



Record Plus Ed. 04

Moulded Case Circuit Breakers
Selective & Current Limiting



GE imagination at work

Moulded case circuit breakers - Selective and current limiting

The breaker

Order codes

Trip units

Components & Accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

A

B

C

D

E

F

G

X





EN 60947-2 Standard

Circuit Breaker type	Denomination	FD160					FD160					FE160		
		N	H	C	E	S	N	H	L	L	N	H	L	
Poles	Number of	1					3,4					3,4		
Rated insulation voltage	Ui (Volts)	750					750					750		
Rated impulse withstand voltage	Uimp (Kilovolt)	3					8					8		
Rated operational voltage Ue	Volts AC	240					690					690		
	Volts DC	250					500					500		
Line Protection device														
Category of use		A					A					A		
Suitable for use as a isolator	Positive ON & OFF	yes					yes					yes		
Rated current Ith = Ie	A at 40°C	160					160					160		
Ultimate breaking capacity Icu (kA)	230/240V AC	25	50	25	40	50	85	100	200	85	100	200		
	400/415V AC	-	-	18	25	36	50	80	150	50	80	150		
	440V AC	-	-	14	14	25	30	65	130 ⁽⁴⁾	42	65	130		
	500V AC	-	-	10	12	18	22	36	50 ⁽⁴⁾	30	50	100		
	690V AC	-	-	-	4,5	6	8	10	12	10	22	75		
	250V DC Single pole	-	50	-	-	25	40	65	100	50	85	100		
	500V DC Two Pole	-	-	-	-	25	40	65 ⁽²⁾	100 ⁽²⁾	50	85 ⁽²⁾	100 ⁽²⁾		
Service breaking capacity Ics (%Icu)	≤ 500V	100%	100%	75%	75%	100%	100%	100%	100%	100%	100%	100%		
	690V AC	-	-	-	-	50%	50%	50%	100%	75%	25%			
Making capacity Icm (kA peak)	400/415V AC	-	-	36	52,5	75	110	176	330	110	176	330		
	500V AC	-	-	17	24	36	46	75	110	63	110	220		
Single phase breaking capacity I _{IT} (kA)	230V AC	25	50	16	25	30	50	80	150	50	80	150		
	400/415V AC	-	-	-	4,5	6	8	10	12	15	22	36		
Endurance (CO operations)	Mechanical	10000					10000					25000		
	Electrical at In	5000					5000					10000		
	Electrical at In/2	10000					10000					20000		
Endurance (On-Tripped operations)	Mechanical	4000					4000					10000		
	Electrical at In/2	10000					10000					20000		
Trip Units	Interchangeable	no					no					yes		
	Thermal Magnetic line	LTM					LTM					LTM		
	Thermal Magnetic generator						GTM					GTM		
	Thermal Magnetic discriminating						LTMD					LTMD		
	Magnetic Only						Mag Break™					Mag Break™		
	Electronic discriminating											SMR1		
	Electronic enhanced													

NEMA AB-1 Standard

3 ph, Interruption rating	240V AC	-	-	-	-	50	65	100	-	100	150	200
	480V AC	-	-	-	-	25	36	50	-	50	65	130
	600V AC	-	-	-	-	6	8	10	-	25	36	42

EN 60947-3 Standard

Non Automatic Circuit Breaker/Switch type	Denomination	FD160			FE160		
		Y - 63A	Y - 160A	Y	Y - 160A	Y	Y
Rated current In (class AC23)	220V AC to 690V AC	63	160	160	160	160	160
Rated making capacity	Icm (kA peak)	1,7	2,8	4,2	4,2	4,2	4,2
Short-term withstand current Icw (A)	Icw eff. 1 second	1,2	2	3	3	3	3
	Icw eff. 3 seconds	1,2	2	3	3	3	3

EN 60947-4 Standard

Use in motor circuits		FD160	FE160
Rated current Ith	A at 65°C	125	150
Endurance (CO operations)	Mechanical	25000	40000
	Electrical at In class AC23	10000	20000
	Operations per hour	120	120
Protection	Short Circuit only (separate overload device)	Mag Break™	Mag Break™
	Overload class 10 and Short circuit		SMR1
	Max In (A) class 10	100	150
	Max In (A) class 30	50	150
	Earth fault unit (differential)	Optional FDQ type	Optional FEQ type

Installation

Circuit Breaker or Switch type	Number of poles	FD160			FE160	
		1	3	4	3	4
Mounting	On symmetrical DIN Rail	yes	yes	yes	no	no
	Fixed	yes	yes	yes	yes	yes
	Plug-in	no	yes	yes	yes	yes
	Draw-out	no	no	no	yes	yes
Connection	Front	yes	yes	yes	yes	yes
	Rear	yes	yes	yes	yes	yes
Dimensions (w x h x d) mm	Fixed front connection	27x130	81x130	108x130	105x170	140x265
		x85	x85	x85	x95	x115
Weights (kg)	Fixed front connection	0,4	0,9	1,3	1,5	2

(1) N type only
(2) 3 poles are needed.

(3) 2 poles are needed
(4) The 160Amp current rating of the L type is limited to 65kA at 440v & 36kA at 500V.



V	FE250				FG400			FG630			FK800			FK1250			FK1600	
	N	H	L		N	H	L	N	H	L	N	H	L	N	H	L	N	H
	3,4				3,4			3,4			3,4			3,4			3,4	
690	750				750			750			1000			1000			1000	
8	8				8			8			8			8			8	
500	690				690			690			690			690			690	
250	500				500			500			500			500			500	
A				B			B ⁽⁵⁾			B			B			B		
yes				yes			yes			yes			yes			yes		
250				400			630			800			1250			1600		
65	85	100	200	90	100	200	85	100	200	85	100	170	85	100	170	85	100	
36	50	80	150	50	80	150	50	80	150	50	80	100	50	80	100	50	80	
25	42	65	130	42	65	130	42	65	130	42	50	80	42	50	80	42	50	
18	30	50	100	30	50	100	30	50	100	36	42	50	36	42	50	36	42	
-	10	15	22	10	22	75 ⁽⁷⁾	10	22	40 ⁽⁷⁾	20	25	30	20	25	30	20	25	
25	50	85	100							50	80	100	50	80	100	-	-	
-	50	85 ⁽²⁾	100 ⁽²⁾							36	50	65	36	50	65	-	-	
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-	100%	75%	50%	100%	75%	25%	100%	75%	50%	100%	100%	75%	100%	75%	50%	100%	75%	
75	110	176	330	110	176	330	110	176	330	110	176	220	110	176	220	110	176	
36	63	110	220	63	110	220	63	110	220	75	110	220	75,6	110	220	75	110	
36	50	80	150	50	80	150	50	80	150	50	80	150	50	80	150	50	80	
-	10	15	22	10	15	22	10	15	22	20	25	30	20	25	30	20	25	
10000	25000				20000			20000			10000			10000			10000	
5000	10000				7500			5000			4000			3000			2000	
10000	20000				15000			10000			8000			6000			4000	
4000	10000				8000			8000			4000			3000			2000	
yes				yes			yes			yes			yes			yes		
LTM				GTM			LTM			LTM			LTM					
				LTMD														
				Mag Break™			Mag Break™											
				SMR1			SMR1						SMR1e					
				SMR2			SMR2						SMR 1s & g					

65	100	150	200	100	150	200	100	150	200	85	-	-	85	-	-	85	-
36	50	65	130	50	65	130	50	65	130	42	-	-	42	-	-	42	-
22	25	36	42	25	36	42	25	36	42	25	-	-	25	-	-	25	-

FE250				FG400			FG630			FK800			FK1250			FK1600	
Y				Y			Y			Y			Y			Y	
250				400			630			800			1250			1600	
5,7				7,1			9,2			14,1			21,2			28,3	
4				5			6,5			10			15			20	
4				5			6,5			10			15			20	

230	400	500	720	1000
25000	20000	20000	10000	10000
10000	7500	5000	4000	3000
120	120	60	60	60
Mag Break™	Mag Break™	Mag Break™	Mag Break™	Mag Break™
SMR1	SMR1 or SMR2	SMR1 or SMR2		
225	400	500	720	1000
225	400	500	720	1000
Optional FEQ type	Optional FGQ type	Optional FGQ type		

FE250			FG400			FG630			FK800			FK1250			FK1600	
3	4		3	4		3	4		3	4		3	4		3	4
no	no		no	no		no	no		no	no		no	no		no	no
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
105x170	140x265	140x265	185x265	140x265	185x265	185x265	210x320	280x320	210x320	280x320	210x320	280x320	210x320	280x320	210x320	280x320
x95	x115	x115	x115	x115	x115	x115	x160	x160	x160	x160	x160	x160	x160	x160	x160	x160
1,5	2,0	4,5	6,0	4,5	6,0	6,0	12,2	15,1	18,0	23,4	18,0	23,4	18,0	23,4	18,0	23,4

(5) Limited to 500Amp

(6) Please contact your nearest GE Sales Office

(7) At a voltage of 690V the uses of a long widened

Shield is mandatory (see page D.9)



Breaker type → FE250

Insulation Voltage → U_i: 750V

Breaking Capacities to EN 60947 (AC)

U _e 150/60kV	I _{cu} /I _{cs}
230/240V~	200kA
400/415V~	150kA
480V~	130kA
500V~	100kA
690V~	22/11kA

Serial Number → GPJ3410391P834

Relevant Standards

- BS CEI JIS UNE VDE
- IEC 60947-2
- G814048.2
- AD10947 Cat. A

Product Description

Record Plus™
Circuit Breaker

Interruption Ratings 3ph. To NEMA AB1 standard

Breaking Capacities to EN 60947 (DC)

Breaker current ratings & temperature

Breaker Frame cat. Code and 6 digit

Breaker Trip Unit Cat. code

NEMA AB1 3ph

240V~	200kA
460V~	130kA
600V~	42kA

U_e (DC) I_{cu}/I_{cs}

250V ==	1p 100kA
500V ==	3p 100kA

Tripping → 200A 40°C

Catalogue Number

- FEL306F250KF
- 431422
- FETD3K0200

Certification

The **Record Plus™** line of circuit breakers has been designed to comply with the following standards:

EN 60947 Low-voltage switchgear and controlgear

- EN 60947-1: General rules
- EN 60947-2: Circuit-breakers
- EN 60947-3: Switches, disconnectors, switch-disconnectors and fuse-combination units
- EN 60947-4-1: Contactors and motor-starters
- Section One: Electromechanical contactors and motorstarters
- EN 60947-5-1: Control circuit devices and switching elements
- Section One: Electromechanical control circuit devices

This compliance has been verified by three authorities; the Kema, the CCC organization and Lovag. (Appropriate certificates can be made available on request)

Meeting the international standards. The requirements are met of **BS, VDE, UTE, KEMA, CEI**. Record Plus breakers have been tested in accordance with the NEMA standards

For the Record Plus product certificates are available from the following regulatory bodies:
 Germanische Lloyds - RINA
 Lloyds Register of Shipping - CCC (China)
 Further tests are being undertaken to meet the requirements of the following regulatory bodies:
 Bureau Veritas - Det Norske Veritas

Please contact us to check the availability of individual certificates.

A UL489 certified variant of the Record Plus line of Molded Case Circuit Breakers is also available. The line covers three frame sizes with current ratings of 3 to 600Amps. Please contact our GE sales offices in the U.S.A for further details.

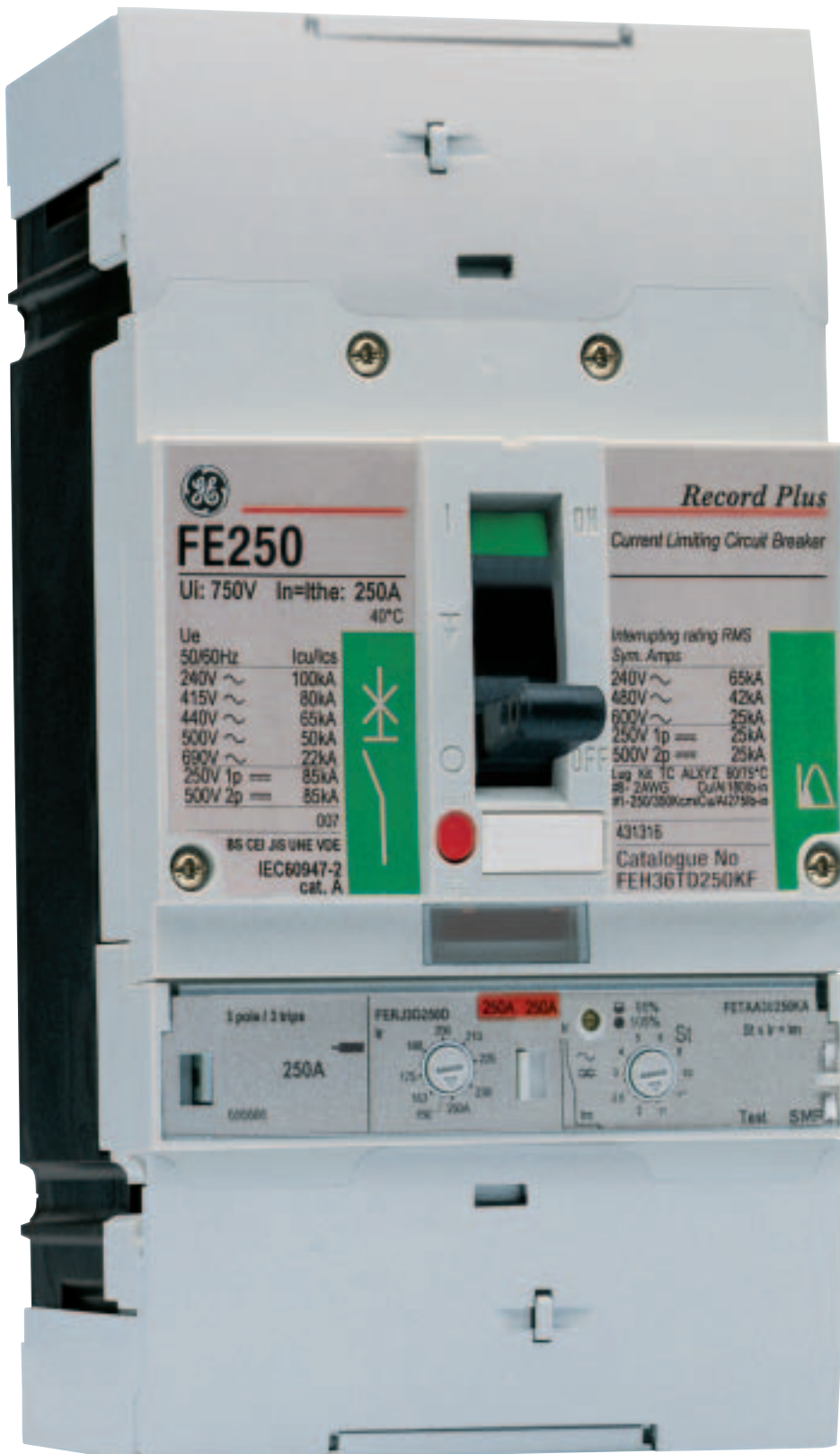
Breaking capacities according to Standard EN 60 947-2

FD 160*	240V AC	400 / 415V AC	FD 160	FE 160	FE 250	FG 400	FG 630	FK 800**	FK 1250**	FK 1600**
	L	150kA								
	H	80kA								
	N	50kA								
	Residential	36kA								
	Effective	25kA								
	Concise	18kA								

* 1 pole version

** Limiters L 800 and 1250A 400 / 415V 100kA

Moulded Case Circuit Breakers designed for global applications



Contents

A complete line of selective & current limiting breakers

Protection with flexible & interchangeable trip units

Common accessories safe & easy to mount

Wide range of electrical & mechanical operators

Versatile installation options

A full solution for low voltage distribution

The **Record Plus**[™] family of circuit breakers has been developed as a line of aesthetically and technically coordinated protection devices for low voltage distribution and control applications. The circuit breakers are available in four sizes, each of which is tailored to the individual requirements associated with its application.

The line offers a current range running from 3A to 1600A in single, 3 and 4 pole ratings. Numerous versions as fixed, plug-in and draw-out are available and the line is completed with a full range of accessories.

FD160

Rated at 160A, the FD160 frame size is designed for use in both a DIN-rail environment with modular equipment and in industrial applications. It is supplied with IPXXB terminals suitable for direct connection of one or two conductors totalling up to 95 mm² and is available as a thermal-magnetic breaker, a moulded case switch, and as a magnetic-only motor circuit protector.

The FD160 bridges the gap between residential miniature circuit breakers and industrial moulded case circuit breakers.

FE160 and FE250

Rated at 160 and 250A, the FE frame sizes are designed for side-by-side mounting with FD160 types in panels. FE sizes are equipped with an easily accessible busbar connection and can also be supplied with cable lugs for use with copper or aluminum conductors. The design allows the use of interchangeable thermal-magnetic, magnetic-only, and electronic trip units.



A complete line of selective & current limiting breakers

FG400 and FG 630

Rated at 400 and 630A, the FG frame size includes all of the advanced features of the FD and FE frame sizes.

The FG connection area features easy-to-access busbar connections. Cable lugs for use with single or multiple copper or aluminum conductors are optionally available. The breaker is designed for use with interchangeable electronic units that can be easily adapted to multiple levels of protection.



FK 800, 1250 and 1600

Rated at 800, 1250 and 1600A, the FK frame sizes are designed for use with the FG400 and 630 frame sizes. The design uses electronic trips units available in a number of performance ranges and allowing a wide variety of setting options and groundfault protection. If needed thermal-magnetic and magnetic only trip units are also available. The FK connection area features easy-to-access busbar connections or cable lugs for use with single or multiple copper or aluminum conductors.



Record Plus™ circuit breakers are designed to protect, isolate and switch circuits in low voltage distribution networks. Circuit protection is provided by a combination of the devices unique current limiting properties and integrated protection devices commonly referred to as trip units.

The trip units are designed to protect circuits and/or the equipment connected to these circuits and exist as electromechanical or electronic devices. Numerous electromechanical types are available as thermal magnetic devices with overload and short-circuit protection or magnetic-only types providing short-circuit protection. Electronic devices offering wide setting ranges and a more sophisticated level of protection are available in several versions. Each trip unit has a setting area finished with a sealable transparent trip unit door.

Electromechanical devices

Devices available in a current range of 16 to 1250A as single, two, three or four pole devices. The electromechanical trip units exist as thermal magnetic, magnetic-only and generator protection models. The high-performance thermal magnetic trip units exist as selective and non-selective versions and are equipped with a fault indicator that distinguishes between overload and short-circuit events in accordance with HD 384⁽¹⁾. This patented safety feature allows users to reduce downtime by resetting the breaker directly after an overload event.

Electronic devices SMR1

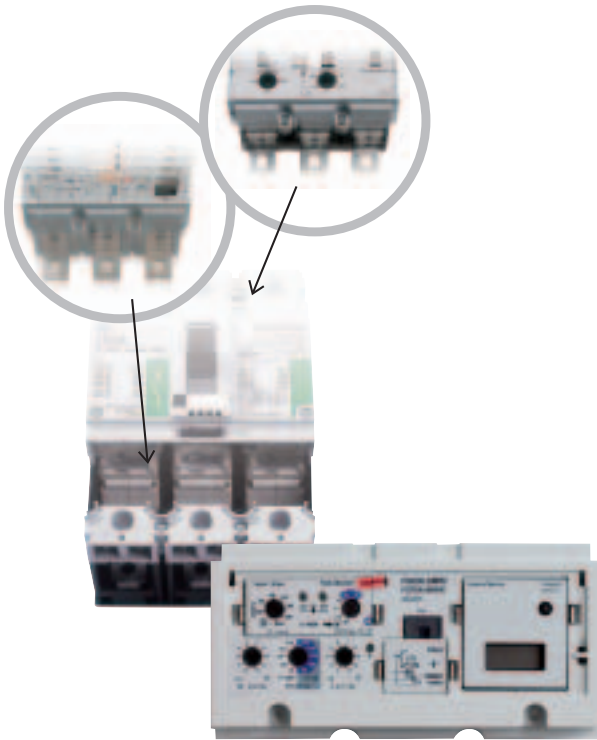
The **Record Plus™** FE, FG and FK sizes can be equipped with rigorously designed and tested interchangeable electronic trip units available in three and four pole units in currents ranging from 25 to 1600A.

The SMR1 and SMR2 types offer adjustable overload and selective short-circuit protection. The SMR1 range is designed for simplicity and includes numerous exciting features such as an overload signalling option, a built-in temperature sensor and rating plugs suitable for both line and motor protection.



(1) Only applicable for the FE frame type.





Protection with flexible & interchangeable trip units

Personnel protection

A line of three and four pole add-on residual current devices are available as side or bottom mounted units with ratings up to 630A and sensitivities of 30mA to 10A. The devices slide on to the breaker easily and are fixed by simply tightening the main electrical connections. Designed to meet the latest standards, they each have a mechanical and electrical test option and share a common cut out.

A de-electric disconnect plug unit and setting areas with transparent, tamper-free cover are standard for the whole line.

For ratings above 630A, separate sensors and relays are available, or an integrated ground fault protection can be used.

Electronic devices SMR2

Designed to provide a flexible solution for all protection scenarios the standard device provides an extensive set of protection features as:

- Long Time Protection adjustable from 0.4 to 1 x In.
- A choice of up to five Long Time Delay Bands.
- Short Time protection adjustable from 2 to 12 x In
- A choice of up to five Short Time Delay Bands with a set of optional I²T bands.
- Instantaneous Short Circuit Protection adjustable from 2 to 13 x In.
- Zone selective interlock on ST and GF functions (When a GF module is added)
- A Battery that supplies the Thermal Memory function.

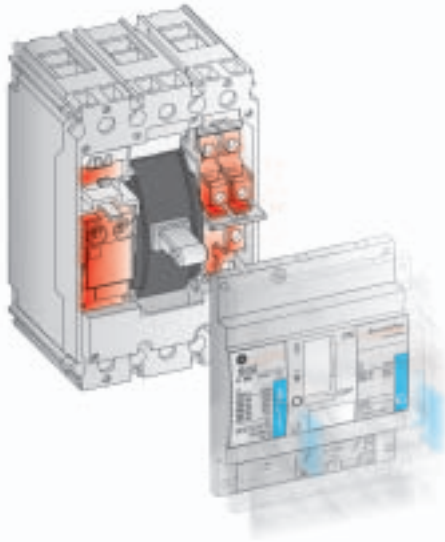
An SMR2 can be equipped with unique Field mountable Plug-in modules that extend the Trip Units functionality to include:

- Modbus Communication
- Ground Fault Protection (GF)
- A two Channel Load Shedding Option.
- Trip Reason Indication module (LT, ST & I)
- Current measurement by Ammeter

An external Contact/Communication module allows the user to monitor the SMR2 via Modbus rtu communication or by using the available 1A relay contacts.



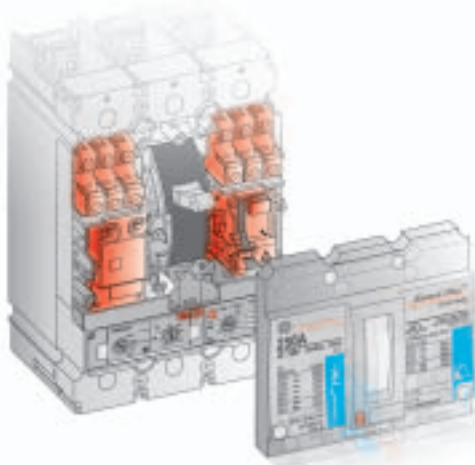
Common accessories safe & easy to mount



Safe and easy to mount

The internal accessories are designed for safe and easy mounting. The breaker trips upon cover removal and remains tripped until the cover is replaced. Cover removal provides access to a specifically designed, isolated compartment into which the accessories can be mounted easily and safely in conveniently marked areas.

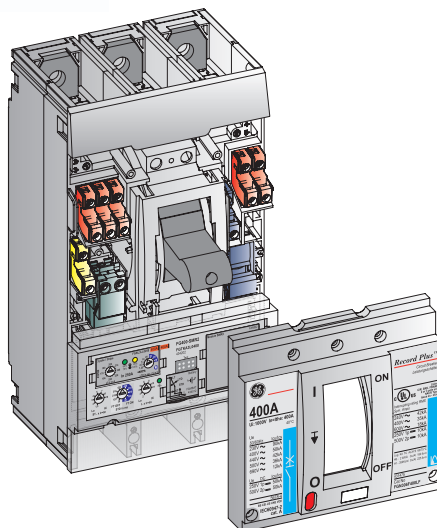
The advanced design includes routing channels for external wiring that allows access to internal terminals, making it easier to connect accessories. Particular attention has been paid to the design of these terminals that allow the connection of wiring from 0.5 to 2.5 mm².

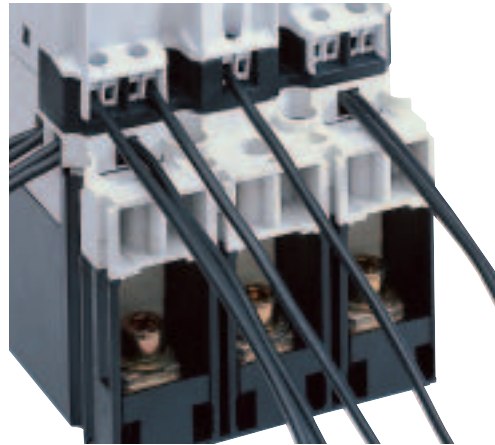
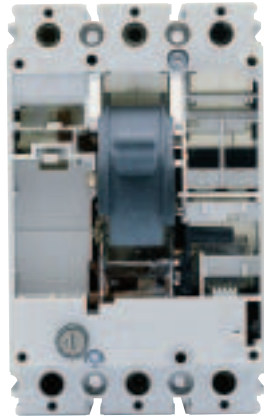


Common and adaptable

The same internal accessories are used in the FD, FE and FG frame sizes. The mounting system and wiring access methodology remains the same: simple and effective. The FK frame has equivalent accessories and the same connection options.

For plug-in and draw-out breakers 6, 8 and 10 pole plug/socket combinations are available. These are equipped with wiring that can be led through specific openings in the breaker rear.



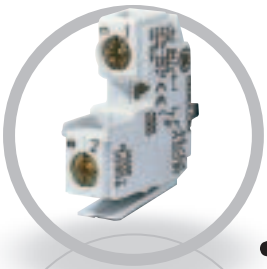


Mounting

Internal accessories can be easily clicked into conveniently marked areas in the isolated compartment. Clearly marked indication of the accessory position and a mechanical interchange prevention system assure an error-proof and solid mounting of the accessory.

Wiring

External wiring is routed through the top or the side of the breaker lid through break out openings. The wiring can then be connected to the accessory terminals. These cage terminals allow for cross sections from 0.75 to 2.5 mm² and even allow the connection of two wires. All contact points are coded in accordance with the EN 60947 standard thus allowing for universal wiring diagrams.



Auxiliary and Bell Alarm contacts

The internal accessories are common to **Record Plus**[™] FD, FE and FG circuit breakers. They offer a unique, patented, auxiliary contact block with normally open and normally closed contacts which are suitable for use in high current and high fidelity applications. Selective Fault Indication is possible by using one or a combination of the two Bell Alarm contact types.

Releases

The shunt and undervoltage releases are a totally new design combining the best in electromechanical and electronic engineering. Most releases are common for AC and DC voltages and are available in a wide voltage range. They combine low power consumption, a kiss-free, lock-out design and the ease of use common to all **Record Plus**[™] internal accessories.

Wide range of electrical & mechanical operators



Can be turned 90° to allow horizontal mounting of breaker.



Easy-to-mount rotary handles

Fitted onto the breaker front the device allows the vertical handle movement to be changed into a rotary operation with the OFF position at 3 o'clock and the OFF position at 6 o'clock. An accurate position indication of the three breaker positions ON-OFF and TRIPPED is provided by a totally new internal design that also allows the user to install one or two early closing and late opening contact blocks which are the same as the standard internal accessory types.

Easy to install

The handles are available as a breaker mounted device, a type that can be mounted through a door or a panel and a version where the operator is mounted on the door or panel front. The door and/or panel mounted units are equipped with (bypassable) interlocks to prevent the door from opening or the panel being removed whilst the breaker is ON. The door/panel mounted operators use a drilling common across the line. Each breaker size and breaking capacity rating has its own escutcheon and handle that can be equipped with padlocks and/or a keylock.



Safe to operate

Locking/Interlocking devices

To allow users to safely work on the installations or installation segments protected by the **Record Plus™** moulded case circuit breakers it is possible to padlock the devices in their OFF position. A padlocking facility can be attached to the breaker front allowing the breaker to be equipped with up to three padlocks of 5 to 8 mm.

A second type (depicted in the photo) is only firmly attached to the breaker when it is padlocked and can be removed for use on another breaker when not in use. Key locking devices allow the creation of multiple key interlocking configurations. A walking beam system is available for interlocking two or three breakers. The system can be upgraded to a fully automatic power transfer system.

Easy to operate

Electrical operators

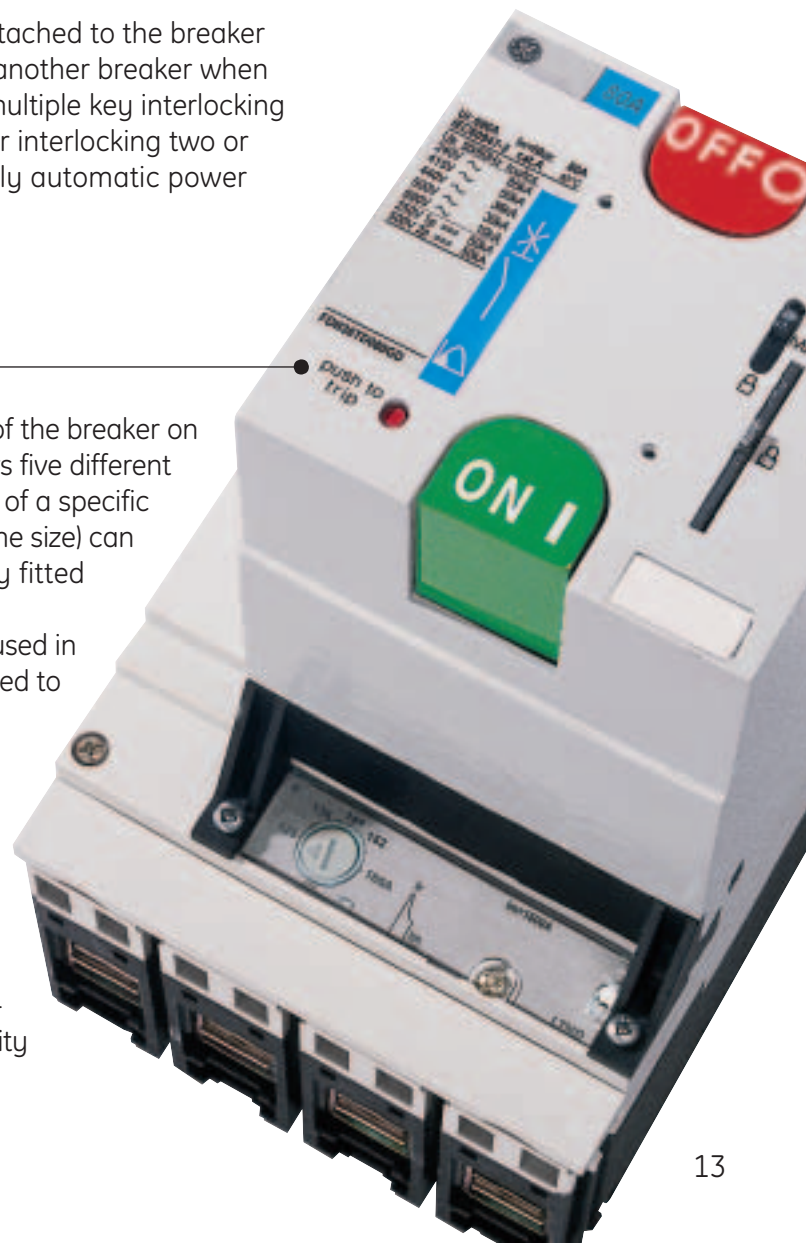
Front mounted devices that allow electrical operation of the breaker on which the device is mounted. The Record Plus line offers five different electrical operators each tailored to the characteristics of a specific frame size. Four of these devices (one for each frame size) can be mounted in the field. An additional Hi speed factory fitted operator is available for the FK frame size.

Common to each of these devices is that they can be used in a simple 3 wire connection scheme that can be extended to include a more complex functionality.

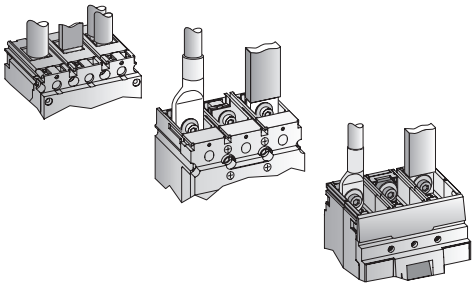
All Electrical Operators have a user interface that includes a CLEAR and ACCURATE ON, OFF and TRIPPED indication and offer the option to operate locally (Manual) or remotely (Auto).

All devices can be padlocked or keylocked in OFF position.

Easy connection is achieved by locating the terminals in the immediate vicinity of those of the internal accessories and by using terminals with a connection capacity of 0.5 to 2.5 mm².



Versatile installation options

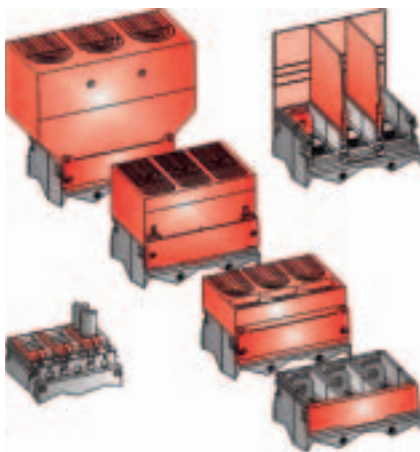
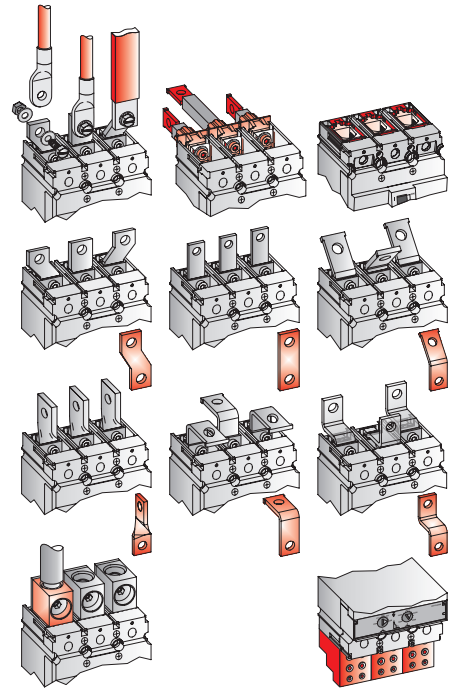


Standard connection options

The breakers are equipped with front access terminals designed to allow the user to quickly and easily connect standard conductors. The FD160 frame has box clamps suited for one or two cable cores or busbars while the FE, FG and FK frame sizes are configured to allow for easy busbar connection.

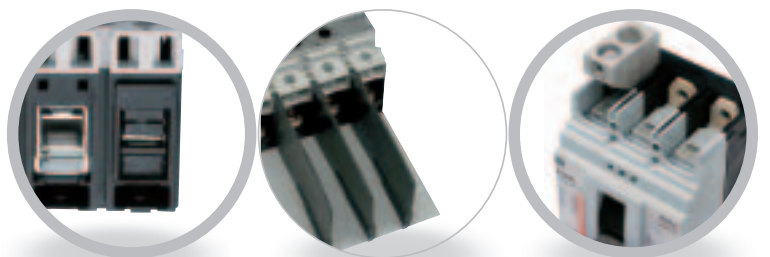
Configurable connection options

A wide range of alternatives are available in kit form with rear and angular connectors, spreaders, customised ring terminal connectors and extenders. Single and multiple box clamps can be directly fitted to the breaker terminals or in combination with extenders and spreaders. This flexibility allows the user to adapt **Record Plus™** circuit breakers to almost all standard connection configurations while at the same time allowing for the use of over-dimensioned and/or multiple conductors.



Terminal shields

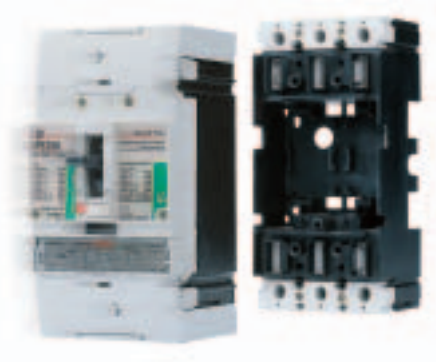
Each breaker can be fitted with tamper resistant, short or long, terminal shields that allow a IP30 finishing of the product. Backplates and phase separators complete this line and consistently enable the user to connect the products safely. Additionally, frame specific accessories as the IPXXB terminal cover for the FD160 and the widened and elongated terminal shield for the FG frame are available.



Plug-in systems

Plug-in mounting systems are available for current ratings through 630A in both kit and assembled options. The plug-in system consists of a single-piece moulded base in an IPXXB configuration. The mounting system features a safety interlock which ensures that the breaker is mechanically tripped before it is fully withdrawn or re-inserted in the ON position.

An optional set of plug-in terminal block(s) are available for use with internal accessory connections. Plug-in mounting bases are normally supplied with exactly the same front access terminal configuration as the standard fixed breaker. This allows the use of the same wide range of connection accessories that are available in kit form on the fixed version. These include rear and angular connectors, spreaders, customised ring terminal connectors and extenders. Internal accessories can be easily clicked into conveniently marked areas in the isolated compartment. Clearly marked indication of the accessory position and a mechanical interchange prevention system assures an error-proof and solid mounting of the accessory.

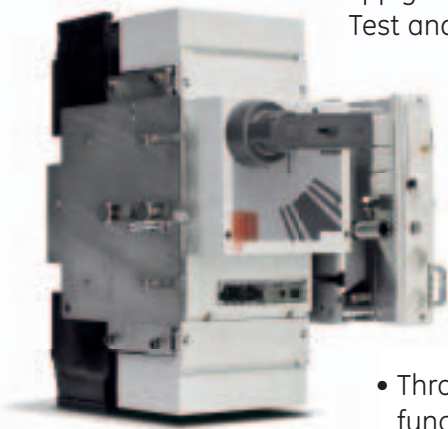


Draw-out system

A simple, hand operated draw-out system is available for the FE, FG and FK frame sizes. The draw-out system enables **Record Plus™** breakers with rating from 3A to 1600A to be configured as devices that can be fully insulated from the power supply and installation. Each device has three positions inserted and connected. Test and isolated, and withdrawn.

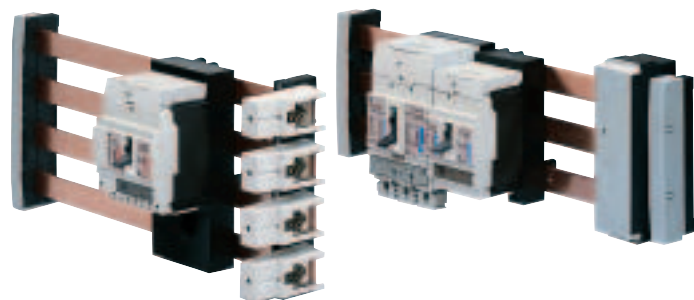
A design modelled on our ACB constructions and incorporating a standard plug-in base encapsulated in a sturdy metal cradle. The devices have a protection degree of IP40 in withdrawn or inserted position and offer a major step forward in MCCB draw-out construction. A system offering a host of features as:

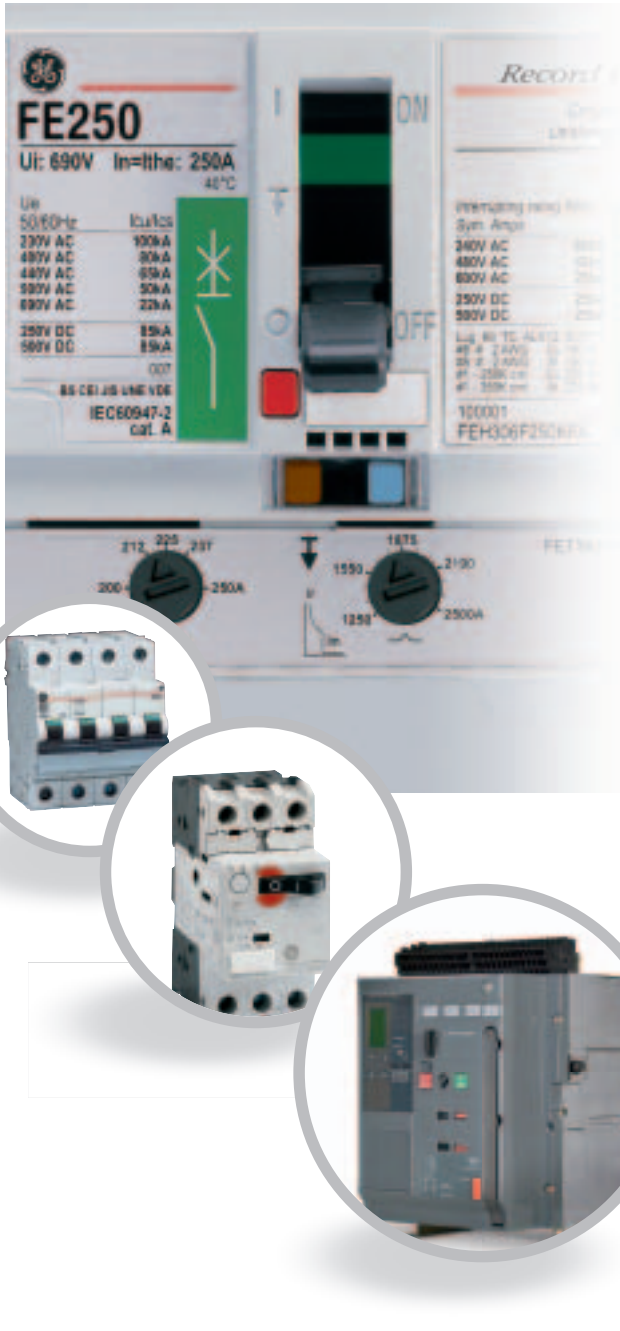
- Use behind door.
- Trip functionality on insertion and withdrawal.
- With MCCB style test position.
- Easily accessible earthing point.
- Through door version allowing accessibility of all draw-out and/or breaker functions from the door front.
- A locking option for multiple padlocks and/or multiple key locks.
- Multiple carriage indication switches for each position.
- Optional ACB style TEST position.



Connectivity

The installation of a breaker is much easier and more cost effective when the mounting and connecting of the breaker can be reduced to a few simple, automateable tasks. Based on these principles GE have devised a unique system that allows the user to mount and connect the breaker before installation. An adaptor plate, specifically designed for the **Record Plus™** breaker line and incorporating all the connection hardware, is fitted to the breaker using 5 to 6 simple screws. Once mounted the adaptor is then simply plugged onto a three or four pole busbar system already installed in the equipment.





Using world class design and development tools like Six Sigma, Computer Simulation and Lean Manufacturing, **Record Plus™** is intended to meet and exceed the most stringent quality and safety standards. At GE we are proud to offer a product that will offer years of reliable and dependable protection.

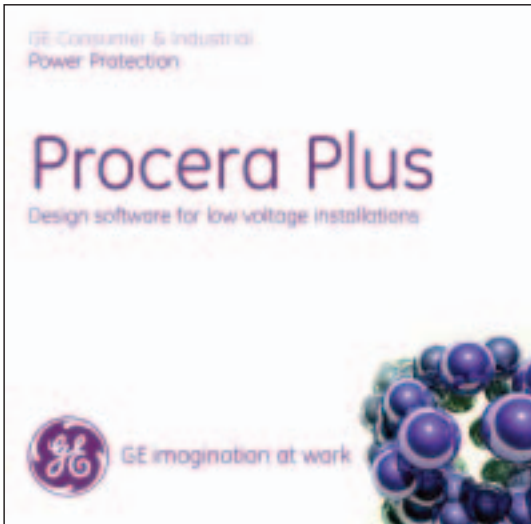
GE's name is synonymous with a broad range of products designed to meet our customer's changing and competitive environment. Our drive to exceed our customer's expectations is the foundation for continual renewal of our commitment to provide innovative low voltage solutions.

The **Record Plus™** MCCB, Elfa Plus MCB, Surion Breaker and Motor starter line and the new EntelliGuard™ G Power Circuit Breaker lines combine to offer a full line of hi-performance protection devices. They Provide a Fully coordinated approach to circuit and device protection for use in the Domestic, Commercial and Industrial environment.

GE's new lines meet the latest technical standards and regulations and have been certified by authorities as Lovag, the KEMA and Lloyd's. The components in these lines have been designed to be an integral part of a solution. A complete low voltage distribution and control range including components, accessories and the distribution and controls equipment they go into.



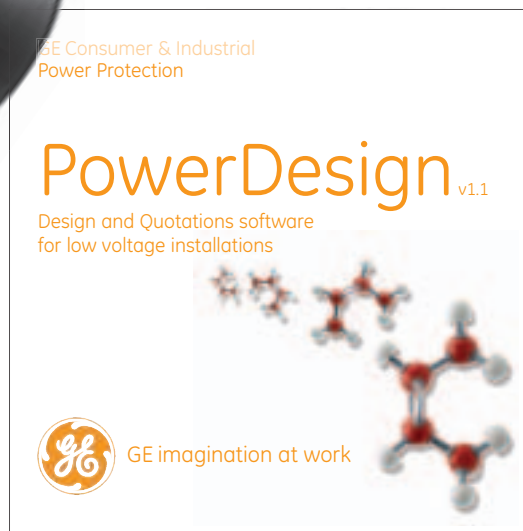
Full solution for low voltage distribution



Application Software

The new HD 384 and R064-03 standards require that the design of a low voltage distribution system includes the determination of all perspective short-circuit and fault currents levels. GE has developed a windows based software package to do this:

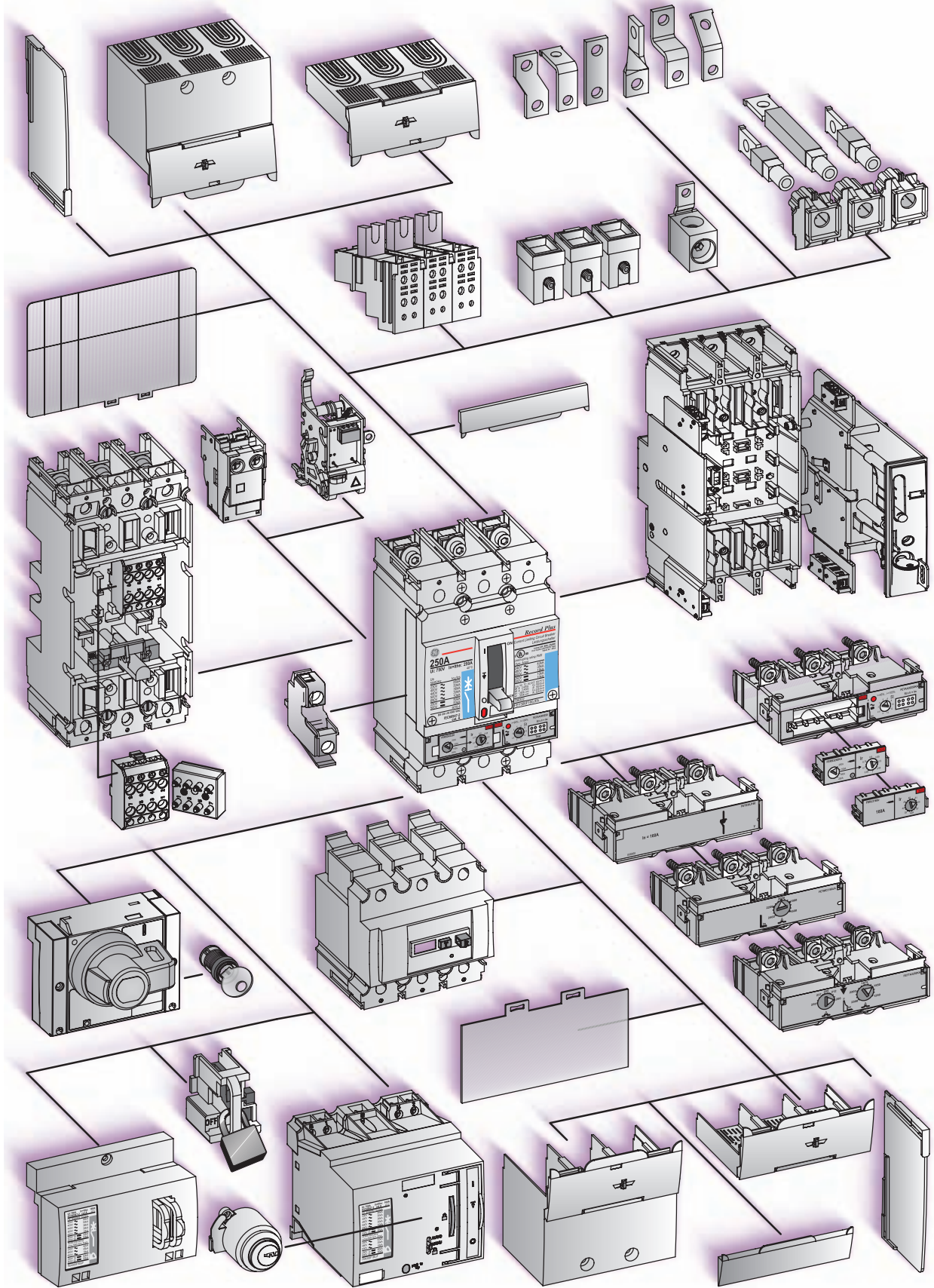
Procera Plus offers a multi standard and multi lingual software package to accompany our new product line.



Implementation Software

Two ranges of software are designed to allow a user to select the correct protection devices, the associated components needed to install it, and a distribution system in which they can be installed.

The software **PowerDesign** can be linked with Procera Plus and automatically produces drawings and ordering details.



A.2 **How to order a standard breaker**

A.4 **FD frame**

A.5 Complete circuit breakers FD160

A.9 Accessories

A.12 **FE frame**

A.13 Complete circuit breakers FE160 & FE250

A.19 Accessories

The breaker

Order codes

A.24 **FG frame**

A.25 Complete circuit breakers FG400 & FG630

A.30 Accessories

A.34 **FK frame**

A.35 Complete circuit breakers FK800, FK1250 & FK1600

A.38 Accessories

A.42 **Connectivity**, 60mm busbar system

A.44 **Changeover devices**

A.45 Electrical and mechanical interlocks

A.47 Automatic changeover sets

A.48 **Residual current devices** with separate sensor

A.50 **Breakers in components**

A.50 FE frame

A.52 FG frame

Trip units

Components & Accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

A

B

C

D

E

F

G

X



How to order a standard breaker

To determine the basic breaker, the required current rating, the short circuit breaking capacity and the number of switched and protected poles must be defined. This information can be found on page 2 and 3 of this catalogue and is repeated in short-form within the ordering code part of each breaker size.

After selecting the basic device the circuit protection element or trip unit needs to be defined. Numerous different types are available, each briefly described in the ordering code section of each breaker size. A full functional description is included in section B of this catalogue.

With the above mentioned information the correct code for the required moulded case circuit breaker can be found in the order code pages. Here the selected product is a version suited for fixed mounting and front access connection.

Internal accessories

Common internal accessories are available for the FD160, FE160, FE250, FG400 and FG630 frame sizes. Taking the maximum breaker content into account as indicated in section E the procedure just requires a correct code selection. The FK800, 1250 and 1600 types have equivalent accessories.

Operators

The breakers are normally supplied with an elongated toggle operator. Other operators, as rotary handles and electrical operators, can be ordered separately.

Residual Current devices (RCD)

Available as add-on devices for side mounting (FD160) or mounting below the trip unit area of the breaker (FD160, FE160, FE250, FG400 and FG630 frame sizes). For breakers large than 630A separate RCD relays and sensors are available. Alternatively the FG400, FG630, FK800, FK1250 and FK1600 types can be equipped with a fully integrated Ground Fault protection device.

Breakers in Plug-in or Draw-out version

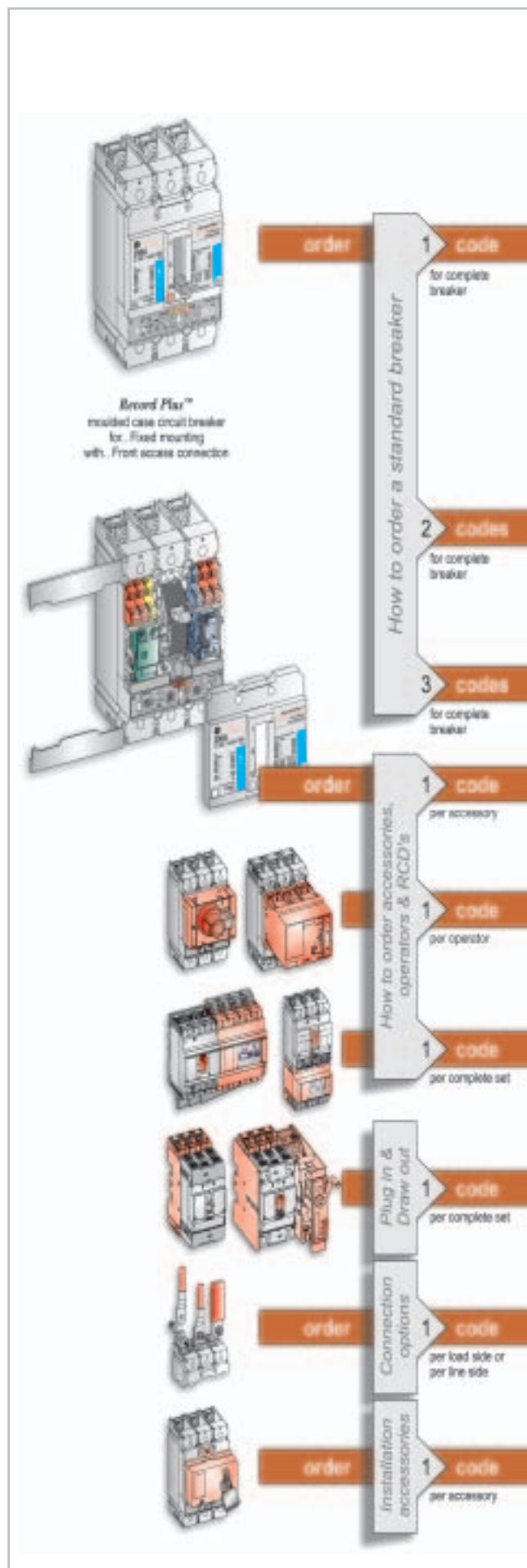
A breaker in fixed rating can easily be converted to a breaker in plug-in or draw-out rating. The plug-in device is supplied in two parts, one set for mounting on the breaker and one multipole base. The draw-out unit is ordered as one complete conversion kit for the required breaker. On ordering plug-in or draw-out breakers with accessories, please take into account that the auxiliary wiring also needs to be executed as such (6, 8 or 10 pole socket system required).

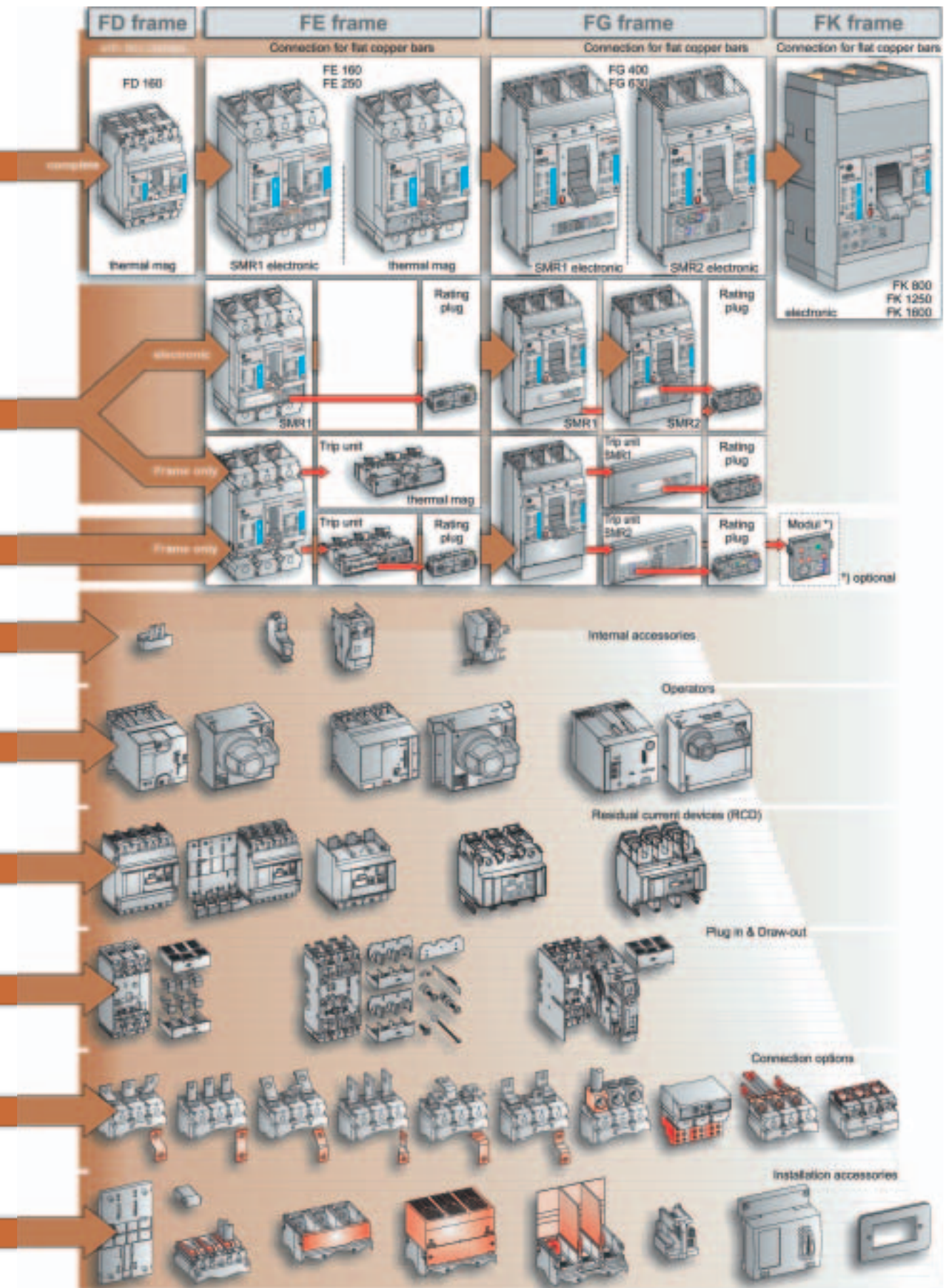
Connection options

If the standard connection options do not meet the requirements a wide variety of others is available. The connection options are supplied in kit form for mounting on one side (load or line) of a breaker and can be used for the fixed, plug-in or draw-out version of the breaker.

Installation accessories

Additional requirements, as to the protection degree of the connection area, the locking or padlocking of the breaker and finishing of cut-outs for operators can be met by the use of these parts.





Order codes

Intro

A

B

C

D

E

F

G

X





- LTM**
Line thermal magnetic protection
- LTMD**
Selective thermal magnetic protection
- GTM**
Generator thermal magnetic protection
- Mag Break™**
Magnetic Only protection
- Y**
Non Automatic or switch (not mentioned in tables)

FD frame

Breaking capacities

2, 3 and 4 pole types

Single pole types

Icu 400/415V AC
in kA eff.

Icu 230/240V AC
in kA eff.

Type	C	E	S	N	H	L	N	H
FD160	18	25	36	50	80	150	25	50

Protection

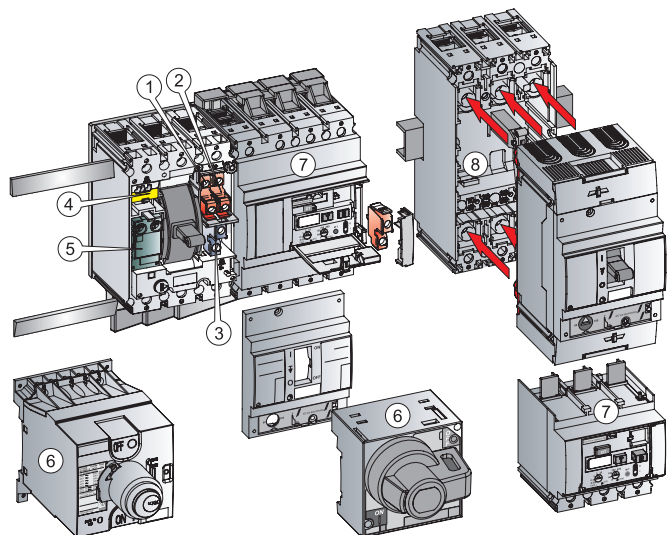
Trip Unit	Rated Current (A)	FD160 (2,3 & 4 pole)				FD160 (1 pole)		
		LTM	LTMD	GTM	Mag Break™	Trip Unit	Rated Current (A)	LTM
	3	-	-	-	N,H		-	-
	7	-	-	-	N,H		-	-
	12.5	-	-	-	N,H		-	-
	16	C,E	S,N,H	-	-		16	N,H
	20	C,E	S,N,H	-	N,H,L		20	N,H
	25	C,E	S,N,H,L	N,H	-		25	N,H
	30	-	-	-	N,H,L		-	-
	32	C,E	S,N,H,L	N,H	-		32	N,H
	40	C,E	S,N,H,L	N,H	-		40	N,H
	50	C,E	S,N,H,L	N,H	N,H,L		50	N,H
	63	C,E	S,N,H,L	N,H	-		63	N,H
	80	C,E	S,N,H,L	N,H	N,H,L		80	N,H
	100	C,E	S,N,H,L	N,H	N,H,L		100	N,H
	125	C,E	S,N,H,L	N,H	-		125	N,H
	160	C,E	S,N,H,L	N,H	-		160	N,H

Number of poles/ protected poles (trips)	FD160 (2,3 & 4 pole)				FD160 (1 pole)	
	LTM	LTMD	GTM	Mag Break™	Trip Unit	Rated Current (A)
2 pole 2 trips	-	N	-	-		
3 pole 3 trips	C,E	S,N,H,L	N,H	N,H,L		
4 pole 3 trips	-	N,H,L	N,H	N,H,L		
4 pole 4 trips	C,E	S,N,H,L	N,H	-		
4 pole 3.5 trips (N=50%) ⁽²⁾	-	N,H,L	N,H	-		

Accessories

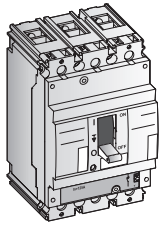
- ① Auxiliary contact left mounted (NO or NC)
- ② Auxiliary contact right mounted (NO or NC)
- ③ Bell Alarm trip unit (NO or NC)
- ④ Bell Alarm mechanism (CO)⁽¹⁾
- ⑤ Shunt or Undervoltage release
- ⑥ Operators
Rotary Handle
Electrical Operator
- ⑦ RCD, side or bottom mounted⁽¹⁾
(Insert indicates Bell alarm contact mounting)
- ⑧ Plug-in system

(1) Not applicable for some FDC and FDE types.



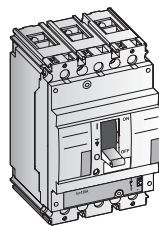
FD160 - Complete circuit breaker

Line Thermal Magnetic LTM (fixed settings calibrated at 40°C)



In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
16	FDC35TF016EF	433532	FDC45TF016EF	433926
20	FDC35TF020EF	433553	FDC45TF020EF	433928
25	FDC35TF025EF	433864	FDC45TF025EF	433930
32	FDC35TF032EF	433867	FDC45TF032EF	433932
40	FDC35TF040EF	433870	FDC45TF040EF	433934
50	FDC35TF050EF	433873	FDC45TF050EF	433936
63	FDC35TF063EF	433876	FDC45TF063EF	433938
80	FDC35TF080GF	433879	FDC45TF080GF	433940
100	FDC35TF100GF	433882	FDC45TF100GF	433942
125	FDC35TF125GF	433885	FDC45TF125GF	433944
160	FDC35TF160GF	433899	FDC45TF160GF	433946

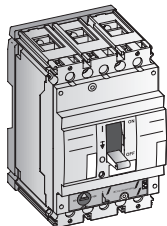
One code covers: A standard, fixed front connection breaker with fixation hardware.
RCD device and bell alarm mechanism cannot be fitted.



16	FDE36TF016EF	435127	FDE46TF016EF	435207
20	FDE36TF020EF	435129	FDE46TF020EF	435229
25	FDE36TF025EF	435130	FDE46TF025EF	435231
32	FDE36TF032EF	435132	FDE46TF032EF	435238
40	FDE36TF040EF	435135	FDE46TF040EF	435240
50	FDE36TF050EF	435138	FDE46TF050EF	435242
63	FDE36TF063EF	435145	FDE46TF063EF	435244
80	FDE36TF080GF	435147	FDE46TF080GF	435246
100	FDE36TF100GF	435193	FDE46TF100GF	435248
125	FDE36TF125GF	435195	FDE46TF125GF	435256
160	FDE36TF160GF	435205	FDE46TF160GF	435258

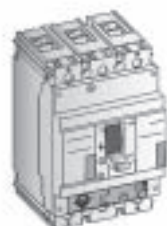
One code covers: A standard, fixed front connection breaker with fixation hardware.
RCD device and bell alarm mechanism cannot be fitted.

Line Thermal Magnetic LTM (adjustable thermals calibrated at 40°C)



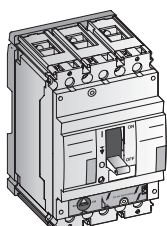
In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
16	FDC35TE016ED	433907	FDC45TE016ED	433948
20	FDC35TE020ED	433911	FDC45TE020ED	433949
25	FDC35TE025ED	433914	FDC45TE025ED	433950
32	FDC35TE032ED	433918	FDC45TE032ED	433951
40	FDC35TE040ED	436117	FDC45TE040ED	433952
50	FDC35TE050ED	436118	FDC45TE050ED	433953
63	FDC35TE063ED	436133	FDC45TE063ED	433954
80	FDC35TE080GD	436143	FDC45TE080GD	436145
100	FDC35TE100GD	436144	FDC45TE100GD	436146
125	FDC35TE125GD	433924	FDC45TE125GD	436147
160	FDC35TE160GD	433925	FDC45TE160GD	436148

One code covers: A standard, fixed front connection breaker with:
DIN-Rail mounting kit + Breaker finishing covers + Fixation hardware.



16	FDE36TC016EF	430001	FDE46TC016EF	430008
20	FDE36TC020EF	430002	FDE46TC020EF	430009
25	FDE36TC025EF	430003	FDE46TC025EF	430010
32	FDE36TC032EF	430004	FDE46TC032EF	430011
40	FDE36TC040EF	430005	FDE46TC040EF	430012
50	FDE36TC050EF	430006	FDE46TC050EF	430013
63	FDE36TC063EF	430007	FDE46TC063EF	430014
80	FDE36TC080GF	430276	FDE46TC080GF	430299
100	FDE36TC100GF	430279	FDE46TC100GF	430302
125	FDE36TC125GF	430282	FDE46TC125GF	430305
160	FDE36TC160GF	433566	FDE46TC160GF	433569

One code covers: A standard, fixed front connection breaker with fixation hardware.



16	FDE36TE016ED	433649	FDE46TE016ED	433697
20	FDE36TE020ED	433651	FDE46TE020ED	433699
25	FDE36TE025ED	433653	FDE46TE025ED	433701
32	FDE36TE032ED	433655	FDE46TE032ED	433703
40	FDE36TE040ED	433657	FDE46TE040ED	433705
50	FDE36TE050ED	433659	FDE46TE050ED	433707
63	FDE36TE063ED	433661	FDE46TE063ED	433709
80	FDE36TE080GD	433663	FDE46TE080GD	433711
100	FDE36TE100GD	433665	FDE46TE100GD	433713
125	FDE36TE125GD	433667	FDE46TE125GD	433715
160	FDE36TE160GD	433669	FDE46TE160GD	433717

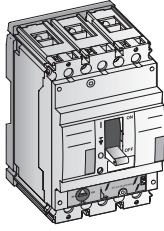
One code covers: A standard, fixed front connection breaker with:
DIN-Rail mounting kit + Breaker finishing covers + Fixation hardware.

(1) Neutral on the left. If neutral on the right is needed, please contact us.

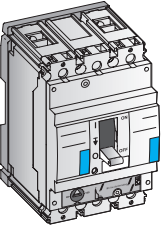
FD160 - Complete circuit breaker

Selective Thermal Magnetic LTMD (Settable thermals calibrated at 40°C)

In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Cat. no.	Ref. no.	Cat. no.	Ref. no.				
16	FDS36TD016ED	430161	FDS46TD016ED	430224				
20	FDS36TD020ED	430163	FDS46TD020ED	430226				
25	FDS36TD025ED	430165	FDS46TD025ED	430228				
32	FDS36TD032ED	430167	FDS46TD032ED	430230				
40	FDS36TD040ED	430169	FDS46TD040ED	430232				
50	FDS36TD050ED	430178	FDS46TD050ED	430241				
63	FDS36TD063ED	432952	FDS46TD063ED	432964				
80	FDS36TD080GD	432955	FDS46TD080GD	432967				
100	FDS36TD100GD	432958	FDS46TD100GD	432970				
125	FDS36TD125GD	432961	FDS46TD125GD	432973				
160	FDS36TD160GD	433602	FDS46TD160GD	433604				



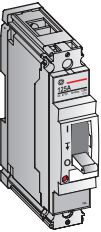
In (A)	2 pole 2 trips		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Cat. no.	Ref. no.				
16	FDN66TD016ED	430143				
20	FDN66TD020ED	430144				
25	FDN66TD025ED	430145				
32	FDN66TD032ED	430146				
40	FDN66TD040ED	430147				
50	FDN66TD050ED	430148				
63	FDN66TD063ED	430149				
80	FDN66TD080GD	430794				
100	FDN66TD100GD	430797				
125	FDN66TD125GD	430800				
160	FDN66TD160GD	433599				



One code covers: A standard fixed front connection breaker + DIN-Rail mounting kit + Toggle elongator + Breaker finishing covers + Fixation hardware

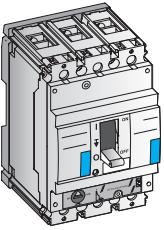
Line Thermal Magnetic LTM (fixed settings calibrated at 40°C)

In (A)	1 pole 1 trip ⁽²⁾		Cat. no.	Ref. no.	1 pole 1 trip ⁽²⁾	
	Cat. no.	Ref. no.			Cat. no.	Ref. no.
16	FDN13TF016EF	433316			FDH13TF016EF	433246
20	FDN13TF020EF	433322			FDH13TF020EF	433255
25	FDN13TF025EF	433328			FDH13TF025EF	433262
32	FDN13TF032EF	433334			FDH13TF032EF	433268
40	FDN13TF040EF	433340			FDH13TF040EF	433274
50	FDN13TF050EF	433346			FDH13TF050EF	433280
63	FDN13TF063EF	433352			FDH13TF063EF	433286
80	FDN13TF080GF	433519			FDH13TF080GF	433292
100	FDN13TF100GF	433522			FDH13TF100GF	433298
125	FDN13TF125GF	433525			FDH13TF125GF	433304
160	FDN13TF160GF	433527			FDH13TF160GF	433310

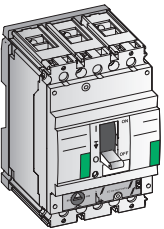


Selective Thermal Magnetic LTMD (Settable thermals calibrated at 40°C)

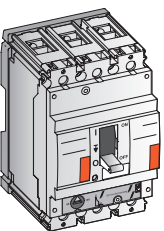
In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
16	FDN36TD016ED	430100	FDN436TD016ED	430117	FDN46TD016ED	430131	-	-
20	FDN36TD020ED	430101	FDN436TD020ED	430118	FDN46TD020ED	430132	-	-
25	FDN36TD025ED	430102	FDN436TD025ED	430119	FDN46TD025ED	430133	-	-
32	FDN36TD032ED	430103	FDN436TD032ED	430120	FDN46TD032ED	430134	-	-
40	FDN36TD040ED	430104	FDN436TD040ED	430121	FDN46TD040ED	430135	-	-
50	FDN36TD050ED	430105	FDN436TD050ED	430122	FDN46TD050ED	430136	-	-
63	FDN36TD063ED	430106	FDN436TD063ED	430123	FDN46TD063ED	430137	FDN456TD063ED	430129
80	FDN36TD080GD	430630	FDN436TD080GD	430688	FDN46TD080GD	430752	FDN456TD080GD	430718
100	FDN36TD100GD	430633	FDN436TD100GD	430691	FDN46TD100GD	430755	FDN456TD100GD	430721
125	FDN36TD125GD	430636	FDN436TD125GD	430694	FDN46TD125GD	430758	FDN456TD125GD	430724
160	FDN36TD160GD	433572	FDN436TD160GD	433578	FDN46TD160GD	433590	FDN456TD160GD	433584



16	FDH36TD016ED	430020	FDH436TD016ED	430037	FDH46TD016ED	430051	-	-
20	FDH36TD020ED	430021	FDH436TD020ED	430038	FDH46TD020ED	430052	-	-
25	FDH36TD025ED	430022	FDH436TD025ED	430039	FDH46TD025ED	430053	-	-
32	FDH36TD032ED	430023	FDH436TD032ED	430040	FDH46TD032ED	430054	-	-
40	FDH36TD040ED	430024	FDH436TD040ED	430041	FDH46TD040ED	430055	-	-
50	FDH36TD050ED	430025	FDH436TD050ED	430042	FDH46TD050ED	430056	-	-
63	FDH36TD063ED	430026	FDH436TD063ED	430043	FDH46TD063ED	430057	FDH456TD063ED	430049
80	FDH36TD080GD	430338	FDH436TD080GD	430396	FDH46TD080GD	430460	FDH456TD080GD	430426
100	FDH36TD100GD	430341	FDH436TD100GD	430399	FDH46TD100GD	430463	FDH456TD100GD	430429
125	FDH36TD125GD	430344	FDH436TD125GD	430402	FDH46TD125GD	430466	FDH456TD125GD	430432
160	FDH36TD160GD	435821	FDH436TD160GD	435827	FDH46TD160GD	435839	FDH456TD160GD	435833



25	FDL36TD025ED	430070	FDL436TD025ED	430082	FDL46TD025ED	430090	-	-
32	FDL36TD032ED	430071	FDL436TD032ED	430083	FDL46TD032ED	430091	-	-
40	FDL36TD040ED	430072	FDL436TD040ED	430084	FDL46TD040ED	430092	-	-
50	FDL36TD050ED	430073	FDL436TD050ED	430085	FDL46TD050ED	430093	-	-
63	FDL36TD063ED	430074	FDL436TD063ED	430086	FDL46TD063ED	430094	FDL456TD063ED	430087
80	FDL36TD080GD	430518	FDL436TD080GD	430557	FDL46TD080GD	430591	FDL456TD080GD	430568
100	FDL36TD100GD	430521	FDL436TD100GD	430560	FDL46TD100GD	430594	FDL456TD100GD	430571
125	FDL36TD125GD	430524	FDL436TD125GD	430563	FDL46TD125GD	430597	FDL456TD125GD	430574
160	FDL36TD160GD	435845	FDL436TD160GD	435848	FDL46TD160GD	435854	FDL456TD160GD	435851



One code covers: A standard fixed front connection breaker + DIN-Rail mounting kit + Toggle elongator + Breaker finishing covers + Fixation hardware

(1) Neutral on the left. If neutral on the right is needed, please contact us.
 (2) Fixation hardware not suitable for mounting of one individual single pole breaker (see page A.10)

Order Codes

A

B

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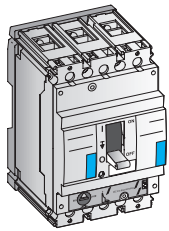
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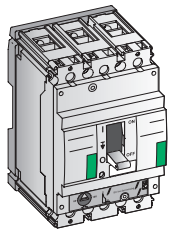


FD160 - Complete circuit breaker

Generator Thermal Magnetic LTMD (Settable thermals calibrated at 40°C)



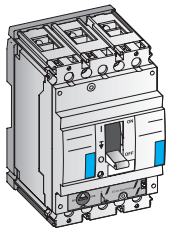
In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
25	FDN36TG025ED	430107	FDN436TG025ED	430124	FDN46TG025ED	430138	-	-
32	FDN36TG032ED	430108	FDN436TG032ED	430125	FDN46TG032ED	430139	-	-
40	FDN36TG040ED	430109	FDN436TG040ED	430126	FDN46TG040ED	430140	-	-
50	FDN36TG050ED	430110	FDN436TG050ED	430127	FDN46TG050ED	430141	-	-
63	FDN36TG063ED	430111	FDN436TG063ED	430128	FDN46TG063ED	430142	FDN456TG063ED	430130
80	FDN36TG080GD	430649	FDN436TG080GD	430707	FDN46TG080GD	430771	FDN456TG080GD	430729
100	FDN36TG100GD	430652	FDN436TG100GD	430710	FDN46TG100GD	430774	FDN456TG100GD	430732
125	FDN36TG125GD	430655	FDN436TG125GD	430713	FDN46TG125GD	430777	FDN456TG125GD	430735
160	FDN36TG160GD	433575	FDN436TG160GD	433581	FDN46TG160GD	433593	FDN456TG160GD	433587



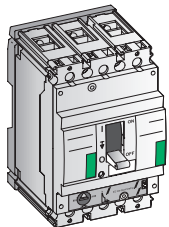
25	FDH36TG025ED	430027	FDH436TG025ED	430044	FDH46TG025ED	430058	-	-
32	FDH36TG032ED	430028	FDH436TG032ED	430045	FDH46TG032ED	430059	-	-
40	FDH36TG040ED	430029	FDH436TG040ED	430046	FDH46TG040ED	430060	-	-
50	FDH36TG050ED	430030	FDH436TG050ED	430047	FDH46TG050ED	430061	-	-
63	FDH36TG063ED	430031	FDH436TG063ED	430048	FDH46TG063ED	430062	FDH456TG063ED	430050
80	FDH36TG080GD	430357	FDH436TG080GD	430415	FDH46TG080GD	430479	FDH456TG080GD	430437
100	FDH36TG100GD	430360	FDH436TG100GD	430418	FDH46TG100GD	430482	FDH456TG100GD	430440
125	FDH36TG125GD	430363	FDH436TG125GD	430421	FDH46TG125GD	430485	FDH456TG125GD	430443
160	FDH36TG160GD	435824	FDH436TG160GD	435830	FDH46TG160GD	435842	FDH456TG160GD	435836

One code covers: A standard fixed front connection breaker + DIN-Rail mounting kit + Toggle elongator + Breaker finishing covers + Fixation hardware

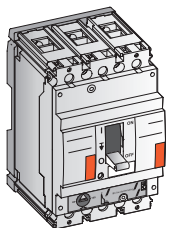
Motor Protection (Mag Break™ Magnetic Only Breakers (Rated at 40°C)



In (A)	3 pole		4 pole ⁽¹⁾	
3	FDN36MC003ED	436409	FDN436MC003ED	436411
7	FDN36MC007ED	430095	FDN436MC007ED	430112
12.5	FDN36MC012ED	430096	FDN436MC012ED	430113
20	FDN36MC020ED	430097	FDN436MC020ED	430114
30	FDN36MC030ED	430098	FDN436MC030ED	430115
50	FDN36MC050ED	430099	FDN436MC050ED	430116
80	FDN36MC080GD	430610	FDN436MC080GD	430668
100	FDN36MC100GD	430613	FDN436MC100GD	430671



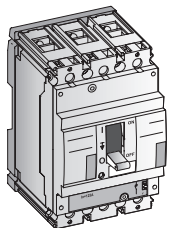
3	FDH36MC003ED	436396	FDH436MC003ED	436398
7	FDH36MC007ED	430015	FDH436MC007ED	430032
12.5	FDH36MC012ED	430016	FDH436MC012ED	430033
20	FDH36MC020ED	430017	FDH436MC020ED	430034
30	FDH36MC030ED	430018	FDH436MC030ED	430035
50	FDH36MC050ED	430019	FDH436MC050ED	430036
80	FDH36MC080GD	430318	FDH436MC080GD	430376
100	FDH36MC100GD	430321	FDH436MC100GD	430379



20	FDL36MC020ED	430065	FDL436MC020ED	430077
30	FDL36MC030ED	430066	FDL436MC030ED	430078
50	FDL36MC050ED	430067	FDL436MC050ED	430079
80	FDL36MC080GD	430498	FDL436MC080GD	430537
100	FDL36MC100GD	430501	FDL436MC100GD	430540

One code covers: A standard fixed front connection breaker + DIN-Rail mounting kit + Toggle elongator + Breaker finishing covers + Fixation hardware + IPXXB covers (Finger protection on connection clamps)

Complete Non-Automatic Circuit Breaker (Switch rated at 40°C)



In (A)	3 pole		4 pole ⁽¹⁾	
63	FDY306D063ED	430150	FDY406D063ED	430151
160	FDY306D160GD	430805	FDY406D160GD	430810

One code covers: A standard fixed front connection breaker + DIN-Rail mounting kit + Toggle elongator + Breaker finishing covers + Fixation hardware

(1) Neutral on the left. If neutral on the right is needed, please contact us.

FD frame

Intro

A

B

C

D

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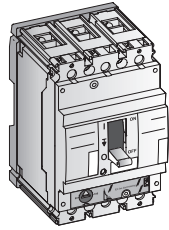
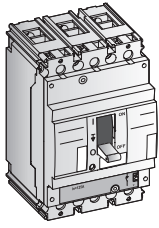
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FD160 - Complete Circuit Breaker

Line Thermal Magnetic LTM or LTMD (Settable Thermals calibrated at 55°C)



	3 pole 3 trips			3 pole 3 trips		
	In (A)	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
25 kA FDE	16	FDE36T5C016EF	436582	FDS36T5D016ED	430546	
	20	FDE36T5C020EF	436583	FDS36T5D020ED	430577	
	25	FDE36T5C025EF	436584	FDS36T5D025ED	430578	
	32	FDE36T5C032EF	436588	FDS36T5D032ED	430579	
	40	FDE36T5C040EF	436589	FDS36T5D040ED	430580	
	50	FDE36T5C050EF	436591	FDS36T5D050ED	430814	
	63	FDE36T5C063EF	436593	FDS36T5D063ED	430816	
	80	FDE36T5C080GF	436594	FDS36T5D080GD	430817	
	100	FDE36T5C100GF	436595	FDS36T5D100GD	430819	
	125	FDE36T5C125GF	436596	FDS36T5D125GD	430820	
	160	FDE36T5C155GF	436600	FDS36T5D160GD	430822	
50 kA FDN	16	FDN36T5D016ED	430833	FDH36T5D016ED	430850	
	20	FDN36T5D020ED	430835	FDH36T5D020ED	430851	
	25	FDN36T5D025ED	430836	FDH36T5D025ED	430853	
	32	FDN36T5D032ED	430838	FDH36T5D032ED	430854	
	40	FDN36T5D040ED	430839	FDH36T5D040ED	430857	
	50	FDN36T5D050ED	430841	FDH36T5D050ED	430862	
	63	FDN36T5D063ED	430842	FDH36T5D063ED	430866	
	80	FDN36T5D080GD	430844	FDH36T5D080GD	430871	
	100	FDN36T5D100GD	430845	FDH36T5D100GD	430874	
	125	FDN36T5D125GD	430847	FDH36T5D125GD	430875	
	160	FDN36T5D160GD	430848	FDH36T5D160GD	430881	
One code covers: A standard fixed front connection breaker + Fixation hardware + DIN rail mounting kit (Except 25kA variant)						

Order Codes

Intro

A

B

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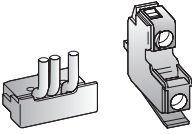
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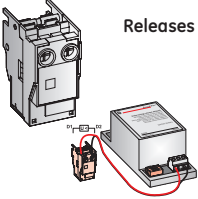
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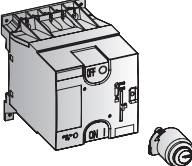


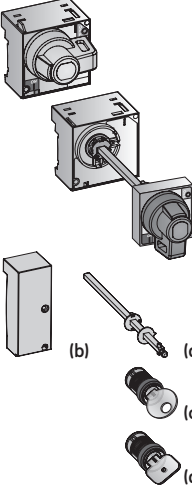
FD - Internal accessories

Contacts	Normally open		Normally closed		Changeover	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Aux. switch right mounted	FAS10R	430837	FAS01R	430831	-
	Aux. switch left mounted	FAS10L	430834	FAS01L	430828	-
	Bell alarm trip unit	FABAT10	430818	FABAT01	430815	-
	Bell alarm RCD device	FABAT10	430818	FABAT01	430815	-
	Bell alarm mechanism ⁽¹⁾	-	-	-	-	FDBAM11

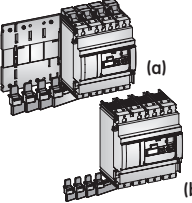
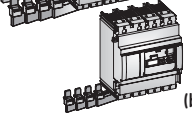
Releases	Shunt		Undervoltage		Delayed undervoltage		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	12V AC/DC	FASHTB	430840	FAUVRB	431960	-	
	24V AC/DC	FASHTD	430843	FAUVRD	430861	-	
	48V AC/DC	FASHTF	430846	FAUVRF	430864	-	
	60V AC/DC	FASHTH	435118	FAUVRH	435120	-	
	110V AC/DC	FASHTJ	430849	FAUVRJ	430867	-	
	220/240V AC/DC	FASHTN	430852	FAUVRN	430870	FAUVDN	430858
	400/415V AC	FASHTU	430855	FAUVRU	436472	-	
	440/480V AC	-	-	FAUVRU	430873	-	

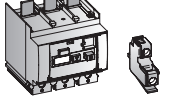
FD - Operators

Electrical operators	Direct on device		Rotary handle for use through door or cover plate ⁽³⁾		Panel or door mounted	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	24V AC/DC	FDEMF	430926	-	-	-
	48V AC/DC	FDEMF	430929	-	-	-
	60V AC/DC	FDEMFH	430932	-	-	-
	110V AC/DC	FDEMFJ	430935	-	-	-
	220/250V AC/DC	FDEMFN	430938	-	-	-
	400/440V AC	FDEMF8	430920	-	-	-
	Keylock for operator Ronis ⁽²⁾	FD1BRE	430877	-	-	-
	Keylock for operator Profalux ⁽²⁾	FD1BPE	430876	-	-	-

Rotary handles	Direct on device		Rotary handle for use through door or cover plate ⁽³⁾		Panel or door mounted		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	Grey	FDNRF/5	436478	FDNRC/5	436474	-	
	Red	FDNRFV/5	436479	FDNRCV/5	436475	-	
	Grey + Early closing Aux. Switches 2xNO ⁽⁴⁾	-	-	FDNRY/5	436487	-	
	Red + Early closing Aux. Switches 2xNO ⁽⁴⁾	-	-	FDNRYV/5	436488	-	
	Grey	-	-	-	-	FDNRD/5	436476
	Red	-	-	-	-	FDNRDV/5	436477
	Grey + Early closing Aux. Switches 2xNO ⁽⁴⁾	-	-	-	-	FDNRZ/5	436489
	Red + Early closing Aux. Switches 2xNO ⁽⁴⁾	-	-	-	-	FDNRZV/5	436490
	Accessories						
	Extension shaft kit (max. 600 mm) (a)	FDNRE	430986	Only for use with panel or door mounted type			
	Side-by-side installation adapter kit (b)	FDNR4	430971	Not for use with panel or door mounted type			
	Ronis keylock 1104B nr. BC 1027 ⁽²⁾ (c)	FA1BR1	430088				
	Ronis keylock 1104B nr. BC 1053 ⁽²⁾ (c)	FA1BR2	430089				
	Ronis keylock 1104B nr. BC 2932 ⁽²⁾ (c)	FA1BR3	430504				
	Ronis keylock 1104B nr. BC 2911 ⁽²⁾ (c)	FA1BR4	430505				
Ronis keylock 1104B nr. BC 2936 ⁽²⁾ (c)	FA1BR5	430506					
Ronis keylock 1104B nr. BC 2940 ⁽²⁾ (c)	FA1BR6	430507					
Ronis lock with random key ⁽²⁾ (c)	FA1BRH	430068					
Profalux lock with random key ⁽²⁾ (d)	FA1BPH	430813					

FD - Residual current devices

RCD side mounted ⁽⁵⁾	Standard		3 pole		4 pole	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Voltage 220/440V AC	(a) FDQDS3M/6	431095	FDQDS4M/6	431103	-
	Voltage 400/690V AC	(a) FDQDS3H/6	431090	FDQDS4H/6	431101	-
	One code covers an RCD with: DIN-Rail mounting kit & multidirectional supply kit					
Side connected only						
	Voltage 220/440V AC	(b) FDQDI3M/6	431086	FDQDI4M/6	431088	-
	One code covers an RCD with: DIN-Rail mounting kit and interconnection kit.					

RCD bottom mounted ⁽⁵⁾ (below trip unit area)	Normally open		Normally closed			
	Cat. no.	Ref. no.	Cat. no.	Ref. no.		
	Voltage 220/440V AC	FDQDB3M/6	431078	FDQDB4M/6	431084	
	Voltage 400/690V AC	FDQDB3H/6	431076	FDQDB4H/6	431080	
Bell Alarm RCD device	FABAT10	430818	FABAT 01	430815	-	
One code covers an RCD with: Sealable connection cover (cut-out adaptor FDUF)						

(1) Not for all FDC and FDE types

(2) Key included

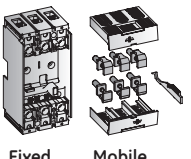
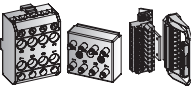
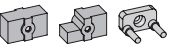
(3) Add door flange FDFH to allow use of the door interlock options

(4) On request 1xNO/1xNC is available.

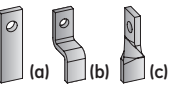
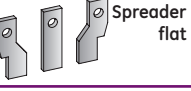
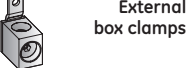
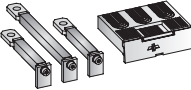
(5) Not possible on FDC and FDE types with TF and TC trip unit. 100/200V AC rating available on request



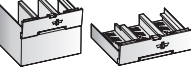
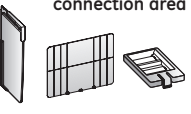
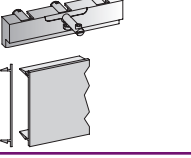
FD - Plug-in system⁽¹⁾

Main system complete	3 pole		4 pole		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
 <p>Fixed Mobile</p>	Complete set for breaker	FDDDF3	430893	FDDDF4	430896
	Fixed part for breaker	FDDFF3	430899	FDDFF4	430902
	Mobile part for breaker	FDDMP3	430905	FDDMP4	430908
	Fixed part for breaker & RCD	FDDFQ3	433489	FDDFQ4	433492
	Mobile part for breaker & RCD	FDDMP3	430905	FDDMP4	430908
	Complete set: Fixed and mobile part with connection and fixation hardware Fixed part: Fixed base with connection and fixation and hardware Mobile part: Mechanism trip device, terminal shields and set of 3 or 4 pole plugs				
 <p>Auxiliary disconnects secondary wiring⁽²⁾</p>	Complete set 8 pole	FAPFM	430824		
	Fixed part 8 pole	FAPF8	430823		
	Mobile part 8 pole	FAPM8	430826		
	10 pole wired Plug & Socket for Plug-in Device	FAPPS	430827		
 <p>Insertion prevention kit (of ...wrong A rating)</p>	FAPIP	430825			

FD - Connections: Optional⁽⁴⁾

Extenders	3 pole		4 pole		
	(a)	(b)	(c)		
	Standard flat type	FDBES3	430887	FDBES4	430888
	Heightened type	FDBEH3	430885	FDBEH4	430886
	Twisted 90°	FDBEA3	430883	FDBEA4	430884
 <p>Spreaders (a), (b), (c)</p>	Pole spacing 35 mm	FDBSS3	430891	FDBSS4	430892
 <p>External box clamps</p>	Cable Cu/Al 95 mm ² ⁽³⁾	FDTCA1316	433400	FDTCA1416	433401
 <p>Rear connections</p>	Set 3 pole (2 short, 1 long)	FDBRC3	430889	-	-
	Set 4 pole (2 short, 2 long)	-	-	FDBRC4	430890
	Spares, set of 2 short types	FDBRCS2	433358	-	-
	Spares, set of 2 long types	FDBRCL2	433357	-	-

FD - Installation accessories

Terminal shields (with finishing covers)	3 pole		4 pole		
	Long, set of 2 pcs.	FDJL3	430951	FDJL4	430954
	Short, set of 2 pcs.	FDJS3	430960	FDJS4	430963
 <p>Specific to connection area</p>	Phase separators, set of 12 pcs.	FDJP	430957		
	Backplate set of 2 pcs. (3 or 4 pole)	FDJB	430945		
	Finger protection IPXXB (set of 12 pcs.) ⁽⁵⁾	FDJK	430069		
 <p>Covers</p>	Cutout adaptor, Breaker + Trip unit	FDUF3	430830	FDUF4	430832
	Cutout filler for cover plate (64 mm), length of 1.2 m	FBF6	883970	-	-

(1) Plug-in system max. 125A.




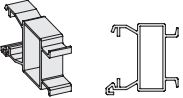
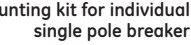

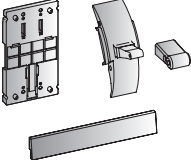
(2) Only necessary when internal accessories or an electrical operator are used.

(3) External box clamps are always delivered with standard extender

(4) Set for equipping the line OR load side of breaker.

(5) Supplied with mag. break types.

FD - Installation accessories (continued)

	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
Padlocking devices for toggle operator ⁽¹⁾  	Padlocking removable	FD1PR	430879		
	Padlocking fixed	FD1PF	430878		
Circuit indication/coding 	Set of 20 blank labels	FAC	430821		
Heightning set for Redline/ElfaPlus MCB's 	Length = (18 mod. of 18 mm) 354 mm	FDKE	617947		
Mounting kit for individual single pole breaker 	Set of 50 pcs.	FDKM1	436720		
Door Flanges 		3 pole		4 pole	
	Breaker front face and RCD	FDF3	430941	FDF4	430942
	Rotary handle (through cover plate model)	FDFH	430829	-	-
	Electrical operator	FDFE	432010	-	-
Spare parts 	DIN-rail adaptor kit ⁽²⁾	FDKD3	430966	FDKD4	430967
	Finishing covers, set of 2 pcs. ⁽²⁾	FUA3	431025	FUA4	431026
	Spare toggle (set of 5 pieces)	FDUT	433539	-	-

(1) Padlocks not included

(2) Supplied with breakers, not with all FDC and FDE types



- LTM**
Line thermal magnetic protection
- LTMD**
Selective thermal magnetic protection
- GTM**
Generator thermal magnetic protection
- Mag Break™**
Magnetic Only protection
- SMR1**
Selective electronic trip unit
- Y**
Non Automatic or switch (not mentioned in tables)

- ① Auxiliary contact left mounted (NO or NC) 1 or 2pcs.
- ② Auxiliary contact right mounted (NO or NC) 1 or 2pcs.
- ③ Bell Alarm thermal magnetic trip unit (NO or NC)
- ③^a Bell Alarm electronic trip unit (NO or NC)
- ④ Bell Alarm mechanism (NO or NC)
- ⑤ Shunt or Undervoltage release
- ⑤^a Actuator for electronic trip unit.
- ⑥ Operators
 - Rotary handle
 - Electrical operator
- ⑦ Bottom mounted RCD (below trip unit) (Insert indicates Bell alarm contact mounting)
- ⑧ Plug-in or draw-out system

FE Frame

Breaking capacities

Icu 400/415V AC in kA eff.

Type	V	N	H	L
FE160		50	80	150
FE250	36	50	80	150

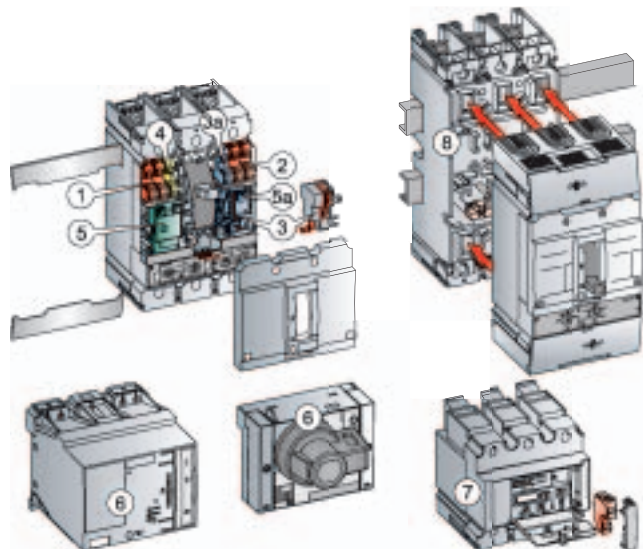
Protection

Trip Unit	Rated Current (A)	LTM	LTMD	GTM	Mag Break™	SMR1
FE160	3	-	-	-	N, H, L	-
	7	-	-	-	N, H, L	-
	12.5	-	-	-	N, H, L	-
	20	-	-	-	N, H, L	-
	25	N, H, L	-	-	-	N, H, L
	30	-	-	-	N, H, L	-
	32	N, H, L	-	-	-	-
	40	N, H, L	-	-	-	-
	50	N, H, L	-	-	N, H, L	-
	63	N, H, L	-	-	-	N, H, L
	80	N, H, L	-	-	N, H, L	-
	100	N, H, L	N, H, L	N, H, L	N, H, L	-
125	N, H, L	N, H, L	N, H, L	N, H, L	N, H, L	
160	N, H, L	N, H, L	N, H, L	N, H, L	N, H, L	
FE250	125	V	N, H, L	-	-	N, H, L
	160	V	N, H, L	N, H, L	N, H, L	N, H, L
	200	V	N, H, L	N, H, L	N, H, L	-
	250	V	N, H, L	N, H, L	N, H, L	N, H, L

Number of poles/ protected poles (trips)	V	N	H	L
3 pole 3 trips	V, N, H, L	N, H, L	N, H	N, H, L
4 pole 3 trips	N, H, L	N, H, L	N, H	N, H, L
4 pole 4 trips	V, N, H, L	N, H, L	N, H	-
4 pole 3.5 trips (N=50%) ⁽¹⁾	N, H, L	N, H, L	N, H	-

(1) Rated current ≥ 63A

Accessories (main types)



FE160 - Complete circuit breaker

Line Thermal Magnetic LTM (adjustable settings; calibrated at 40°C)

In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50 kA FEN	25	FEN36TA025JF	435103	FEN436TA025JF	435178	FEN46TA025JF	435214	-	-
	32	FEN36TA032JF	435106	FEN436TA032JF	435181	FEN46TA032JF	435217	-	-
	40	FEN36TA040JF	435109	FEN436TA040JF	435184	FEN46TA040JF	435220	-	-
	50	FEN36TA050JF	435112	FEN436TA050JF	435187	FEN46TA050JF	435223	-	-
	63	FEN36TA063JF	435115	FEN436TA063JF	435190	FEN46TA063JF	435226	FEN456TA063JF	435202
	80	FEN36TA080JF	431751	FEN436TA080JF	431838	FEN46TA080JF	431949	FEN456TA080JF	431886
	100	FEN36TA100JF	431757	FEN436TA100JF	431844	FEN46TA100JF	431955	FEN456TA100JF	431892
	125	FEN36TA125JF	431763	FEN436TA125JF	431850	FEN46TA125JF	431961	FEN456TA125JF	431898
160	FEN36TA160JF	431769	FEN436TA160JF	431856	FEN46TA160JF	431967	FEN456TA160JF	431904	
80 kA FEH	25	FEH36TA025JF	434772	FEH436TA025JF	434847	FEH46TA025JF	434883	-	-
	32	FEH36TA032JF	434775	FEH436TA032JF	434850	FEH46TA032JF	434886	-	-
	40	FEH36TA040JF	434778	FEH436TA040JF	434853	FEH46TA040JF	434889	-	-
	50	FEH36TA050JF	434781	FEH436TA050JF	434856	FEH46TA050JF	434892	-	-
	63	FEH36TA063JF	434784	FEH436TA063JF	434859	FEH46TA063JF	434895	FEH456TA063JF	434871
	80	FEH36TA080JF	431165	FEH436TA080JF	431252	FEH46TA080JF	431363	FEH456TA080JF	431300
	100	FEH36TA100JF	431171	FEH436TA100JF	431258	FEH46TA100JF	431369	FEH456TA100JF	431306
	125	FEH36TA125JF	431177	FEH436TA125JF	431264	FEH46TA125JF	431375	FEH456TA125JF	431312
160	FEH36TA160JF	431183	FEH436TA160JF	431270	FEH46TA160JF	431381	FEH456TA160JF	431318	
150 kA FEL	25	FEL36TA025JF	434970	FEL436TA025JF	435013	FEL46TA025JF	435049	-	-
	32	FEL36TA032JF	434973	FEL436TA032JF	435016	FEL46TA032JF	435052	-	-
	40	FEL36TA040JF	434976	FEL436TA040JF	435019	FEL46TA040JF	435055	-	-
	50	FEL36TA050JF	434979	FEL436TA050JF	435022	FEL46TA050JF	435058	-	-
	63	FEL36TA063JF	434982	FEL436TA063JF	435025	FEL46TA063JF	435061	FEL456TA063JF	435037
	80	FEL36TA080JF	431458	FEL436TA080JF	431545	FEL46TA080JF	431656	FEL456TA080JF	431593
	100	FEL36TA100JF	431464	FEL436TA100JF	431551	FEL46TA100JF	431662	FEL456TA100JF	431599
	125	FEL36TA125JF	431470	FEL436TA125JF	431557	FEL46TA125JF	431668	FEL456TA125JF	431605
160	FEL36TA160JF	431476	FEL436TA160JF	431563	FEL46TA160JF	431674	FEL456TA160JF	431611	

One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

Selective Thermal Magnetic LTMD (adjustable settings; calibrated at 40°C)

In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50 kA FEN	100	FEN36TD100JF	432945	FEN436TD100JF	432994	FEN46TD100JF	433061	FEN456TD100JF	433028
	125	FEN36TD125JF	432953	FEN436TD125JF	433001	FEN46TD125JF	433067	FEN456TD125JF	433034
	160	FEN36TD160JF	432971	FEN436TD160JF	433007	FEN46TD160JF	433073	FEN456TD160JF	433040
80 kA FEH	100	FEH36TD100JF	431007	FEH436TD100JF	432198	FEH46TD100JF	432287	FEH456TD100JF	432242
	125	FEH36TD125JF	431021	FEH436TD125JF	432205	FEH46TD125JF	432296	FEH456TD125JF	432250
	160	FEH36TD160JF	431965	FEH436TD160JF	432214	FEH46TD160JF	432303	FEH456TD160JF	432259
150 kA FEL	100	FEL36TD100JF	432332	FEL436TD100JF	432374	FEL46TD100JF	432907	FEL456TD100JF	432699
	125	FEL36TD125JF	432341	FEL436TD125JF	432573	FEL46TD125JF	432921	FEL456TD125JF	432747
	160	FEL36TD160JF	432349	FEL436TD160JF	432585	FEL46TD160JF	432927	FEL456TD160JF	432834

One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

Generator Thermal Magnetic GTM (adjustable settings; calibrated at 40°C)

In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50 kA FEN	100	FEN36TG100JF	435139	FEN436TG100JF	436014	FEN46TG100JF	435250	FEN456TG100JF	436020
	125	FEN36TG125JF	435142	FEN436TG125JF	436015	FEN46TG125JF	435253	FEN456TG125JF	436021
	160	FEN36TG160JF	435148	FEN436TG160JF	436016	FEN46TG160JF	435259	FEN456TG160JF	436022
80 kA FEH	100	FEH36TG100JF	434808	FEH436TG100JF	435902	FEH46TG100JF	434919	FEH456TG100JF	436026
	125	FEH36TG125JF	434811	FEH436TG125JF	435903	FEH46TG125JF	434922	FEH456TG125JF	436027
	160	FEH36TG160JF	434817	FEH436TG160JF	435904	FEH46TG160JF	434928	FEH456TG160JF	436028
150 kA FEL	100	FEL36TG100JF	435923	FEL436TG100JF	435944	FEL46TG100JF	435992	FEL456TG100JF	435962
	125	FEL36TG125JF	435926	FEL436TG125JF	435947	FEL46TG125JF	435995	FEL456TG125JF	435965
	160	FEL36TG160JF	435932	FEL436TG160JF	435950	FEL46TG160JF	436002	FEL456TG160JF	435968

One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

(1) Neutral on the left. If neutral on the right is needed, please contact us.



FE160 - Complete circuit breaker

Motor protection (Mag Break™) Magnetic Only Breaker⁽²⁾ (Rated at 40°C)

Order Codes

Intro

A

B

C

D

E

F

G

X



In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FEN	3	FEN36MC003JF	436365	-	-	-	-	-
	7	FEN36MC007JF	435073	-	-	-	-	-
	12.5	FEN36MC012JF	435076	-	-	-	-	-
	20	FEN36MC020JF	435079	-	-	-	-	-
	30	FEN36MC030JF	435082	-	-	-	-	-
	50	FEN36MC050JF	435085	FEN436MC050JF	435160	-	-	-
	80	FEN36MC080JF	435899	-	-	-	-	-
	100	FEN36MC100JF	435088	FEN436MC100JF	435163	-	-	-
125	FEN36MC125JF	436335	FEN436MC125JF	436356	-	-	-	
160	FEN36MC160JF	435094	FEN436MC160JF	435169	-	-	-	



80kA FEH	3	FEH36MC003JF	436361	-	-	-	-	-
	7	FEH36MC007JF	434742	-	-	-	-	-
	12.5	FEH36MC012JF	434745	-	-	-	-	-
	20	FEH36MC020JF	434748	-	-	-	-	-
	30	FEH36MC030JF	434751	-	-	-	-	-
	50	FEH36MC050JF	434754	FEH436MC050JF	434829	-	-	-
	80	FEH36MC080JF	435893	-	-	-	-	-
	100	FEH36MC100JF	434757	FEH436MC100JF	434832	-	-	-
125	FEH36MC125JF	436327	FEH436MC125JF	436329	-	-	-	
160	FEH36MC160JF	434763	FEH436MC160JF	434838	-	-	-	



150kA FEL	3	FEL36MC003JF	436363	-	-	-	-	-
	7	FEL36MC007JF	434940	-	-	-	-	-
	12.5	FEL36MC012JF	434943	-	-	-	-	-
	20	FEL36MC020JF	434946	-	-	-	-	-
	30	FEL36MC030JF	434949	-	-	-	-	-
	50	FEL36MC050JF	434952	FEL436MC050JF	434994	-	-	-
	80	FEL36MC080JF	435896	-	-	-	-	-
	100	FEL36MC100JF	434955	FEL436MC100JF	434997	-	-	-
125	FEL36MC125JF	436331	FEL436MC125JF	436333	-	-	-	
160	FEL36MC160JF	434961	FEL436MC160JF	435004	-	-	-	

One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

Selective Electronic Trip Unit (SMR1) without Rating Plug



In (A)	3 pole		4 pole ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50 kA FEN	25	FEN36AA025JBF	435881	FEN46AA025JBF	435887
	63	FEN36AA063JEF	435884	FEN46AA063JEF	435890
	125	FEN36AA125JGF	431698	FEN46AA125JGF	431787
	160	FEN36AA160JJF	431703	FEN46AA160JJF	431790



80 kA FEH	25	FEH36AA025JBF	435857	FEH46AA025JBF	435863
	63	FEH36AA063JEF	435860	FEH46AA063JEF	435866
	125	FEH36AA125JGF	431112	FEH46AA125JGF	431201
	160	FEH36AA160JJF	431117	FEH46AA160JJF	431204

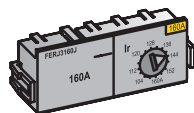


150 kA FEL	25	FEL36AA025JBF	435869	FEL46AA025JBF	435875
	63	FEL36AA063JEF	435872	FEL46AA063JEF	435878
	125	FEL36AA125JGF	431405	FEL46AA125JGF	431494
	160	FEL36AA160JJF	431410	FEL46AA160JJF	431497

One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

Ir 0.625: 1xIn

Adjustable Rating Plugs for Trip Units SMR1



In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
25A	16	FERJ3B0016	432174	FERJ43B0016	432210	FERJ4B0016	432276	-	-
	25	FERJ3B0025	432177	FERJ43B0025	432213	FERJ4B0025	432279	-	-
63A	40	FERJ3E0040	432180	FERJ43E0040	432216	FERJ4E0040	432282	-	-
	63	FERJ3E0063	432183	FERJ43E0063	432219	FERJ4E0063	432285	FERJ45E0063	432249
125A	80	FERJ3G0080	432186	FERJ43G0080	432222	FERJ4G0080	432288	FERJ45G0080	432252
	125	FERJ3G0125	432192	FERJ43G0125	432228	FERJ4G0125	432294	FERJ45G0125	432258
160A	100	FERJ3J0100	432189	FERJ43J0100	432225	FERJ4J0100	432291	FERJ45J0100	432255
	160	FERJ3J0160	432195	FERJ43J0160	432231	FERJ4J0160	432297	FERJ45J0160	432261

(1) Neutral on the left. If neutral on the right is needed, please contact us.

(2) All 3 and 7Amp FE size magnetic only breaker types have a breaking capacity at 690 Volt of 10kA.



FE160 - Complete circuit breaker

Ir 0.4: 1xIn		Switchable Rating Plugs for Trip Units SMR1							
In (A)	Cat. no.	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
25A	25	FERS3B0025	432312	FERS43B0025	432330	FERS4B0025	432363	-	-
63A	63	FERS3E0063	432315	FERS43E0063	432333	FERS4E0063	432366	FERS45E0063	432348
125A	125	FERS3G0125	432318	FERS43G0125	432336	FERS4G0125	432369	FERS45G0125	432351
160A	160	FERS3J0160	432321	FERS43J0160	432339	FERS4J0160	432372	FERS45J0160	432354

Selective Electronic Trip Unit (SMR1) with Switchable Rating Plug									
In (A)	Cat. no.	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
50 kA FEN	125	FEN36SA125JGF	431724	FEN436SA125JGF	431811	FEN46SA125JGF	431922	FEN456SA125JGF	431871
	160	FEN36SA160JJF	431727	FEN436SA160JJF	431814	FEN46SA160JJF	431925	FEN456SA160JJF	431874
80 kA FEH	125	FEH36SA125JGF	431138	FEH436SA125JGF	431225	FEH46SA125JGF	431336	FEH456SA125JGF	431285
	160	FEH36SA160JJF	431141	FEH436SA160JJF	431228	FEH46SA160JJF	431339	FEH456SA160JJF	431288
150 kA FEL	125	FEL36SA125JGF	431431	FEL436SA125JGF	431518	FEL46SA125JGF	431629	FEL456SA125JGF	431578
	160	FEL36SA160JJF	431434	FEL436SA160JJF	431521	FEL46SA160JJF	431632	FEL456SA160JJF	431581
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware									

Complete Non-Automatic Circuit Breaker (Switch rated at 40°C)									
In (A)	Cat. no.	3 pole		4 pole ⁽¹⁾					
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
160	FEY306D160JF	431988	FEY406D160JF	431994					
FEY	One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware								

(1) Neutral on the left. If neutral on the right is needed, please contact us

FE frame

Intro

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B

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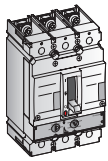
G

X



FE250 - Complete circuit breaker

Line Thermal Magnetic LTM (adjustable settings; calibrated at 40°C)



36 kA FEV	In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	125	FEV36TA125KF	432416	FEV46TA125KF	431082
	160	FEV36TA160KF	436798	FEV46TA160KF	436817
	200	FEV36TA200KF	431058	FEV46TA200KF	431094
	250	FEV36TA250KF	431061	FEV46TA250KF	431097
One code covers: A standard fixed front connection breaker + Fixation hardware					

Selective Thermal Magnetic LTMD (adjustable settings; calibrated at 40°C)



50 kA FEN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	125	FEN36TD125KF	432962	FEN436TD125KF	433004	FEN46TD125KF	433070	FEN456TD125KF	433037
	160	FEN36TD160KF	432976	FEN436TD160KF	433010	FEN46TD160KF	433076	FEN456TD160KF	433043
	200	FEN36TD200KF	432979	FEN436TD200KF	433013	FEN46TD200KF	433079	FEN456TD200KF	433046
	250	FEN36TD250KF	432982	FEN436TD250KF	433016	FEN46TD250KF	433082	FEN456TD250KF	433049



80 kA FEH	125	FEH36TD125KF	431393	FEH436TD125KF	432209	FEH46TD125KF	432300	FEH456TD125KF	432254
	160	FEH36TD160KF	431980	FEH436TD160KF	432218	FEH46TD160KF	432307	FEH456TD160KF	432263
	200	FEH36TD200KF	432076	FEH436TD200KF	432223	FEH46TD200KF	432311	FEH456TD200KF	432266
	250	FEH36TD250KF	432096	FEH436TD250KF	432227	FEH46TD250KF	432316	FEH456TD250KF	432269



150 kA FEL	125	FEL36TD125KF	432344	FEL436TD125KF	432576	FEL46TD125KF	432924	FEL456TD125KF	432780
	160	FEL36TD160KF	432353	FEL436TD160KF	432588	FEL46TD160KF	432930	FEL456TD160KF	432843
	200	FEL36TD200KF	432357	FEL436TD200KF	432618	FEL46TD200KF	432933	FEL456TD200KF	432868
	250	FEL36TD250KF	432361	FEL436TD250KF	432621	FEL46TD250KF	432936	FEL456TD250KF	432871
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware									

Generator Thermal Magnetic GTM (adjustable settings; calibrated at 40°C)



50 kA FEN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FEN36TG160KF	435151	FEN436TG160KF	436017	FEN46TG160KF	435262	FEN456TG160KF	436023
	200	FEN36TG200KF	435154	FEN436TG200KF	436018	FEN46TG200KF	435265	FEN456TG200KF	436024
	250	FEN36TG250KF	435157	FEN436TG250KF	436019	FEN46TG250KF	435268	FEN456TG250KF	436025



80 kA FEH	160	FEH36TG160KF	434820	FEH436TG160KF	435905	FEH46TG160KF	434931	FEH456TG160KF	435908
	200	FEH36TG200KF	434823	FEH436TG200KF	435906	FEH46TG200KF	434934	FEH456TG200KF	435909
	250	FEH36TG250KF	434826	FEH436TG250KF	435907	FEH46TG250KF	434937	FEH456TG250KF	435910



150 kA FEL	160	FEL36TG160KF	435935	FEL436TG160KF	435953	FEL46TG160KF	436005	FEL456TG160KF	435971
	200	FEL36TG200KF	435938	FEL436TG200KF	435956	FEL46TG200KF	436008	FEL456TG200KF	435974
	250	FEL36TG250KF	435941	FEL436TG250KF	435959	FEL46TG250KF	436011	FEL456TG250KF	435977
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware									

Motor protection (Mag Break™) Magnetic Only Breaker (Rated at 40°C)



50 kA FEN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FEN36MC160KF	435097	FEN436MC160KF	435172
	200	FEN36MC200KF	436764	FEN436MC200KF	436765
	250	FEN36MC250KF	435100	FEN436MC250KF	435175



80 kA FEH	160	FEH36MC160KF	434766	FEH436MC160KF	434841
	200	FEH36MC200KF	436754	FEH436MC200KF	436755
	250	FEH36MC250KF	434769	FEH436MC250KF	434844



150 kA FEL	160	FEL36MC160KF	434964	FEL436MC160KF	435007
	200	FEL36MC200KF	436756	FEL436MC200KF	436763
	250	FEL36MC250KF	434967	FEL436MC250KF	435010
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware					

(1) Neutral on the left. If neutral on the right is needed, please contact us.



FE250 - Complete circuit breaker

		Selective Electronic Trip Unit (SMR1) without Rating Plug								
		3 pole		4 pole ⁽¹⁾						
50 kA FEN	In (A)	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
		125	FEN36AA125KGF	431920	FEN46AA125KGF	431938				
	160	FEN36AA160KJF	431706	FEN46AA160KJF	431793					
	250	FEN36AA250KKF	431709	FEN46AA250KKF	431796					
80 kA FEH	125	FEH36AA125KGF	431116	FEH46AA125KGF	431824					
	160	FEH36AA160KJF	431120	FEH46AA160KJF	431207					
	250	FEH36AA250KKF	431123	FEH46AA250KKF	431210					
150 kA FEL	125	FEL36AA125KGF	431836	FEL46AA125KGF	431890					
	160	FEL36AA160KJF	431413	FEL46AA160KJF	431500					
	250	FEL36AA250KKF	431416	FEL46AA250KKF	431503					
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware										
Ir 0.625: 1xIn		Adjustable Rating Plugs for Trip Units SMR1								
		In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
125A	80	FERJ3G0080	432186	FERJ43G0080	432222	FERJ4G0080	432288	FERJ45G0080	432252	
	125	FERJ3G0125	432192	FERJ43G0125	432228	FERJ4G0125	432294	FERJ45G0125	432258	
160A	100	FERJ3J0100	432189	FERJ43J0100	432225	FERJ4J0100	432291	FERJ45J0100	432255	
	160	FERJ3J0160	432195	FERJ43J0160	432231	FERJ4J0160	432297	FERJ45J0160	432261	
250A	160	FERJ3K0160	432204	FERJ43K0160	432240	FERJ4K0160	432306	FERJ45K0160	432270	
	250	FERJ3K0250	432207	FERJ43K0250	432243	FERJ4K0250	432309	FERJ45K0250	432273	
Ir 0.4: 1xIn		Switchable Rating Plugs for Trip Units SMR1								
		In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
125A	125	FERS3G0125	432318	FERS43G0125	432336	FERS4G0125	432369	FERS45G0125	432351	
	160	FERS3J0160	432321	FERS43J0160	432339	FERS4J0160	432372	FERS45J0160	432354	
250A	250	FERS3K0250	432327	FERS43K0250	432345	FERS4K0250	432378	FERS45K0250	432360	
			Selective Electronic Trip Unit (SMR1) with Switchable Rating Plug							
50 kA FEN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	160	FEN36SA160KJF	431730	FEN436SA160KJF	431817	FEN46SA160KJF	431928	FEN456SA160KJF	431877	
	250	FEN36SA250KKF	431733	FEN436SA250KKF	431820	FEN46SA250KKF	431931	FEN456SA250KKF	431880	
80 kA FEH	160	FEH36SA160KJF	431144	FEH436SA160KJF	431231	FEH46SA160KJF	431342	FEH456SA160KJF	431291	
	250	FEH36SA250KKF	431147	FEH436SA250KKF	431234	FEH46SA250KKF	431345	FEH456SA250KKF	431294	
150 kA FEL	160	FEL36SA160KJF	431437	FEL436SA160KJF	431524	FEL46SA160KJF	431635	FEL456SA160KJF	431584	
	250	FEL36SA250KKF	431440	FEL436SA250KKF	431527	FEL46SA250KKF	431638	FEL456SA250KKF	431587	
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware										
		Complete Non-Automatic Circuit Breaker (Switch rated at 40°C)								
		In (A)	3 pole		4 pole ⁽¹⁾					
FEY		250	FEY306D250KF	431991	FEY406D250KF	431997				
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware										

(1) Neutral on the left. If neutral on the right is needed, please contact us

FE frame

Intro

A

B

C

D

E

F

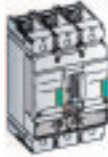
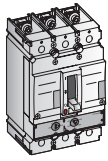
G

X



FE250 - Complete Circuit Breaker

Line Thermal Magnetic LTM or LTMD (Settable Thermals calibrated at 55°C)



		3 pole 3 trips				
	In (A)	Cat. no.	Ref. no.			
36 kA FDS	125	FEV36T5A125KF	431219			
	160	FEV36T5A160KF	431220			
	200	FEV36T5A200KF	431221			
	250	FEV36T5A225KF	431222			
50 kA FDN	100	FEN36T5D100KF	431223			
	125	FEN36T5D125KF	431224			
	160	FEN36T5D160KF	431226			
	200	FEN36T5D200KF	431229			
	250	FEN36T5D225KF	431232			
80 kA FDH	100	FEH36T5D125KF	431235			
	125	FEH36T5D125KF	431235			
	160	FEH36T5D160KF	431244			
	200	FEH36T5D200KF	431245			
	250	FEH36T5D250KF	431247			

One code covers: A standard, fixed front connection breaker + Fixation hardware

Order Codes

Intro

A

B

C

D

E

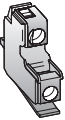
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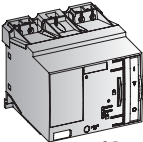
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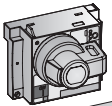
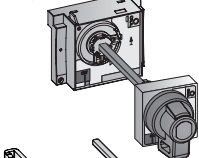
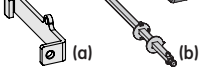
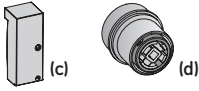
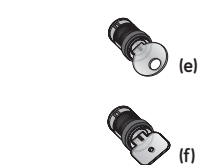


FE - Internal accessories

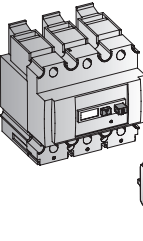
Contacts	Normally open		Normally closed		Cat. no.	Ref. no.
	Cat. no.	Ref. no.	Cat. no.	Ref. no.		
	Aux. switch right mounted	FAS10R	430837	FAS01R	430831	
	Aux. switch left mounted	FAS10L	430834	FAS01L	430828	
	Bell alarm electronic trip unit	FABAT10	430818	FABAT01	430815	
	Bell alarm thermal magnetic trip unit	FEBAT10	430970	FEBAT01	430969	
	Bell alarm mechanism	FABAM10	432003	FABAM01	432000	
	Bell alarm RCD device	FABAT10	430818	FABAT01	430815	
Releases	Shunt		Undervoltage		Delayed undervoltage	
	12V AC/DC	FASHTB	430840	FAUVRB	431960	-
	24V AC/DC	FASHTD	430843	FAUVRD	430861	-
	48V AC/DC	FASHTF	430846	FAUVRF	430864	-
	60V AC/DC	FASHTH	435118	FAUVRH	435120	-
	110 AC/DC	FASHTJ	430849	FAUVRJ	430867	-
	220/240V AC/DC	FASHTN	430852	FAUVRN	430870	FAUVDN 430858
	400/415V AC	FASHTU	430855	FAUVR8	436472	-
440/480V AC	-	-	FAUVRU	430873	-	

FE - Operators

Electrical operators			
	24V AC/DC	FEEMFD	432052
	48V AC/DC	FEEMFF	432055
	60V AC/DC	FEEMFH	432058
	110/130V AC/DC	FEEMFJ	432061
	220/250V AC/DC	FEEMFN	432064
	400/440V AC	FEEMF8	435812
Keylock for electr. operator Ronis ⁽¹⁾	FE1BRE	432012	
Keylock for electr. operator Profalux ⁽¹⁾	FE1BPE	432011	

Rotary handles	Direct on device		Rotary handle through door or cover plate ⁽²⁾		Panel or door mounted	
	Grey	FENRF/5	436495	FENRC/5	436491	-
	Red	FENRFV/5	436496	FENRCV/5	436492	-
	Grey + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	FENRY/5	436500	-
	Red + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	FENRYV/5	436501	-
	Grey	-	-	-	FENRD/5	436493
	Red	-	-	-	FENRDV/5	436494
	Grey + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	FENRZ/5	436502
	Red + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	FENRZV/5	436503
Accessories						
	Flex oper. adaptor push to trip, set of 2 pcs. (a)	FENFT	433531	Only for use with panel or door mounted type		
	Extension shaft kit (max. 600 mm) (b)	FDNRE	430986	Only for use with panel or door mounted type		
	Side-by-side installation adapter kit (c)	FENR4	432099	Not for use with panel or door mounted type		
	Adaptor for drawout (d)	FENRW	432120			
	Ronis keylock 1104B nr. BC 1027 ⁽¹⁾ (e)	FA1BR1	430088			
	Ronis keylock 1104B nr. BC 1053 ⁽¹⁾ (e)	FA1BR2	430089			
	Ronis keylock 1104B nr. BC 2932 ⁽¹⁾ (e)	FA1BR3	430504			
	Ronis keylock 1104B nr. BC 2911 ⁽¹⁾ (e)	FA1BR4	430505			
	Ronis keylock 1104B nr. BC 2936 ⁽¹⁾ (e)	FA1BR5	430506			
	Ronis keylock 1104B nr. BC 2940 ⁽¹⁾ (e)	FA1BR6	430507			
Ronis lock with random key ⁽¹⁾ (f)	FA1BRH	430068				
Profalux lock with random key ⁽¹⁾ (f)	FA1BPH	430813				

FE - Residual current devices

RCD bottom mounted ⁽⁴⁾	3 pole		4 pole		
	160A Voltage 220/440V AC	FEQDB3MJ/6	431136	FEQDB4MJ/6	431159
	160A Voltage 400/690V AC	FEQDB3HJ/6	431118	FEQDB4HJ/6	431145
	250A Voltage 220/440V AC	FEQDB3MK/6	431139	FEQDB4MK/6	431161
	250A Voltage 400/690V AC	FEQDB3HK/6	431124	FEQDB4HK/6	431151
		Normally open	Normally closed		
	Bell Alarm RCD device	FABAT10	430818	FABAT 01	430815
One code covers an RCD with: Fixation hardware + Sealable interconnection cover					

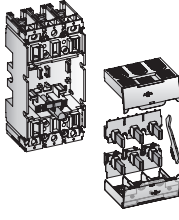
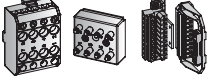
(1) Key included

(2) Add door flange FDFH for door lock options

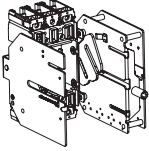
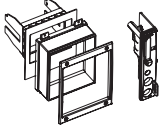

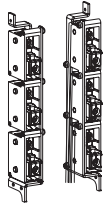
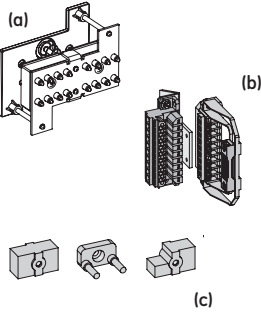
(3) On request 1xNO/1xNC is available.

(4) 100/200V AC execution available on request.

FE - Plug-in system

Main system		3 pole		4 pole	
		Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
	Complete set for breaker	FEDDF3	432034	FEDDF4	432037
	Fixed part for breaker	FEDFF3	432040	FEDFF4	432043
	Mobile part for breaker	FEDMP3	432046	FEDMP4	432049
	Fixed part for breaker & RCD	FEDFQ3	430987	FEDFQ4	431842
	Mobile part for breaker & RCD	FEDMP3	432046	FEDMP4	432049
	Complete set: Fixed and mobile part with connection and fixation hardware Fixed part: Fixed base with connection and fixation hardware Mobile part: Mechanism trip device, terminal shields and set of plugs				
Auxiliary disconnects⁽¹⁾ (Secondary wiring) 	Complete set 8 pole	FAPFM	430824		
	Fixed part 8 pole	FAPF8	430823		
	Mobile part 8 pole	FAPM8	430826		
	10 pole wired plug & socket for plug-in device	FAPPS	430827		
Spares	Set of nutplates and connection bolts (For connection of bases used as spare)	FEJN3	436467	FEJN4	436467

FE- Drawout system

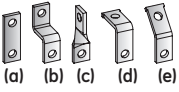
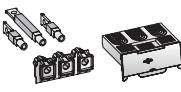
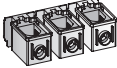

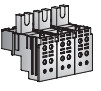
FE - Drawout system		3 pole		4 pole	
		Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
	Complete set for breaker				
	Drawout system for behind door applications	FEWB3	432538	FEWB4	432544
Through Door mounting kits 	Through Door Adaption kit with padlocking and keylocking option⁽²⁾				
	Toggle Operated	FEWT	432580		
	With Motor Operator	FEWM	432583		
	Toggle Operated FE frame FENRC & FENRY	FEWN	432586		
	Adaption kit ONLY with padlocking and keylocking option on door Breaker operation behind door	FAWE	432619		
Keylocks 	Keylock for Drawout position RONIS 1104b ⁽³⁾	FA1BRWD	432613		
	Keylock for Drawout position Profalux ⁽³⁾	FA1BPWD	432616		
Position Indication 	Set of 3 NO contacts (1 set per position)	FAS30W	432607		
	Set of 3 NO + NG contacts (1 set per position)	FAS33W	432610		
Set of 3 NO+NC contacts 	16 pole complete set for Drawout Breaker (a) (Secondary wiring)	FEWA2	432589		
	10 pole wired plug & socket for Plug-in or Drawout device (b)	FAPPS	430827		
	Rating adjustable interlock kit between fixed & Mobile parts (c)	FAPIP	430825		

(1) Only necessary when internal accessories or an electrical operator are used (a maximum of two per FE frame size)

(2) Keylocks not included

(3) A maximum of two locks can be placed (with through door kits only)

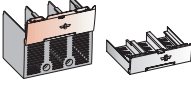
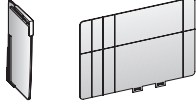
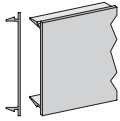
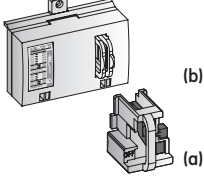

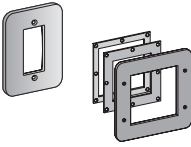
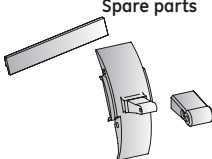
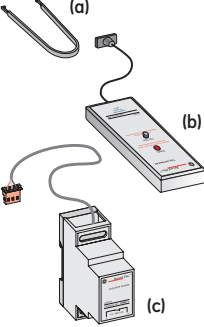
FE - Connections: Optional

Extenders ⁽¹⁾		3 pole		4 pole	
		Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
	Standard flat type	(a) FEBES3	432026	FEBES4	432027
	Heightened type	(b) FEBEH3	432024	FEBEH4	432025
	Twisted 90°	(c) FEBEA3	432022	FEBEA4	432023
	Angled 45°	(d) FEBE43	432018	FEBE44	432019
	Angled 90°	(e) FEBE93	432020	FEBE94	432021
Spreader flat ⁽¹⁾	Pole spacing 45mm	FEBSS3	432032	FEBSS4	432033
	Set 3 pole (2 short, 1 long)	FEBRC3	432028	-	-
	Set 4 pole (2 short, 2 long)	-	-	FEBRC4	432029
	Set 3 pole (3 short)	FEBRCS3	432190	-	-
	Set 4 pole (4 short)	-	-	FEBRCS4	432191
	Internal box clamps ⁽¹⁾	2,5 - 95mm ²		16 - 150mm ²	
		Box Clamp Cu/Al, set 3 pole	FETCA1316	432156	FETCA1320
	Box Clamp Cu/Al, set 4 pole	FETCA1416	432158	FETCA1420	432159
	External box clamps ⁽¹⁾	70 - 185mm ²			
		Box Clamp Cu/Al, set 3 pole ⁽²⁾	FETCA1323	432160	
	Box Clamp Cu/Al, set 4 pole ⁽²⁾	FETCA1423	432161		
	External connectors ⁽¹⁾	6 copper cable cores 25mm ² or 35 mm ²			
		Set 3 pole	FETCA630A	880954	
	Set 4 pole	FETCA640A	880955		

(1) Set for equipping the line OR load side of the breaker

(2) External box clamps are always delivered with standard extender

FE - Installation accessories

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
Terminal shields (with finishing covers) 	Long, set of 2 pcs.	FEJL3	432079	FEJL4	432082
	Short, set of 2 pcs.	FEJS3	432088	FEJS4	432091
Specific to connection area 	Phase separators, set of 12 pcs	FEJP	432085		
	Backplate set of 2 pcs (3 or 4 pole)	FEJB	432073		
Covers 	Cutout filler for cover plate (64 mm), length of 1.2 m	FBF6	883970		
Padlocking devices for toggle operator⁽¹⁾ 	Padlocking removable (a)	FD1PR	430879		
	Padlocking fixed (b)	FE1PF	432017		
Circuit indication/coding 	Set of 20 blank labels	FAC	430821		
Door flanges 	Breaker front face	FEFF3	432067	FEFF4	432068
	RCD unit front face for 3 and 4 pole	FDF3	430941	FDF3	430941
	Front face toggle area	FEFT	432071	FEFT	432071
	Rotary handle (through cover plate model)	FDH	430829	FDH	430829
	Motor operator	FEFE	430943	FDFE	430843
Spare parts 	Finishing covers, set of 2 pcs. ⁽²⁾	FEUA3	432162	FEUA4	432163
	Spare toggle (set of 5 pieces)	FEUT	433540	FEUT	433540
FE - Accessories electronic trip units					
	Rating plug tool (a)	FAR	433500		
	Battery test device SMR1 (b)	FAZ	431406		
	Longtime module (c)	FAMLT1	433376		

(1) Padlocks not included
 (2) Supplied with breakers, not with FEV type.

Notes

Grid of dotted lines for notes.

FE frame

Intro

A

B

C

D

E

F

G

X





FG Frame

Breaking capacities

Icu 400/415V AC in kA eff.

Type	N	H	L
FG400	50	80	150
FG630	50	80	150

Protection

Trip Unit	Rated Current (A)	SMR1	SMR2	Mag Break™
FG400	A			
	250	N, H, L	N, H, L	N, H, L
	350	-	N, H, L	-
FG630	400	N, H, L	N, H, L	N, H, L
	400	N, H, L	N, H, L	-
	500	N, H, L	N, H, L	N, H, L
	630	N, H, L	N, H, L	-

Number of poles / protected poles (trips)	SMR1	SMR2	Mag Break™
3 pole 3 trips	N, H, L	N, H, L	N, H, L
4 pole 3 trips	N, H, L	N, H, L	N, H, L
4 pole 4 trips	N, H, L	N, H, L	-
4 pole 3.5 trips (N=50%)	N, H, L	N, H, L	-

SMR1

Selective electronic protection.

SMR2

Modular electronic protection with enhanced functionality

Mag Break™

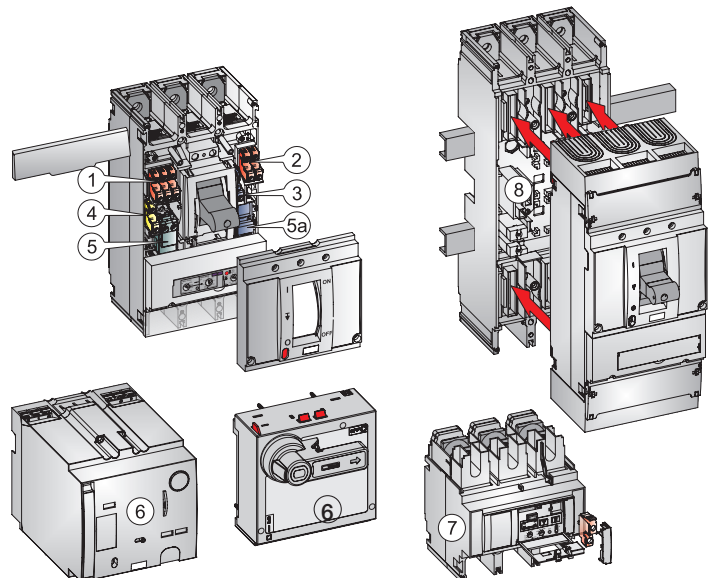
Magnetic Only protection

Y

Non Automatic or switch (not mentioned in tables)

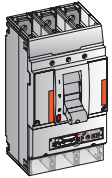
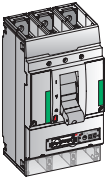
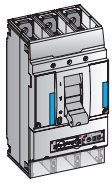
Accessories (main types)

- ① Auxiliary contact left mounted (NO or NC) 1, 2 or 3pcs.
- ② Auxiliary contact right mounted (NO or NC) 1 or 2pcs.
- ③ Bell Alarm electronic trip unit (NO or NC)
- ④ Bell Alarm mechanism (NO or NC)
- ⑤ Shunt or Undervoltage release
- ⑤a Actuator for electronic trip unit.
- ⑥ Operators
 - Rotary handle
 - Electrical operator
- ⑦ Bottom mounted RCD (below trip unit) (Insert indicates Bell alarm contact mounting)
- ⑧ Plug-in or draw-out system



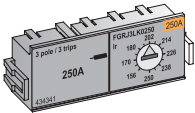
FG400 - Complete circuit breaker

Selective Electronic Trip Unit (SMR1) without Rating Plug



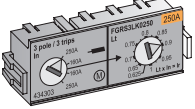
In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FGN	250	FGN36AA250LKF	434248	FGN46AA250LKF	434253			
	400	FGN36AA400LLF	431455	FGN46AA400LLF	431536			
80kA FGH	250	FGH36AA250LKF	434232	FGH46AA250LKF	434237			
	400	FGH36AA400LLF	431032	FGH46AA400LLF	431106			
150kA FGL	250	FGL36AA250LKF	434240	FGL46AA250LKF	434245			
	400	FGL36AA400LLF	431246	FGL46AA400LLF	431330			
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware								

Type line 0.625 - 1 x In Adjustable Rating Plugs for Trip Units SMR1



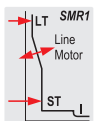
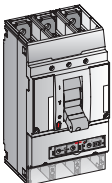
In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
250A	160	FGRJ3LK0160	434337	FGRJ43LK0160	434345	FGRJ4LK0160	434361	FGRJ45LK0160	434353
	250	FGRJ3LK0250	434341	FGRJ43LK0250	434349	FGRJ4LK0250	434365	FGRJ45LK0250	434357
	250	FGRJ3LL0250	435343	FGRJ43LL0250	435356	FGRJ4LL0250	435397	FGRJ45LL0250	435367
400A	400	FGRJ3LL0400	433151	FGRJ43LL0400	433163	FGRJ4LL0400	433187	FGRJ45LL0400	433175

Type line/Motor 0.4 - 1 x In Switchable Rating Plugs for Trip Units SMR1



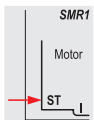
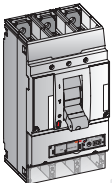
In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
250A	250	FGRS3LK0250	434303	FGRS43LK0250	434307	FGRS4LK0250	434315	FGRS45LK0250	434311
	400A	FGRS3LL0400	435435	FGRS43LL0400	434516	FGRS4LL0400	434537	FGRS45LL0400	434525

Selective Electronic Trip Unit (SMR1) with switchable Rating Plug



In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50kA FGN	250	FGN36SA250LKF	434249	FGN436SA250LKF	434251	FGN46SA250LKF	434254	FGN456SA250LKF	434252
	400	FGN36SA400LLF	434489	FGN436SA400LLF	435277	FGN46SA400LLF	435280	FGN456SA400LLF	434504
80kA FGH	250	FGH36SA250LKF	434233	FGH436SA250LKF	434235	FGH46SA250LKF	434238	FGH456SA250LKF	434236
	400	FGH36SA400LLF	434399	FGH436SA400LLF	434408	FGH46SA400LLF	434426	FGH456SA400LLF	434414
150kA FGL	250	FGL36SA250LKF	434241	FGL436SA250LKF	434243	FGL46SA250LKF	434246	FGL456SA250LKF	434244
	400	FGL36SA400LLF	434444	FGL436SA400LLF	434453	FGL46SA400LLF	434474	FGL456SA400LLF	434462
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Rating plug + Breaker finishing covers + Fixation hardware									

Selective Electronic Trip Unit (SMR1) with Rating Plug, without Overload (LT) protection

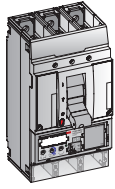


In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50kA FGN	400	FGN36BM400LLF	434687	FGN436BM400LLF	434693
	400	FGH36BM400LLF	434663	FGH436BM400LLF	434669
80kA FGH	400	FGL36BM400LLF	434675	FGL436BM400LLF	434681
	One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Rating plug + Breaker finishing covers + Fixation hardware				

(1) Neutral on the left. If neutral on the right is needed, please contact us.

FG400 - Complete circuit breaker

Modular Electronic Trip Unit (SMR2) without Rating Plug

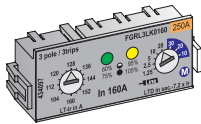


50kA FGN	In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
FGN	250	FGN36KA250LKF	434073	FGN46KA250LKF	436159				
	350 ⁽²⁾	FGN36KA350LLF	434483	FGN46KA350LLF	434510				
	400	FGN36KA400LLF	436156	FGN46KA400LLF	436160				
80kA FGH	250	FGH36KA250LKF	436150	FGH46KA250LKF	434041				
	350 ⁽²⁾	FGH36KA350LLF	434393	FGH46KA350LLF	434420				
	400	FGH36KA400LLF	436151	FGH46KA400LLF	434042				
150kA FGL	250	FGL36KA250LKF	434049	FGL46KA250LKF	436153				
	350 ⁽²⁾	FGL36KA350LLF	434438	FGL46KA350LLF	434468				
	400	FGL36KA400LLF	434050	FGL46KA400LLF	436154				

One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Filler for extension module and battery socket + Breaker finishing covers + Fixation hardware

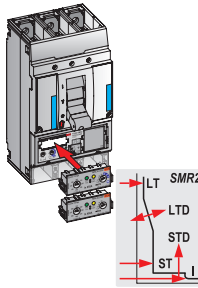
LT: $I_r = 0.625 - 1 \times I_n$
LTD: Line & Motor; 8 options

Adjustable LT & LTD settable Rating Plugs for Trip Units SMR2



	In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾
250A	160	FGRL3LK0160/7	436749	FGRL4LK0160/7	434559
	250	FGRL3LK0250/7	436656	FGRL4LK0250/7	434562
	400	FGRL3LK0400/7	436721	FGRL4LK0400/7	434584
400A	250	FGRL3LL0250/7	436747	FGRL4LL0250/7	434568
	400	FGRL3LL0400/7	436721	FGRL4LL0400/7	434584
	350 ⁽²⁾	FGRL3LL0350/7	436748	FGRL4LL0350/7	434582

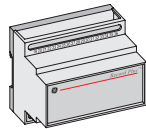
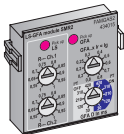
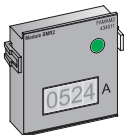
Modular Electronic Trip Unit (SMR2) with two adjustable Rating Plugs, setting 0.4 - 1 x In



50kA FGN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
FGN	400	FGN36VA400LLF	435140	FGN46VA400LLF	435152	FGN46VA400LLF	435170	FGN456VA400LLF	435164	
	80kA FGH	400	FGH36VA400LLF	434953	FGH46VA400LLF	434960	FGH46VA400LLF	434983	FGH456VA400LLF	434971
	150kA FGL	400	FGL36VA400LLF	435065	FGL46VA400LLF	435077	FGL46VA400LLF	435128	FGL456VA400LLF	435095

One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Two rating plugs + Filler for extension module and battery socket + Breaker finishing covers + Fixation hardware

Extension modules for the SMR2 Electronic trip unit Plug-in types replacing the filler module (1 pc max.)



Ammeter with 4 digit LCD display	FAMAM2	436183
Groundfault alarm + Modbus communication (RTu)	FAMGAM2	436185
Groundfault alarm + 2 channel load shedding device	FAMGAS2	436186
Groundfault alarm + Fault type indicators	FAMGAT2	436187
Groundfault protection + Modbus communication (RTu)	FAMGFM2	436188
Groundfault protection + 2 channel load shedding device	FAMGFS2	436189
Groundfault protection + Fault type indicators	FAMGFT2	436190
2 channel load shedding device + Modbus communication (RTu)	FAMSM2	436192
2 channel load shedding device + Fault type indicators	FAMST2	436197
Fault type indicators + Modbus communication (RTu)	FAMMT2	436191
Spare filler module	FAMB2	434448

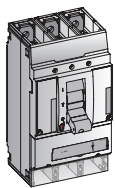
One code covers: A plug-in module and where needed connection hardware

Other Modules

External communication and contact module (4 contacts, 1A/400V) ⁽³⁾	FAMECM	434013
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One code covers: Module and connection hardware

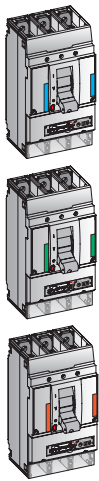
Non-Automatic Circuit Breaker (Switch rated at 40°C)



FGY	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
FGY	400	FGY306D400LF	431659	FGY406D400LF	431671
	One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Breaker finishing covers + Fixation hardware				

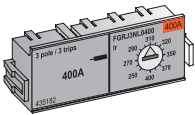
(1) Neutral on the left. If neutral on the right is needed, please contact us.
(2) Specifically configured for Motor Protection
(3) Is needed for Modbus communication (1 per breaker).

FG630 - Complete circuit breaker



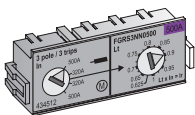
Selective Electronic Trip Unit (SMR1) without Rating Plug									
In (A)	Cat. no.	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FGN	400	FGN36AA400NLF	434561	FGN46AA400NLF	434636				
	500 ⁽²⁾	FGN36AA500NNF	434812	FGN46AA500NNF	434866				
	630	FGN36AA630NNF	431461	FGN46AA630NNF	431539				
80kA FGH	400	FGH36AA400NLF	433142	FGH46AA400NLF	434432				
	500 ⁽²⁾	FGH36AA500NNF	434600	FGH46AA500NNF	434630				
	630	FGH36AA630NNF	431038	FGH46AA630NNF	431132				
150kA FGL	400	FGL36AA400NLF	434459	FGL46AA400NLF	434534				
	500 ⁽²⁾	FGL36AA500NNF	434645	FGL46AA500NNF	434770				
	630	FGL36AA630NNF	431249	FGL46AA630NNF	431333				
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware									

Type line 0.625 - 1 x In

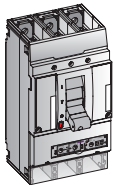


Adjustable Rating Plugs for Trip Units SMR1										
In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	400	FGRJ3NL0400	435182	FGRJ43NL0400	435188	FGRJ4NL0400	435200	FGRJ45NL0400	435194	
	630A	400	FGRJ3NN0400	433154	FGRJ43NN0400	433166	FGRJ4NN0400	433190	FGRJ45NN0400	433178
		630	FGRJ3NN0630	433157	FGRJ43NN0630	433169	FGRJ4NN0630	433193	FGRJ45NN0630	433181

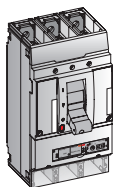
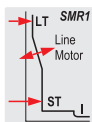
Type line/Motor 0.4 - 1 x In



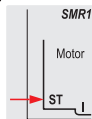
Switchable Rating Plugs for Trip Units SMR1										
In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
500 ⁽²⁾	500	FGRS3NN0500	434512	FGRS43NN0500	434521	FGRS4NN0500	434542	FGRS45NN0500	434530	



Selective Electronic Trip Unit (SMR1) with switchable Rating Plug										
In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	500	FGN36SA500NNF	434835	FGN436SA500NNF	434848	FGN46SA500NNF	434884	FGN456SA500NNF	434860	
80kA FGH	400	FGH36SA400NLF	431091	FGH436SA400NLF	431168	FGH46SA400NLF	431240	FGH456SA400NLF	431198	
	500	FGH36SA500NNF	434612	FGH436SA500NNF	434621	FGH46SA500NNF	434642	FGH456SA500NNF	434627	
150kA FGL	400	FGL36SA400NLF	431309	FGL436SA400NLF	431372	FGL46SA400NLF	431449	FGL456SA400NLF	431425	
	500	FGL36SA500NNF	434657	FGL436SA500NNF	434758	FGL46SA500NNF	434806	FGL456SA500NNF	434764	
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Rating plug + Breaker finishing covers + Fixation hardware										



Selective Electronic Trip Unit (SMR1) with Rating Plug, without Overload (LT) protection										
In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
80kA FGH	500	FGH36BM500NNF	434666	FGH436BM500NNF	434672					
	500	FGL36BM500NNF	434678	FGL436BM500NNF	434684					
150kA FGL	One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Rating plug + Breaker finishing covers + Fixation hardware									



(1) Neutral on the left. If neutral on the right is needed, please contact us.
 (2) Specifically configured for use with Switchable Rating Plug only.

FG frame

Intro

A

B

C

D

E

F

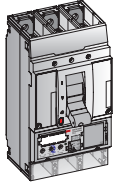
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X



FG630 - Complete circuit breaker

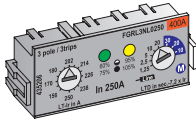
Modular Electronic Trip Unit (SMR2) without Rating Plug



In (A)	Cat. no.	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FGN	400	FGN36KA400NLF	436157	FGN46KA400NLF	436161				
	500 ⁽²⁾	FGN36KA500NNF	434824	FGN46KA500NNF	434872				
	630	FGN36KA630NNF	436158	FGN46KA630NNF	434092				
80kA FGH	400	FGH36KA400NLF	436152	FGH46KA400NLF	434043				
	500 ⁽²⁾	FGH36KA500NNF	434606	FGH46KA500NNF	434633				
	630	FGH36KA630NNF	434028	FGH46KA630NNF	434044				
150kA FGL	400	FGL36KA400NLF	434051	FGL46KA400NLF	436155				
	500 ⁽²⁾	FGL36KA500NNF	434651	FGL46KA500NNF	434782				
	630	FGL36KA630NNF	434052	FGL46KA630NNF	434068				
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Filler for extension module and battery socket + Breaker finishing covers + Fixation hardware									

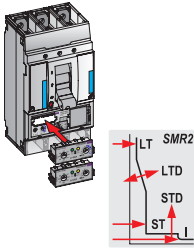
LT: $I_r = 0.625 - 1 \times I_n$
LTD: Line & Motor; 8 options

Adjustable LT & LTD settable Rating Plugs for Trip Units SMR2



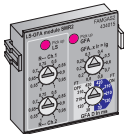
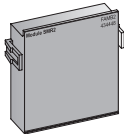
In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾
400A	250	FGRL3NL0250/7 436739	FGRL43NL0250/7 434588	FGRL4NL0250/7 434492
	400	FGRL3NL0400/7 436746	FGRL43NL0400/7 434590	FGRL4NL0400/7 434493
630A	400	FGRL3NN0400/7 436726	FGRL43NN0400/7 434605	FGRL4NN0400/7 434496
	630	FGRL3NN0630/7 436722	FGRL43NN0630/7 434622	FGRL4NN0630/7 434532
500 ⁽²⁾	500 ⁽²⁾	FGRL3NN0500/7 436738	FGRL43NN0500/7 434607	FGRL4NN0500/7 434502

Modular Electronic Trip Unit (SMR2) with two Adjustable Rating Plugs, setting 0.4 - 1 x In



In (A)	3 pole 3 trips	4 pole 3 trips ⁽¹⁾	4 pole 4 trips ⁽¹⁾	4 pole 3.5 trips (N=50%) ⁽¹⁾
50kA FGN	630	FGN36VA630NNF 435146	FGN46VA630NNF 435158	FGN46VA630NNF 435176
	630	FGH36VA630NNF 434958	FGH46VA630NNF 434965	FGH46VA630NNF 435003
80kA FGH	630	FGH36VA630NNF 434958	FGH46VA630NNF 434965	FGH46VA630NNF 435003
	630	FGL36VA630NNF 435071	FGL46VA630NNF 435091	FGL46VA630NNF 435134
150kA FGL	630	FGL36VA630NNF 435071	FGL46VA630NNF 435091	FGL46VA630NNF 435134
	630	FGL36VA630NNF 435071	FGL46VA630NNF 435091	FGL46VA630NNF 435134
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Two rating plugs + Filler for extension module and battery socket + Breaker finishing covers + Fixation hardware				

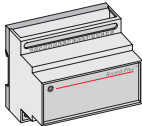
Extension modules for the SMR2 Electronic trip unit Plug-in types replacing the filler module (1 pc max.)



Ammeter with 4 digit LCD display	FAMAM2	436183
Groundfault alarm + Modbus communication	FAMGAM2	436185
Groundfault alarm + 2 channel load shedding device	FAMGAS2	436186
Groundfault alarm + Fault type indicators	FAMGAT2	436187
Groundfault protection + Modbus communication	FAMGFM2	436188
Groundfault protection + 2 channel load shedding device	FAMGFS2	436189
Groundfault protection + Fault type indicators	FAMGFT2	436190
2 channel load shedding device + Modbus communication	FAMSM2	436192
2 channel load shedding device + Fault type indicators	FAMST2	436197
Fault type indicators + Modbus communication	FAMMT2	436191
Spare filler module	FAMB2	434448

One code covers: A plug-in module and where needed connection hardware

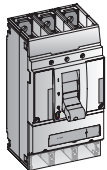
Other Modules



External communication and contact module (4 contacts, 1 A/400V) ⁽³⁾	FAMECM	434013
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One code covers: Module and connection hardware

Non-Automatic Circuit Breaker (Switch rated at 40°C)



In (A)	3 pole	4 pole ⁽¹⁾
630	FGY306D630NF 431665	FGY406D630NF 431687
FGY	One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle elongator + Breaker finishing covers + Fixation hardware	

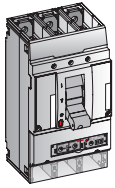
(1) Neutral on the left. If neutral on the right is needed, please contact us.

(2) Specifically configured for Motor Protection.

(3) Is needed for Modbus communication (1 per breaker).

FG400 - Complete Circuit Breaker

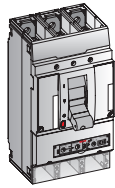
Selective Electronic Trip Unit (SMR1) with adjustable rating plug for use at 55 ° C



50 kA FGN	In (A)	3 pole 3 trips		80 kA FGH	3 pole 3 trips	
		Cat. no.	Ref. no.		Cat. no.	Ref. no.
	400	FGN36JA5400LLF	431305		FGH36JA5400LLF	431303
One code covers: A standard, fixed front connection breaker + Fixation hardware + Toggle Elongator + Adjustable Rating Plug						

FG630 - Complete Circuit Breaker

Selective Electronic Trip Unit (SMR1) with adjustable rating plug for use at 55 ° C



50 kA FGN	In (A)	3 pole 3 trips		80 kA FGH	3 pole 3 trips	
		Cat. no.	Ref. no.		Cat. no.	Ref. no.
	500	FGN36JA5500NNF	431304		FGH36JA5500NNF	431301
One code covers: A standard, fixed front connection breaker + Fixation hardware + Toggle Elongator + Adjustable Rating Plug						

FG frame

Intro

A

B

C

D

E

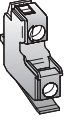
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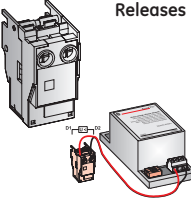
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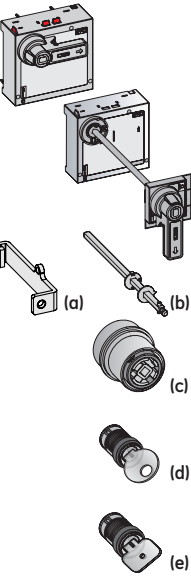
FG - Internal accessories

Contacts	Normally open		Normally closed		Cat. no.	Ref. no.
	Cat. no.	Ref. no.	Cat. no.	Ref. no.		
	Aux. switch right mounted	FAS10R	430837	FAS01R	430831	
	Aux. switch left mounted	FAS10L	430834	FAS01L	430828	
	Bell alarm electronic trip unit	FABAT10	430818	FABAT01	430815	
	Bell alarm mechanism	FABAM10	432003	FABAM01	432000	
	Bell alarm RCD device	FABAT10	430818	FABAT01	430815	

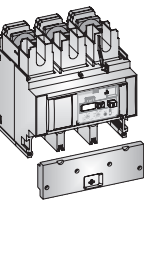
Releases	Shunt		Undervoltage		Delayed undervoltage	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	12V AC/DC	FASHTB	430840	FAUVRB	431960	-
	24V AC/DC	FASHTD	430843	FAUVRD	430861	-
	48V AC/DC	FASHTF	430846	FAUVRF	430864	-
	60V AC/DC	FASHTH	435118	FAUVRH	435120	-
	110 AC/DC	FASHTJ	430849	FAUVRJ	430867	-
	220/240V AC/DC	FASHTN	430852	FAUVRN	430870	FAUVDN
	400/415V AC	FASHTU	430855	FAUVRB	436472	-
	440/480V AC	-	-	FAUVRU	430873	-

FG - Operators

Electrical operators	Cat. no.	Ref. no.				
	24V AC/DC	FGEMFD	432817			
	48V AC/DC	FGEMFF	432820			
	60V AC/DC	FGEMFH	432823			
	110/127V AC/DC	FGEMFJ	432826			
	220/250V AC/DC	FGEMFN	432829			
	400/440V AC	FGEMF8	432811			
Keylock for electr. operator Ronis ⁽¹⁾ (a)	FG1BRE	431404				
Keylock for electr. operator Profalux ⁽¹⁾ (b)	FG1BPE	431403				

Rotary handles	Direct on device		Rotary handle through door or cover plate ⁽²⁾		Panel or door mounted		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	Grey	FGNRF/5	436509	FGNRC/5	436504	-	
	Red	FGNRFV/5	436510	FGNRCV/5	436505	-	
	Grey + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	FGNRY/5	436513	-	
	Red + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	FGNRYV/5	436514	-	
	Grey	-	-	-	-	FGNRD/5	436506
	Red	-	-	-	-	FGNRDV/5	436507
	Grey + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	-	FGNRZ/5	436515
	Red + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	-	FGNRZV/5	436516
	Accessories						
	Flex operator adaptor push to trip (a)	FGNFT	432867	Only for use with panel or door mounted type			
Extension shaft kit (max. 600 mm) (b)	FGNRE	434735	Only for use with panel or door mounted type				
Adaptor for drawout (c)	FGNRW	433892					
Ronis keylock 1104B nr. BC 1027 ⁽¹⁾ (d)	FA1BR1	430088					
Ronis keylock 1104B nr. BC 1053 ⁽¹⁾ (d)	FA1BR2	430089					
Ronis keylock 1104B nr. BC 2932 ⁽¹⁾ (d)	FA1BR3	430504					
Ronis keylock 1104B nr. BC 2911 ⁽¹⁾ (d)	FA1BR4	430505					
Ronis keylock 1104B nr. BC 2936 ⁽¹⁾ (d)	FA1BR5	430506					
Ronis keylock 1104B nr. BC 2940 ⁽¹⁾ (d)	FA1BR6	430507					
Ronis lock with random key ⁽¹⁾ (d)	FA1BRH	430068					
Profalux lock with random key ⁽¹⁾ (e)	FA1BPH	430813					

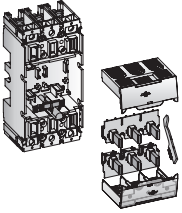
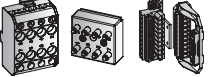
FG - Residual current devices

RCD bottom mounted ⁽⁴⁾	3 pole		4 pole		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	400/630A Voltage 200/440V AC	FGQDB3M/6	431172	FGQDB4M/6	431181
	400/630A Voltage 400/690V AC	FGQDB3H/6	431163	FGQDB4H/6	431175
	Normally open		Normally closed		
Bell Alarm RCD device	FABAT10	430818	FABAT 01	430815	
One code covers an RCD with: Fixation hardware + Sealable interconnection cover					

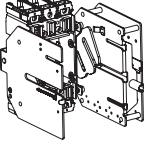
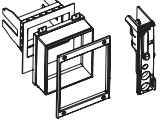

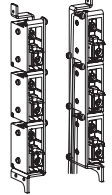
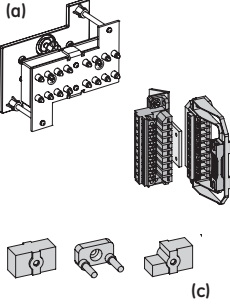
(1) Key included
 (2) Add door flange FGfH for door lock options
 (3) On request 1xNO/1xNC is available.
 (4) 100/200V AC execution available on request



FG - Plug-in system

Main system	3 pole		4 pole	
	Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
	Complete set for breaker	FGDDF3 430944	FGDDF4	431064
	Fixed part for breaker	FGDFF3 431983	FGDFF4	431986
	Mobile part for breaker	FGDMP3 432796	FGDMP4	432799
Complete set: Fixed and mobile part with connection and fixation hardware Fixed part: Fixed base with connection and fixation hardware Mobile part: Mechanism trip device, terminal shields and set of plugs				
Auxiliary disconnects ⁽¹⁾ (Secondary wiring) 	Complete set 8 pole	FAPFM 430824		
	Fixed part 8 pole	FAPF8 430823		
	Mobile part 8 pole	FAPM8 430826		
	10 pole wired plug & socket for plug-in device	FAPPS 430827		
Spares	Set of nutplates and connection bolts (For connection of bases used as spare)	FGJN3 436469	FGJN4	436470

FG- Drawout system

FE - Drawout system	3 pole		4 pole	
	Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
	Complete set for breaker			
	Drawout system for behind door applications	FGWB3 432550	FGWB4	432556
Through Door mounting kits 	Through Door Adaption kit with padlocking and keylocking option⁽²⁾			
	Toggle Operated	FGWT 432592		
	With Motor Operator	FGWM 432595		
	Toggle Operated FE frame FENRC & FENRY	FGWN 432598		
	Adaption kit ONLY with padlocking and keylocking option on door Breaker operation behind door	FAWE 432619		
Keylocks 	Keylock for Drawout position RONIS 1104b ⁽³⁾	FA1BRWD 432613		
	Keylock for Drawout position Profalux ⁽³⁾	FA1BPWD 432616		
Position Indiation 	Set of 3 NO contacts (1 set per position)	FAS30W 432607		
	Set of 3 NO + NG contacts (1 set per position)	FAS33W 432610		
Set of 3 NO+NC contacts 	16 pole complete set for Drawout Breaker (a) (Secondary wiring)	FGWA2 432601		
	24 pole complete set for Drawout Breaker (Secondary wiring)	FGWA3 432604		
	10 pole wired plug & socket for Plug-in or Drawout device (b)	FAPPS 430827		
	Rating adustable interlock kit between fixed & Mobile parts (c)	FAPIP 430825		

(1) Only necessary when internal accessories or an electrical operator are used (a maximum of three per FG frame size)
 (2) Keylocks not included
 (3) A maximum of two locks can be placed (with through door kits only)

FG frame

Intro

A

B

C

D

E


F

G

X



FG - Connections: optional

		3 pole		4 pole	
		Cat. no.	Ref. nr.	Cat. no.	Ref. nr.
 (a) (b) (c)	Extenders	Standard flat type	(a) FGBES3 431696	FGBES4	431697
		Heightened type	(b) FGBEH3 431691	FGBEH4	431695
		Twisted 90° c	(c) FGBEA3 431686	FGBEA4	431690
	Spreader flat⁽¹⁾	Pole spacing 70mm	FGBSS3 431981	FGBSS4	431982
	Rear connections⁽¹⁾	Set 3 pole (2 short, 1 long)	FGBRC3 431701		
		Set 4 pole (2 short, 2 long)		FGBRC4	431702
		Set 3 pole (3 short)	FGBRCS3 432193		
		Set 4 pole (4 short)		FGBRCS4	432194
	Internal box clamps⁽¹⁾		One cable 240 mm² or two cables 95 mm²	Two cables 1x300 mm² & 1x240 mm²	
		Box Clamp Cu/Al, set 3 pole	FGTCA1327 435107	FGTCA230B	433412
		Box Clamp Cu/Al, set 4 pole	FGTCA1427 435116	FGTCA240B	433413

(1) Set for equipping the line OR load side of breaker.

Order Codes

Intro

A

B

C

D

E

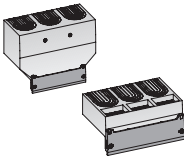
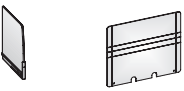
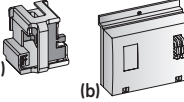

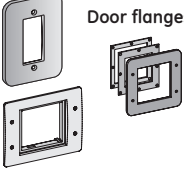
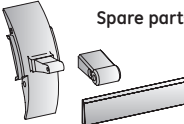
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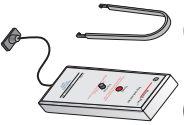
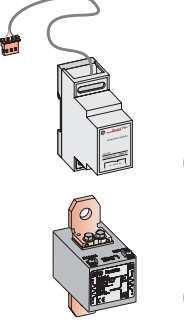
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FG - Installation accessories

	3 pole		4 pole		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
Terminal shields (with finishing covers) 	Long and widened type for spreaders and 690V applications, set of 2 pcs	FGJW3	432861	FGJW4	432864
	Medium, set of 2 pcs.	FGJM3	432846	FGJM4	432849
	Short, set of 2 pcs.	FGJS3	432855	FGJS4	432858
Specific to connection area 	Phase separators, set of 12 pcs	FGJP	432852		
	Backplate (3 or 4pole), set of 2 pcs.	FGJB	432840		
Padlocking devices for toggle operator⁽¹⁾ 	Padlocking removable (a)	FG1PR	431409		
	Padlocking fixed (b)	FG1PF	431408		
Circuit indication / coding 	Set of 20 blank labels	FAC	430821		
Door flanges 	RCD unit front face for 3 and 4 pole	FDFF3	430941		
	Front face toggle area	FGFT	432836		
	Rotary handle (through cover plate model)	FGFH	430545		
	Motor operator	FGFE	430544		
Spare parts 	Finishing covers, set of 2 pcs.	FGUA3	432908	FGUA4	432909
	Spare toggle (set of 5 pcs.)	FGUT	433541	FGUT	433541

FG - Accessories electronic trip units SMR1 and SMR2

	(a)	Rating plug tool (SMR1 & 2)	(a)	FAR	433500
	(b)	Battery test device (SMR1 & 2)	(b)	FAZ	431406
		Long time module (SMR1 only)	(c)	FAMLT1	433376
	(c)	Ground Fault SMR2 Sensor 250A	(d)	FGGS0250	431870
		Ground Fault SMR2 Sensor 400A	(d)	FGGS0400	432838
	(d)	Ground Fault SMR2 Sensor 630A	(d)	FGGS0630	432839

(1) Padlocks not included





FK Frame

Breaking capacities

Icu 400/415V AC in kA eff.

Type	V	N	H	L
FK800	50	50	80	100
FK1250	50	50	80	100
FK1600	50	50	80	

Protection

Trip Unit	Rated Current (A)	LTM	Mag Break™	SMR1e ⁽¹⁾	SMR1s ⁽¹⁾	SMR1g ⁽¹⁾
FK800	630	N, H, L	-	-	-	-
	800	N, H, L	N, H, L	N, H, L	N, H	N, H
FK1250	1000	N, H, L	-	N, H, L	N, H	N, H
	1250	N, H, L	N, H, L	N, H, L	N, H	N, H
FK1600	1600	-	-	N, H	N, H	N, H

Number of poles / protected poles (trips)	LTM	Mag Break™	SMR1e ⁽¹⁾	SMR1s ⁽¹⁾	SMR1g ⁽¹⁾
3 pole 3 trips	N, H, L	N, H, L	N, H, L	N, H	N, H
4 pole 3 trips	N, H, L	N, H, L	-	-	-
4 pole 4 trips ⁽¹⁾	-	-	N, H, L	N, H	N, H

(1) Switchable, 0%, 50% or 100% neutral protection

LTM

Line thermal magnetic protection

SMR1e

Selective electronic protection.

SMR1s

Selective electronic protection with enhanced functionality

SMR1g

Selective electronic protection with enhanced functionality and ground fault

Mag Break™

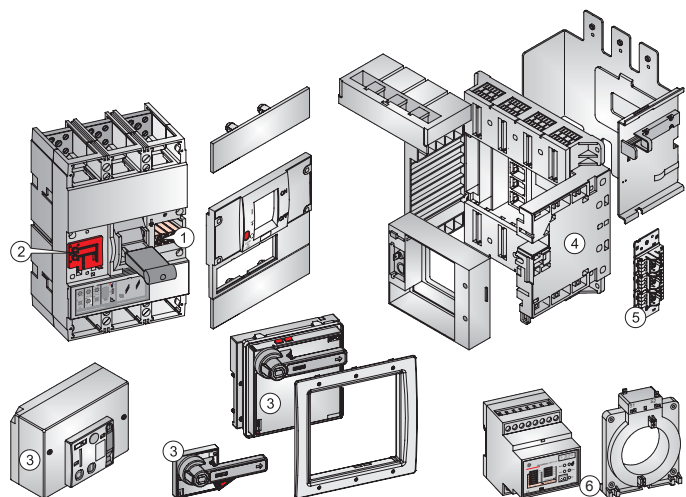
Magnetic only breaker for motor protection

Y

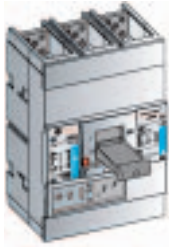
Non Automatic or switch (not mentioned in tables)

Accessories (main types)

- ① A maximum of one Bell Alarm contact AND 3 aux. contacts (all of CO type)
- ② Shunt or Undervoltage release
- ③ Operators
 - Rotary handle
 - OR
 - Electrical operator
- ④ Draw-out system
- ⑤ Connectors for auxiliary wiring
- ⑥ RCD with separate sensor

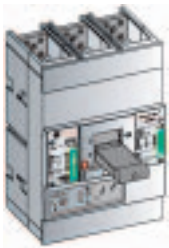


FK800 - Complete circuit breaker



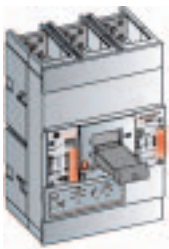
Selective Electronic Trip Unit with fixed time settings type SMR1e

50kA FKV	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
800		FKV36NE800PPF	435041	FKV46NE800PPF	435042
50kA FKN	800	FKN36NE800PPF	435393	FKN46NE800PPF	435447
80kA FKH	800	FKH36NE800PPF	435285	FKH46NE800PPF	435339
100kA FKL	800	FKL36NE800PPF	435390	FKL46NE800PPF	435282
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					



Selective Electronic Trip Unit with adjustable time settings type SMR1s

50kA FKN	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
800		FKN36NS800PPF	435429	FKN46NS800PPF	435483
80kA FKH	800	FKH36NS800PPF	435321	FKH46NS800PPF	435375
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					



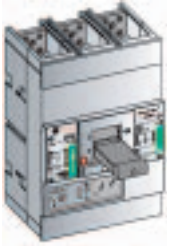
Selective Electronic Trip Unit with adjustable time settings and Groundfault type SMR1g

50kA FKN	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
800		FKN36NG800PPF	435411	FKN46NG800PPF	435465
80kA FKH	800	FKH36NG800PPF	435303	FKH46NG800PPF	435357
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					



Line Thermal magnetic trip unit LTM (adjustable settings)

50kA FKV	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
800		FKV36NT800PF	435005	FKV46NT800PF	435064
50kA FKN	630	FKN36NT630PF	435444	FKN436NT630PF	435408
	800	FKN36NT800PF	435336	FKN436NT800PF	435300
80kA FKH	630	FKH36NT630PF	435426	FKH436NT630PF	435462
	800	FKH36NT800PF	435318	FKH436NT800PF	435354
100kA FKL	630	FKL36NT630PF	435480	FKL436NT630PF	435534
	800	FKL36NT800PF	435372	FKL436NT800PF	435535
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					



Motor Protection (Mag Break™) Magnetic Only Breaker

50kA FKN	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
800		FKN36NM800PF	435537	FKN436NM800PF	435541
80kA FKH	800	FKH36NM800PF	435538	FKH436NM800PF	435542
100kA FKL	800	FKL36NM800PF	435539	FKL436NM800PF	435543
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

(1) Switchable 0%, 50% or 100% neutral protection, neutral on left.
 (2) Neutral on left

FK frame

Intro

A

B

C

D

E

F

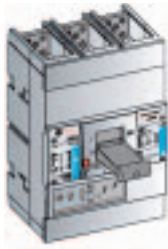
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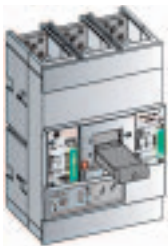
FK1250 - Complete circuit breaker

Selective Electronic Trip Unit with fixed time settings type SMR1e



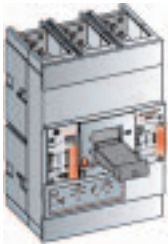
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKV	1000	FKV36NE100SQF	435040	FKV46NE100SQF	435066
	1250	FKV36NE125SSF	435035	FKV46NE125SSF	435083
One code covers: A standard fixed front connection breaker - Assembled trip unit - fixation hardware (Electrical Operator not possible)					
50kA FKN	1000	FKN36NE100SQF	435396	FKN46NE100SQF	435450
	1250	FKN36NE125SSF	435384	FKN46NE125SSF	435438
80kA FKH	1000	FKH36NE100SQF	435288	FKH46NE100SQF	435342
	1250	FKH36NE125SSF	435276	FKH46NE125SSF	435330
100kA FKL	1000	FKL36NE100SQF	435545	FKL46NE100SQF	435547
	1250	FKL36NE125SSF	435546	FKL46NE125SSF	435549
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Selective Electronic Trip Unit with adjustable time settings type SMR1s



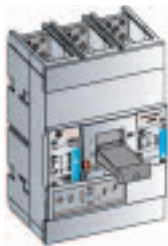
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1000	FKN36NS100SQF	435432	FKN46NS100SQF	435486
	1250	FKN36NS125SSF	435420	FKN46NS125SSF	435474
80kA FKH	1000	FKH36NS100SQF	435324	FKH46NS100SQF	435378
	1250	FKH36NS125SSF	435312	FKH46NS125SSF	435366
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Selective Electronic Trip Unit with adjustable time settings and Groundfault type SMR1g



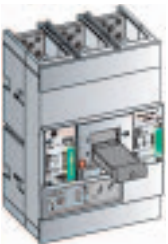
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1000	FKN36NG100SQF	435414	FKN46NG100SQF	435468
	1250	FKN36NG125SSF	435402	FKN46NG125SSF	435456
80kA FKH	1000	FKH36NG100SQF	435306	FKH46NG100SQF	435360
	1250	FKH36NG125SSF	435294	FKH46NG125SSF	435348
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Line Thermal magnetic trip unit LTM (adjustable settings)



	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKV	1000	FKV36NT100SF	435028	FKV46NT100SF	435086
	1250	FKV36NT125SF	435030	FKV46NT125SF	435089
One code covers: A standard fixed front connection breaker - Assembled trip unit - fixation hardware (Electrical Operator not possible)					
50kA FKN	1000	FKN36NT100SF	435550	FKN436NT100SF	435562
	1250	FKN36NT125SF	435551	FKN436NT125SF	435563
80kA FKH	1000	FKH36NT100SF	435553	FKH436NT100SF	435565
	1250	FKH36NT125SF	435554	FKH436NT125SF	435566
100kA FKL	1000	FKL36NT100SF	435555	FKL436NT100SF	435567
	1250	FKL36NT125SF	435557	FKL436NT125SF	435569
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Motor Protection (Mag Break™) Magnetic Only Breaker

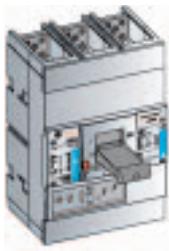


	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1250	FKN36NM125SF	435558	FKN436NM125SF	435570
80kA FKH	1250	FKH36NM125SF	435559	FKH436NM125SF	435571
100kA FKL	1250	FKL36NM125SF	435561	FKL436NM125SF	435573
One code covers: A standard fixed front connection breaker + Assembled dummy trip unit + Toggle elongator + Breaker finishing covers + Fixation hardware					

(1) Switchable 0%, 50% or 100% neutral protection, neutral on left.
(2) Neutral on left

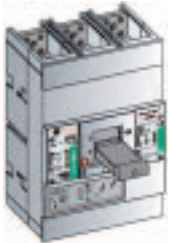
FK1600 - Complete circuit breaker

Selective Electronic Trip Unit with fixed time settings type SMR1e



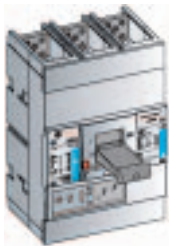
In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50kA FKV	1600	FKV36NE160TTF	435032	FKV46NE160TTF	435092
One code covers: A standard fixed front connection breaker - Assembled trip unit - fixation hardware (Electrical Operator not possible)					
50kA FKN	1600	FKN36NE160TTF	435387	FKN46NE160TTF	435441
80kA FKH	1600	FKH36NE160TTF	435279	FKH46NE160TTF	435333
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Selective Electronic Trip Unit with adjustable time settings type SMR1s



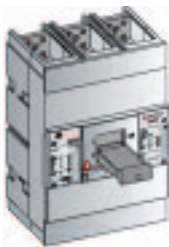
In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50kA FKN	1600	FKN36NS160TTF	435423	FKN46NS160TTF	435477
80kA FKH	1600	FKH36NS160TTF	435315	FKH46NS160TTF	435369
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

Selective Electronic Trip Unit with adjustable time settings and Groundfault type SMR1g



In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
50kA FKN	1600	FKN36NG160TTF	435405	FKN46NG160TTF	435459
80kA FKH	1600	FKH36NG160TTF	435297	FKH46NG160TTF	435351
One code covers: A standard fixed front connection breaker + Assembled trip unit + Toggle Elongator + Breaker finishing covers + Fixation hardware					

FKY- Non-Automatic circuit breaker (Switch)



In (A)	3 pole		4 pole ⁽²⁾		
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
FKY	800	FKY306DN800PF	435495	FKY406DN800PF	435504
	1000	FKY306DN100SF	435381	FKY406DN100SF	435273
	1250	FKY306DN125SF	435489	FKY406DN125SF	435498
	1600	FKY306DN160TF	435492	FKY406DN160TF	435501
One code covers: A standard fixed front connection breaker + Assembled dummy trip unit + Toggle elongator + Breaker finishing covers + Fixation hardware					

(1) Switchable 0%, 50% or 100% neutral protection, neutral on left.
 (2) Neutral on left

FK frame

Intro

A

B

C

D

E


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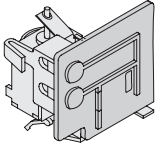
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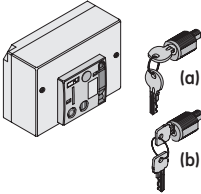


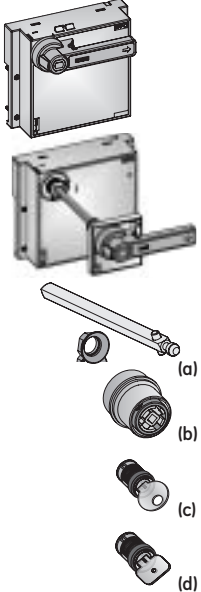
FK - Internal accessories

Contacts	Changeover		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	Cat. no.	Ref. no.						
	Aux. switch right mounted CO	FNS11R	436401					
	Bell alarm contact right mounted CO	FNBA11R	435761					

Releases		Shunt	Undervoltage		Delayed undervoltage		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	24V AC/DC	FNSHTD	435693	-	-	-	-
	24 V AC	-	-	FNUVR1	435698	-	-
	24 V DC	-	-	FNUVRD	435701	-	-
	48 V AC/DC	FNSHTF	435694	-	-	-	-
	48V /DC	-	-	FNUVRF	435702	-	-
	110/130V AC/DC	FNSHTJ	435695	-	-	-	-
	230V AC	-	-	FNUVR6	435699	-	-
	220/240V AC - 220/2450V DC	FNSHTN	435696	-	-	-	-
	400V AC	-	-	FNUVR8	435700	-	-
	380/440V AC/DC	FNSHT8	435692	-	-	-	-
230V AC	-	-	-	-	FNUVD6	435697	

FK - Operators

Electrical operators		Field Mountable Standard model for FK800 & FK1250		Field Mountable Standard model for FK1600		Factory fitted "HI-Speed closing" Model		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	24V AC/DC	FKMF1P	436880	FKF1S	436884	FNEMFD/M	436322	
	24V AC	-	-	-	-	-	-	
	48V AC/DC	FKMF2P	436881	FKF2S	436885	FNEMFF/M	436321	
	48V AC	FKMF3P	436882	FKF3S	436886	FNEMF3/M	436323	
	110V AC	-	-	-	-	FNEMFJ/M	436458	
	110V DC	FKMF6P	436883	FKF6S	436887	FNEMF6/M	436324	
	230V AC	-	-	-	-	FNEMFN/M	436459	
	230V DC	-	-	-	-	-	-	
	Ronis key lock ⁽¹⁾	(a)	FN1BRE	435679	FN1BRE	435679	FN1BRE	435679
	Profalux key lock ⁽¹⁾	(b)	FN1BPE	435678	FN1BPE	435678	FN1BPE	435678

Rotary handles		Direct on device		Rotary handle through door or cover plate ⁽²⁾		Panel or door mounted		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	
	Grey	FNNRF/5	436522	FNNRC/5	436517	-	-	
	Red	FNNRFV/5	436524	FNNRCV/5	436518	-	-	
	Grey + Early closing aux. switches 2xNO ⁽³⁾	-	-	FNNRY/5	436527	-	-	
	Red + Early closing aux. switches 2xNO ⁽³⁾	-	-	FNNRVV/5	436528	-	-	
	Grey	-	-	-	-	FNNRD/5	436519	
	Red	-	-	-	-	FNNRDV/5	436520	
	Grey + Early closing aux. switches 2xNO ⁽³⁾	-	-	-	-	FNNRZ/5	436530	
	Red + Early closing aux. switches 2xNO ⁽³⁾	-	-	-	-	FNNRZV/5	436531	
	Accessories							
	Extension shaft kit (max. 600 mm)	(a)	FNNRE	435738	Only for use with panel or door mounted type			
Adaptor for drawout	(b)	FNNRW	435745					
Ronis keylock 1104B nr. BC 1027 ⁽¹⁾	(c)	FA1BR1	430088					
Ronis keylock 1104B nr. BC 1053 ⁽¹⁾	(c)	FA1BR2	430089					
Ronis keylock 1104B nr. BC 2932 ⁽¹⁾	(c)	FA1BR3	430504					
Ronis keylock 1104B nr. BC 2911 ⁽¹⁾	(c)	FA1BR4	430505					
Ronis keylock 1104B nr. BC 2936 ⁽¹⁾	(c)	FA1BR5	430506					
Ronis keylock 1104B nr. BC 2940 ⁽¹⁾	(c)	FA1BR6	430507					
Ronis lock with random key ⁽¹⁾	(c)	FA1BRH	430068					
Profalux lock with random key ⁽¹⁾	(d)	FA1BPH	430813					

(1) Key included
 (2) Add door flange FGPH for door lock options
 (3) On request 1xNO/1xNC is available.

FK - Residual current devices

Relay	$I_{\Delta n}$	Operating voltage	Settable delay	Nr. of modules	Cat. no.	Ref. no.	Pack.
RD5	0,03 ... 1A	110V AC	0 - 1 s	3	RD5 110	704175	1
	0,03 ... 1A	220V AC	0 - 1 s	3	RD5 220	704169	1
	0,03 ... 1A	380V AC	0 - 1 s	3	RD5 380	704176	1
RD6	0,2 ... 5A	110V AC	0,5 - 5 s	3	RD6 110	704178	1
	0,2 ... 5A	220V AC	0,5 - 5 s	3	RD6 220	704177	1
	0,2 ... 5A	380V AC	0,5 - 5 s	3	RD6 380	704179	1
RD1D	0,01 ... 5A	110V AC	0 - 3 s	3	RD1D 110	872225	1
	0,01 ... 5A	220/230V AC	0 - 3 s	3	RD1D 220	872224	1
	0,01 ... 5A	380/400V AC	0 - 3 s	3	RD1D 380	872226	1
Frame allowing front mounting of RD5, RD6 and RD1D types					RDFR	872227	1

Sensor

Sensor	\varnothing internal (mm) (internal opening)	A		Cat. no.	Ref. no.	Pack.
Round	22	125	closed	TTD 22	560090	1
	35	125	closed	TT 35	872754	1
	60	160	closed	TT 60	872755	1
	80	160	closed	TT 80	872756	1
	110	250	closed	TT 110	872757	1
	160	400	closed	TT 160	872758	1
	210	630/800	closed	TT 210	872759	1
	60	160	open	TTO 60	872760	1
	110	250	open	TTO 110	872761	1
	210	630/800	open	TTO 210	872762	1
Rectangular	70x175	-	closed	BTR 175	704154	1
	115x305	-	closed	BTR 305	704155	1
	130x350	-	closed	BTR 350	704156	1

FK - Draw-out system

Main system	3 pole	4 pole
Model with front connection Complete set for FK800 Complete set for FK1250 & FK1600	FNWS3WP 433434	FNWS4WP 436481
	FNWS3WT 436482	FNWS4WT 433442
Model with rear connection Complete set for FK800 Complete set for FK1250 & FK1600 One code covers the fixed and withdrawable portion of the drawout system, a doorframe with extended toggle operator, mounting accessories and fixation hardware.	FNWS3AP 433436	FNWS4AP 433440
	FNWS3AT 435757	FNWS4AT 435759
Auxiliary disconnects (Sec. wiring) Complete set 6 pole	FNPFM 435758	
Accessories Kit for mounting two keylocks on Chassis with one type Ronis 1104A lock ⁽¹⁾ Provision for 1 extra keylock on Chassis type Ronis 1104A ⁽¹⁾ Position Indication Contact 1 X CO, for withdrawn and/or plugged in position. Spare doorframe for Drawout type Provision for first keylock in doorframe type Ronis 1104A ⁽¹⁾ Provision for second keylock in doorframe type Ronis 1104A ⁽¹⁾	FN1BRW1 435575	
	FN1BRW2 435577	
	FNS11L 435760	
	FNFVW 435578	
	FN1BRY1 433415	
	FN1BRY2 435574	

FK - Connections: optional

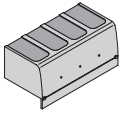
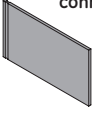


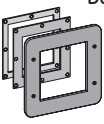
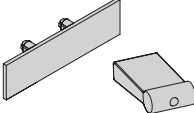
	3 pole	4 pole
Terminal extenders⁽²⁾ Flat FK800 - FK1250 Flat FK1250 - FK 1600	FNBS3P 435706	FNBS4P 435707
	FNBS3R 433420	FNBS4R 433422
Terminal spreader flat⁽²⁾ Flat FK800 - FK1250 Flat FK1250 - FK 1600	FNBS3P 435708	FNBS4P 435711
	FNBS3R 435710	FNBS4R 435712
Rear connections⁽²⁾ Set 3 pole (2 short, 1 long) Set 4 pole (2 short, 2 long) Set 3 pole (3 short) Set 4 pole (4 short)	FNBR3 433423	-
	-	FNBR4 433425
	FNBRCS3 433426	-
	-	FNBRCS4 433427
Internal box clamps⁽²⁾ Box Clamp Cu/Al, for 3 x 70-240 sq.mm. Box Clamp Cu/Al, for 4 x 70-240 sq.mm.	FNTCA3327 436316	FNTCA3427 436651
	FNTCA4327 433438	FNTCA4427 433439

(1) Key included

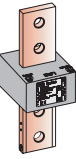
(2) Set for equipping the line OR load side of breaker.



FK - Installation Accessories

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
Terminal shields (with finishing covers) 	Long, set of 2 pcs.	FNJL3	435716	FNJL4	435719
Specific to connection area 	Phase separators				
	Set of 12 pcs for rear connected breaker	FNJP	435722		
	Set of 12 pcs for front connected breaker	FNJF	434804		
Padlocking devices for toggle operator⁽¹⁾ 	Padlocking removable	FN1PR	433417		
Circuit indication / coding 	Set of 20 blank labels	FAC	430821		
Door flanges 	For FK frame in Fixed version				
	Toggle area	FNFT	435715		
	Rotary Handle Operator (Through Door Model)	FNFH	435714		
	Motor Operator	FNFE	435713		
Spare parts 	Finishing covers (set of 2 pieces)	FNUA3	435762	FNUA4	435763
	Spare toggle (set of 5 pieces)	FNUT	435764		

FK - Accessories electronic trip units

	Sensor 800A for Ground fault device	FNGS0800	433419		
	Sensor 1000A for Ground fault device	FNGS1000	433421		
	Sensor 1250A for Ground fault device	FNGS1250	435709		
	Sensor 1600A for Ground fault device	FNGS1600	436471		
TESTKIT					
The Electronic trip units SMR1e, s & g can be tested by means of a PC driven software. Please contact us for availability.					

(1) Padlocks not included

Notes

Grid area for notes.

FK frame

Intro

A

B

C

D

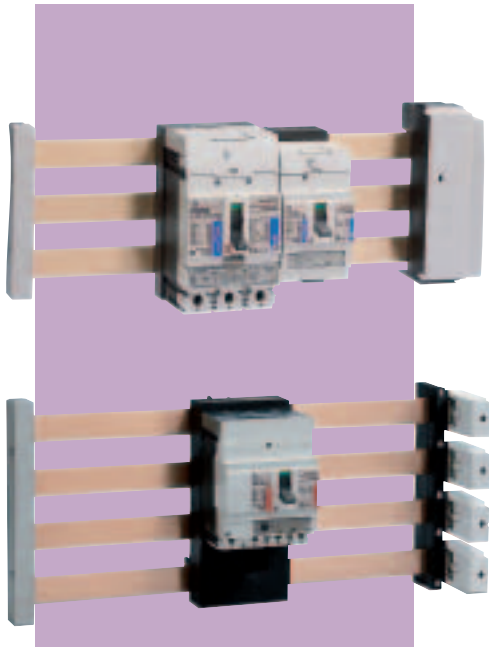
E

F

G

X





Standards

EN 60439-1

VDE 0660 Teil 500

Connectivity

Record Plus™ Breaker types

Adaptor type	Breaker types				
	FBAD	FDE 160A	FDS 160A	FDN 160A	FDH 160A
FBAE		FEV 160/250A	FEN 160/250A	FEH 160/250A	FEL 160/250A

Icu (kA) at 400/415V AC

	25	36	50	80	150
--	----	----	----	----	-----

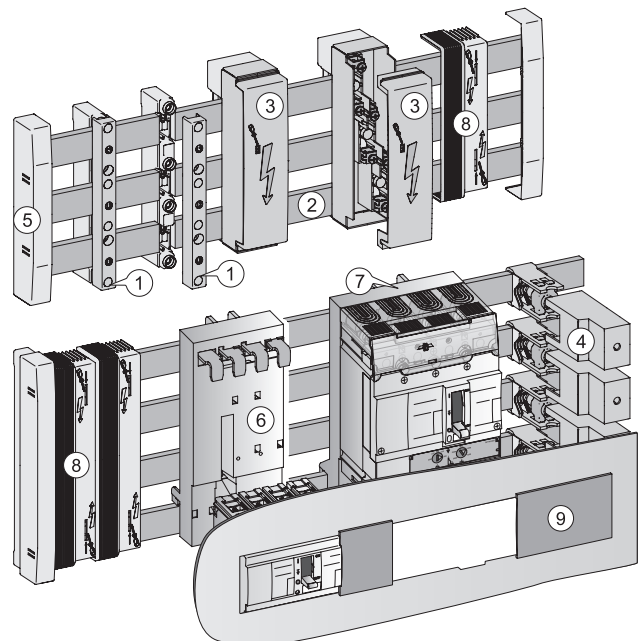
Busbar types and Ratings

Busbar Size	In in A	Icw (kA) at 400/415V AC 1 second rating ⁽¹⁾		
20 x 5	250A	16.7	to	19.9
20 x 10	450A	17.6	to	23.8
30 x 5	400A	22.4	to	27.6
30 x 10	630A	23.3	to	30

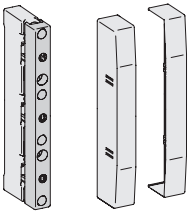
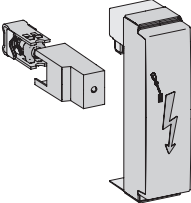
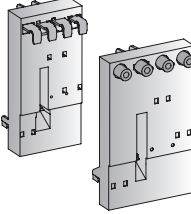
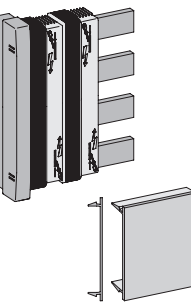
Short-circuit rating of the full system with mounted breakers =
The indicated breaking capacity (Icu) of **Record Plus™** MCCB's

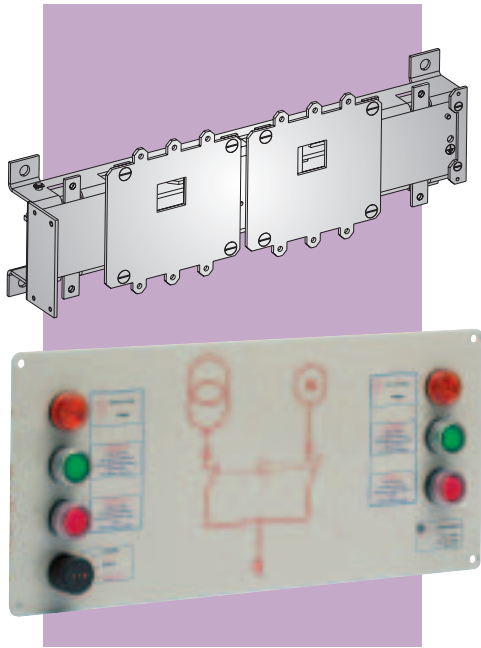
(1) Depending on support spacing (see page C.16)

- ① Busbar support
- ② Busbars (not part of offering)
- ③ Connection set
- ④ Lateral connection set
- ⑤ Support cover
- ⑥ Adaptor FD
- ⑦ Adaptor FE
- ⑧ Busbar covers
- ⑨ Trim/Cover plate filler



Connectivity system with 60mm spacing; three and four pole

		3 pole		4 pole			
		Cat. no.	Ref. no.	Cat. no.	Ref. no.		
		Busbar supports					
		Set of left and right		FBB3S	433458	FBB4S	433464
Endplate covers, pair of		FBB3E	433455	FBB4E	433461		
		Incoming from side		Incoming from front			
		1 pole for lateral bar, flexible bar or cable connection Cu/Al 35-240 mm ² for busbar section 5 mm		FBTS1L12	433468	-	-
		1 pole for lateral bar, flexible bar or cable connection Cu/Al 35-300 mm ² for busbar section 10 mm		FBTS10L12	433474	-	-
		3 pole set for conductors 1.5 to 70mm ²		-	-	FBTF3L12	433456
		4 pole set for conductors 1.5 to 70mm ²		-	-	FBTF4L12	433497
		3 pole		4 pole			
		FD frame 160A		FBAD3	433443	FBAD4	433446
		FE frame 250A		FBAE3	433449	FBAE4	433452
		Installation					
		Busbar cover adjustable 3pole		FBCI3	433377		
		Busbar cover adjustable 4pole		FBCI4	433444		
		Filler for cover plate cut out of 64mm l=1.2m		FBF6	883970		



Changeover devices

Available short-circuit rating at 415V AC in kA

Device	Y	N	H	L
FE 160	3	50	80	150
FE 250	4.5	50	80	150
FG 400	6	50	80	150
FG 630	8	50	80	150
FK 800	10	50	80	100
FK1250	15	50	80	100
FK1600	20	50	80	-

Available trip units, number of poles and trips (protected poles)

Device	Y	LTMD ⁽¹⁾	GTM ⁽¹⁾	SMR types	Mag Break
FE 160	Y	N,H,L	N,H	N,H,L	N,H,L
FE 250	Y	N,H,L	N,H	N,H,L	N,H,L
FG 400	Y	-	-	N,H,L	N,H,L
FG 630	Y	-	-	N,H,L	N,H,L
FK 800	Y	N,H,L	-	N,H,L	N,H,L
FK1250	Y	N,H,L	-	N,H,L	N,H,L
FK1600	Y	-	-	N,H	-
3 pole 3 trips	Y ⁽²⁾	N,H,L	N,H	N,H,L	N,H,L
4 pole 4 trips	Y ⁽²⁾	N,H,L	N,H	N,H,L	-
4 pole 3 trips	-	N,H,L	N,H	N,H,L	N,H,L
4 pole 3.5 trips (N=50%) ⁽³⁾	-	N,H,L	N,H	N,H,L	-

(1) FK type LTM 3 pole and 4 pole 3 Trips only (2) 3 or 4 pole without trips (3) Rated current > 63 A

LTM

Line thermal magnetic protection

LTMD

Selective thermal magnetic protection

GTM

Generator thermal magnetic protection

SMR types

Selective/Modular electronic trip units

Mag Break™

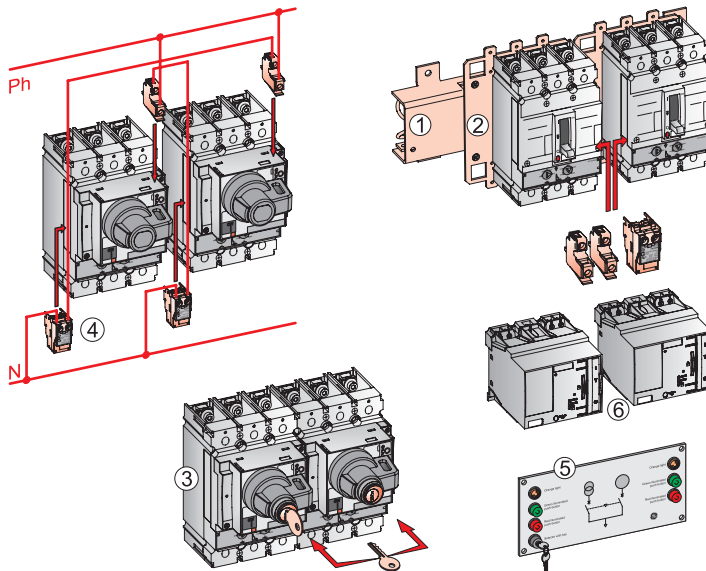
Magnetic Only protection

Y

Non Automatic or switch (not mentioned in tables)

Available device combinations

Main device N		Secondary device R	
FE 160	10 - 160A	FE 160	10 - 160A
FE 250	80 - 250A	FE 250	80 - 250A
FG 400	100 - 400A	FE 160	10 - 160A
FG 630	160 - 630A	FE 250	80 - 250A
FG 400	100 - 400A	FG 400	100 - 400A
FG 630	160 - 630A	FG 630	160 - 630A
FK 800	320 - 800A	FG 400	100 - 400A
FK 1250	400 - 1250A	FG 630	160 - 630A
FK 1600	640 - 1600A		
FK 800	320 - 800A	FK 800	320 - 800A
FK 1250	400 - 1250A	FK 1250	400 - 1250A
FK 1600	640 - 1600A	FK 1600	640 - 1600A



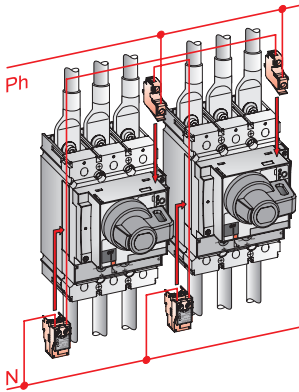
- ① Mechanical interlock for two breakers
- ② Breaker mounting plates
- ③ Mechanical interlock with lock in rotary handles
- ④ Electrical interlock with UVR and SHT release
- ⑤ Controller for automatic changeover suitable for two breakers
- ⑥ Electrical operators

Technical features ● pg. C.18

Changeover systems

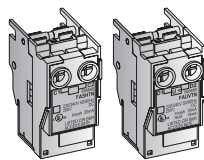
Electrical interlocking of two breakers

System with early action contacts in rotary handle and coils in both breakers⁽¹⁾



Main Device N (left)		Secondary Device R (right)		Required main components		Can be combined with Option 1 or 2			
FE160/250	FG400/630	FK800/1600	FE160/250	FG400/630	FK800/1600	Listed protection devices are breakers or switches order codes can be found on: FE160: page A.13 FE250: page A.16 FG400: page A.25 FG630: page A.27 FK800: page A.35 FK1250: page A.36 FK1600: page A.37	Cat. no.	Ref. no.	Qty
x			x				Rotary handle, grey, through door or panel type FE with 1 NO and 1 NC contact	FENRX/5	436499
						Shunt release in mains device	F-----	4----	1
						Undervoltage release in secondary device	F-----	4----	1
						Rotary handle, grey, through door or panel type FG with 1 NO and 1 NC contact	FGNRX/5	436512	2
						Shunt release in mains device	F-----	4----	1
						Undervoltage release in secondary device	F-----	4----	1
						Rotary handle, grey, through door or panel type FG with 1 NO and 1 NC contact	FGNRX/5	436512	1
						Rotary handle, grey, through door or panel type FE with 1 NO and 1 NC contact	FENRX/5	436499	1
						Shunt release in mains device	F-----	4----	1
						Undervoltage release in secondary device	F-----	4----	1
						Rotary handle, grey, through door or panel type FK with 1 NO and 1 NC contact	FNNRX/5	436526	2
						Shunt release in mains device	F-----	4----	1
						Undervoltage release in secondary device	F-----	4----	1
						Rotary handle, grey, through door or panel type FK with 1 NO and 1 NC contact	FNNRX/5	436526	1
						Rotary handle, grey, through door or panel type FG with 1 NO and 1 NC contact	FGNRX/5	436512	1
						Shunt release in mains device	F-----	4----	1
						Undervoltage release in secondary device	F-----	4----	1

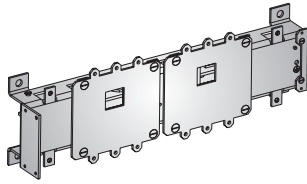
(1) Also applicable for combinations of three breakers.



Shunt release for breaker/switch				
	FE & FG type		FK type	
24V AC/DC	FASHTD	430843	FNSHTD	435693
110/130V AC/DC	FASHTJ	430849	FNSHTJ	435695
220/240V AC 250V DC	FASHTN	430852	FNSHTN	435696

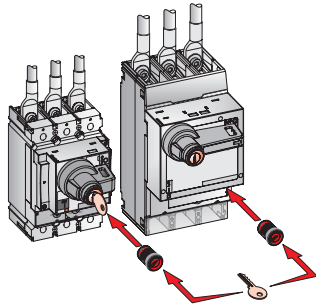
Undervoltage release for breaker/switch				
	FE & FG type		FK type	
24V AC/DC	FAUVRD	430861	-	-
24V AC	-	-	FNUVR1	435698
24V DC	-	-	FNUVRD	435701
110/130V AC/DC	FAUVRJ	430867	FNUVRJ	437018
220/240V AC 250V DC	FAUVRN	430870	-	-
230V AC	-	-	FNUVR6	435699

Mechanical interlocking of two breakers



System with walking beam										
Main Device			Secondary Device			Required components	Option 1			
N (left)			R (right)				Listed protection devices are breakers or switches order codes can be found on: FE 160: page A.13 FE 250: page A.16 FG 400: page A.25 FG 630: page A.27 FK 800: page A.35 FK1250: page A.36 FK1600: page A.37	Cat. no.	Ref. no.	Qty
FE160/250	FG400/630	FK800/1600	FE160/250	FG400/630	FK800/1600					
x			x			Mechanical interlock 2 FE frame breakers	FE1I2	437001	1	
	x			x		Mechanical interlock 2 FG frame breakers	FG1I2	437005	1	
x			x			Mechanical interlock 1 FG & 1 FE frame breakers	FG1I4	437009	1	
			x		x	Mechanical interlock 2 FK frame breakers	FN1I2F	433416	1	
			x		x	Mechanical interlock 1 FK & 1 FG frame breaker	FN1I4F	437016	1	

System with rotary handles, 1 key and two locks (Ronis 1104)^[2]



System with rotary handles, 1 key and two locks (Ronis 1104) ^[2]										
Main Device			Secondary Device			Required components	Option 2			
N (left)			R (right)				Listed protection devices are breakers or switches order codes can be found on: FE 160: page A.13 FE 250: page A.16 FG 400: page A.25 FG 630: page A.27 FK 800: page A.35 FK1250: page A.36 FK1600: page A.37	Cat. no.	Ref. no.	Qty
FE160/250	FG400/630	FK800/1600	FE160/250	FG400/630	FK800/1600					
x			x			Rotary handle, grey, through door or panel type FE Ronis keylock	FENRC/5 FA1BR --	436491 430 ---	2 2	
	x			x		Rotary handle, grey, through door or panel type FG Ronis keylock	FGNRC/5 FA1BR --	436504 430 ---	1 2	
x			x			Rotary handle, grey, through door or panel type FE Rotary handle, grey, through door or panel type FG Ronis keylock	FENRC/5 FGNRC/5 FA1BR --	436491 436504 430 ---	1 1 2	
			x		x	Rotary handle, grey, through door or panel type FK Ronis keylock	FNNRC/5 FA1BR --	436517 430 ---	1 2	
			x		x	Rotary handle, grey, through door or panel type FK Rotary handle, grey, through door or panel type FG Ronis keylock	FNNRC/5 FGNRC/5 FA1BR --	436517 436504 430 ---	1 1 2	

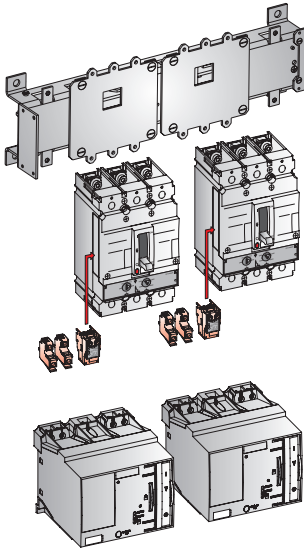
Keylocks type Ronis 1104 with key			
	Ronis keylock 1104B nr. BC 1027	FA1BR1	430088
	Ronis keylock 1104B nr. BC 1053	FA1BR2	430089
	Ronis keylock 1104B nr. BC 2932	FA1BR3	430504
	Ronis keylock 1104B nr. BC 2911	FA1BR4	430505
	Ronis keylock 1104B nr. BC 2936	FA1BR5	430506
	Ronis keylock 1104B nr. BC 2940	FA1BR6	430507

One type only



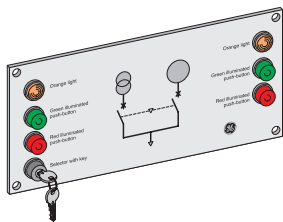
Complete automatic changeover sets

Two power supplies, ONLY one of which is allowed to supply the network



Main Device		Secondary Device		Required main components	Cat. no.	Ref. no.	Qty
N (left)		R (right)					
FE160/250	FG400/630	FK800/1600	FE160/250				
x			x	Option 1 System 110V 50/60Hz with all necessary breaker accessories for two FE frames - WITHOUT CONTROLLER System 220V 50/60Hz with all necessary breaker accessories for two FE frames - WITHOUT CONTROLLER Controller type E or E plus	FEE01J	437000	1
	x		x	Option 2 System 110V 50/60Hz with all necessary breaker accessories for two FG frames - WITHOUT CONTROLLER System 220V 50/60Hz with all necessary breaker accessories for two FG frames - WITHOUT CONTROLLER Controller type E or E plus	FGEO2J	437004	1
x			x	Option 3 System 110V 50/60Hz with all necessary breaker accessories for 1 FG + 1 FE frame - WITHOUT CONTROLLER System 220V 50/60Hz with all necessary breaker accessories for 1 FG + 1 FE frame - WITHOUT CONTROLLER Controller type E or E plus	FGEO3J	437008	1
	x		x	Option 4 System 110V 50/60Hz with all necessary breaker accessories for two FK frames - WITHOUT CONTROLLER System 220V 50/60Hz with all necessary breaker accessories for two FK frames - WITHOUT CONTROLLER Controller type E or E plus	FKE04J	437011	1
	x		x	Option 5 System 110V 50/60Hz with all necessary breaker accessories for 1 FK + 1 FG frame - WITHOUT CONTROLLER System 220V 50/60Hz with all necessary breaker accessories for 1 FK + 1 FG frame - WITHOUT CONTROLLER Controller type E or E plus	FKE05J	437015	1
Allowed combinations	OFF	OFF	OFF				
	ON	OFF	OFF				
	OFF	ON	ON				

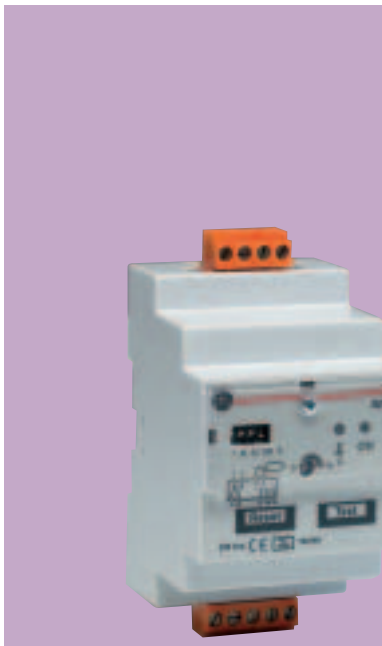
Allowed combinations



Required controller type E model ⁽¹⁾		
Controller 110/127V 50/60 cycles FE-FG frame	FAECA3	436453
Controller 110/127V 50/60 cycles combinations with FK frame	FNECA3	436452
Controller 220/240V 50/60 cycles FE-FG frame	FAECA6	872240
Controller 220/240V 50/60 cycles combinations with FK frame	FNECA6	436451
Required controller type E Plus model ⁽¹⁾		
Controller 110/127V 50/60 cycles FE-FG frame	FAECE3	872141
Controller 110/127V 50/60 cycles combinations with FK frame	FNECE3	436450
Controller 220/240V 50/60 cycles FE-FG frame	FAECE6	872140
Controller 220/240V 50/60 cycles combinations with FK frame	FNECE6	436449
E model with voltage monitoring ⁽¹⁾		
Add indicated code to controller cat nr. and add extra ref.nr.	---- M	872052

(1) This are the reference numbers for the controller in english version. For other languages, consult us.





Residual current devices with separate sensors

RD5, RD6 and RD1D

Function

RCD Relay

The relay part of the RCD device is a DIN-rail mounted device containing the electronics and the setting area. On receipt of a signal from the sensor two contacts are operated.

Sensor

Placed around the phase and neutral current paths it detects the vectorial sum of the current in the circuit. When this sum is no longer zero, a signal is sent to the connected RCD relay.

The connection between the relay and the sensor should be as short as possible, the maximum circuit resistance may not exceed 30 Ohm.

If the lead length is longer than 5 meters and/or the sensitivity is adjusted to values < 0.5A the use of screened cables and earthed screening is recommended. The same recommendation applies in cases where the sensor is installed in an environment where strong magnetic fields occur.

For high nominal currents or high sensitivities the cables must be centered within the sensor.

The use of an oversized sensor and/or reduced cable cross sections not centrally passing within the sensor could result in inaccurate readings.

Applications



Characteristics

RCD Relay

- Complies with EN 50082 & EN 60730
- For sinusoidal and pulsating earth leakages
- Test button and reset (memory clean) button
- Permanent working signal (green) and tripping signal (red) by means of LED
- Adjustable time delay (except 30mA) by means of potentiometer
- Two output contacts, one potential free
- Automatic test feature of the combination relay/sensor is provided
- On disconnection of the sensor, the relay trips
- Plug-in terminal block
- Width: 3 modules of 18 mm
- For installation in modular enclosures, DIN-rail mounted

Sensor

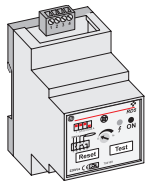
- Accuracy: 3/10,000 of the phase current (TTO type 1/10,000)
- Frequency: from 4 to 400Hz
- Sealable cover terminals
- For use with the relay types RD1D, RD5 and RD6 as described here. Also applicable for use with the reconnection relay RRC1 and RRC2 (see separate publications)

Dimensions ● pg G.33

	RD5	RD6	RD1D
Operating voltage	110; 220; 380/400V 50/60Hz ±15%	110; 220; 380/400V 50/60Hz ±15%	110; 220; 380/400V 50/60Hz ±15%
Power consumption	2.5VA	2.5VA	2.5VA
Sensitivity settings	0.03 ; 0.3 ; 0.5 ; 1A	0.2 ; 0.5 ; 2 ; 5A	0.01 - 5A in steps of 10mA
Setting method	Dipswitches	Dipswitches	Digital with LCD display
Frequency	50/60Hz	50/60Hz	50/60Hz
Time delay adjustment ⁽¹⁾	0 - 1 second	0.5 - 5 seconds	0 - 3 seconds in steps of 50ms
Tripping time 30mA type	1x IdN<50ms - 5 x Idn<35ms	1x IdN<50ms - 5 x Idn<35ms	1x IdN<50ms - 5 x Idn<35ms
Tripping threshold	75% of set sensitivity value	75% of set sensitivity value	75% of set sensitivity value
Pre Alarm at 50% setting	----	----	Contact settable at 50% Idn
Contact ratings	5A / 230V	5A / 230	5A / 230V
Operating temperature	- 20 to + 50°C	- 20 to + 50°C	- 20 to + 50°C
Terminal capacity	2.5 mm ² ; plug-in terminal box	2.5 mm ² ; plug-in terminal box	2.5 mm ² ; plug-in terminal box

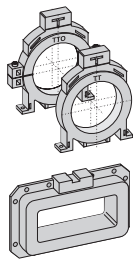
(1) Time setting ALWAYS disabled when 30mA setting is chosen.

RD range differential relay



	I Δ n	Operating voltage	Settable delay	Nr. of modules	Cat. no.	Ref. no.	Pack.
RD5	0,03 ... 1A	110V AC	0 - 1 s	3	RD5 110	704175	1
	0,03 ... 1A	220/230V AC	0 - 1 s	3	RD5 220	704169	1
	0,03 ... 1A	380/400V AC	0 - 1 s	3	RD5 380	704176	1
RD6	0,2 ... 5A	110V AC	0,5 - 5 s	3	RD6 110	704178	1
	0,2 ... 5A	220/230V AC	0,5 - 5 s	3	RD6 220	704177	1
	0,2 ... 5A	380/400V AC	0,5 - 5 s	3	RD6 380	704179	1
RD1D	0,01 ... 5A	110V AC	0 - 3 s	3	RD1D 110	872225	1
	0,01 ... 5A	220/230V AC	0 - 3 s	3	RD1D 220	872224	1
	0,01 ... 5A	380/400V AC	0 - 3 s	3	RD1D 380	872226	1

Sensor



	\varnothing internal (mm) (internal opening)	A		Cat. no.	Ref. no.	Pack.
Round	22	125	closed	TTD 22	560090	1
	35	125	closed	TT 35	872754	1
	60	160	closed	TT 60	872755	1
	80	160	closed	TT 80	872756	1
	110	250	closed	TT 110	872757	1
	160	400	closed	TT 160	872758	1
	210	630/800	closed	TT 210	872759	1
Rectangular	60	160	open	TTO 60	872760	1
	110	250	open	TTO 110	872761	1
	210	630/800	open	TTO 210	872762	1
	70x175	-	closed	BTR 175	704154	1
	115x305	-	closed	BTR 305	704155	1
	130x350	-	closed	BTR 350	704156	1

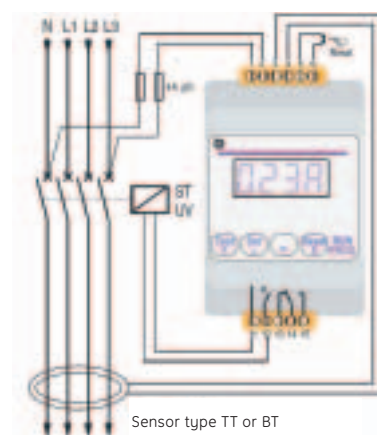
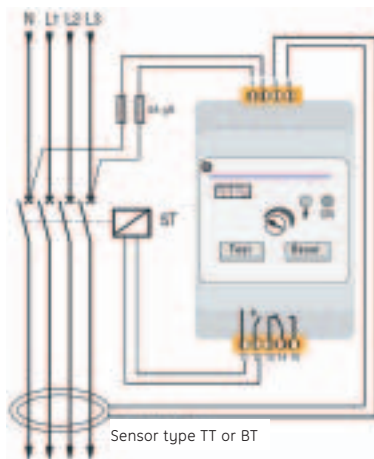
Accessories

	Cat. no.	Ref. no.	Pack.
Through Panel/Door mounting kit for relay with DIN -rail, mounting hardware and doorflange.	RDFR	872227	1

Wiring Diagram

When the Shunt Release in the Record Plus Breaker or Switch is connected to point 11 and point 12 of the release is supplied by the relay. (Voltage rating = Phase Neutral Voltage of the network)

Alternately points 13, 14 & 15 can be used allowing the use of a Shunt or Undervoltage release of a different voltage rating.



Intro

A

B

C

D

E

F

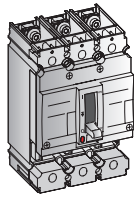
G

X



FE160 - Circuit breaker in components

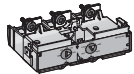
Breaker frames: Without trip unit



50kA FEN	In (A)	3 pole		4 pole		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
	160	FEN306F160JF	431712	FEN406F160JF	431799				
80kA FEH	160	FEH306F160JF	431126	FEH406F160JF	431213				
150kA FEL	160	FEL306F160JF	431419	FEL406F160JF	431506				

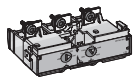
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware

Trip units: Line Thermal Magnetic (adjustable settings)



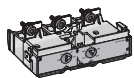
LTM	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	25	FETTA3J0025	432546	FETTA43J0025	432391	FETTA4J0025	432636	-	-
	32	FETTA3J0032	432549	FETTA43J0032	432394	FETTA4J0032	432639	-	-
	40	FETTA3J0040	432552	FETTA43J0040	432397	FETTA4J0040	432642	-	-
	50	FETTA3J0050	432555	FETTA43J0050	432400	FETTA4J0050	432645	-	-
	63	FETTA3J0063	432558	FETTA43J0063	432403	FETTA4J0063	432648	FETTA45J0063	432603
	80	FETTA3J0080	432561	FETTA43J0080	432406	FETTA4J0080	432651	FETTA45J0080	432606
	100	FETTA3J0100	432564	FETTA43J0100	432409	FETTA4J0100	432654	FETTA45J0100	432609
	125	FETTA3J0125	432567	FETTA43J0125	432412	FETTA4J0125	432657	FETTA45J0125	432612
	160	FETTA3J0160	432570	FETTA43J0160	432582	FETTA4J0160	432660	FETTA45J0160	432615

Trip units: Selective Thermal Magnetic (adjustable settings)



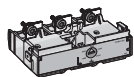
LTMD	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	100	FETTD3J0100	433159	FETTD43J0100	433201	FETTD4J0100	433269	FETTD45J0100	433231
	125	FETTD3J0125	433164	FETTD43J0125	433204	FETTD4J0125	433272	FETTD45J0125	433234
	160	FETTD3J0160	433168	FETTD43J0160	433207	FETTD4J0160	433275	FETTD45J0160	433239

Trip units: Generator Thermal Magnetic



GTM	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	100	FETTG3J0100	433296	FETTG43J0100	433311	FETTG4J0100	433332	FETTG45J0100	433326
	125	FETTG3J0125	433293	FETTG43J0125	432717	FETTG4J0125	432774	FETTG45J0125	432741
	160	FETTG3J0160	432696	FETTG43J0160	432720	FETTG4J0160	432777	FETTG45J0160	432744

Trip units: Mag Break™, Magnetic only type for motor protection



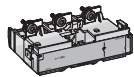
MC	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	12.5	FETMC3J0012	432495	-	-
	20	FETMC3J0020	432498	-	-
	30	FETMC3J0030	434736	-	-
	50	FETMC3J0050	432501	FETMC43J0050	432528
	80	FETMC3J0080	436078	-	-
	100	FETMC3J0100	432504	FETMC43J0100	432531
	125	FETMC3J0125	436358	FETMC43J0125	436359
	160	FETMC3J0160	432510	FETMC43J0160	432537

Trip units: Selective Electronic type without Rating Plug



SMR1	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	25	FETAA3J0025	432414	FETAA4J0025	432432
	63	FETAA3J0063	432417	FETAA4J0063	432435
	125	FETAA3J0125	432420	FETAA4J0125	432438
	160	FETAA3J0160	432423	FETAA4J0160	432441

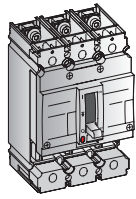
Trip units: Dummy for non Automatic Circuit Breaker (Switch)



Y	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FETD3J0160	432480	FETD4J0160	432486

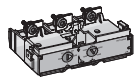
(1) Neutral on the left. If neutral on the right is needed, please contact us

FE250 - Circuit breaker in components



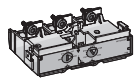
Breaker frames: Without trip unit

50kA FEN	In (A)	3 pole		4 pole		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
	250	FEN306F250KF	431715	FEN406F250KF	431802				
80kA FEH	250	FEH306F250KF	431129	FEH406F250KF	431216				
150kA FEL	250	FEL306F250KF	431422	FEL406F250KF	431509				
One code covers: A standard fixed front connection breaker + Toggle elongator + Breaker finishing covers + Fixation hardware									



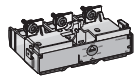
Trip units: Selective Thermal Magnetic (adjustable settings)

LTMD	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	125	FETTD3K0125	433182	FETTD43K0125	433216	FETTD4K0125	433284	FETTD45K0125	433252
	160	FETTD3K0160	433186	FETTD43K0160	433219	FETTD4K0160	433287	FETTD45K0160	433257
	200	FETTD3K0200	433191	FETTD43K0200	433222	FETTD4K0200	433290	FETTD45K0200	433260
	250	FETTD3K0250	433195	FETTD43K0250	433225	FETTD4K0250	433293	FETTD45K0250	433263



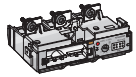
Trip units: Generator Thermal Magnetic

GTM	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FETTG3K0160	432705	FETTG43K0160	432729	FETTG4K0160	432786	FETTG45K0160	432753
	200	FETTG3K0200	432708	FETTG43K0200	432732	FETTG4K0200	432789	FETTG45K0200	432756
	250	FETTG3K0250	432711	FETTG43K0250	432735	FETTG4K0250	432792	FETTG45K0250	432759



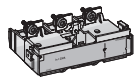
Trip units: Mag Break™, Magnetic only type for motor protection

MC	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FETMC3K0160	432513	FETMC43K0160	432540
	200	FETMC3K0200	436778	FETMC43K0200	436779
	250	FETMC3K0250	432516	FETMC43K0250	432543



Trip units: Selective Electronic type without Rating Plug

SMR1	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	125	FETAA3K0125	432004	FETAA4K0125	432007
	160	FETAA3K0160	432426	FETAA4K0160	432444
	250	FETAA3K0250	432429	FETAA4K0250	432447



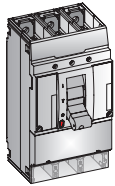
Trip units: Dummy for non Automatic Circuit Breaker (Switch)

Y	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	250	FETD30K0250	432483	FETD40K0250	432489

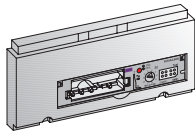
(1) Neutral on the left. If neutral on the right is needed, please contact us.

FG400 - Circuit breaker in components

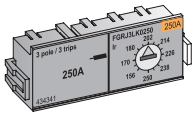
Breaker frame without Trip Unit									
50kA FGN	In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
	250	FGN306F250LF	434247	FGN406F250LF	434250				
	400	FGN306F400LF	431473	FGN406F400LF	431548				
80kA FGH	250	FGH306F250LF	434231	FGH406F250LF	434234				
	400	FGH306F400LF	431050	FGH406F400LF	431150				
150kA FGL	250	FGL306F250LF	434239	FGL406F250LF	434242				
	400	FGL306F400LF	431261	FGL406F400LF	431351				
One code covers: A standard fixed front connection breaker with current sensors + Toggle Elongator + Breaker finishing covers + Fixation hardware									



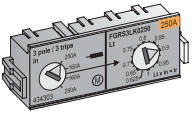
Selective Electronic Trip Unit (SMR1) without Rating Plug									
SMR1	In (A)	3 pole		4 pole ⁽¹⁾		Long time protection Two long time delay bands (with choice of protection mode) Short time protection Instantaneous protection	Adj. Ir = 0.4 - 1 x In Line, no phase loss protection Motor with phase loss protection Adj. 2 - 13 x Ir (current dependant delay) ⁽²⁾ Fixed 14 x Is ⁽²⁾		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
	250	FGTAA3L0250	434319	FGTAA4L0250	434323				
	400	FGTAA3L0400	431718	FGTAA4L0400	431742				



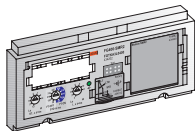
Type line 0.625 - 1 x In Adjustable Rating Plugs for Trip Units SMR1									
250A 400A	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FGRJ3LK0160	434337	FGRJ43LK0160	434345	FGRJ4LK0160	434361	FGRJ45LK0160	434353
	250	FGRJ3LK0250	434341	FGRJ43LK0250	434349	FGRJ4LK0250	434365	FGRJ45LK0250	434357
	250	FGRJ3LL0250	435343	FGRJ43LL0250	435356	FGRJ4LL0250	435397	FGRJ45LL0250	435367
	400	FGRJ3LL0400	433151	FGRJ43LL0400	433163	FGRJ4LL0400	433187	FGRJ45LL0400	433175



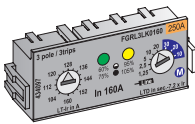
Type line/Motor 0.4 - 1 x In Switchable Rating Plugs for Trip Units SMR1									
250A 400A	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	250	FGRS3LK0250	434303	FGRS43LK0250	434307	FGRS4LK0250	434315	FGRS45LK0250	434311
	400	FGRS3LL0400	435435	FGRS43LL0400	434516	FGRS4LL0400	434537	FGRS45LL0400	434525



Modular Electronic Trip Unit (SMR2) without Rating Plug									
SMR2	In (A)	3 pole		4 pole ⁽¹⁾		4 for line, no phase loss protection Six long time delay bands Short time protection Switchable to I ² t curve Five short time delay bands Instantaneous protection	Adj. Ir = 0.4 - 1 x In 4 for line, no phase loss protection 2 for motor, with phase loss protection ⁽²⁾ Adj. 1.5-12 x Ir ⁽²⁾ From 40 to 410 milliseconds Adj. 2-13 x Is ⁽²⁾		
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
	250	FGTKA3L0250	434201	FGTKA4L0250	434205				
	350 ⁽³⁾	FGTKA3L0350	434902	FGTKA4L0350	434908				
	400 ⁽²⁾	FGTKA3L0400	434202	FGTKA4L0400	434261				



LT: Ir = 0.625-1 x In LTD: Line & Motor; 8 options Adjustable LT & LTD settable Rating Plugs for Trip Units SMR2									
250A 400A 350A ⁽²⁾	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
	160	FGRL3LK0160/7	436749	FGRL43LK0160/7	434469	FGRL4LK0160/7	434559	FGRL45LK0160/7	434472
	250	FGRL3LK0250/7	436656	FGRL43LK0250/7	434615	FGRL4LK0250/7	434562	FGRL45LK0250/7	434481
	250	FGRL3LL0250/7	436747	FGRL43LL0250/7	434599	FGRL4LL0250/7	434568	FGRL45LL0250/7	434579
	400	FGRL3LL0400/7	436721	FGRL43LL0400/7	434617	FGRL4LL0400/7	434584	FGRL45LL0400/7	434482
	350 ⁽²⁾	FGRL3LL0350/7	436748	FGRL43LL0350/7	434601	FGRL4LL0350/7	434582	FGRL45LL0350/7	434596



(1) Neutral on the left. If neutral on the right is needed, please contact us.
 (2) 400A trip unit limited to 5 LTD band settings(SMR2), a maximum ST setting of 10 x Ir and a maximum instantaneous setting of 11 x Is.
 (3) Specifically configured for Motor Protection

Order Codes

Intro

A

B

C

D

E

F

G

X



FG630 - Circuit breaker in components

Breaker frame without Trip Unit									
50kA FGN	In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
400	400	FGN306F400NF	431488	FGN406F400NF	431554				
	630	FGN306F630NF	431491	FGN406F630NF	431560				
80kA FGH	400	FGH306F400NF	431067	FGH406F400NF	431153				
	630	FGH306F630NF	431073	FGH406F630NF	431156				
150kA FGL	400	FGL306F400NF	431267	FGL406F400NF	431354				
	630	FGL306F630NF	431282	FGL406F630NF	431357				
One code covers: A standard fixed front connection breaker with current sensors + Toggle Elongator + Breaker finishing covers + Fixation hardware									

Selective Electronic Trip Unit (SMR1) without Rating Plug									
SMR1	In (A)	3 pole		4 pole ⁽¹⁾		Long time protection Two long time delay bands (with choice of protection mode)	Short time protection	Instantaneous protection	Adj. Ir = 0.4 - 1 x In Line, no phase loss protection Motor with phase loss protection Adj. 2 - 13 x Ir (current dependant delay) ⁽²⁾ Fixed 14 x Is ⁽²⁾
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
400	400	FGTAA3N0400	431721	FGTAA4N0400	431745				
	500 ⁽³⁾	FGTAA3N0500	434893	FGTAA4N0500	434899				
	630	FGTAA3N0630	431736	FGTAA4N0630	431748				

Type line 0.625 - 1 x In Adjustable Rating Plugs for Trip Units SMR1									
400A	In (A)	3 pole 3 trips		4 pole ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
250	250	FGRJ3NL0250	433148	FGRJ43NL0250	433160	FGRJ4NL0250	433184	FGRJ45NL0250	433172
	400	FGRJ3NL0400	435182	FGRJ43NL0400	435188	FGRJ4NL0400	435200	FGRJ45NL0400	435194
630A	400	FGRJ3NN0400	433154	FGRJ43NN0400	433166	FGRJ4NN0400	433190	FGRJ45NN0400	433178
	630	FGRJ3NN0630	433157	FGRJ43NN0630	433169	FGRJ4NN0630	433193	FGRJ45NN0630	433181

Type line/Motor 0.4 - 1 x In Switchable Rating Plugs for Trip Units SMR1									
400A	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
400	400	FGRS3NL0400	433235	FGRS43NL0400	433241	FGRS4NL0400	433253	FGRS45NL0400	433247
	500 ⁽³⁾	FGRS3NN0500	434512	FGRS43NN0500	434521	FGRS4NN0500	434542	FGRS45NN0500	434530

Modular Electronic Trip Unit (SMR2) without Rating Plug									
SMR2	In (A)	3 pole		4 pole 4 trips ⁽¹⁾		4 for line, no phase loss protection Six long time delay bands	Short time protection Switchable to I ² t curve Five short time delay bands Instantaneous protection	Adj. Ir = 0.4 - 1 x In 4 for line, no phase loss protection 2 for motor, with phase loss protection ⁽²⁾ Adj. 1.5-12 x Ir ⁽²⁾ From 40 to 410 milliseconds Adj. 2-13 x Is ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
400	400	FGTKA3N0400	434203	FGTKA4N0400	434263				
	500 ⁽³⁾	FGTKA3N0500	434905	FGTKA4N0500	434911				
	630 ⁽²⁾	FGTKA3N0630	434204	FGTKA4N0630	434265				

LT: Ir = 0.625-1 x In LTD: Line & Motor; 8 options Adjustable LT & LTD settable Rating Plugs for Trip Units SMR2									
400A	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N=50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
250	250	FGRL3NL0250/7	436739	FGRL43NL0250/7	434588	FGRL4NL0250/7	434492	FGRL45NL0250/7	434592
	400	FGRL3NL0400/7	436746	FGRL43NL0400/7	434590	FGRL4NL0400/7	434493	FGRL45NL0400/7	434594
630A	400	FGRL3NN0400/7	436726	FGRL43NN0400/7	434605	FGRL4NN0400/7	434496	FGRL45NN0400/7	434581
	630	FGRL3NN0630/7	436722	FGRL43NN0630/7	434622	FGRL4NN0630/7	434532	FGRL45NN0630/7	434624
500 ⁽²⁾	500 ⁽²⁾	FGRL3NN0500/7	436738	FGRL43NN0500/7	434607	FGRL4NN0500/7	434502	FGRL45NN0500/7	434597

Extension modules for the SMR2 Electronic trip unit

Plug-in types replacing the filler module (1 pc max.)										
SMR2	Ammeter with 4 digit LCD display					FAMAM2	436183			
	Groundfault alarm + Modbus communication					FAMGAM2	436185			
	Groundfault alarm + 2 channel load shedding device					FAMGAS2	436186			
	Groundfault alarm + Fault type indicators					FAMGAT2	436187			
	Groundfault protection + Modbus communication					FAMGFM2	436188			
	Groundfault protection + 2 channel load shedding device					FAMGFS2	436189			
	Groundfault protection + Fault type indicators					FAMGFT2	436190			
	2 channel load shedding device + Modbus communication					FAMSM2	436192			
	2 channel load shedding device + Fault type indicators					FAMST2	436197			
	Fault type indicators + Modbus communication					FAMMT2	436191			
	Spare filler module					FAMB2	434448			
	One code covers: A plug-in module and where needed connection hardware									
	Other Modules									
SMR2	External communication and contact module (4 contacts, 1A/400V) ⁽⁴⁾					FAMECM	434013			
One code covers: Module and connection hardware										

(1) Neutral on the left. If neutral on the right is needed, please contact us.
 (2) 630A trip unit limited to 5 LTD band settings(SMR2), a maximum ST setting of 10 x Ir and a maximum instantaneous setting of 11 x Is.
 (3) Specifically configured for Motor Protection
 (4) Is needed for Modbus communication (1 per breaker).



Just rel

Thermal magnetic & Magnetic only trip units

- B.2 FD frame: LTM, LTMD, GTM, Mag Break™
- B.6 FE frame: LTM, LTMD, GTM, Mag Break™

Electronic trip units

- B.11 SMR1 range
- B.12 FE160 & FE250 selective electronic trip unit SMR1
- B.13 Setting the selective electronic trip unit SMR1
- B.18 SMR2 range
- B.19 FG400 & FG630 advanced electronic trip unit SMR2
- B.24 FK800 - FK1600 electronic trip unit SMR1e, s & g
- B.28 Accessories for SMR1 and SMR2 types
- B.29 Trip units - overview of available types

The breaker

Order codes

Trip units

Components & Accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

A

B

C

D

E

F

G

X

y on us



Thermal Magnetic Trip Units

FD frame

Record Plus™ circuit breakers are designed to isolate and switch low voltage distribution circuits and to protect the conductors, equipment and devices included in these circuits.

The FD frame size is designed to use electro-mechanical trip units. These are typical thermal magnetic devices which offer an overload (thermal) and short-circuit protection (magnetic).

The breaker can also be equipped with a Mag Break™ magnetic-only trip unit that offers short-circuit protection.

The trip units have been designed with the user in mind. The trip unit ratings are always indicated in amperes. To prevent unauthorized manipulation of the breaker settings each trip unit comes with a transparent, tamper-free (sealable) cover.

The units come as 1, 2, 3 and 4 pole devices and are available in a number of application-defined subvariants. Thermal protection devices are normally calibrated at an ambient temperature of 40 degrees centigrade. Some executions are also available in a version calibrated at 55 degrees. The time current curves published here are valid for both executions.

The trip unit is an integrated part of the breaker and is not interchangeable. The following versions are available:

LTM (line protection thermal magnetic)

(FD...TF sub type)

A trip unit designed for the protection of generic loads, the device is available as 3 and 4p model for the Concise (FD160C) and Effective (FD160E) breaker types. The same trip unit is also used in the single pole variants of the standard (FD160N) and Hi-Breaker (FD160H) types.

This sub type has a fixed thermal device ($=I_n$) and a fixed magnetic relay set at $10 \times I_n$ ($8 \times I_n$ for the 160A rating).

LTM (line protection thermal magnetic)

(FD..TC & TE sub type)

A trip unit designed for the protection of generic loads, the device is available as 3 and 4p model for the Concise (FD160C) and Effective (FD160E) breaker types.

This sub type has an adjustable thermal setting of 0.8 to $1 \times I_n$ and a fixed magnetic relay set at $10 \times I_n$ ($8 \times I_n$ for the 160A rating).

LTMd (line thermal magnetic, selective)

(FD..TD sub type)

A trip unit designed for the selective protection of generic loads, it is available as 2p model for the FD160N and as 3 and 4p model for the FD160S, N, H & L breaker types.

Making full use of the FD frames unique properties this device offers both full and enhanced selectivity with downstream devices as the ElfaPlus, Red Line MCB's and the Surion Motor Starter.

It has an adjustable thermal setting of 0.8 to $1 \times I_n$ and a fixed magnetic relay set at $10 \times I_n$ ($8 \times I_n$ for the 160A rating).

GTM (generator thermal magnetic)

(FD..TG sub type)

Suitable for the protection of generator circuits and or long cable runs, the device is available as 3 and 4p model for the Standard (FD160N) and Hi-Break (FD160H) breaker types.

This sub type has an adjustable thermal setting of 0.8 to $1 \times I_n$ and a reduced fixed magnetic relay setting of 4 or $5 \times I_n$.

Mag Break™ (magnetic only)

(FD..MO sub type)

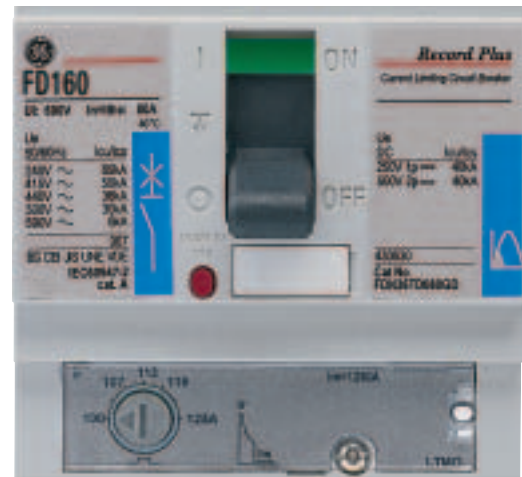
A trip unit designed to offer short circuit protection for, use in motor protection circuits in coordination with a contactor and thermal overload relay in accordance with the EN 60 947-4 standard. The device is available as 3 and 4p model for the FD160N, H & L breaker types. This sub type has NO thermal protection and an magnetic relay that is adjustable from 10 to $15 \times I_n$.

Y (non automatic - switch disconnecter)

A device available in a 63A and 160A variant.

Has no protection elements.

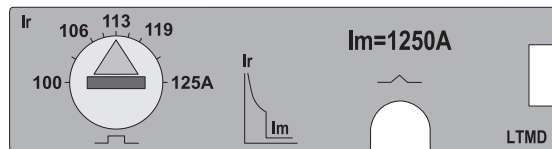
Designed as switch disconnecter



FD160 Trip Unit options

FD frame				Trip unit overview								
Type	Sub-type	Applicable for breaker types		In	Thermal setting I _r		Magnetic setting I _m		Neutral protection			
				(A)	pick-up band 1.05 ÷ 1.3 I _r min (A) max (A)		pick-up band ± 20% I _m fix (A)		4P4T	4P 3.5T	4P3T	
LTM	TF	C	E	16	I _r = I _n	16	10 x I _n	160	=I _r			
				20		20		200				=I _r
				25		25		250				=I _r
				32		32		320				=I _r
				40		40		400				=I _r
				50		50		500				=I _r
				63		63		630				=I _r
				80		80		800				=I _r
				100		100		1000				=I _r
				125		125		1250				=I _r
				160		160		1280				=I _r
LTM	TC TE	C	E	16	I _r = 0.8÷1I _n	12.8 16	10 x I _n	160	=I _r			
				20		16 20		200				=I _r
				25		20 25		250				=I _r
				32		25.6 32		320				=I _r
				40		32 40		400				=I _r
				50		40 50		500				=I _r
				63		50.4 63		630				=I _r
				80		64 80		800				=I _r
				100		80 100		1000				=I _r
				125		100 125		1250				=I _r
				160		128 160		1280				=I _r
LTMD	TD	S	N H L	16	I _r = 0.8÷1I _n	12.8 16	10 x I _n	160	=I _r		not protected (1)	
				20		16 20		200				=I _r
				25		20 25		250				=I _r
				32		25.6 32		320				=I _r
				40		32 40		400				=I _r
				50		40 50		500				=I _r
				63		50.4 63		630				=I _r
				80		64 80		800				=I _r
				100		80 100		1000				=I _r
				125		100 125		1250				=I _r
				160		128 160		1280				=I _r
GTM	TG		N H	25	I _r = 0.8÷1I _n	20 25	5 x I _n	125	=I _r		not protected	
				32		25.6 32		160				=I _r
				40		32 40		160				=I _r
				50		40 50		200				=I _r
				63		50.4 63	252	=I _r				
				80		64 80	320	=I _r				
				100		80 100	400	=I _r				
				125		100 125	500	=I _r				
160	128 160	640	=I _r									
Mag. Break™	MO		N H L	3	No protection		Adjustable 10÷15I _n	35 52.5			not protected	
				7				70 105				
				12.5				125 187.5				
				20				200 300				
				30				300 450				
				50				500 750				
				80				800 1200				
100		1000 1500										
Y		Y		63							No protection	
				160								No protection

(1) Not available in S type



Depicted is the LTMD type

FD frame
Intro
A
B
C
D
E
F
G
X



Time Current Curves

FD frame

Trip Units

Intro

A

B

C

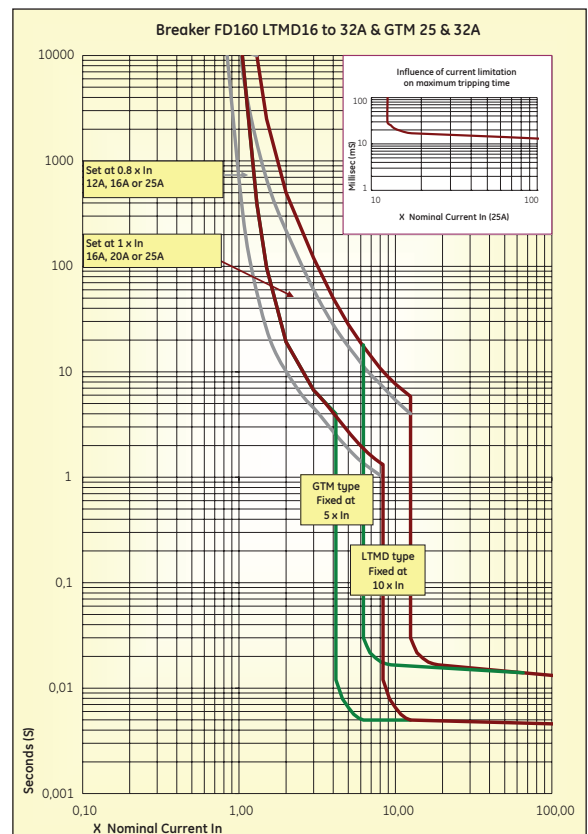
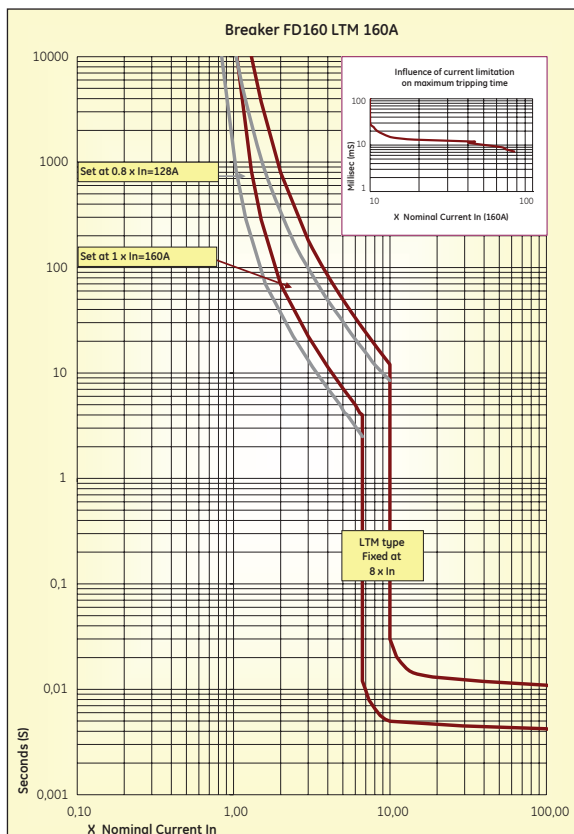
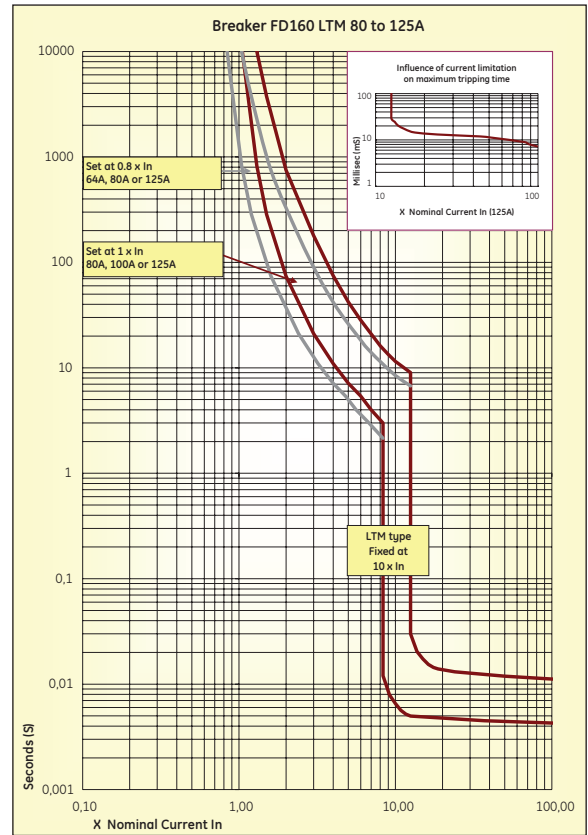
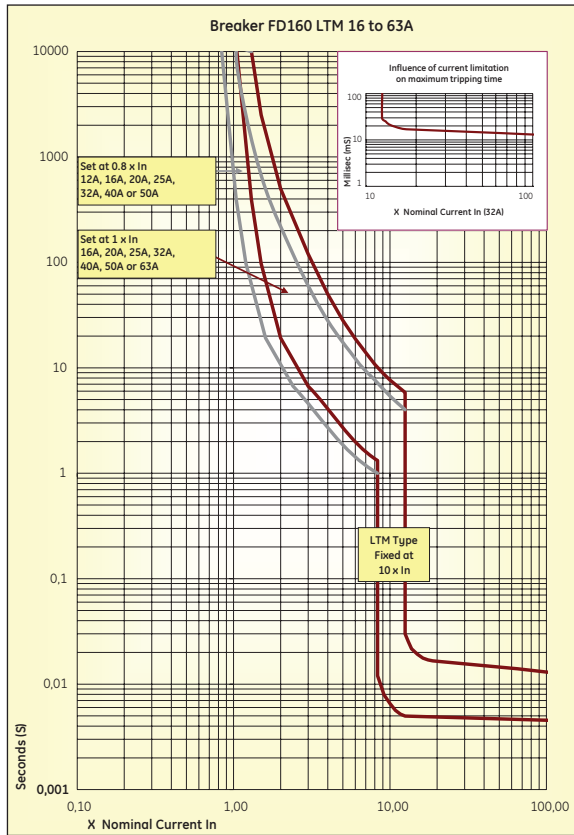
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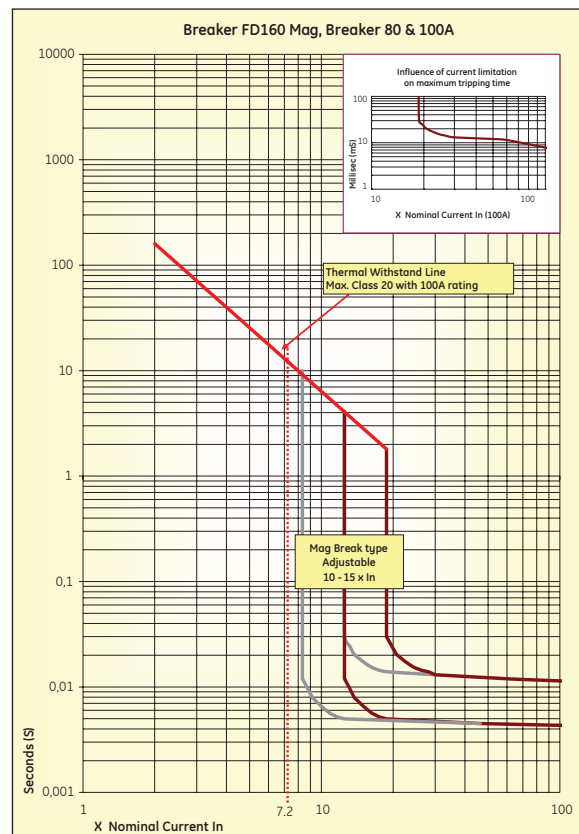
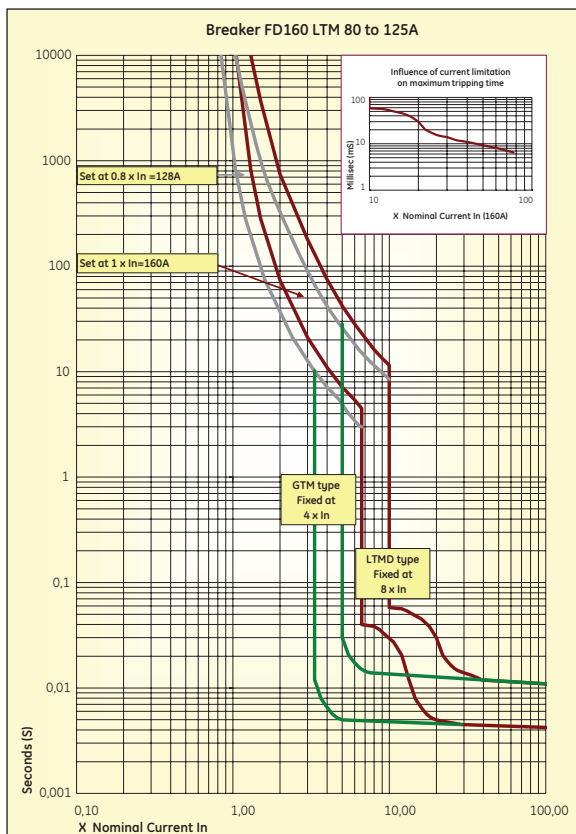
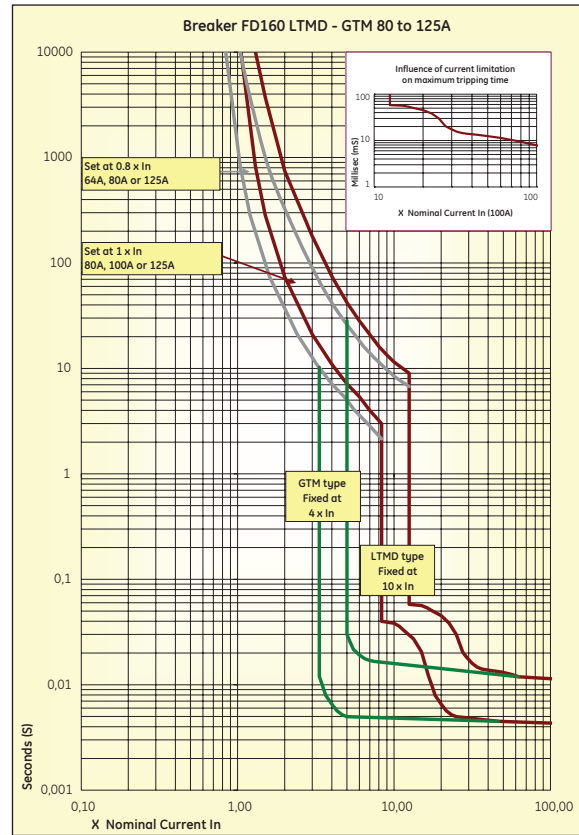
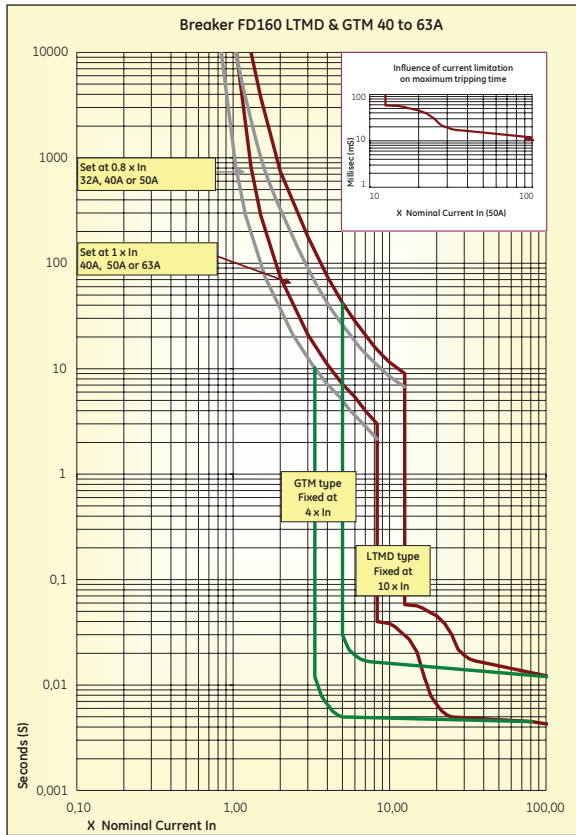
X



Time current curves are depicted in cold state.
For the types with fixed thermal settings (FD..TF) the 'set at 1x in' curves apply



Time Current Curves



Time current curves are depicted in cold state.
For the types with fixed thermal settings (FD..TF) the 'set at 1x in' curves apply

FD frame

Intro

A

B

C

D

E

F

G

X



Thermal Magnetic Trip Units

FE frame

The breakers are available as a complete entity or in kit form where a Breaker Frame and an interchangeable trip unit are the basic components. The interchangeability feature covers the electromechanical trip units described here and the electronic devices described on page B12. Each Trip Unit is equipped with an Interchange Interlock that prevents the inadvertent use of a trip unit designed for the FE250 model in an FE160 or vice versa. The standard Electromechanical Trip Units are equipped with a GE patented fault type indicator. The device has

two indicator flags, one indicating an overload event (coloured brown) and a second, coloured blue, indicating a short circuit or an event triggered by an RCD. (If the indicated protection devices are present). Thermal protection devices are normally calibrated at an ambient temperature of 40 degrees centigrade. Some executions are also available in a version calibrated at 55 degrees. The time current curves published here are valid for both executions.

The following versions are available:

LTM (line thermal magnetic protection)

(FE...TA sub type)

A trip unit designed for the protection of generic loads, the device is available as 3 and 4p model for the FE160 and FE 250 frame sizes.

This sub type has an adjustable thermal and magnetic setting. The thermal setting range is 0.8 to 1 x In and the magnetic relay is adjustable from 5-10 x In. (Fixed at 8 x In for Ratings < 80A).

LTMD (Selective thermal magnetic protection)

(FE...TD sub type)

A trip unit designed for the selective protection of generic loads, it is available as 3 and 4p model for the FE160 and FE250 N, H & L breaker types.

Making full use of the FE frames unique properties this device offers both full and enhanced selectivity with downstream devices as the Record Plus FD160, the ElfaPlus, Red Line MCB's and the Surion Motor Starter. This sub type has an adjustable thermal and magnetic setting. The thermal setting range is 0.8 to 1 x In and the magnetic relay is adjustable from 5-10 x In.

GTM (generator thermal magnetic)

(FE...TG sub type)

Suitable for the protection of generator circuits and or long cable runs, the device is available as 3 and 4p model for the Standard (FE160N & FE250N) and Hi-Break (FE160H & FE250H) breaker types.

This sub type has an adjustable thermal and magnetic setting. The thermal setting range is 0.8 to 1 x In and the magnetic relay is adjustable from 3-5 x In.

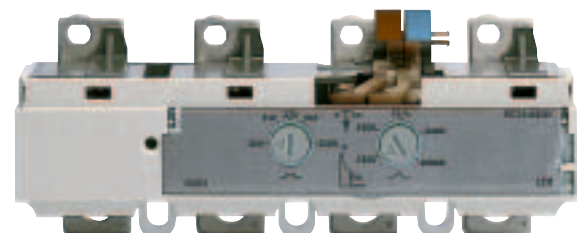
Mag Break™ (magnetic only)

(FE...MO sub type)

A trip unit designed to offer short circuit protection for, use in motor protection circuits in coordination with a contactor and thermal overload relay in accordance with the EN 60 947-4 standard. The device is available as 3 and 4p model for the FE160 & FE250 N, H & L breaker types. This sub type has NO thermal protection and an magnetic relay that is adjustable from 10 to 15 x In.

Y (non automatic - switch disconnecter)

A 'dummy' trip unit available in a 160A and 250A variant. Has no protection elements. Designed as switch disconnecter.



FE160 and FE250 breakers - trip unit overview (electromechanical)

FE frame					Electro-mechanical trip unit overview									
Type	Subtype	Applicable for breaker types			In (A)	Thermal Ir		Magnetic Im		Neutral protection				
						pick-up band $1.05 \div 1.3 I_r$		pick-up band $\pm 20\% I_m$		4P4T	4P 3.5T	4P3T		
					min (A)	max (A)	min (A)	max (A)						
LTM	TA	N	H	L	FE160	25	20	25	200	=Ir	not protected			
						32	26	32	256	=Ir				
						40	adjustable	32	40	Fixed		320	=Ir	
						50	0.8÷1xIn	40	50	8 x In		400	=Ir	
						63		50	63			504	=Ir	
						80		64	80			400	800	=Ir
	100		80	100		500	1000	=Ir						
	125		100	125		625	1250	=Ir						
	160		128	160		800	1600	=Ir						
	125	V			FE250	125	100	125	adjustable	625		1250		
	160					adjustable	128	160	5÷10 In	800		1600		
	200					0.8÷1xIn	160	200		1000		2000		
250						200	250		1250	2500				
100						80	100		500	1000	=Ir			
125	adjustable					100	125	adjustable	625	1250	=Ir			
160	0.8÷1xIn	128	160	5÷10 In	800	1600	=Ir							
125		100	125		625	1250	=Ir							
160	adjustable	128	160	adjustable	800	1600	=Ir							
200	0.8÷1xIn	160	200	5÷10 In	1000	2000	=Ir							
250		200	250		1250	2500	=Ir							
LTMD	TD	N	H	L	FE160	100	80	100	500	1000	=Ir	not protected		
						125	adjustable	100	125	adjustable	625		1250	=Ir
						160	0.8÷1xIn	128	160	5÷10 In	800		1600	=Ir
						125		100	125		625		1250	=Ir
						160	adjustable	128	160	adjustable	800		1600	=Ir
						200	0.8÷1xIn	160	200	5÷10 In	1000		2000	=Ir
250		200	250		1250	2500	=Ir							
GTM	TG	N	H	L	FE160	100	adjustable	60	100	300	400	=Ir	not protected	
						125	0.8÷1xIn	100	125		375	625		=Ir
						160		128	160		480	800		=Ir
						125		100	125	adjustable	375	625		=Ir
						160	adjustable	128	160	3-5 In	480	800		=Ir
						200	0.8÷1xIn	160	200		600	1000		=Ir
250		200	250		750	1250	=Ir							
Mag. Break™	MO	N	H	L	FE160	3.5			24.5	52.5	not protected			
						7			49	105				
						12.5			adjustable	87.5		188		
						20			7÷15In	140		300		
						30				210		450		
						50				500		750		
						80				800		1200		
						100				1000		1500		
						125				adjustable		1250	1875	
						160				10÷15In		1600	2400	
						160						1600	2400	
						200						2000	3000	
250					2500	3750								
Y		Y			FE160	No protection								
					FE250	No protection								

FE frame

Intro

A

B

C

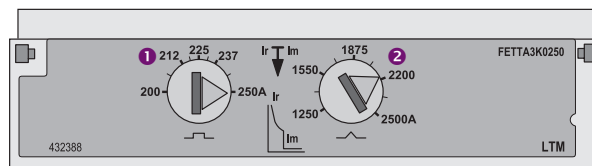
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E

F

G

X



Depicted is the LTMD type



Time Current Curves

FE frame

Trip Units

Intro

A

B

C

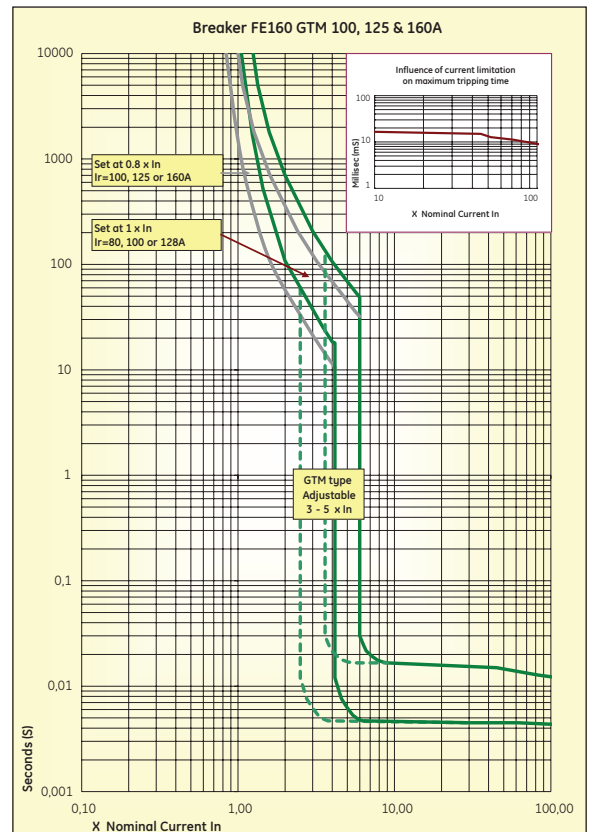
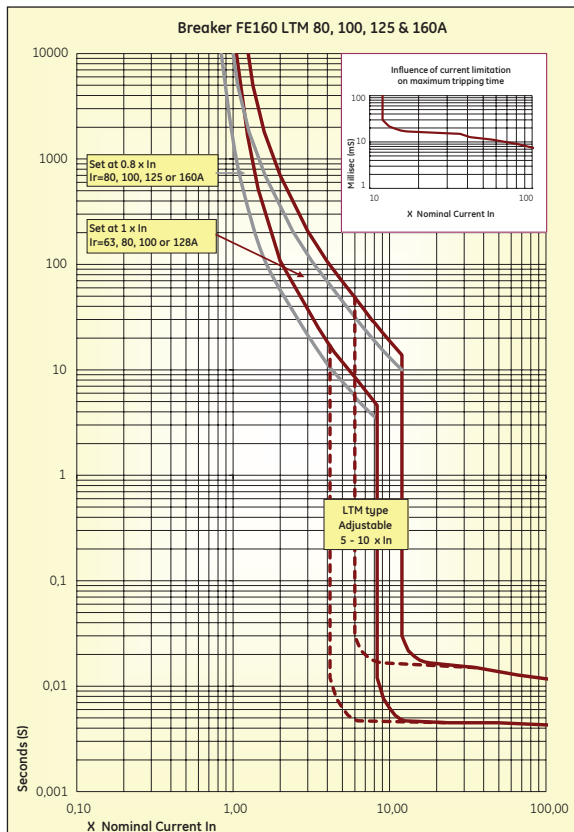
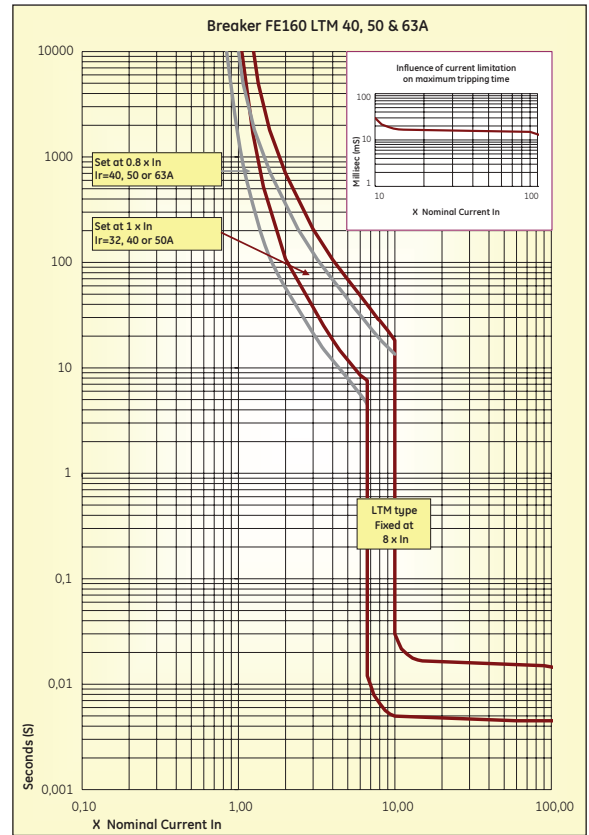
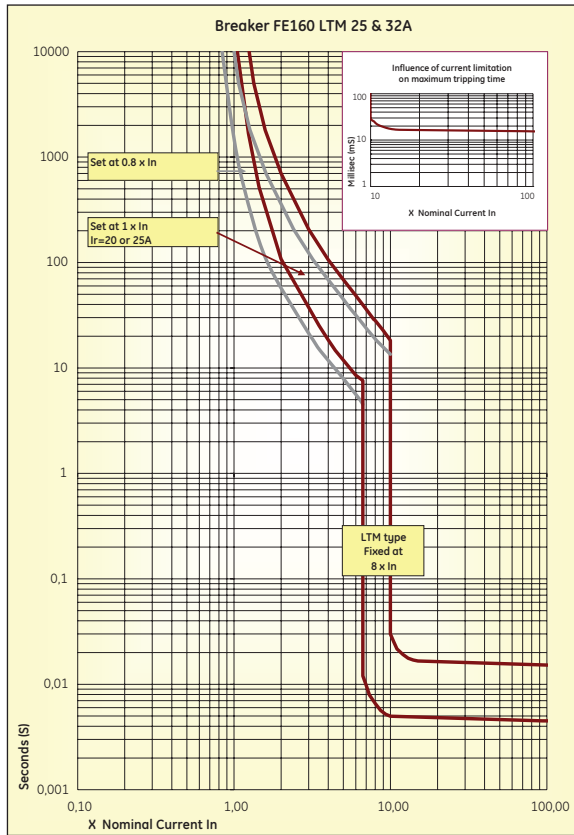
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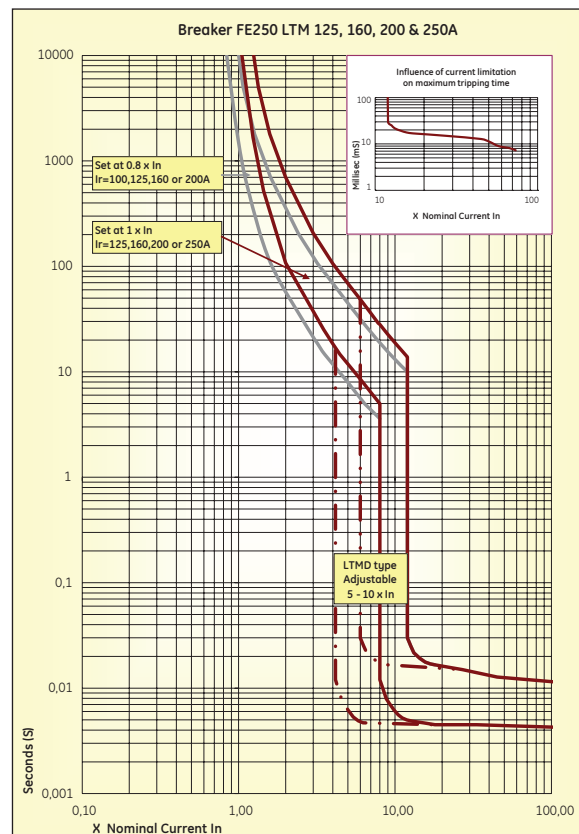
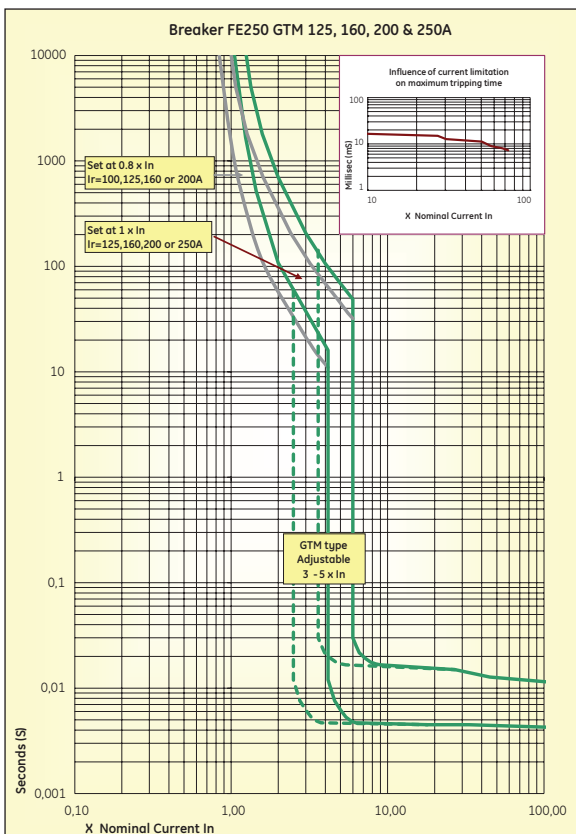
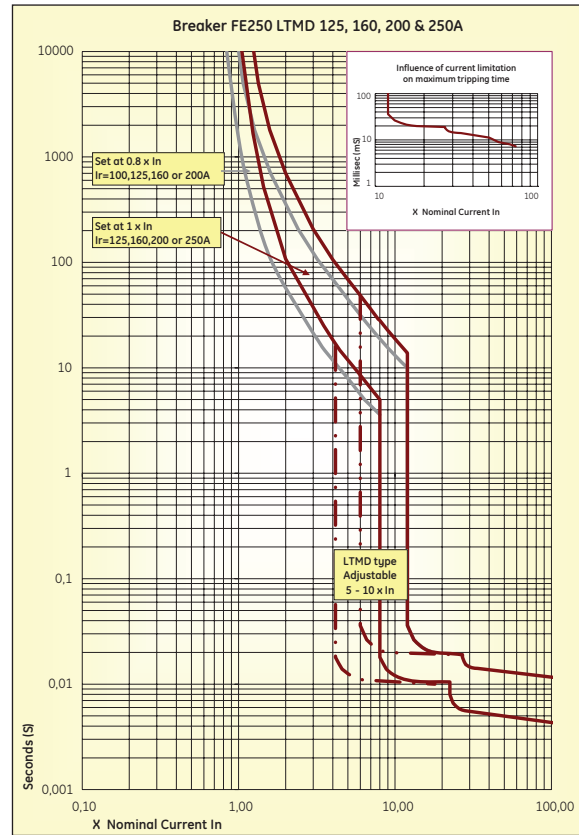
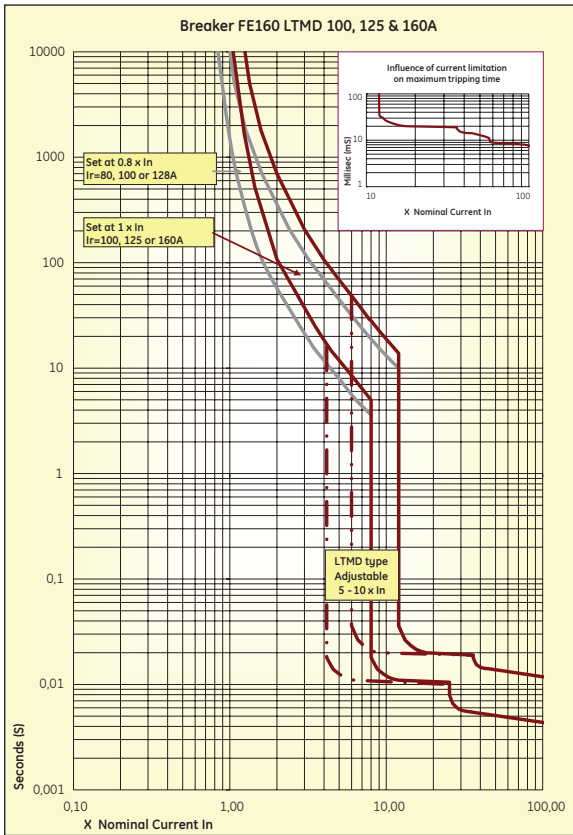
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Time current curves are depicted in cold state.



Time Current Curves



Time current curves are depicted in cold state.

FE frame

Intro

A

B

C

D

E

F

G

X



Time Current Curves

FE frame

Trip Units

Intro

A

B

C

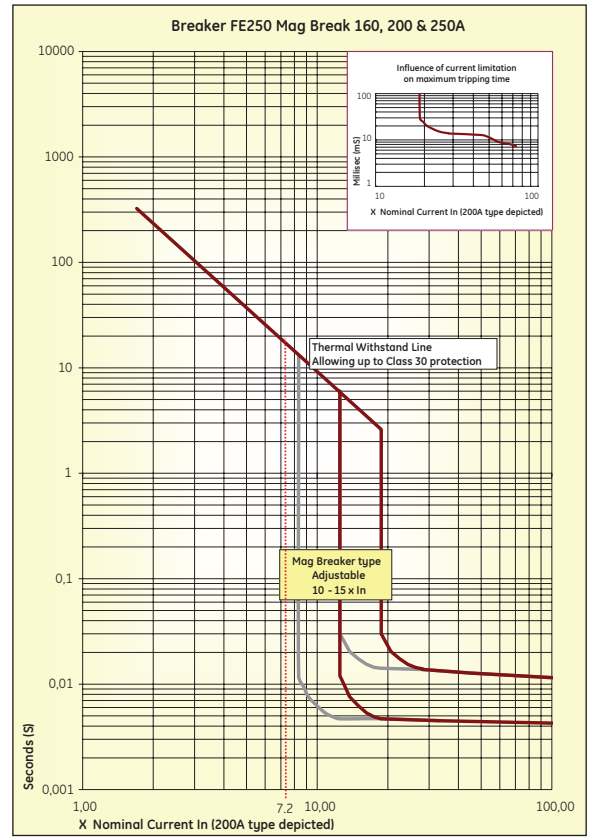
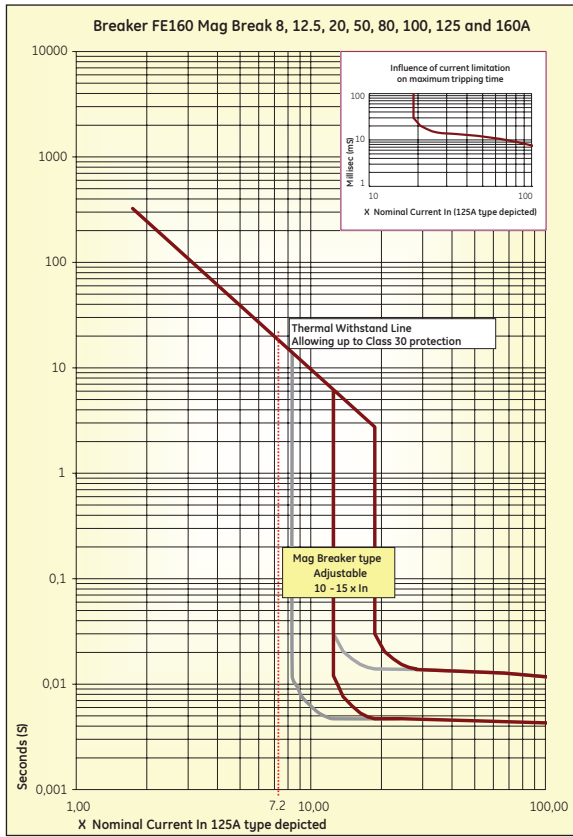
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E

F

G

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Time current curves are depicted in cold state.



Electronic Trip Units

SMR range

Electronic trip units that offer sophisticated protective functions and wide setting bands are standard protection devices for the FG400, FG630, FK800, FK1250 and FK1600 frame sizes. The FE frame can be equipped with interchangeable trip units offering a choice of the electronic or the electro-mechanical device. Each electronic device has been designed with the abnormalities of modern low voltage distribution

circuits in mind and has been rigorously tested to cope with harmonic currents, electromagnetic fields, inrush currents and spikes, thus preventing phenomena as incorrect current measurement and nuisance tripping. The devices exist in a number of performance tiers, the SMR1 device for the FE and FG frame sizes, the SMR 2 for the FG frame size and the SMR1e, 1s and 1g types for the FK frame size.

SMR1

The SMR1 trip unit type is available for all FE and FG frame sizes. The device has two basic protective functions. The first is a **Long Time** or overload protection with two time bands designed to match motor or cable characteristics and a user definable setting range. When set to motor protection mode a phase loss protection is initiated that will trip the breaker when the difference in current between one phase line and the average of all three phase drops below 20% .

The second device, the **Short Time** protection, offers protection against short-circuits and is settable from 2 to 13⁽¹⁾ x the adjusted LT protection.



This easy-to-adjust trip unit is equipped with a LT pre-alarm device made up of a LED indicator on the trip unit front face and an electronic contact.

Before the breaker trip is initialized the LED will at first start to blink (at about 0.95 x Ir). When the current flowing through the breaker reaches about 1.05 x Ir and a trip is imminent , the LED stops blinking, remains on and an electronic contact closes, this just before the circuit breaker trips and power is disconnected. This electronic signal can be linked to an external LT module that transforms the electronic signal into one that allows the operation of an external relay. (The LT module is a modular DIN-rail device).

All SMR 1 trip units have a built-in temperature sensor that trips the breaker at temperatures above 90°C. It thus prevents the breaker and electrical components in its immediate vicinity from overheating.

Each SMR1 trip unit comes with a transparent, tamper-free (sealable) cover, this to prevent unauthorized manipulation of the breaker settings. In the FE frame size they are supplied in a single housing including current sensors that can fully displace the alternative electromechanical device while the FG type is supplied as an electronic pouch (current sensors supplied with the breaker).

Sensor color code	
FE frame	25A
	63A
	125A
	160A
	250A
FG400	350A
	400A
	400A
FG630	500A
	630A

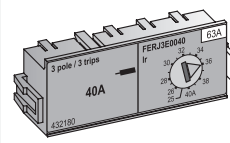
The SMR 1 uses rating plugs that allow the user flexibility to make a last minute choice in the required current rating, protected poles or protection band. These exist in two variants, adjustable and switchable. In order to prevent an insertion of a rating plug into the incorrect trip unit (number of poles and current rating) a mechanical interlock and color coding system are present.

The device is supplied with an electronic actuator coil that fits into a pocket in the breaker housing and is then connected to the trip unit. Without mounted and connected actuator coil the breaker will not function. However, in order to verify a correct operation of the combination a simple test device is available to test the assembly.

We strongly recommend the use of this test device.

Adjustable rating plug

Specifically designed for line protection with a setting range of 0.625 to 1 x the plug rating over 16 setpoints. The settings on the devices are in current values and thus allow for ease of setting.



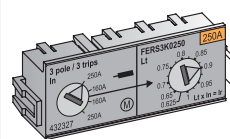
Each trip unit size can be equipped with one of two available adjustable rating plugs types. For 4 pole trip units the rating plugs exist

in 3 and 4pole protected versions with a choice in neutral rating between 50 or 100% of the phase value.

Switchable rating plug

Allows for a choice of line or class 10 motor protection⁽²⁾. The device has two setting knobs: one for the desired rating and band selection and one for the definite current setting.

The current setting is in multiples of the selected rating and has a range of 0.4 to 1 x the trip unit size over 32 setpoints. Each trip unit size has one switchable rating plug. For 4 pole trip units the rating plugs exist in 3 and 4 pole protected versions with a choice in neutral rating between 50 or 100% of the phase value.



(1) Some FG types have a smaller ST setting range.
(2) according to IEC EN 60947-4.1

SMR1 range

FE160 & FE250 Selective Electronic Trip Unit SMR1

Trip units are available in 10 different versions depending on the frame rating and the network frequency.
 FE 160 frame size 50/60 Hz 25, 63, 125 and 160A
 FE250 frame size 50/60 Hz 125, 160 and 250A
 For use at 400 cycles applications the following variants are available on request:
 FE160 125 & 160A ratings, FE250 -250A rating

The trip units must be equipped with a rating plug that establishes the rated current of the protective device and its setting. A colour code and a mechanical interlock prevent incorrect combinations of electronic trip units and rating plugs. The 50/60Hz and 400Hz variants use the same rating plug. When NO rating plug is installed in the breaker, all protective functions remain operational. This at a reduced current rating. (15 -20% of the chosen trip unit rating).

Trip Units

Intro

A

B

C

D

E

F

G

X

FE frame				Electronic trip unit overview										
	N	H	L	FE frame	In ⁽¹⁾	LT		ST		Neutral protection				
					(A)	pick-up band 1.05±1.2 Ir	pick-up band ± 20% Im	Im setting	min (A)			max (A)		
					Ir setting	min (A)	max (A)						min (A)	max (A)
SMR1 + adjustable rating plug	N	H	L	FE160	16		10	16		20	208	=Ir	not protected	
					25		16	25		32	325	=Ir		
					40	0.625-1xIn	25	40		50	520	=Ir		
					63	16 steps	40	63	2-13xIr	79	819	=Ir		=Ir/2
					80	line protection	50	80	10 steps	101	1040	=Ir		=Ir/2
				125		80	125		160	1625	=Ir	=Ir/2		
				100		63	100		126	1300	=Ir	=Ir/2		
				160		100	160		200	2080	=Ir	=Ir/2		
				80		50	80		79	819	=Ir	=Ir/2		
				125	0.625-1xIn	63	125		126	1625	=Ir	=Ir/2		
FE250	100	16 steps	80	100	2-13xIr	160	1300	=Ir	=Ir/2					
	160	line protection	100	160	10 steps	200	2080	=Ir	=Ir/2					
	160		100	160		200	2080	=Ir	=Ir/2					
	250		160	250		320	3250	=Ir	=Ir/2					
	250		160	250		320	3250	=Ir	=Ir/2					
SMR1 + switchable rating plug	N	H	L	FE160	25	0.4-1xIn	10	25		20	325	=Ir	not protected	
					63	32 steps	25	63	2-13xIr	50	819	=Ir		=Ir/2
					125	line/mot. protection	50	125	10 steps	100	1625	=Ir		=Ir/2
					160		64	160		128	2080	=Ir		=Ir/2
					125	0.4-1xIn 32	50	125	2-13xIr	100	1625	=Ir		=Ir/2
				160	steps line/	64	160	10 steps	128	2080	=Ir	=Ir/2		
				250	mot. prot.	100	250		200	3250	=Ir	=Ir/2		
				250		100	250		200	3250	=Ir	=Ir/2		
				250		100	250		200	3250	=Ir	=Ir/2		
				250		100	250		200	3250	=Ir	=Ir/2		

(1) Colour code indicates which rating plug can be applied where

On switching to Motor Protection a phase loss protection is initiated. Do not use for line protection.

FG400 & FG630 Selective Electronic Trip Unit SMR1

Trip Units are available in 7 different versions depending on the frame rating and the network frequency.
 FG400 frame size 50/60 Hz 250 & 400A
 FG630 frame size 50/60 Hz 400, 500 & 630A
 For use at 400 cycles applications the following variants are available on request:
 FG400 400A ratings, FG630 -630A rating

The trip units must be equipped with a rating plug that establishes the rated current of the protective device and its setting. A colour code and a mechanical interlock prevent incorrect combinations of electronic trip units and rating plugs. The 50/60Hz and 400Hz variants use the same rating plug.

For special applications a version with disabled LT or overload protection is available complete with a specific rating plug.

FG frame				Electronic trip unit overview										
	N	H	L	FG frame	In ⁽¹⁾	LT		ST		Neutral protection				
					(A)	pick-up band 1.05±1.2 Ir	pick-up band ± 20% Im	4P4T	4P 3TN	4P3T				
					Ir setting	min (A)	max (A)				Im setting	min (A)	max (A)	
SMR1 + adjustable rating plug	N	H	L	FG400	160		100	160		200	2080	=Ir	=Ir/2	not protected
					250	0.625-1	160	250	2-13xIr	320	3250	=Ir	=Ir/2	
					250	xIn	160	250	10 steps	320	3250	=Ir	=Ir/2	
					400	16 steps	250	400		500	5200	=Ir	=Ir/2	
					400	line prot.	250	400		500	5200	=Ir	=Ir/2	
FG630	400		400	630		400	630		800	6300	=Ir	=Ir/2		
	630		400	630	2-10 Ir	800	6300	=Ir	=Ir/2					
	630		400	630		800	6300	=Ir	=Ir/2					
SMR1 + switchable rating plug	N	H	L	FG400	250	0.4-1xIn	100	250		200	3250	=Ir	=Ir/2	not protected
					400	32 steps	160	400	2-13 Ir	320	3250	=Ir	=Ir/2	
					400	line/mot. protection	160	400	10 steps	320	5200	=Ir	=Ir/2	
					400		160	400		320	5200	=Ir	=Ir/2	
					500		250	500		500	6500	=Ir	=Ir/2	
FG630	400		400	630		400	630		800	6300	=Ir	=Ir/2		
	630		400	630	2-10 Ir	800	6300	=Ir	=Ir/2					
	630		400	630		800	6300	=Ir	=Ir/2					

(1) Colour code indicates which rating plug can be applied where

On switching to Motor Protection a phase loss protection is initiated. Do not use for line protection.



SMR1 range

Setting the Selective Electronic Trip Unit SMR1

How to set the device

The defined rating plug defines the long time (LT) setting range and the manner of its adjustment.

LT setting with adjustable rating plug

One knob with 16 positions allows the user a current setting (I_r) between 0.625 and 1 times the chosen rating. (values in A)

LT setting with switchable rating plug

One knob to set the protection band (line class 5 or motor class 10) and the rated current value (2 current value settings of 0.625 and 1 x the trip unit rating) - in sketch trip unit rating **250A** settings **160A** or **250A**.

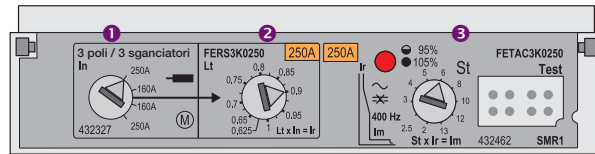
A second knob with 16 positions allows the user to set the current (I_r in multipliers of chosen rating).

The combination of these two knobs allows a setting range of 0.4 to 1 x the trip unit rating with 32 setpoints.

Protection band timing ⁽¹⁾

Band timings	1.5 x I_r	7.2 x I_r
Line protection	65 - 95 sec	2.0 - 3.0 sec
Motor protection	200 - 300 sec	6.4 - 9.6 sec

The indicated timings are valid in cold state. Warm state timings take into account the heating of the installation due to current flow and are lower.



ST or I_m setting

Is set in multiples of the LT current setting and has a setting of 2 to 13 x this value with 10 setpoints.

Other Protections

Each SMR1 is equipped with a Instantaneous short circuit protection device set at $14 \times I_{ct}$ (= Trip Unit rating). This hi speed tripping device will not react to the first short circuit peak but will only initiate a trip signal after a second short circuit peak is detected. Discrimination is thus always ensured.

All Record Plus devices are equipped with a HIOSC (hi set Instantaneous) protection device. This device mechanically trips the breaker when a short circuit is detected of a value exceeding the capabilities of the breaker in which it is installed and initiates a current limiting interruption of the fault.

The combination of these two protection devices and the unique current limiting properties of the Record Plus breaker improve Selectivity whilst maintaining Current Limitation.

Setting Examples

Example

A line protection device; required overload or **LT** setting 120A, short-circuit or **ST** setting 6 x the LT setting.

SMR1 of 250A + switchable rating plug of 250A.

LT settingknob 1 set to line and 160A

.....knob 2 set at 0.75 (0.75 x 160 = 120A)

ST settingknob 3 set a 8 x (=8 x 120)

SMR1 of 250A + adjustable rating plug of 160A.

LT settingknob 2 set at 120 (value on scale)

ST settingknob 3 set a 8 x (=8 x 120)

A line protection device; required overload or **LT** setting 280A, short-circuit or **ST** setting 6 x the LT setting.

SMR1 of 400A + switchable rating plug of 400A.

LT settingknob 1 set to line and 315A

.....knob 2 set at 0.9 (0.9 x 315)

ST settingknob 3 set a 6 x (=6 x 280)

SMR1 of 400A + adjustable rating plug of 315A.

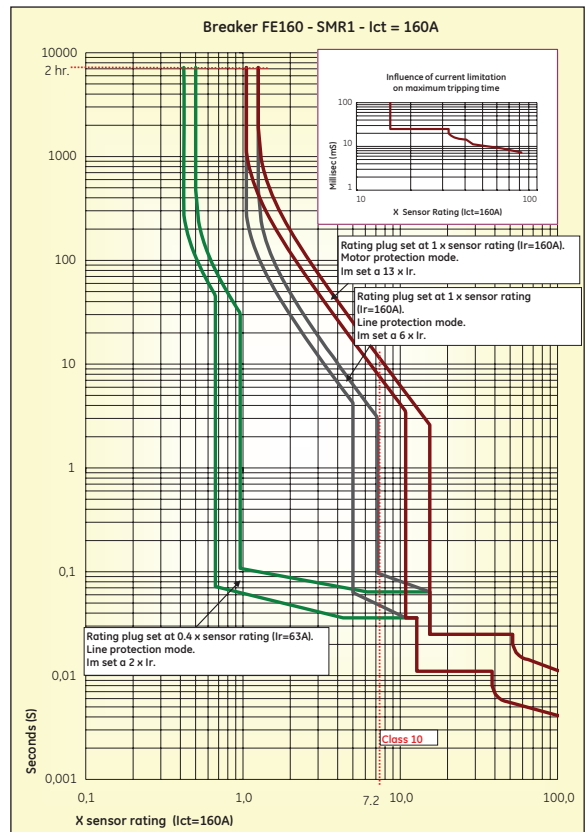
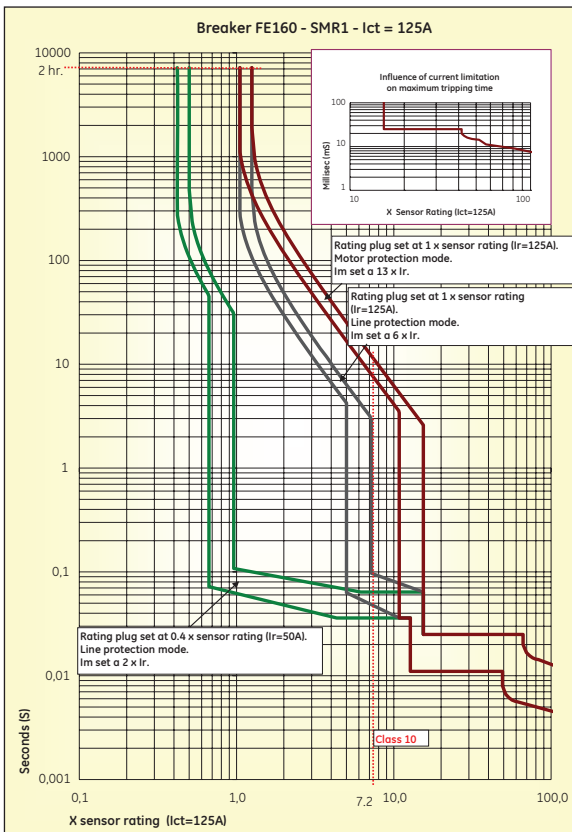
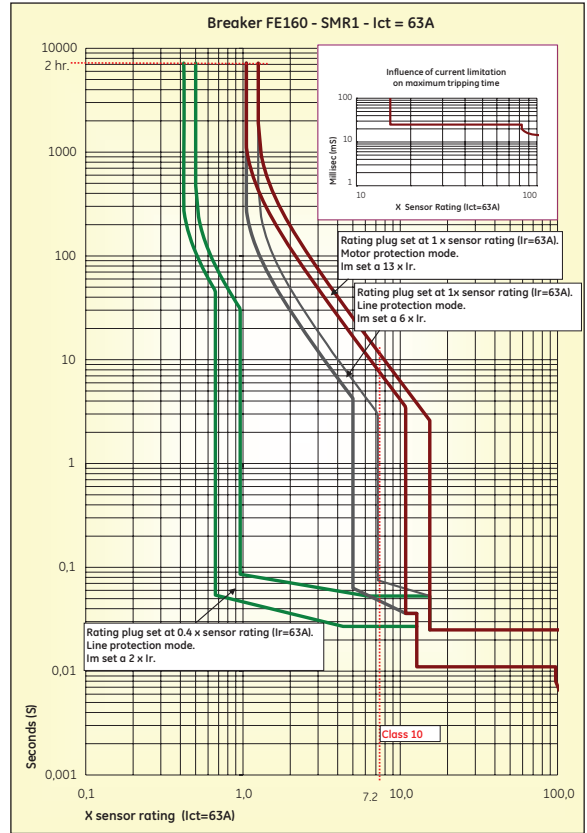
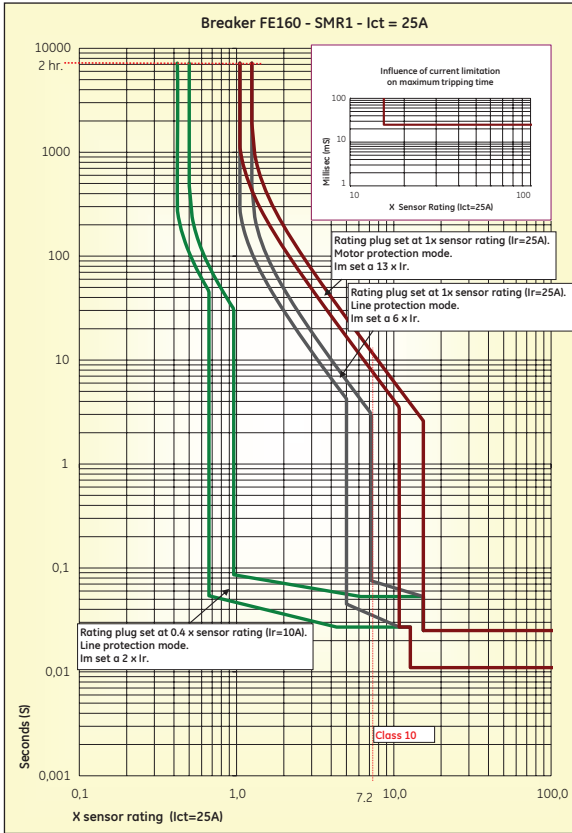
LT settingknob 1 set at 280

ST settingknob 3 set a 6 x (=6 x 280)

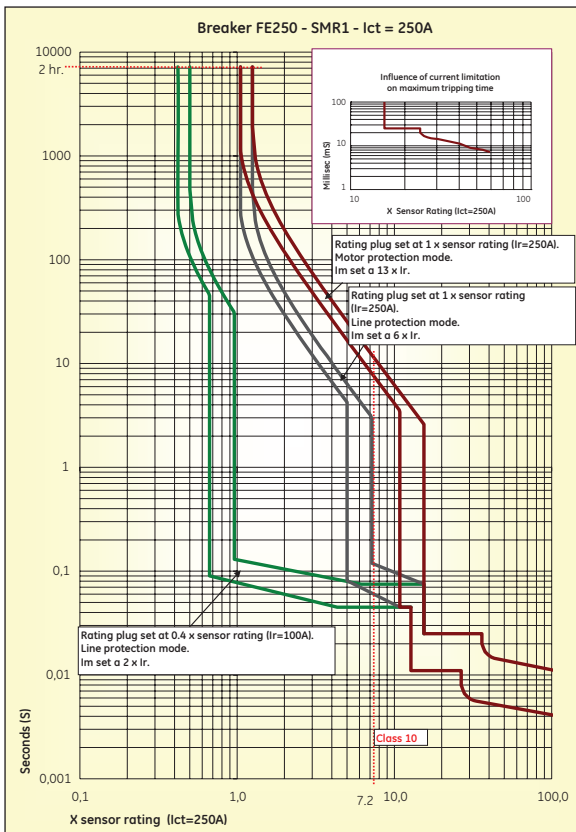
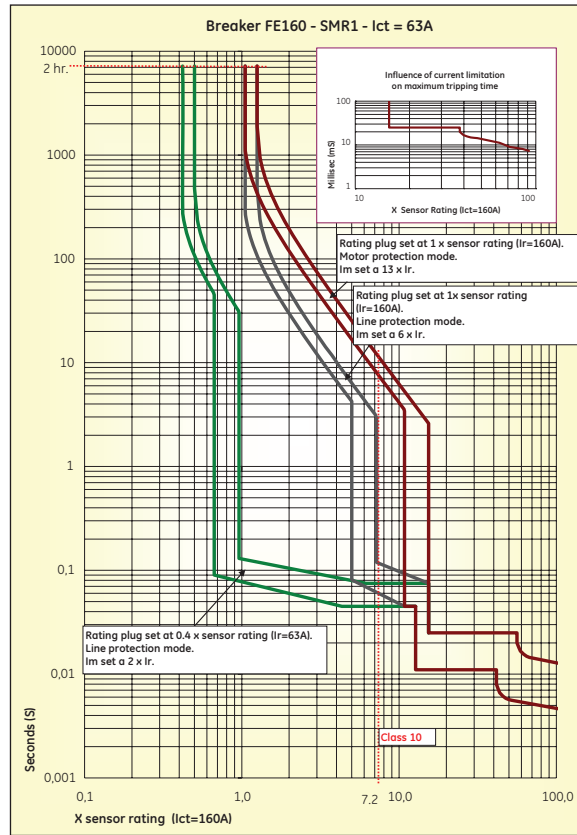
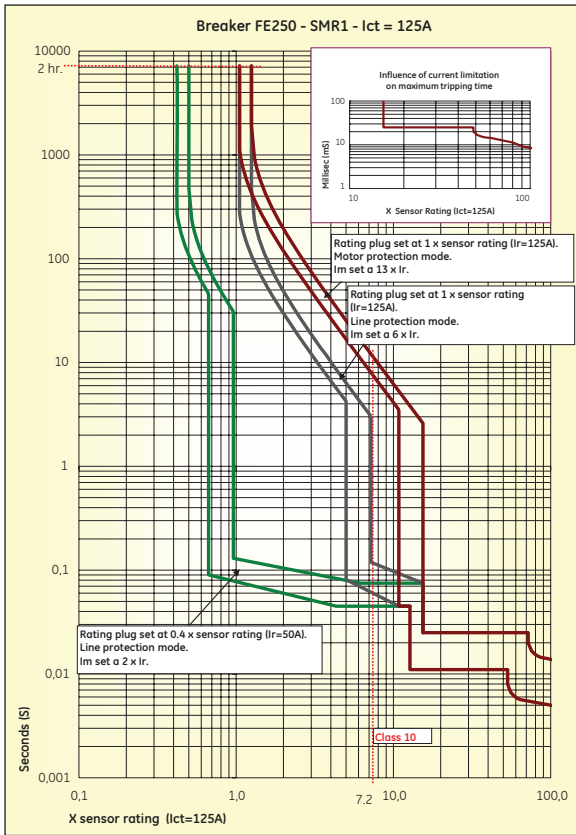
(1) a Tripping time of 5 seconds can be warranted at 6 x I_r .

Time Current Curves

FE160 & FE250 Electronic Trip Unit SMR1

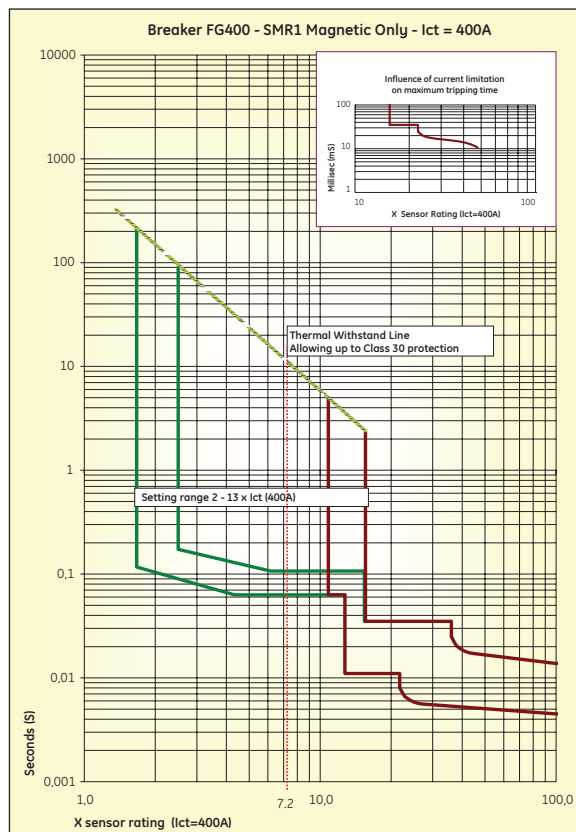
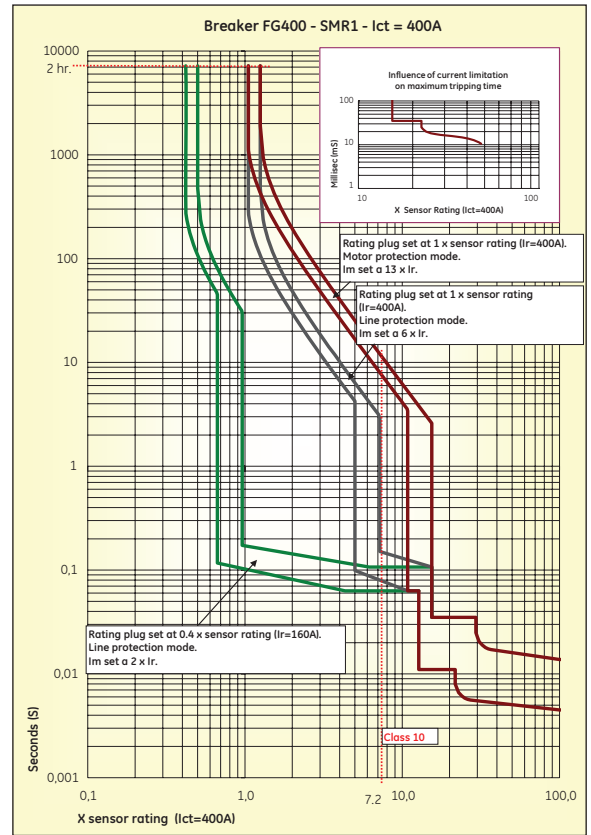
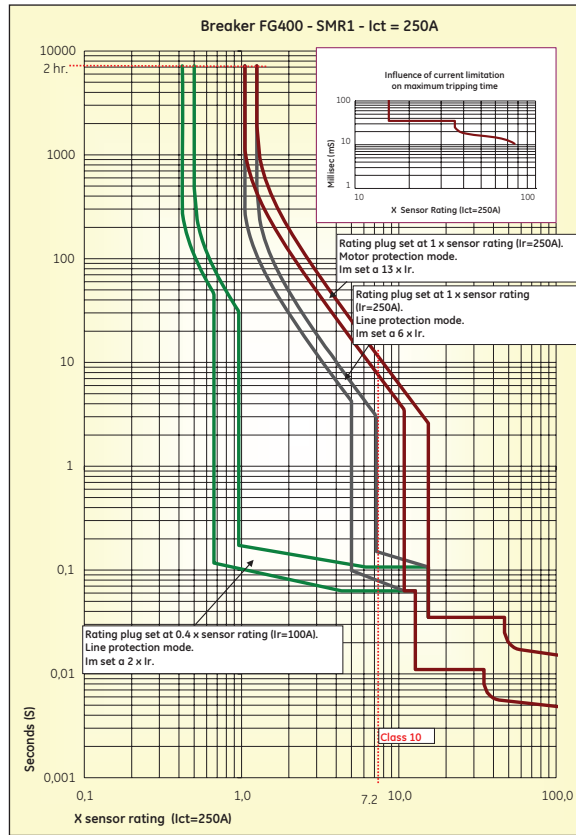


Time Current Curves

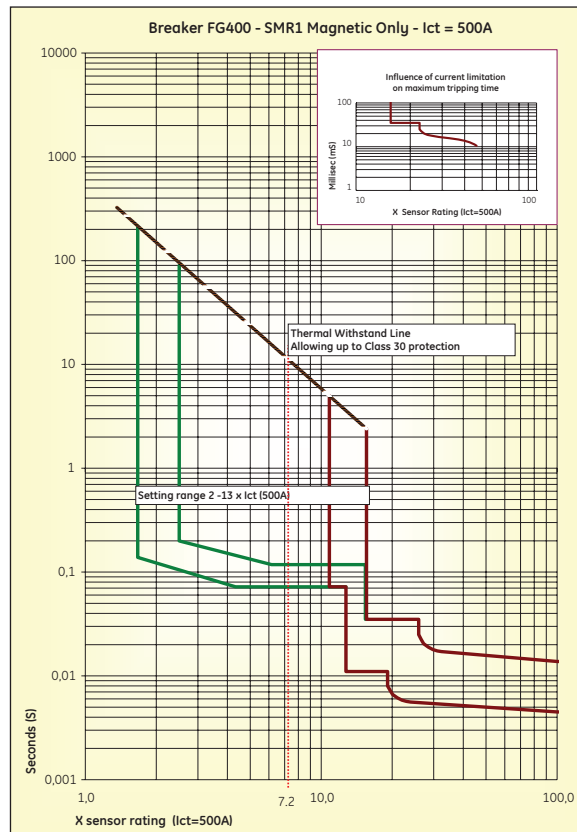
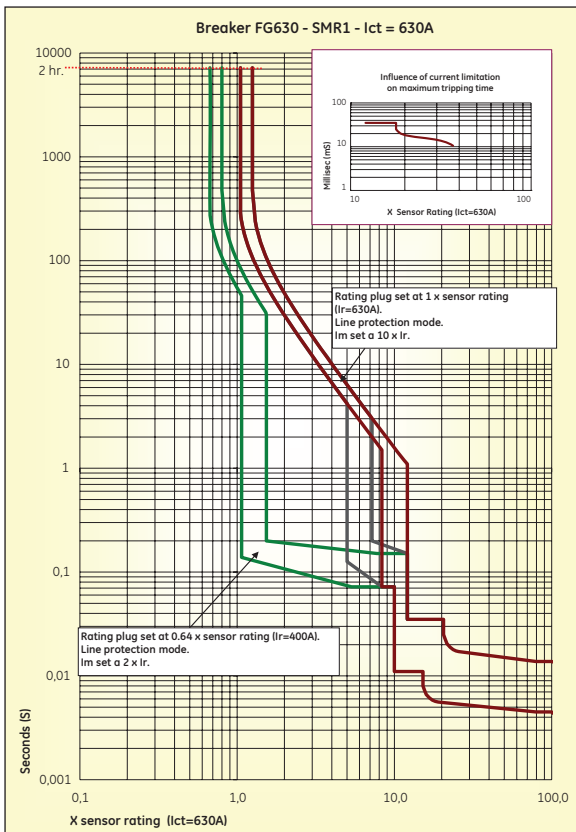
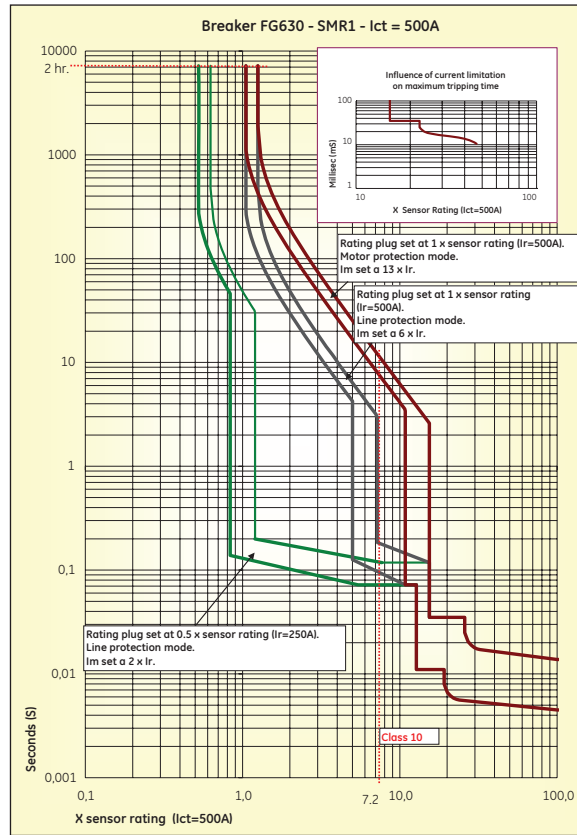
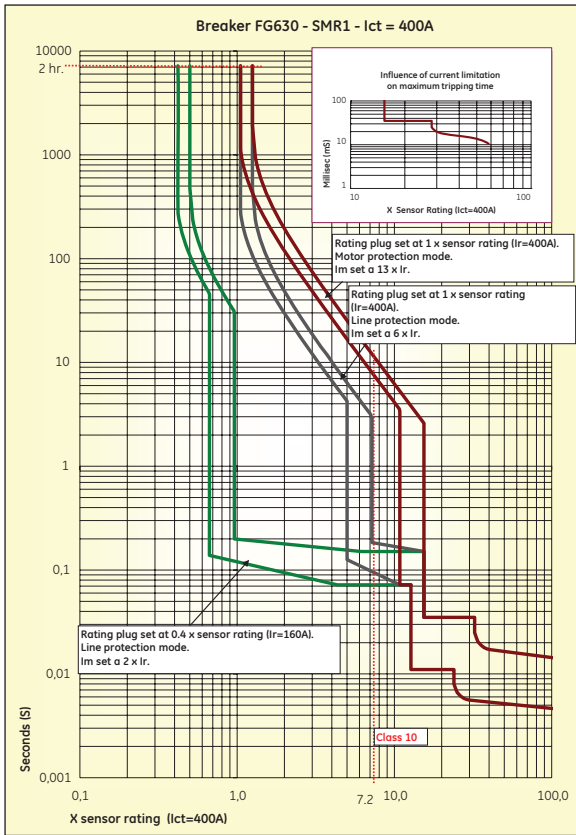


Time Current Curves

FG400 & FG630 Electronic Trip Unit SMR1



Time Current Curves



Electronic Trip Units

SMR2 range

The SMR2 is an electronic trip unit offering a fixed set of sophisticated protective functions that can be extended at will by the addition of separately available modules. Designed for use with the FG400 and FG630 frame sizes the device has a fixed set of 3 protective functions allowing a selective and fully adjustable protection against Overloads (LT) and short-circuits (ST and I).

Both the LT and ST protection can be set to different time settings or bands (LTD and STD) whilst the ST device can be switched to a energy protection mode (I^2t).

The SMR2 uses rating plugs that give the user the flexibility to make a last minute choice in the required current rating, protected poles or protection band.

A 24V DC auxiliary supply can be connected to the trip unit via the contact module. This enabling all modules to be used to their full capacity and allowing the use of the ZSI function (if installed in the trip unit).

Overload protection LT (long time)

The Long Time or overload protection is adjustable from 0.4 (0.64⁽¹⁾) to 1 x the chosen sensor ratings in 16 (32⁽¹⁾) steps. The user can also define one of 6 time bands (LTD) each designed to match specific loads, motor or cable characteristics. Of these 6 time band settings, 4 have time bands for line applications and 2 are dedicated to motor protection (for time band classes see EN 60 947-4.1). When set to motor protection mode, a phase loss protection is initiated



that will trip the breaker when the difference in current between one phase current and the other phases exceeds 80% for more than two seconds.

This easy-to-adjust trip unit is equipped with a LT load indicator device that operates by means of two LED indicators located on the trip unit front face. If the load reaches a 60% of the set I_r value, a **green LED** will start to blink (3 flashes a second). When the load reaches 75% of I_r it will stop blinking and remain on. The second **orange LED** will start to blink at 95% of the I_r value. It will remain on when the load reaches 105% of I_r and a trip is imminent.

(1) Normally supplied with two rating plugs, each with a setting range of 0.64-1.

(2) Some types limited to 10 x

(3) Some types limited to 11 x

All SMR2 trip units have a built-in temperature sensor that trips the breaker at temperatures above 90°C. It thus prevents the breaker and electrical components in its immediate vicinity from overheating. The SMR2 is also equipped with a so called thermal memory device. This memory tracks overheating even after the device has tripped and prevents the breaker from being switched whilst its environment is still at a too high temperature.

Short-circuit Protection ST (short time)

Offering a selective protection against low value short-circuits the Short Time protection is settable from 1.5 to 12⁽²⁾ x the adjusted LT protection (I_r). The device can be set to five time setting bands (STD), this allowing selectivity between different breaker sizes.

The STD device can be set to an 'energy curve mode'. This mode changes the fixed delay and reaction time value of the device, when the set current level is reached, into a reaction time that depends on the energy flowing in the circuit.

Short-circuit Protection I (instantaneous)

Offering a protection against short-circuits the Instantaneous protection is settable from 2 to 13⁽³⁾ x the chosen sensor rating.

This hi speed tripping device will not react to the first short circuit peak but will only initiate a trip signal after a second short circuit peak is detected. Discrimination is thus always ensured.

All Record Plus devices are equipped with a HIOSC (hi set Instantaneous) protection device. This device mechanically trips the breaker when a short circuit is detected of a value exceeding the capabilities of the breaker in which it is installed and initiates a current limiting interruption of the fault.

The combination of these two protection devices and the unique current limiting properties of the Record Plus breaker improve Selectivity whilst maintaining Current Limitation.

Each SMR2 trip unit comes with a transparent, tamper-free (sealable) cover, this to prevent unauthorized manipulation of the breaker settings. They are supplied as a simple to mount, plug-in electronic pouch (current sensors supplied with the breaker). The device is supplied with an actuator with flux shifter that fits into a pocket in the breaker housing and is then connected to the trip unit. Without a mounted and connected actuator coil the breaker will not function. In order to verify a correct operation of the combination a simple device is available to test the assembly.

We strongly recommend the use of this test device.

SMR2 range

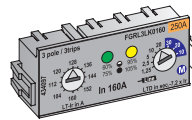
FG400 & FG630 Advanced Electronic Trip Unit SMR2

Each SMR 2 device has three plug in elements of which at least two are needed to allow the device to work properly.

- 1) A rating plug is plugged into the jack at the top left of the device. Without rating plug the SMR2 device will not provide any circuit protection and the breaker will trip immediately.
- 2) A battery⁽¹⁾ module (supplied with trip unit) needs to be placed in the appropriate module this to power the thermal memory within the trip unit when the breaker has tripped. If not installed the thermal memory function is disabled. The battery module also enhances the functionality of the Trip Reason Indicator Module. The third, and optional, plug in module is:
- 3) An Extension module providing extra functionality and/or features. A standard SMR2 is supplied with a blank non function module.

Adjustable rating plug

An SMR2 rating plug has two setting knobs. The first is used for the setting of the overload current device (LT) and has a setting range of 0.625 to 1 x the chosen rating over 16 setpoints. The settings on the devices are in current values thus avoiding the use of complicated multipliers. The second knob is used to set the time delay band of the overload protection (LTD) and has 6 possible time settings.



Each trip unit size can be equipped with one of two available adjustable rating plug types.

There is a version of the trip unit without rating plug and one in which the two rating plug types are included. For 4pole trip units the rating plugs exist in 3 and 4pole protected versions with a choice in neutral rating between 50 or 100% of the phase value.

SMR2 - FG frame

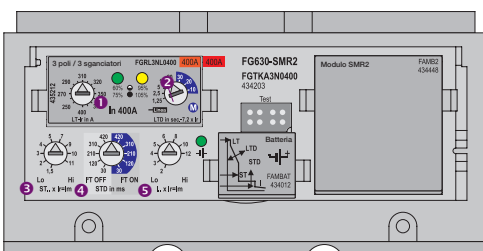
FG frame				Electronic trip unit overview												
SMR2 + adjustable rating plug	N	H	L	In (A)	LT		ST		I		Neutral protection					
					pick-up band	1.05±1.2 Ir		pick-up band ± 20% Ist		pick-up band ± 10% Ii		4P4T	4P 3TN	4P3T		
						Ir setting	min (A)	max (A)	Ist setting min (A)	max (A)	Ii setting min (A)				max (A)	
FG400	FG400	160	100	160	3	150	1920	5	500	3250	=lr	=lr/2	not protected			
		250	160	250	1.5-12 lr	240	3000	2-13 lct	700	4550	=lr	=lr/2				
		250	160	250	10 steps	240	3000	10 steps	700	4550	=lr	=lr/2				
		350	0.4-1 In	250	500	3500	=lr	=lr/2	Utilising two Rating Plugs	750	4400	=lr		=lr/2		
		400	32 steps	250	400	1.5-10 lr	375	4000		2-11 lct	750	4400		=lr	=lr/2	
		400	10 steps	250	400	1.5-12 lr	375	4800	10 steps	1000	6500	=lr		=lr/2		
		500	1.5-12 lr	400	500	10 steps	600	6000	10 steps	=lr	=lr/2	not protected				
		630	1.5-10 lr	400	630	10 steps	600	6300	2-11 lct	1260	6930			=lr	=lr/2	
			10 steps													
		LTD, Line no phase loss		Setting ⁽¹⁾		min (sec.)	max (sec.)	STD Standard		Setting	min (sec.)	max (sec.)				
				1.25		1	1.5			0.04	0.036	0.07				
				2.5		1.5	3			0.12	0.108	0.16				
		5		3	5			0.21	0.190	0.26						
		10		6	2			0.31	0.280	0.37						
LTD, Motor with phase loss protection ⁽¹⁾								0.42	0.380	0.49						
		20		10	14			-OR- I ² T								
		30 ⁽²⁾		14	20			(see trip curves)								

(1) Timing applies at 7.2 x the set current value. (Ir)

(2) Not applicable for 400 & 630A

SMR2 front view

Indicating the location of the settings, the battery, rating plug and extension modules. The in/out put terminals are located within the trip unit pouch just below the battery modules and can be accessed by removing a break away cover.



On switching to Motor Protection a phase loss protection is initiated. Do not use for line protection.

The indicated timings are valid in cold state. Warm state timings take into account the heating of the installation due to current flow and are lower.

(1) Expected life span under normal circumstances three to five years. Replacement type 2 x BR1220 or equivalent.



Intro

A

B

C

D

E

F

G

X

SMR2 range

FG400 & FG630 Advanced Electronic Trip Unit SMR2 (continued)

Modules

Each SMR2 device can be equipped with two plug-in elements, a rating plug and an extension module. The extension modules are simple plug-in devices that allow the user to enhance the SMR2 as a protective device or to add in extra functional features. There is a single function module available with Ammeter and a range of functional modules each adding two functions to the device. This allows an SMR 2 to be equipped with:

Ground fault Protection

Ground fault alarm

Load shedding across two channels

Trip Reason indicators

Communication (modbus RTU)

Each module has a low level electronic output that can be channeled through the communication bus (when present) or in some cases trigger a 1A/250 Volt change-over contact placed in an external contact module containing four contacts (type FAECM2).

Ground fault protection

Designed for protection against indirect contact, the ground fault device measures the vectorial sum of the three phase currents and, if present, that of the neutral conductor. If the sum of these values exceeds the set current thresholds for a period of time greater than the set time delay, the breaker is tripped.

The **Ground Fault** protection option is adjustable from 0.2 to 1 x the chosen sensor ratings in 9 steps. The user can also define one of 5 delay time bands (**GFD**) designed to allow selectivity between different sensor ratings.

The **GFD** device can be set to an 'energy curve mode'. This mode changes the fixed delay and reaction time value of the device, when the set current level is reached, into a reaction time that depends on the energy flowing in the circuit.

A breaker trip due to a ground fault event can be channeled through the communication output (when present) or be wired out to the contact module. (type ECM)

Ground fault alarm

The **Ground Fault Alarm** option offers the same functionality as the Ground Fault protection, here however **ONLY** an alarm signal is given and the breaker is **NOT TRIPPED**. It is adjustable from 0.2 to 0.8 x the chosen sensor ratings in 12 steps. The user can also define one of 5 delay time bands (**GFD**).

The **GFD** device can be set to an 'energy curve mode'. This changes the fixed delay and reaction time value of the device, when the set current level is reached, into a reaction time that depends on the energy flowing in the circuit.

A 100mA/240Volt NC contact is included in the module and can be wired out through the 12 pole breaker connector plug on the breaker.

Load shedding device

The Load Shedding device (**R**) is designed to allow the user to switch off non priority loads before the **LT** function trips the breaker due to an overload. It measures the current within the circuit and provides a signal if the current measured in the three phases exceeds the set current values. The device has two

channels, both adjustable from 0.55 to 1 x the set **LT** protection value (Ir).

Each channel is equipped with a time delay directly proportional to that of the **LTD** setting. Channel 1 is set to a time delay equal to **LTD/2** and channel two is set to a time delay of **LTD/4**. If the current drops below the set thresholds the signal is reset. The reset signal being given in a time proportional with the chosen LTD curve. A signal due to a load shedding event can be channeled through the communication output (when present) or be wired out to the contact module. (type ECM)

Trip Reason Indicators

In order to indicate the reason of a breaker trip a set of tptal of three LED's are provided on the trip unit front face. One indicating a trip due to the **LT** device, one indicating a trip due to the **ST** device and one for the **I** device.

Without auxilliary power, the use of the trip reason button is necessary to light up the appropriate **LED**. With auxilliary power the use of the trip reason push button is unnecessary.

The three trip signals can be channeled through the communication output (when present) or be wired out as an overload (LT) or short circuit signal (ST & I) to the contact module (type FAECM)

Communication

When the communication option is added to the SMR2 trip unit the following data can be viewed:

- The position of the switches on all installed devices, thus providing the settings of the breaker.
- Signals indicating on which of the installed protection devices the breaker has tripped.
- Load shedding orders.
- Zone selective interlock occurrences.

For each breaker with Modbus rtu the use of an internal communication module AND an external contact module type FAECM2 (see page b.28) is required. A 24V DC auxiliary supply is needed that supplies the system through the external contact module.

Zone Selective Interlock

A device that allows the user to achieve selectivity combined with the fastest possible fault reaction time. When the **ZSI** is active the SMR2 trip unit will always trip the breaker as quickly as possible, ignoring the time delays set by means of the **STD** or **GFD** devices. However, when a **ZSI** signal is received from a downstream breaker equipped with an SMR2, the **STD** or **GFD** of the upstream SMR2 device revert to wherever the adjustment is set.

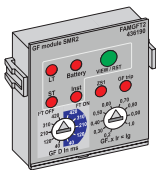
With standard cables the distance between breakers is a maximum of 30 meters. The use of shielded cables allows the distance between breakers to be increased to 1 km. A maximum of five SMR2 trip units can be linked in this manner.

The ZSI option requires a 24VDC auxiliary supply. One FAECM2 module connected with one of the breakers in the ZSI loop can be used. The FAECM2 needs then connected to an auxiliary supply of 24V DC.

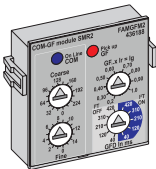
When the breaker is equipped with a "COM" option the ZSI status signal is also available on the communication output.

Ammeter

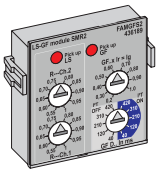
Provides the user with the current running in one of the breaker phases. The device has an accuracy of 10% and normally indicates the current in the highest loaded phase. Use of the push buttons on the module front allows the user to select an indication of the current in one of the other phases or neutral (if present). After a set delay of 10 seconds the device reverts to its standard indication setting.



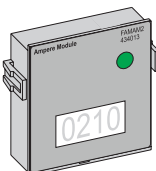
Module FAMGFT2
A combination of the Ground Fault protection and the Trip Reason indicators.



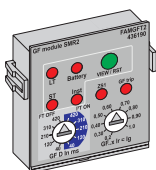
Module FAMGFM2
A combination of the Ground Fault protection and the communication option.



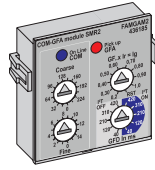
Module FAMGFS2
A combination of the Ground Fault protection and the load shedding device.



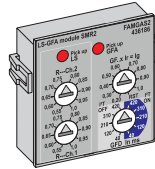
Module FAMAM2
An Ammeter.



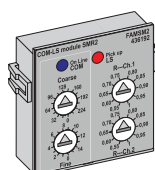
Module FAMGAT2
A combination of the Ground Fault Alarm function and the Trip Reason Indicators.



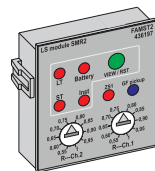
Module FAMGAM2
A combination of the Ground Fault alarm function and the communication option.



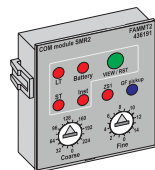
Module FAMGAS2
A combination of the Ground Fault alarm option and the load shedding device.



Module FAMSM2
A combination of the load shedding device and the communication option.



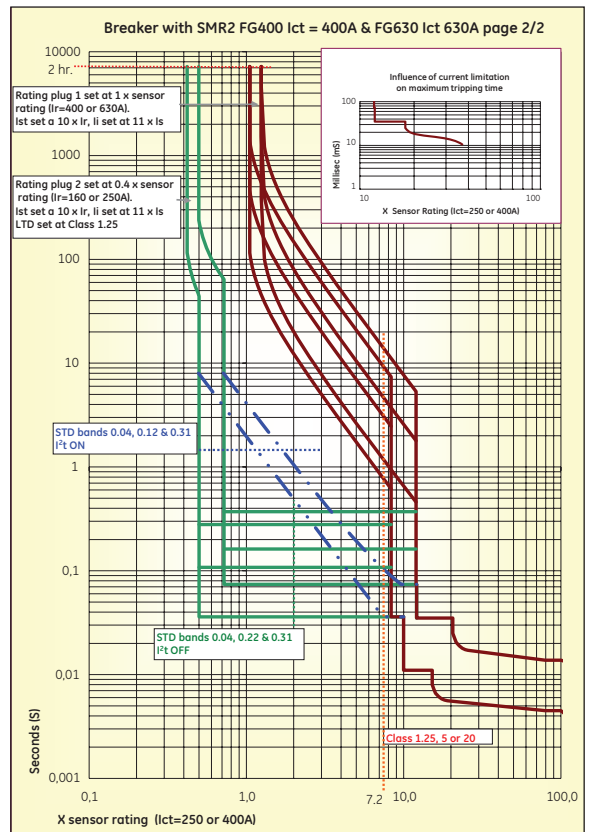
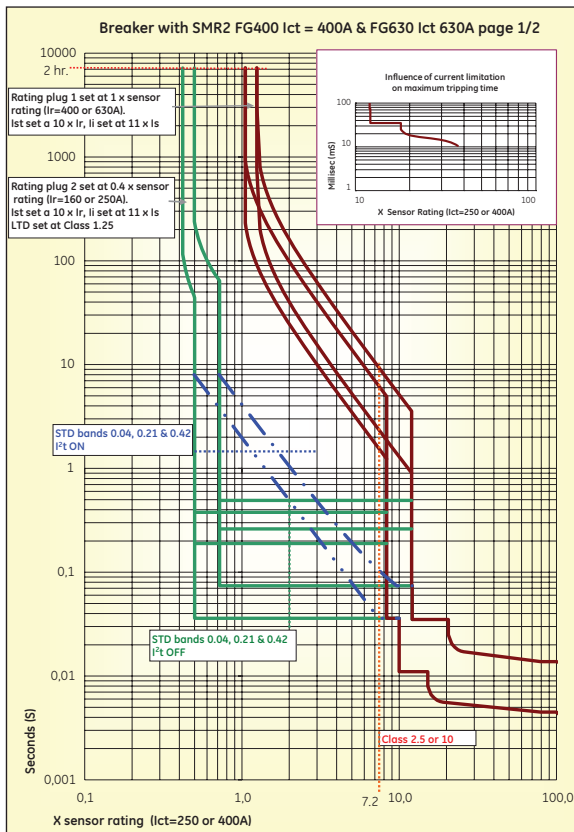
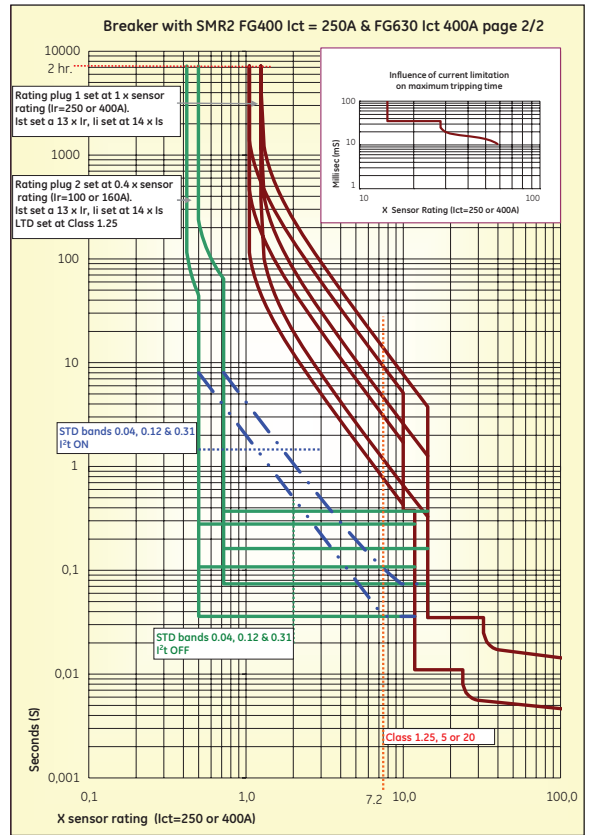
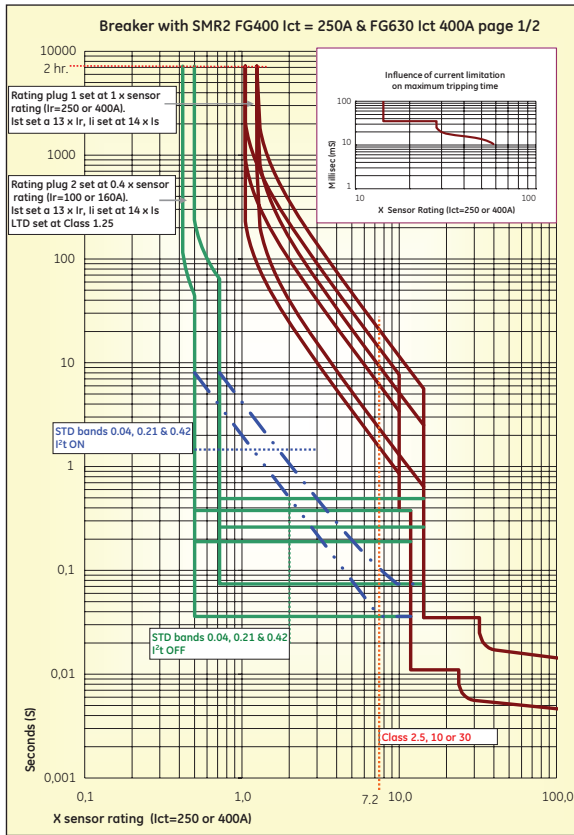
Module FAMST2
A combination of the load shedding device and the Trip Reason Indicators.



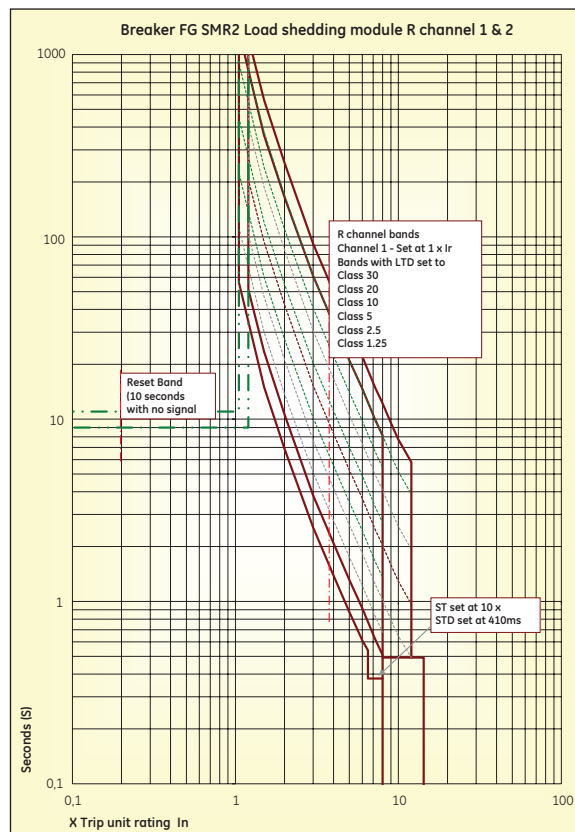
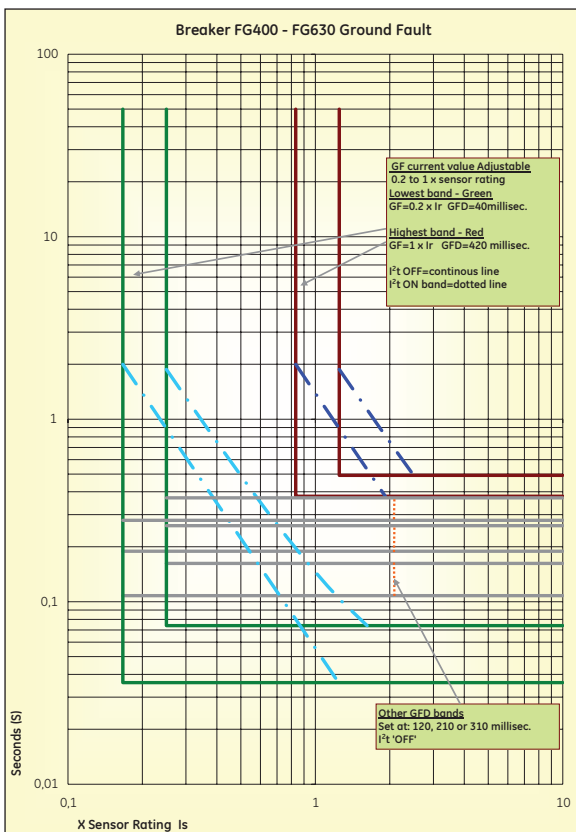
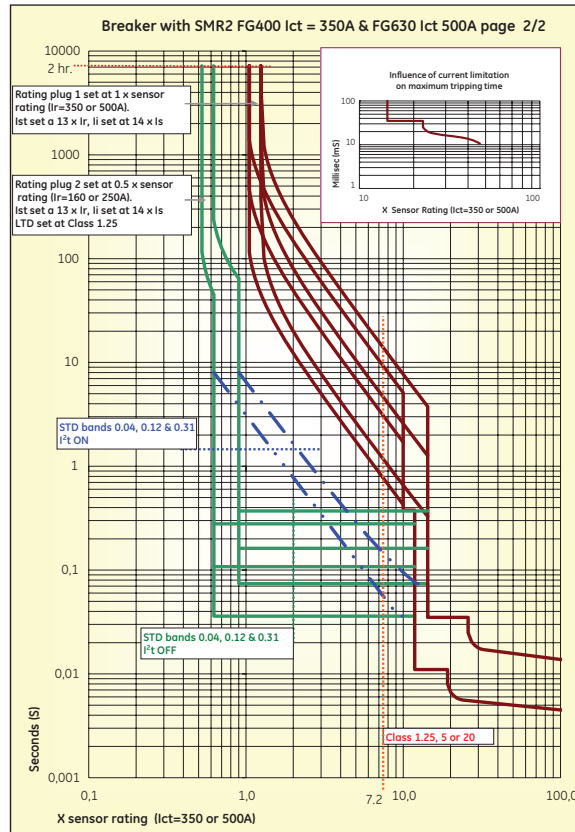
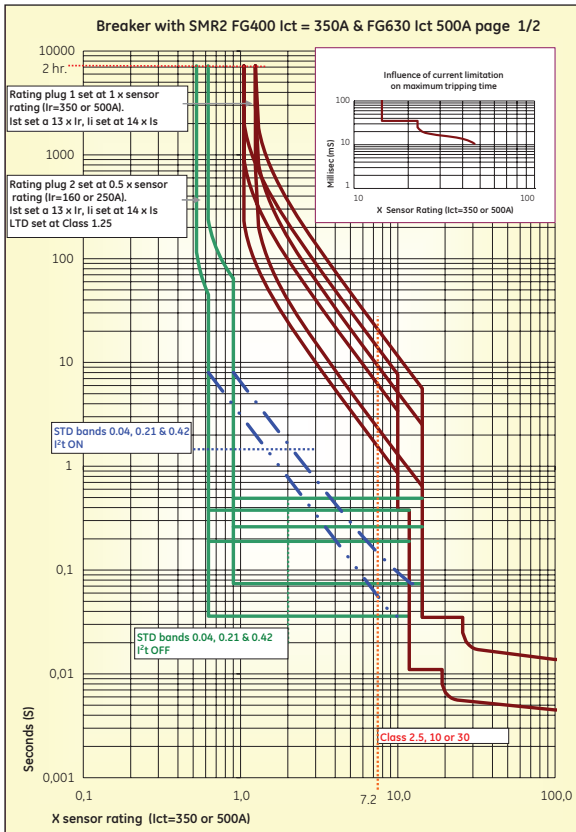
Module FAMMT2
A combination of the communication option and the Trip Reason Indicators.

Time Current Curves

FG400 & FG630 Electronic Trip Unit SMR2



Time Current Curves



Electronic trip units

FK800 - FK1600 Electronic Trip Unit SMR1e, s & g

Non inter changeable electronic Trip Units designed to allow the user to conveniently tailor the protection device to match individual circuit requirements. The available options include adjustable overload pickup values, overload trip time characteristics, short time pick-up circuit values, short time delay circuit trip times and energy values. The trip unit can be equipped with a ground-fault protection and provides a flexible solution to all protection scenarios.

This easy-to-use trip unit with overload and selective short-circuit protection is equipped with an overload signalling option and has a built-in temperature sensor to prevent the breaker and electrical components in its immediate vicinity from overheating. The 4 pole units are equipped with a switchable neutral protection option, allowing the user to set the neutral at 0,50 or 100% of the phase ratings.

Overload Protection (LT or Long Time)

Designed to meet the newest IEC 60 364 installation regulations all variants can trip the breaker with 5 seconds at 8 times the LT setting (I_r). The SMR1e is supplied with this 5 second time band whilst the SMR1s and g variants have 4 selectable time bands that trip the breaker within 5, 10, 20 or 30 seconds. The device is adjustable from 0.4 to 1 x the breaker (I_n) or I_{ct} rating in 9 steps.

All SM1e, s or g trip units have LED's indicating that the Trip unit has powered up (green) and a second LED that provides information on a imminent tripping event. This LED flashes at three times a second when the current reaches 95% of the breaker setting (I_r) and will remain fully lit when 105% of this values is reached. If the temperature in the electronic circuits reaches 75 degrees centigrade both LED's light up simultaneously whilst a trip is initiated once the temperature exceeds a 90 degree centigrade limit.

A third LED located in the vicinity of the LT setting knob indicates a breaker trip on an overload event.



Timed Short Circuit Protection (ST or Short Time)

Offering a selective protection against low value short-circuits the Short Time protection is settable from 1.5 to 10 x the adjusted LT protection (I_r).

The SMR1e has a fixed time band of 100 millisecond's. A setting that allows discrimination with downstream FG devices.

The SMR1s and g variants have a choice of four time setting bands (STD), designed to allow selectivity between different breaker sizes. Here the STD device can be set to an 'energy curve mode' that changes the reaction of the device from a fixed delay and reaction time value when the set current level is reached to a reaction time that depends on the energy flowing in the circuit.

HIOSC Tripping Device (If setting)

All Record Plus devices are equipped with a HIOSC (Hi set Instantaneous) protection device. This device mechanically

trips the breaker when a short circuit is detected of a value exceeding the capabilities of the breaker in which it is installed and initiates a current limiting interruption of the fault.

This device once combined with unique current limiting properties of the downstream Record Plus breaker provide a high level of Selectivity whilst maintaining Current Limitation.

Ground Fault Protection (GF)

Designed for protection under fault conditions the ground fault device measures the vectorial sum of the three phase current and, if present, that of the neutral conductor if the sum of these values exceeds the set current thresholds for a period of time greater than the set time delay, the breaker is tripped.

The Ground Fault protection option is adjustable from 0.2 to 1 x the chosen breaker rating (I_{ct}) in 9 steps. The user can also define one of 4 delay time bands (GFD) designed to allow selectivity between different sensor ratings. The groundfault device is available in the SMR1g trip unit type.

Zone Selective Interlock

A device that allows the user to achieve selectivity combined with the fastest possible fault reaction time. With connected ZSI the SMR1s and SMR1g trip unit will always trip the breaker as quickly as possible, ignoring the time delays set by means of the STD or GFD devices. However when a ZSI signal is received from a downstream breaker equipped with an SMR1 s, 1g or 2 the STD or GFD of the upstream device are reset to the previously ignored original GFD & STD timings. The Ground Fault and Short Time Zone Selective Interlock signals are shared on one in/out put. The device only works when auxiliary power is present and operates up to a distance between breakers of 1 kilometer. The use of shielded cable is required. A maximum of five SMR 1s, g or SMR2 trip units can be linked in this manner. (not available in the SMR1e)

Connection of trip unit



Each SMR1s & G Trip Unit has a connector located on the right side of the breaker. This connector is normally hidden behind a break-away cover and is required to connect the following: Auxiliary power supply (24V DC), ZSI in and out, long time pre-alarm signal, connection of external CT for 4 pole groundfault on three pole breakers.

SMR1e, s & g Range

FK800- FK1600 Electronic Trip Units

Trip Units are available in 4 ratings and 3 different versions depending on the frame rating and the chosen functionality.

FK800 frame size 50/60 Hz 800A
 FK1250 frame size 50/60 Hz 1000 & 1250A
 FK1600 frame size at 50/60Hz 1600A

In order to verify the correct operation of the breaker an Trip Unit a PC based software package is available.

We strongly recommend the use of this option.

FK800, FK1250 and FK1600 breakers - Electronic trip unit overview

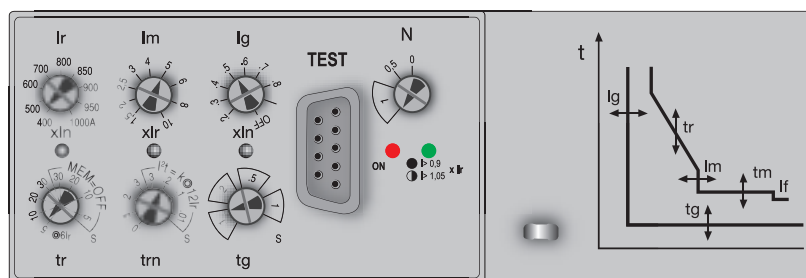
FK frame				Electronic trip unit overview								
	In (A)	LT pick-up band 1.05±1.3 Ir		ST pick-up band ± 20% Im		Neutral protection Switchable type						
		Ir setting min (A)	max (A)	Im setting min (A)	max (A)	4P4T	4P 3TN	4P3T				
		in 9 steps		in 9 steps		not protected						
SMR 1e	800	320	800	480	8000	=Ir	=Ir/2	not protected				
	1000	400	1000	600	100000	=Ir	=Ir/2					
	1250	500	1250	750	12500	=Ir	=Ir/2					
FK1600	1600	640	1600	960	16000	=Ir	=Ir/2					
SMR 1s	800	320	800	480	8000	=Ir	=Ir/2	not protected				
	1000	400	1000	600	100000	=Ir	=Ir/2					
	1250	500	1250	750	12500	=Ir	=Ir/2					
	FK1600	1600	640	1600	960	16000	=Ir		=Ir/2			
	LTD ⁽¹⁾		STD ⁽²⁾									
	Setting	min (sec.)	max (sec.)	Setting	min (sec.)	max (sec.)						
	5	4	6	0	0.015	0.05						
	10	8	12	0.1	0.095	0.17						
	20	16	24	0.2	0.175	0.29						
	30	24	36	0.3	0.255	0.41						
SMR 1g	800	320	800	480	8000	=Ir	=Ir/2	not protected				
	1000	400	1000	600	100000	=Ir	=Ir/2					
	1250	500	1250	750	12500	=Ir	=Ir/2					
	FK1600	1600	640	1600	960	16000	=Ir		=Ir/2			
	LTD ⁽¹⁾		STD ⁽²⁾									
	Setting	min (sec.)	max (sec.)	Setting	min (sec.)	max (sec.)						
	5	4	6	0	0.015	0.05						
	10	8	12	0.1	0.095	0.17						
	20	16	24	0.2	0.175	0.29						
	30	24	36	0.3	0.255	0.41						
GF		GFD ⁽²⁾										
pick-up band ± 20% Ig	Setting	min (sec.)	max (sec.)									
lg setting	min.(A)	max.(A)										
800	160	800	0	0.015	0.05							
1000	200	1000	0.1	0.095	0.17							
1250	250	1250	0.2	0.175	0.29							
FK1600	320	1600	0.3	0.255	0.41							

(1) At 7.2 x Ir: Min. is minimum settable delay; Max: Is maximum total tripping time.
 (2) At set value: Min. is minimum settable delay; Max: Is maximum total tripping time.

Trip units are available in 4 ratings and 3 different versions depending on the frame rating and the chosen functionality.

- FK800 frame size 800A, SMR 1e, s or g
- FK1250 frame size 1000 and 1250A, SMR 1e, s or g
- FK1600 frame size 1600A, SMR 1e, s or g

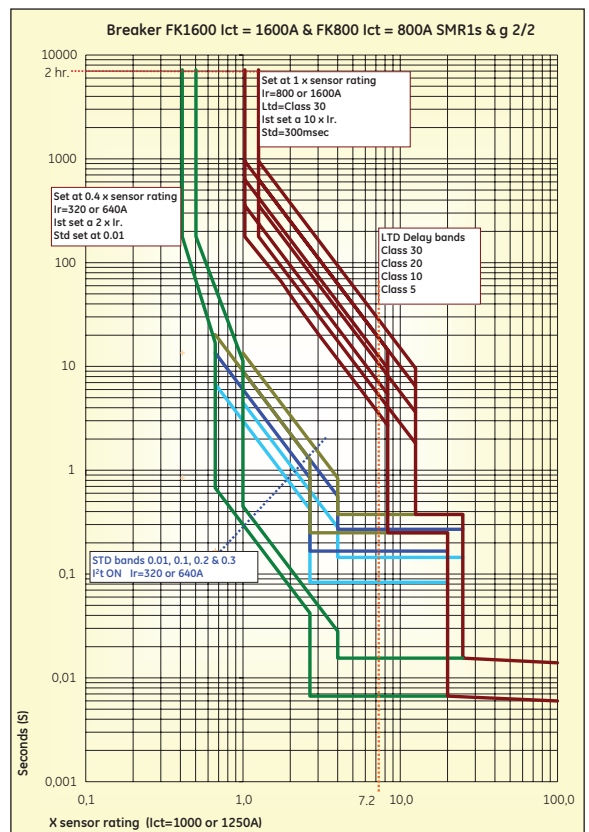
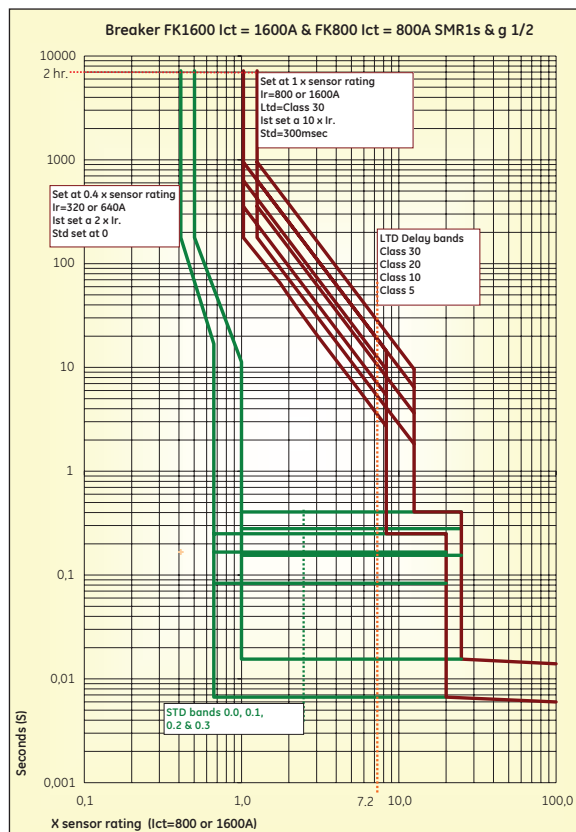
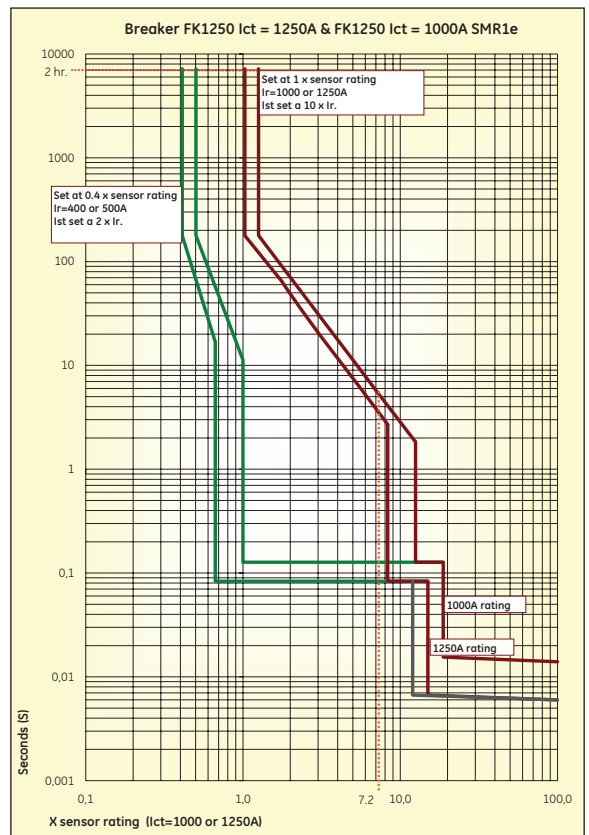
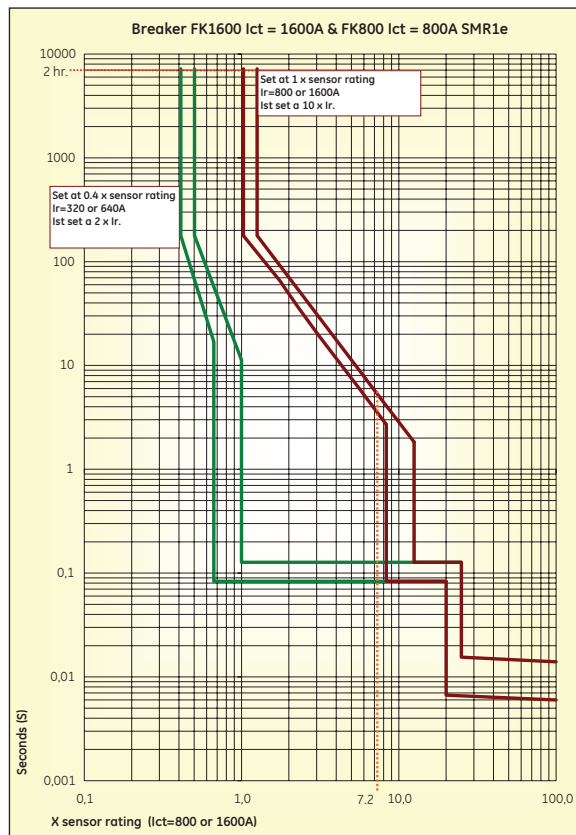
The trip units are an integral part of the breaker and are NON interchangeable.



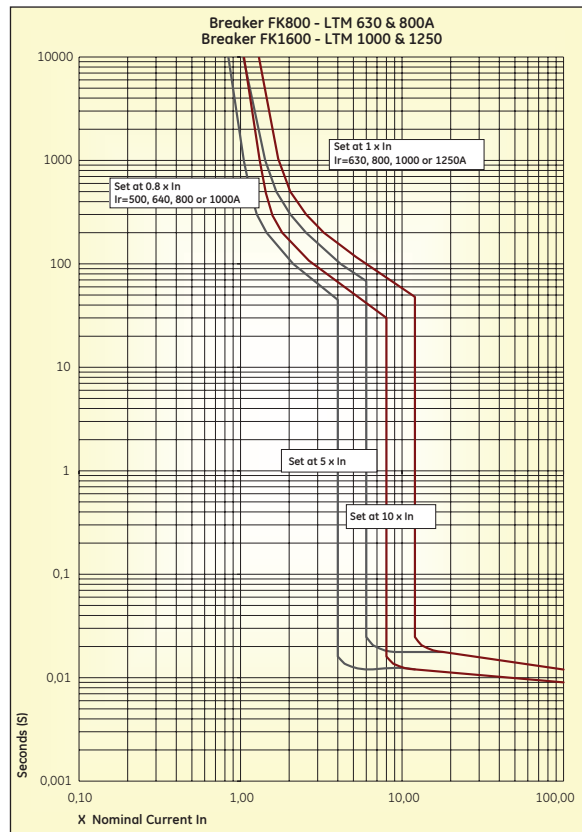
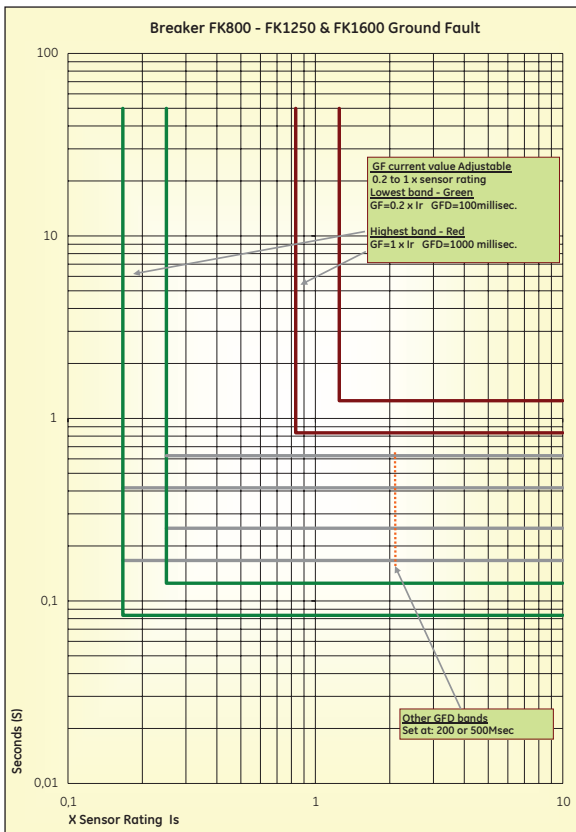
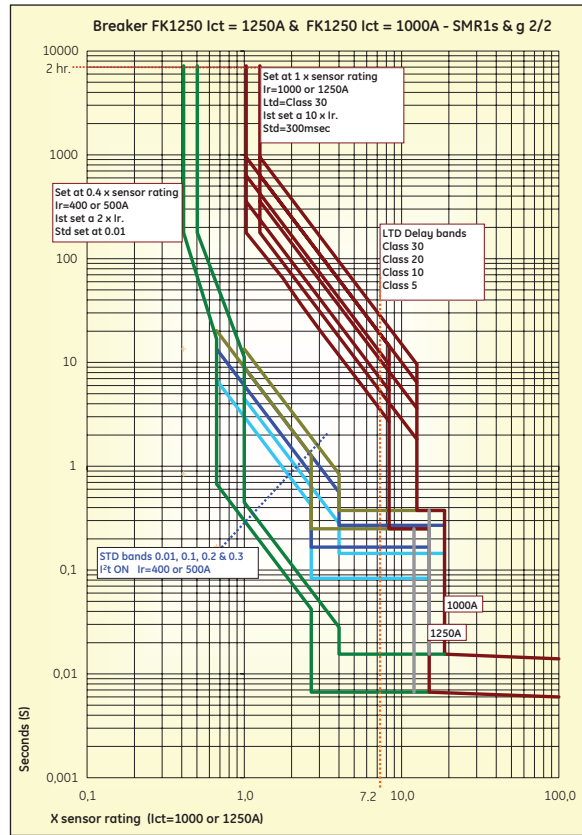
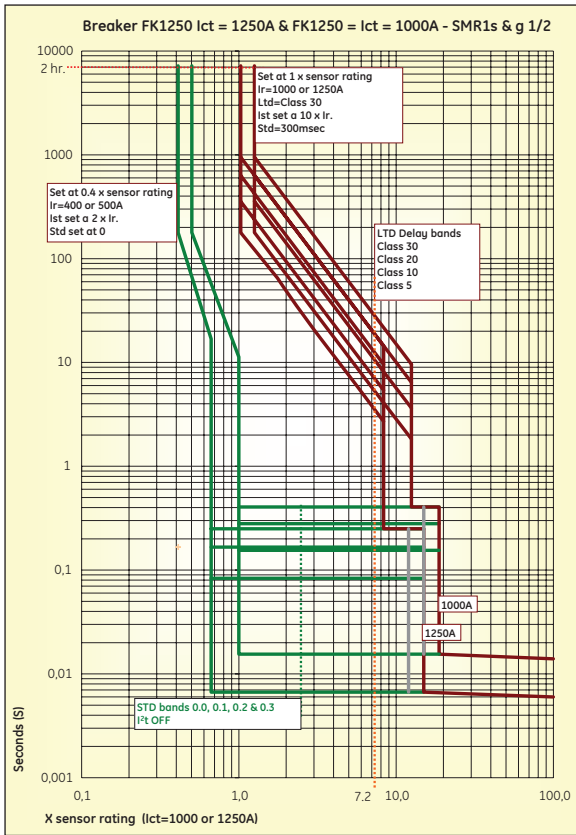
Time Current Curves

FK800 - FK1600

Trip Units SMR1e, s & g



Time Current Curves



Electronic Trip Units

Accessories for SMR1 and SMR2 types

Long time module SMR1 (FAMLT)⁽¹⁾



This external DIN-rail mounted device with modular dimensions is directly connected to the SMR1 electronic trip unit. The device is equipped with a NC 1A/400V AC contact that opens to a signal which indicates that a LT trip will shortly be initiated by the SMR1.

The SMR1 emits this before a trip action is initiated. When set to motor protection this occurs 0.5 seconds before the tripping event and at 0.05 seconds when set to line protection. Contact is reset when breaker trips.

Test kit for SMR1 & SMR2 devices (FAZ)



Designed to test the actuator trip unit combinations the device is plugged into the test jack on the trip unit front face. Just remove the test jack cover, insert and plug in the test device. Releasing the push

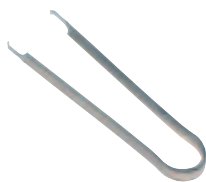
button on the tester FAZ front should now initiate a trip event. The tester requires a 9V battery type 6F22 and is also equipped with a battery status indicator.

Testing the SMR1e, s & g Trip Unit & FK Frame Breakers

A PC based package is available designed to test these combinations. The use of specific GE software and a PC connected to the Trip Unit test jack allows the user to simulate a fault event that should trip the breaker.

Please contact your local GE sales office for availability.

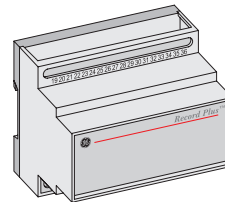
Rating plug tool SMR1 & SMR 2 (FAR)



A rating plug can be removed by using two small screwdrivers.

In case of repeated removal the **Record Plus™** rating plug removal tool is advised to enhance the ease and safety of this operation.

Communication & contact module SMR2 (FAMECM)



This external DIN-rail mounted device with modular dimensions is directly connected to the SMR2 electronic trip unit. It is a multi functional unit acting as an interface between the breaker and the

communication network.

To use the communication option the FAMECM module requires an auxiliary supply of 24V DC.

The device is also equipped with four NC 1A/400V AC contacts that can provide the following outputs:

- Breaker trip reason (Overload (LT) **OR** Short Circuit (ST/I))
- Load shedding device contacts. Channel 1 **AND** Channel 2

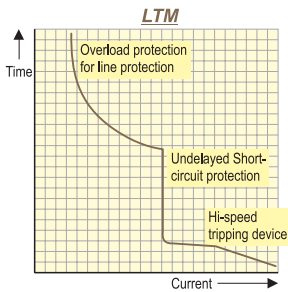
⁽¹⁾ Use of an RC suppressor is recommended. (See Controls and Automation catalogue)

Intro
A
B
C
D
E
F
G
X

Trip units

Overview of available types

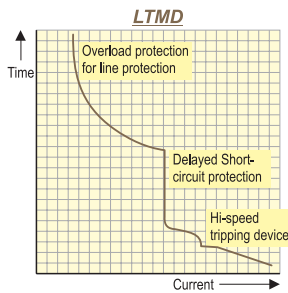
LTM - Line thermal magnetic



This trip unit offers overload and short-circuit protection. The overload protection is adjustable from 0.8 to 1 x the chosen rating whilst the short-circuit protection is set at 10 x the chosen rating (FD frame) or adjustable from 5 to 10 x the

chosen rating (FE and FK frame). The unit is designed to protect the lines and/of loads present in standard circuits.

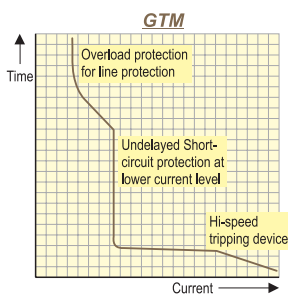
LTMD - Line thermal magnetic, selective type



This trip unit offers overload and short-circuit protection. The overload protection is adjustable from 0.8 to 1 x the chosen rating whilst the short-circuit protection is set at 10 x the chosen rating (FD frame) or adjustable from 5 to 10 x the

chosen rating (FE frame). The unit is designed to offer discrimination with downstream protection devices. It also protects the lines and/of loads present in standard circuits.

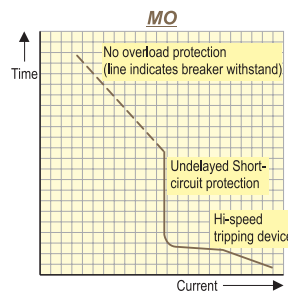
GTM - Line thermal magnetic



A trip unit designed to offer overload and short-circuit protection. The overload protection is adjustable from 0.8 to 1 x the chosen rating whilst the short-circuit protection is set at about 4 x the chosen rating (FD frame) or adjustable from 2.5 to

5 x the chosen rating (FE frame). Due to its low short-circuit current setting the unit can be used to protect long cable runs or to provide generator protection.

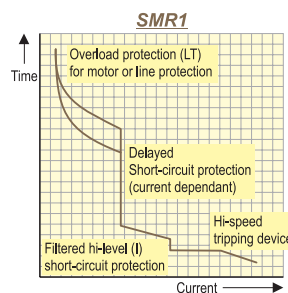
MO - Magnetic Only



This trip unit offers short-circuit protection only, the device is adjustable from 10 to 15 x the chosen rating. In order to prevent the protection device (Circuit Breaker) from overheating, the current of the circuit that it protects, needs to be

limited. (see dotted line) The unit is primarily designed to be used with thermal relays in motor protection circuits.

SMR1 (e) - Selective Electronic Protection⁽²⁾

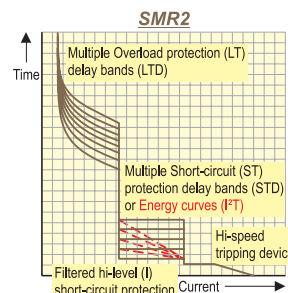


A trip unit designed to offer an overload (LT) and short-circuit protection (ST). The overload protection is adjustable from 0.4 to 1 x the chosen rating and has two protection bands (LTD), one for line protection and one for motor protection (class

10)⁽¹⁾. To ensure full discrimination the short-circuit protection has a current dependant fixed time setting that varies per frame size. The device is adjustable from 2 to 13* x the set LT current value.

The unit is designed to protect all circuit types and to offer a high level of discrimination with downstream devices.

SMR2 (1s & 1g) - Enhanced Electronic Protection⁽²⁾



A trip unit designed to offer an overload (LT) and short-circuit protection (ST). The overload protection is adjustable from 0.4 to 1 x the chosen rating and has multiple protection bands (LTD). The short-circuit protection (ST) is adjustable from 2

to 13 x the set LT value and has multiple protection bands (STD). The short-circuit protection can also be set to an energy mode. The unit is designed to protect all circuit types and to offer a high level of discrimination with downstream devices. Different modules allow the user to expand the device including groundfault, load shedding and communications etc.

(1) Not available on FK frame execution.

(2) Text applicable for SMR1/2. For SMR1e, SMR1s and g see relevant section.



Just rel

Internal Accessories

- C.2 Auxiliary contacts
- C.4 Releases

External Accessories

- C.6 Residual current devices RCD's
- C.8 Rotary handles
- C.12 Electrical operators
- C.16 Connectivity, 60 mm system
- C.18 Changeover / Power transfer systems

Versions

- C.23 Plug-in devices
- C.25 Draw-out devices, FE & FG frame
- C.27 Draw-out, FK frame

Installation

- C.28 Padlocks, keylocks
- C.29 Door flanges
- C.30 Terminal shields
- C.31 FD frame adaptors and other accessories

Mounting positions

- C.33 Allowed mounting position per frame size
- C.33 Breaker supply

Components & Accessories**Connections**

- C.34 Standard connection terminals
- C.36 Rear connections facilities
- C.38 Optional connection terminals
- C.40 Optional connection - box clamps
- C.42 Optional connection terminals - extenders variants
- C.43 Phase separators & Back plates

The breaker

Order codes

Trip Units

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

A

B

C

D

E

F

G

X

yon on us



Internal accessories

Auxiliary contacts

FD, FE & FG frame

Auxiliary contact blocks are conveniently fitted into an auxiliary-device compartment, accessible by removing the breaker cover. This fully insulated compartment has several pouches, a number of which are reserved for contact blocks. To allow for a logical and traceable schematics each contact block has a pre-defined position within the auxiliary device compartment indicated by a symbol printed both on the breaker case and on the auxiliary device itself. External wiring can be brought into the accessory compartment through - specifically designed and positioned - break-out openings in the breaker lid or can go through

channels in the breaker rear. Once this is done the wiring can be stripped and easily connected to the box terminals on the internal accessories. These terminals are designed to connect wiring up to 2.5 mm².

To identify the correct mounting position within the accessory compartment symbols are moulded into the breaker and contact housing.

For Auxiliary switches suited for mounting on the right (Ⓡ) and on the left (Ⓛ).

For Bell Alarm switches; Mechanism operated types (M) Trip unit operated types (T).

Numerous types are available all meeting the requirement of the EN 60 947-5 and UL standards. Each breaker type allows the use of three basic types indicating the breaker contact position, fault indication and trip position indication. For the FE & FG frame draw-out execution a fourth type is available that indicates the plugged in, test or withdrawn position of the breaker in the draw-out chassis (carrage indication contacts). Please take into account that when the contacts are not linked or mounted in the breaker, their function is reversed. *i.e. NO becomes NC and NC becomes NO.*

The contact numbering of each device is indicated in the schematics next to each photo. **eg. 5 or 6**
 The intermediate cover of the breaker has a separate set of codes that indicate the number of the device when it is mounted in the breaker. **eg. 1 or 2**
 The combination of these two codes provides a standardized coding system of each connection point⁽¹⁾. **eg. 15 or 26**

FAS/CA (open - closed indication)

They indicate the breaker contact status (open/closed). The contact is mounted in a simple click-in block and is available in 4 different versions:

- FAS10L auxiliary contact left mounted NO
- FAS01R auxiliary contact right mounted NC
- FAS10R auxiliary contact left mounted NO
- FAS01L auxiliary contact right mounted NC

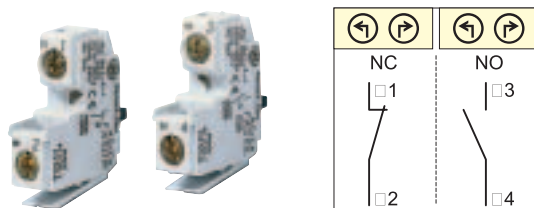
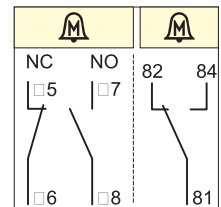
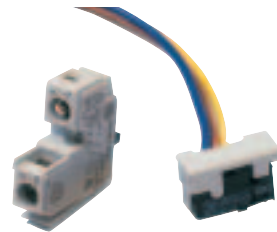
The FAS10 & FAS01 contacts blocks are also used in kits as carriage indication contacts for the draw-out versions of the FE & FG frame. Premounted sets, one with 1 NO indication contact per position (total 3 NO contacts) and a second with 1 NO and 1 NC contact per position (total 3 NO + 3 NC contacts) are available. These sets come as easy to fit and connect field mountable kits.

BAM/CDM (Bell alarm mechanism)

Indicates that the breaker has moved to its "Tripped" position. This can be caused by a fault (see BAT/CD contact), the operation of the push to trip button on the breaker front or a shunt or undervoltage release operation.

The contact is a simple click-in block and can only be placed in the BAM position inside the accessory compartment indicated by the symbol (M). By using a combination of the BAM and BA contacts it is possible to discriminate between the kind of fault the breaker has reacted to.


- 3 versions of bell alarm mechanisms are available:
- FABAM10 bell alarm mechanism NO for FE and FG frame
 - FABAM01 bell alarm mechanism NC for FE and FG frame
 - FABAM11 bell alarm mechanism (change over) only for FD frame
 (Is delivered with 0.75 mm² cables of 60 cm length).



(1) See wiring diagram section for complete overview.



BAT/CD (Bell alarm trip unit)

Indicates that the breaker has detected a fault condition resulting in it moving to its "Tripped" position. A Record Plus breaker trips on a fault condition due to a Trip Unit protection device or RCD operation. The operation of this device can be verified mechanically by depressing the RCD operation interface lever located below the Trip Unit. The contact is a simple click-in block and can only be placed in the BAT position inside the accessory compartment (indicated by the symbol ). By using a combination of the BAM and BAT contacts it is possible to discriminate between the kind of fault the breaker has reacted to.

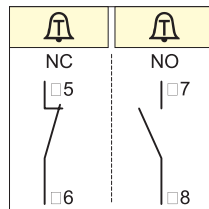
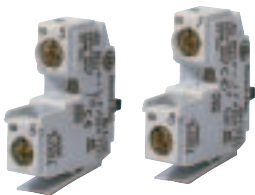
4 versions are available:

for general use:

- **FABAT10** bell alarm trip NO
- **FABAT01** bell alarm trip NC

for use in FE frame thermal magnetic and magnetic only types:

- **FEBAT10** bell alarm trip NO
- **FEBAT01** bell alarm trip NC



FK frame

Optimized for use in the larger FK frame size mounting and connecting takes place in the same manner as in the FD, FE and FG frame sizes. The contact blocks are of the changeover type (form C) and are available in easy to mount click in devices with a bell alarm contact or auxiliary switch. A maximum of three auxiliary switches and one bell alarm contact can be mounted. To indicate the breaker position in the draw-out chassis (see page C.23 and C.24) a similar contact block is used.)

The contact numbering of each device is indicated in the schematics next to each photo. **eg. 5 or 6**

The intermediate cover of the breaker has a separate set of codes that indicate the number of the device when it is mounted in the breaker. **eg. 1 or 2**

The combination of these two codes provides a standardized coding system of each connection point. **eg. 15 or 26**

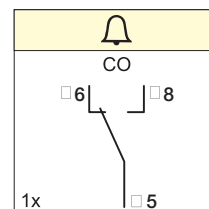
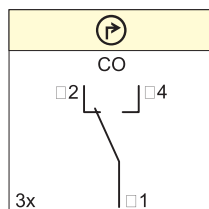
FAS/CA (open - closed)

They indicate the breaker contact status (open/closed). The contacts are mounted in a simple click-in block, of which a maximum of three fit into the auxiliary device compartment (right side).

FNS11R Auxiliary contact right mounted CO BA/CD (Bell alarm)

A contact that indicates that the breaker has tripped. The contact is mounted in a simple click-in block and fits into the auxiliary device compartment (right side).

FNBA11R Bell Alarm contact right mounted CO



Performance

The values mentioned here have been determined in accordance with the EN 60947-5-1 standard and apply for inductive loads.

	AC (A)		DC (A)	
	FAS (co)	BA (co)	FAS (co)	BA (co)
≤ 24V	10	10	2	2
48V	6	6	1.5	1.5
60V	6	6	1	1
110V	4	4	0.5	0.5
220V	3	3	0.25	0.25
400V	1.5	1.5	-	-

Performance

The contacts offer a combination of a high thermal current rating and can be used down to typical PLC operating levels of 12V 5 mA, AC/DC. The contacts are self-reansing and offer a life span equivalent to or exceeding that of the breakers. The values mentioned here have been determined in accordance with the EN 60947-5-1 standard.

	AC (A)				DC (A)			
	FAS (no/nc)	BAT (no/nc)	BAM (co)	BAM (no/nc)	FAS (no/co)	BAT (no/nc)	BAM (co)	BAM (no/nc)
≤ 24V	10	10	10	10	2.5	2.5	4	2.5
48V	10	10	10	10	1.4	1.4	0.5	1.4
60V	10	10	10	10	1	1	0.3	1
110V	6	6	6	6	0.55	0.55	0.2	0.55
220V	3	3	3	3	0.27	0.27	0.1	0.27
380V	2	2	2	2	0.2	0.2	-	0.2
500V	1.5	1.5	-	1.5	-	-	-	-
600V	1.2	1.2	-	1.2	-	-	-	-

Intro

A

B

C

D

E

F

G

X



Internal Accessories

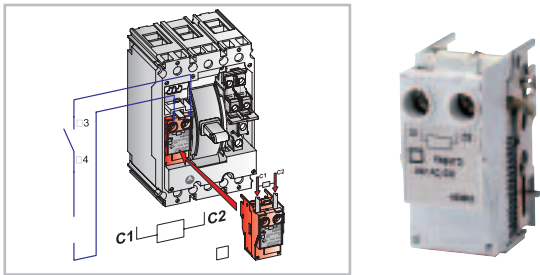
Releases

Shunt and undervoltage releases can be fitted easily and quickly in a specifically designed accessory compartment which is accessible by removing the breaker lid. This fully insulated compartment has several pouches one of which is reserved for a shunt or undervoltage release indicated by a symbol printed in the breaker case and on the auxiliary device itself. External wiring can be brought into the accessory compartment through - specifically designed and positioned - break out openings in the breaker lid,

or can go through channels in the breaker rear. Once this is done the wiring can be stripped and easily connected to the box terminals on the internal accessories. These terminals are designed to connect wiring up to 2.5 mm². The devices are designed to trip the breaker when its contacts are closed and the handle indicates the "On" position. When the breaker contacts are open and the breaker handle indicates "Off" or "Trip" activating the releases will have no effect.⁽¹⁾

FD, FE & FG frame

Shunt release (SHT/EA)



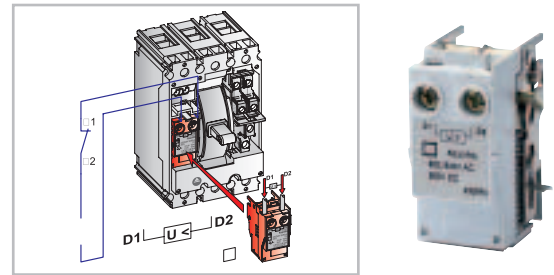
The **Record Plus™** shunt and undervoltage releases are common for all frame sizes up to 630A and all offer a unique combination of low power consumption and a kiss-free, lock out operation. Most types are common for equivalent AC and DC ratings and all are available in a wide range of voltages. When the breaker is in the "ON" position and the shunt trip is activated the breaker will trip and its contacts will open. The device can be constantly activated at its nominal voltage allowing it to be used as a lock out coil. The connection clamps are marked C1 and C2. Switches, relay contacts and push buttons can be used to operate the shunt release. The use of illuminated push buttons is limited by the power that these lamps require to operate and the value that the shunt release requires to trip. Here the maximum total consumption of the lamps may not exceed 2mA.

Voltage operational band	0.7 - 1.1 Un
Minimum pulse duration	10 msec
Total intervention time	≤ 50 msec

Shunt release - Performance

Voltage rating	Current consumption mA		Power consumption mW/mVA	
	inrush	hold	inrush	hold
12V DC	200	200	2.4	2.4
24V AC/DC	150	150	3.6	3.6
48V AC/DC	60	60	2.88	2.88
110/130V AC/DC	40	40	4.8	4.8
220/240V AC 250V DC	20	20	4.6	4.6
440/440V AC	15	15	6.6	6.6
480V AC	15	15	7.2	7.2

Undervoltage releases (UVR/MV)



When the breaker is in the "ON" position and the undervoltage release is deactivated the breaker will trip and its contacts will open. In de-energized status the device prevents the breaker contacts from moving and is suitable for use as a lock-out coil. The connection clamps are marked D1 and D2. De-energization of the device or a drop in its supply voltage to a value below the mentioned lower voltage limit will activate the device. To prevent voltage-dip-driven nuisance tripping an undervoltage release with time delay is available. An external DIN-rail mountable box contains a time delay unit with settable timings and is linked up with a DC UV undervoltage release. This version is only available for an AC voltage of 230/240V.

Voltage operation band (all types)	
deactivates between	0.35 - 0.7 Un
activates between	0.85 - 1.1 Un
minimum reaction time	10 msec
total intervention time (undelayed type)	≤ 50 msec
delayed version (extra delay)	settable 100 to 250 msec

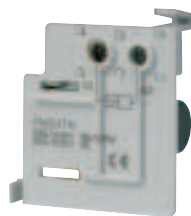
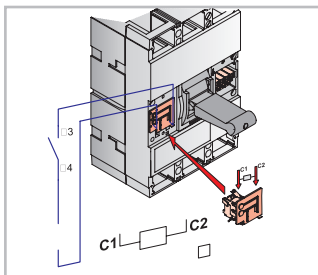
Undervoltage releases - Performance

Voltage rating	Current consumption mA		Power consumption mW/mVA	
	inrush	hold	inrush	hold
24V AC/DC	50	50	1.2	1.2
48V AC/DC	20	20	0.96	0.96
110/130V AC/DC	15	15	1.8	1.8
220/240V AC 250V DC	15	15	3.45	3.45
440/440V AC	15	15	6.6	6.6
480V AC	15	15	7.2	7.2

(1) Not applicable for FK Frame undervoltage release.

FK frame

Shunt release (SHT/EA)



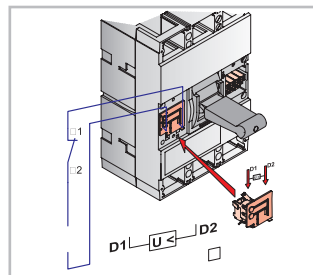
When the breaker is in the "ON" position and the shunt trip is activated the breaker will trip and its contacts will open. The device can be constantly activated at its nominal voltage allowing it to be used as a lock out coil. The connection clamps are marked C1 and C2. Switches, relay contacts and push buttons are used to operate the shunt release.

Voltage operational band 0.7 - 1.1 Un
 Minimum pulse duration 10 msec
 Total intervention time ≤ 50 msec

Shunt release - Performance

Voltage rating	Current consumption mA		Power consumption mW/mVA	
	inrush	hold	inrush	hold
24V AC/DC	12.5	1.3	300	30
48V AC/DC	6.3	0.6	300	30
110/130V AC/DC	2.3	0.2	300	30
220/240V AC 250V DC	1.2	0.1	300	30
380-400V AC	0.8	0.1	300	30

Undervoltage releases (UVR/MV)



When the breaker is in the "ON" position and the undervoltage release is deactivated the breaker will trip and its contacts will open. In de-energized status the device prevents the breaker contacts from moving and is suitable for use as a lock-out coil. The connection clamps are marked D1 and D2. De-energization of the device or a drop in its supply voltage to a value below the mentioned lower voltage limit will activate the device. To prevent voltage-dip-driven nuisance tripping an undervoltage release with time delay is available. An external DIN-rail mountable box contains a time delay unit with settable timings and is linked up with a DC UV undervoltage release. This version is only available for an AC voltage of 230/240V.

voltage operation band (all types)
 deactivates between 0.35 - 0.7 Un
 activates between 0.85 - 1.1 Un
 minimum reaction time 10 msec
 total intervention time (undelayed type) ≤ 50 msec
 delayed version (extra delay) settable 100 to 250 msec

Undervoltage releases - Performance

Voltage rating	Current consumption mA		Power consumption mW/mVA	
	inrush	hold	inrush	hold
24V DC	1.3	0.13	30	3
24V AC	1.3	0.13	30	3
48V DC	0.6	0.06	30	3
110-127V AC	0.2	0.02	30	3
230V AC	0.1	0.01	30	3
400-415V AC	0.1	0.01	30	3



External accessories

Residual current devices

A **Record Plus™** circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). A line of three and four pole completely integrated add-on devices are available as side mounted models (FD frame size) or as units that are fitted below the trip unit of the breaker (FD, FE and FG frame sizes). In all cases the RCD unit interfaces directly with the circuit breaker without the use of any secondary wiring or connections.

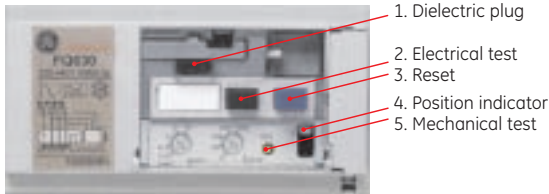
Each RCD has a sensor placed around the phase and neutral current paths that detects the vectorial sum of the phase and neutral currents. When this sum is no longer zero it is assumed that current is flowing to earth (residual current). If this value exceeds the threshold set

on the RCD the breaker connected to the device is tripped.

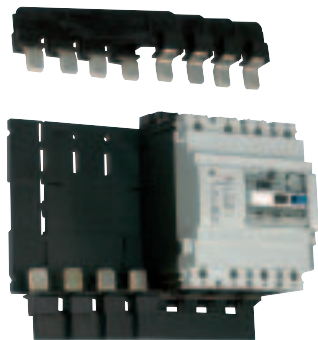
The RCD unit's electrical power is supplied by the line voltage of the breaker it is linked to. By use of a multi-phase bridge the design still works when one phase and the neutral is present. A pouch on the RCD allows one to place one BAT contact NO or NC which allows a remote signal on earth faults.

A **Record Plus™** breaker and an RCD combination can be connected like any stand-alone breaker and are available as fixed or plug-in devices. The mains connection interface of the RCD is an exact replica of the breaker connection area, thus allowing the use of all standard breaker terminals.

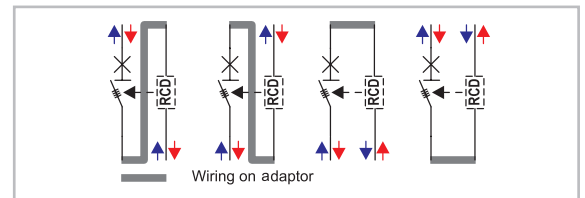
Designed to meet the latest IEC 947 (industrial), IEC 1009 (residential) and the IEC 755 standards, **Record Plus™** RCDs are available in a version suited for side or bottom mounting as three and four pole units. The tamper free setting area illustrated below is common for the whole line and includes a mechanical and an electrical test option.



The mechanical test button tests the mechanical operation of the breaker and RCD unit without power, whereas the electrical option tests both the electrical and mechanical operation of the device. In order to allow for a dielectric test of the breaker and RCD combination without damaging the electronics, a so called "dielectric disconnect plug unit" is placed within the setting area. All devices have a setting area with a standard front cut-out of 45 mm. The device has numerous current and time settings and an override blocking the time settings when set to 30mA. The devices are class A, surge resistant (500A 8/20 microsecond) and are finished with a transparent, tamper-free cover.



The FD-frame RCD is available in two versions: for mounting on the right hand side of the breaker or for mounting below the trip unit of the breaker. The side mounted type is available in two versions. The first one comes with a multifunctional DIN-rail mounting kit including a connection kit to link up the breaker and the RCD. The connection kit allows the user to feed the breaker and RCD assembly from a multitude of directions while placing the RCD up- or downstream. The second version of the side-mounted RCD is designed for screw mounting and comes with a simplified connection set (see sketch). Both side mounted devices are designed to accommodate a 45 or 64 mm cover plate cut-out. This allows usage in an environment with other DIN-modular devices or with other breakers.



The screw mounted type that only allows for two connection options is depicted on the right.



The FE- and FG-frame RCD units are designed to be mounted directly below the breaker trip unit area, thus forming an integrated circuit breaker plus RCD device. All 'bottom' mounted devices are available as three and four pole units and have a setting area that is common for the whole line.

Programme overview

	FDQI or S	FDQ ⁽¹⁾	FEQ ⁽¹⁾	FEQ ⁽¹⁾	FGQ ⁽¹⁾
	FD frame side mounted	FD frame mounted below breaker ⁽¹⁾	FE frame mounted below breaker ⁽¹⁾	FE frame mounted below breaker ⁽¹⁾	FG frame mounted below breaker ⁽¹⁾
In (A)	160	160	160	250	400/630
Number of poles	3-4	3-4	3-4	3-4	3-4
Delay at 2 I _{dn} (msec)	Inst-60-150-300-600	Inst-60-150-300-600	Inst-60-150-300-600	Inst-60-150-300-600	Inst-60-150-300-600
Total tripping time at 2 x I _{dn} (msec)	40-100-190-340-640	40-100-190-340-640	40-100-190-340-640	40-100-190-340-640	40-100-190-340-640
Available voltages (AC 50/60Hz)	220-440V / 440-690V	220-440V / 440-690V	220-440V / 440-690V	220-440V / 440-690V	220-440V / 440-690V
I _{dn} setting (A)	0.03 - 0.3 - 1 - 3 - 10	0.03 - 0.3 - 1 - 3 - 10	0.03 - 0.3 - 1 - 3 - 10	0.03 - 0.3 - 1 - 3 - 10	0.03 - 0.3 - 1 - 3 - 10

(1) Must be linked to the trip unit side of the breaker

Selectivity

To assure selectivity/discrimination between two residual current devices the following rules are applicable.

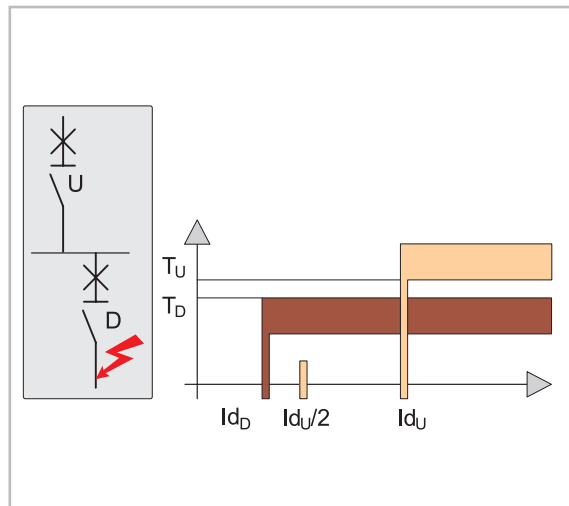
$I_{dU} > 2 \times I_{dD}$

Where I_{dU} is the threshold of the upstream device and I_{dD} that of the downstream one.

$T_{rU} > T_{oD}$

Where T_{rU} is the reaction time of the upstream device and T_{oD} is the total opening time of the downstream device.

The table included here indicates where selectivity/discrimination can be achieved and takes into account the threshold and time settings of the devices.



Selectivity overview

outgoing		Elfa Plus "S"		F-Q RCD 60 ms			F-Q RCD 150 ms			F-Q RCD 300 ms			F-Q RCD 600 ms		
incoming	I _{dn} (mA)	300	1000	300	1000	3000	300	1000	3000	300	1000	3000	300	1000	3000
ElfaPlus	30	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	Inst. Type 300		T		T	T	T	T	T	T	T	T	T	T	T
	1000				T	T									
ElfaPlus "S" type	30						T	T	T	T	T	T	T	T	T
	Inst. Type 300							T	T	T	T	T	T	T	T
	1000								T	T	T	T	T	T	T
FD-Q RCD set at inst.	30		T		T	T	T	T	T	T	T	T	T	T	T
	Inst. Type 300					T									
	1000														
FD-Q RCD set at: 60 msec.	30						T	T	T	T	T	T	T	T	T
	Inst. Type 300							T	T	T	T	T	T	T	T
	1000								T	T	T	T	T	T	T
FD-Q RCD set at: 150 msec.	30									T	T	T	T	T	T
	Inst. Type 300										T	T	T	T	T
	1000											T	T	T	T
FD-Q RCD set at: 300 msec.	30												T	T	T
	Inst. Type 300													T	T
	1000														T
	3000														

T = Total (or Full) selectivity



External accessories

Rotary handles

The **Record Plus™** rotary handle is specifically designed to allow the user to change the linear motion of the breaker to a rotation over a 90 degree angle. This can be accomplished by simply adding an adaption box to the breaker front.

The design is universal for the whole breaker line and has the OFF position placed at 3 o'clock and the ON position at 6 o'clock. The third breaker position "TRIP" is located

between the ON and the OFF position.

The design has room for two early closing and late opening contact blocks that, in order to save installation time, are delivered pre-mounted and pre-wired with a specific rotary-handle device.

Each **Record Plus™** rotary handle is designed to allow the user to place one to three 5 to 8 mm padlocks or one keylock that can lock the breaker in OFF position.

Record Plus™ Rotary handles

Three operators types are available, one for direct breaker mounting, a device for through door or panel mounting and a third type where the operator is mounted on the door front.

All operators have a common operation moded and a clear position indication:

Breaker OFF - handle horizontal

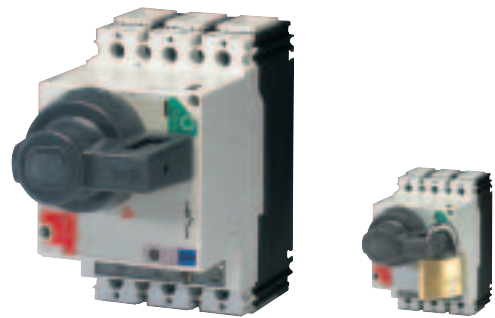
Breaker ON - handle Vertical

The standard padlocking and keylocking mechanism can be bypassed to allow the breaker to be locked in other positions than OFF.



A special version is available with two normally open auxiliary contacts (FABAM10) that are pre-mounted and pre-wired with leads of 0.75 mm² and a length of 60 cm. The use of a through door rotary handle door flange is recommended.

Record Plus™ rotary handle mounted directly on the breaker front

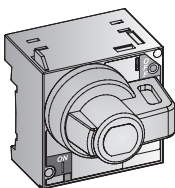


A specifically designed adaptor box with a handle is directly installed onto the breaker front. It is available in grey for normal applications and in a yellow/red execution for machine tool applications.

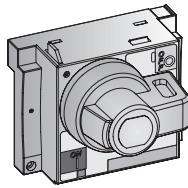
An extra Ronis or Profalux key lock can be clicked into the handle front, thus allowing one to lock the breaker in the same manner as the padlocking device.

The Ronis key locks are available in a number of versions:

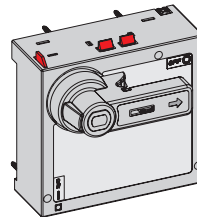
- A version where each lock has a different key number
- A version where the user can choose one of six keys for several locks



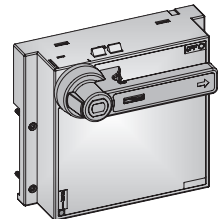
FD 63/160



FE 160/250

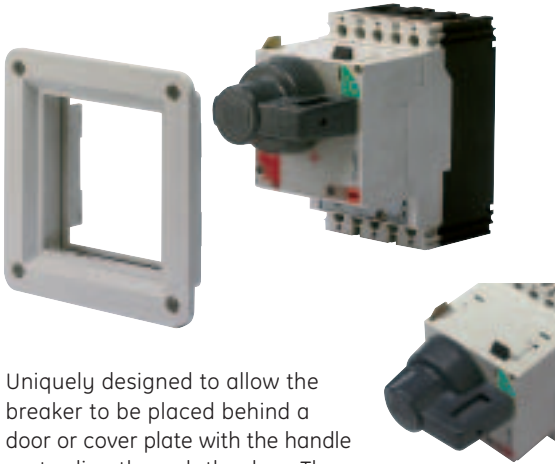


FG 400/630



FK 800-1600

Rotary handle for use through door or cover plate



Uniquely designed to allow the breaker to be placed behind a door or cover plate with the handle protruding through the door. The rotary handle features a door-opening or cover-plate-removal prevention, interlock in the ON position and a mechanism that automatically trips the breaker if the door or cover plate is not present (a bypass is available). The rotary handle is available in grey for normal applications and in a yellow/red execution for machine-tool applications.



Rotary handle for panel or hinged door mounting



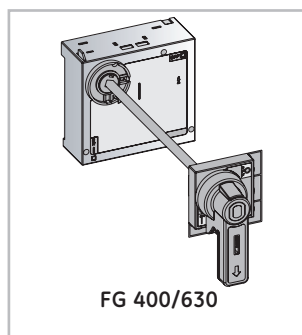
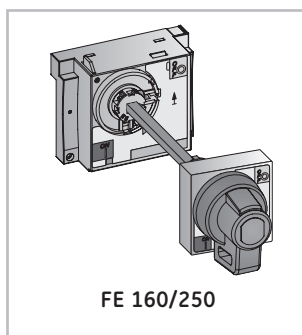
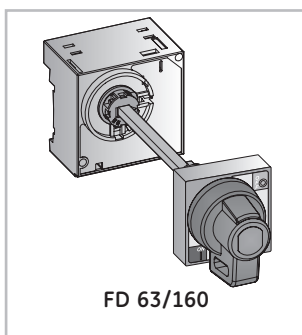
A handle and escutcheon is mounted on the door or panel front and connected to the breaker by an elongation shaft that goes into an adaptor box directly installed onto the breaker front. The design allows for a total depth of up to 350 mm (from the back of the breaker mounted behind the door or panel and the door front).

The handle is available in grey for normal applications and in a yellow/red execution for machine-tool applications. Interlocks that prevent the opening of the door while the breaker is "ON" (are standard). For override operation see red indicators on euchenon front.

All **Record Plus™** rotary handles have the same standard "single hole" front door drilling and are specifically designed to tackle mounting issues as "shaft droop" and tolerance in user drillings.

Available in grey or in yellow/red the device is supplied with an adaptor box for installation on the breaker front, a mounting position definer, a shaft, a handle with escutcheon for door or panel mounting and all necessary fixation hardware.

The door or panel mounted operating handle has a protection degree of IP54.



Intro

A

B

C

D

E

F

G

X

External accessories

Rotary handles - accessories

Extension shaft set



- The "long shaft set" allows the user to install a breaker with a door or panel mounted rotary handle up to a depth of 600 mm, measured from the back of the breaker to the front of the door
- The set includes a shaft and a shaft droop prevention adapter
- Available for all frames

Flex operator push to trip (Bowden cable)



- For the door/panel-mounted rotary handle accessory
- Allows the operation of the push-to-trip button from the door front by use of a bowden cable (cable NOT supplied).
- Available for FE & FG Frame sizes

Keylock



An extra Ronis or Profalux key lock can be clicked into the handle front, thus allowing one to lock the breaker in the same manner as the padlocking device. The Ronis key locks are available in a number of versions:

- A version where each lock has a different key number
- A version where the user can choose one of six keys for several locks

Draw-out adaptor



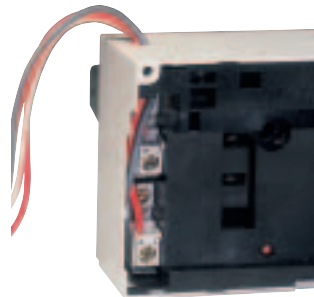
- For use with the door/panel mounted rotary handle with the standard or long shaft
- The device allows for the difference in breaker position in the draw-out device (depth difference, withdrawn and plugged in)
- The telescopic construction allows one to close the door or panel with the breaker in the withdrawn position
- Available for FE, FG and FK frame sizes

Side-by-side installation adapter boxes



- A set of covers that bridge the gap between breakers with rotary handles on use through cover plate
- Provides an aesthetically pleasing finish to the breaker fronts
- Available for FD and FE frame sizes

Auxiliary contacts



- Special rotary handle versions can be provided with two FABAM NO contacts. These close before the main contacts close and open after the main contacts open
- The contacts come pre-installed in the rotary handle and have 2 cables 0.75 mm², 60 cm long
- Available for FD, FE, FG and FK frame sizes

C

D

E

F

G

X

External accessories

Electrical operators

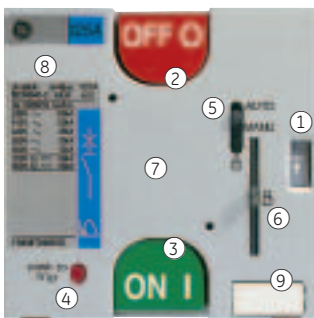
In order to allow a **Record Plus™** circuit breaker to be operated electrically, front mounted electrical drives are available. These drives are designed for easy mounting onto the breaker front have three clearly indicated positions "OFF", "ON" and "TRIPPED".

The Record Plus standard Electrical Operator offering covers a total of five different devices. For each frame size a field mountable execution is available, one for the FD frame (3-160A), one for the FE frame (3-250A), one for the FG frame (250-630A) and one for the FK frame (630-1600A).

For Hi end applications the Fk frame can be equipped with a factory mounted electrical operator with an enhanced performance. Each device is easy to mount and connect whilst the connection diagrams allow a simple yet flexible application of the device.

The devices are connected by means of IPXXB box terminals accessible from the breaker front and located in the immediate vicinity of the terminals of the internal accessories. The box terminals allow for wiring with a cross section of 0.5 to 2.5 mm².

Operation



- ① Breaker Position Indicator - OFF- ON-Tripped-
- ② Breaker "ON" push-button
- ③ Breaker "OFF" push-button
- ④ Breaker "quick" Trip/OFF push-button
- ⑤ Manual-Automatic switch
- ⑥ Padlocking device (-O- Off only)
- ⑦ Area reserved for Optional field mountable KeyLock
- ⑧ Breaker data labels
- ⑨ Circuit indication label

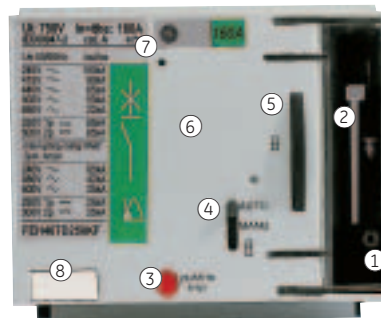
FD frame operator

Designed to be used in a side by side configuration with the FE frame operators the breaker & drive combination have the same depth whilst the cut-outs are of the same size.

Each Record Plus FD breaker is supplied with two extra data labels. This to indicate the breaker data on the operator front (standard labels are hidden once the device is mounted).

FD operators have two coils one to close the Record Plus device and a second to open. The operating panel has a Auto & Manual position that will only allow local OFF & ON operations when the switch is set to Manual. In all conditions a recessed push to trip knob is available to allow for emergency disconnection of the device.

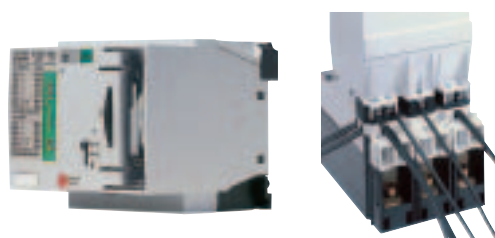
Padlocking or keylocking is possible in OFF position whilst each operator is supplied with a clear "ON", "OFF" and "TRIPPED" position indicator and a space for a optional circuit indicator label.



- ① Breaker Position Indicator - OFF- ON-Tripped-
- ② Breaker operating handle behind transparent door
- ③ Breaker "quick" Trip/OFF push-button
- ④ Manual-Automatic switch
- ⑤ Padlocking device (-O- Off only)
- ⑥ Area reserved for Optional field mountable KeyLock
- ⑦ Breaker data labels
- ⑧ Circuit indication label

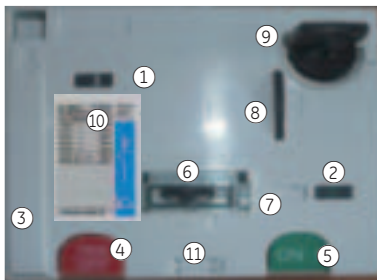
FE frame operator

Designed to be used in a side by side configuration with the FD frame operators the breaker & drive combination have the same depth whilst the cut outs are of the same size. Each Record Plus FE breaker is supplied with two extra data labels. This to indicate the breaker data on the operator front (standard labels are hidden once the device is mounted). FE operators are equipped with a motor that changes direction to close or open the Record Plus devices. The operating panel has a Auto & Manual position that only will allow acces to the manual operating handle when the switch is set to Manual (transparent cover can be opened). In all conditions a recessed push to trip knob is available to allow for emergency disconnection of the device. Padlocking or keylocking is possible in OFF position whilst each operator is supplied with a clear "ON", "OFF" and "TRIPPED" position indicator and a space for a optional circuit indicator label.



Electrical operators

Operation



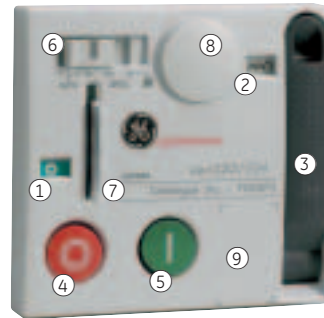
- ① Breaker Position Indicator -Tripped- -Non Tripped -
- ② Breaker Position Indicator -O- -I - (OFF or ON)
- ③ Breaker Manual -O- OFF handle (Pump mechanism)
- ④ Breaker "quick" Tripped/OFF push-button
- ⑤ Breaker -I- ON push-button
- ⑥ Sealable Manual-Automatic switch
- ⑦ Spring Charge Indicator
- ⑧ Padlocking device (-O- Off only)
- ⑨ Optional field mountable KeyLock
- ⑩ Breaker data labels
- ⑪ Circuit Indication label

FG frame Operator

A new Device, simple and easy to mount to all FG frame breakers in all situations. Each operator has a easy to use mounting interface allowing the device to be mounted in the field whilst allowing wiring access to all internal accessories. This mounting interface is linked to the electrical operator via a simple and easy to use hinging mechanism. After mounting and wiring simply close the hinging mechanism and the electrical operator is sturdily linked to the breaker. Suitable for all FG frame breakers each device is equipped with a upgraded and comprehensive user interface.

FG operators have a motor to open the device and a closing coil. The operating panel has a Auto & Manual position that only will allow use of the manual operating handle when the switch is set to Manual. In all conditions a recessed push to trip knob is available to allow for emergency disconnection of the device.

Padlocking or keylocking is possible in OFF position whilst each operator is supplied with a clear "ON", "OFF" indicator, a separate "TRIPPED" position indicator and a space for a optional circuit indicator label.



- ① Breaker Position Indicator -O- -I - (OFF, ON or Tripped)
- ② Operator Position Indicator Ready to Close/Open
- ③ Breaker Manual -O- OFF handle (Pump mechanism)
- ④ Breaker "quick" Tripped/OFF push-button
- ⑤ Standard version. Selector switch (Manual only - Handle pump -OFF- or -ON-)
- ⑤ Enhanced version (depicted) "ON" coil actuator knob
- ⑥ Manual-Automatic-Lock switch
- ⑦ Padlocking device (-O- Off only)
- ⑧ Optional field mountable KeyLock
- ⑨ Breaker data labels

FK frame Operator

A new Device, simple and easy to mount to all FK frame breakers in all situations. Each operator has a easy to use mounting interface that replaces the original breaker cover and allows the Electrical Operator to be mounted in the field. The Electrical Operator is then simply screwed on to mounting interface linking it to the breaker mechanism. Suitable for 3 or 4 pole FK frame breakers with ratings of 630, 800, 1000, 1250 & 1600Amps each device is equipped with a upgraded and comprehensive user interface.

Standard FK operators are equipped with a motor that changes direction to close or open the Record Plus devices. The operating panel has a Auto & Manual position that only will allow use of the manual operating handle when the switch is set to Manual.

A selector switch allows the user to switch between the use of the operating handle to switch OFF or ON. In all conditions a recessed push to trip knob is available to allow for emergency disconnection of the device.

Enhanced FK operators have a motor to open the device and a closing coil. The operating panel has a Auto & Manual position that only will allow use of the manual operating handle when the switch is set to Manual. In all conditions a recessed push to trip knob is available to allow for emergency disconnection of the device.

All devices can be padlocked or keylocked in their OFF position whilst each operator is supplied with a clear "ON", "OFF" and "Tripped" indicator.

Specifications

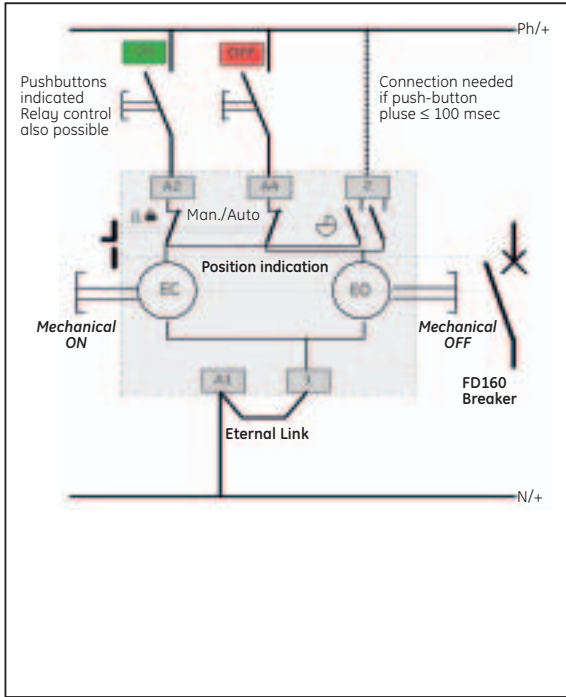
Record Plus Types	FD frame 3 or 4 pole	FD frame 3 or 4 pole	FD frame 3 or 4 pole	FD frame 3 or 4 pole	FD frame 3 or 4 pole
Electrical operator types Mounting	FDEMF Field	FEEMF Field	FGEMF Field	FKEMF Field	FNEMF Factory only
Rated voltages					
24V AC/DC	•	•	•	-	•
48V AC/DC	•	•	•	-	•
60V AC/DC	•	•	•	-	-
210-130V AC/DC	•	•	•	-	-
200-250V AC/DC	•	•	•	-	-
400-440V AC/DC	•	•	•	-	-
24V AC	-	-	-	•	-
48V AC	-	-	-	•	-
110V AC	-	-	-	•	•
110V DC	-	-	-	-	•
220V AC	-	-	-	•	•
220V DC	-	-	-	-	•
Power consumption					
During ON cycle	700VA/W	700VA/W	500VA/W	460VA..110VA	500VA/W
During OFF cycle by operator	700VA/W	700VA/W	500VA/W	460VA..110VA	500VA/W
During OFF tripped cycle by shunt release	max 7.5 mVA/mW	max 7.5 mVA/mW	max 7.5 mVA/mW	max 300 mVA/mW	max 300 mVA/mW
Power consumption					
AC15 24V	4A	4A	4A	4A	4A
AC15 230V	1A	1A	1A	1A	1A
Operating times					
"ON" via electrical operator	50 milliseconds	100 milliseconds	50 milliseconds	≤ 1.5 seconds	50 milliseconds
"OFF" via electrical operator	50 milliseconds	100 milliseconds	8 seconds	3 seconds	12 seconds
"OFF" via shunt release	50 milliseconds	50 milliseconds	50 milliseconds	50 milliseconds	50 milliseconds
"Reset" time between an "OFF" and "ON" pulse	80 milliseconds	100 milliseconds	8 seconds	≤ 1.5 seconds	12 seconds
Life span					
Mechanical endurance	100000	10000	5000	5000	5000
Operating frequency (per hr.)	120	120	60	30	30

Electrical operators

Field mountable models schematics

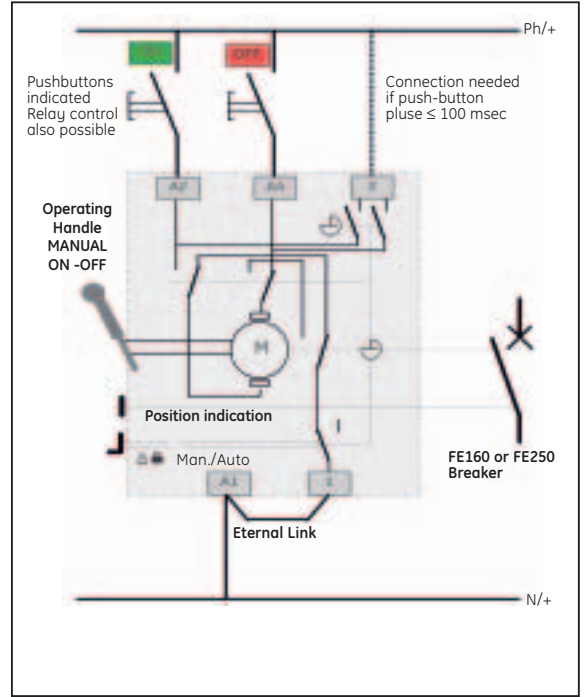
FD frame standard scheme

For use with NON Automatic breakers or in cases where no RESET functionality is required.



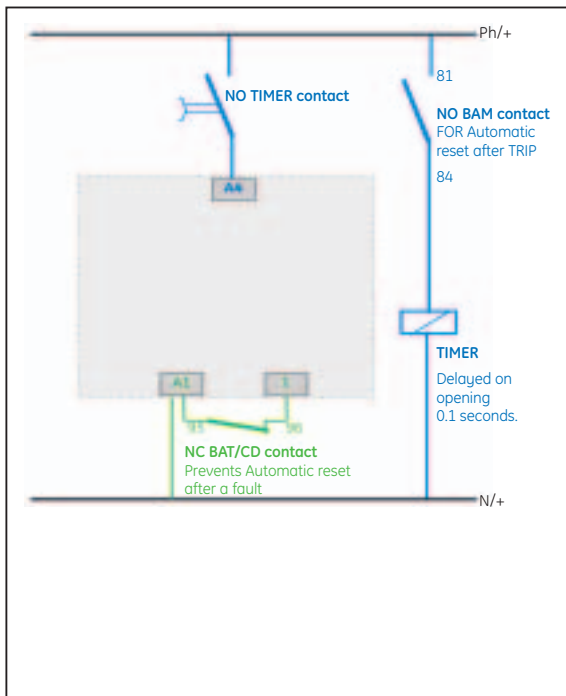
FE frame standard scheme

For use with NON Automatic breakers or in cases where no RESET functionality is required.



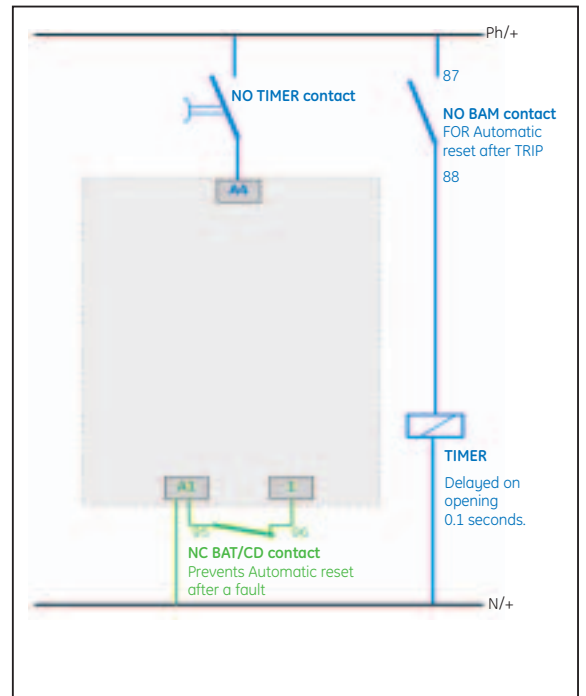
FD frame alternate options

One or both of the options (depicted in blue and green) can be added to create the indicated functionality.



FE frame alternate options

One or both of the options (depicted in blue and green) can be added to create the indicated functionality.

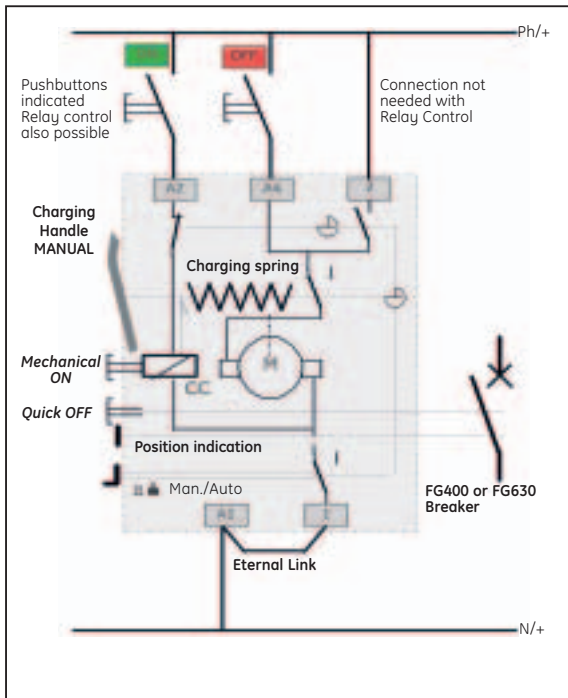


Electrical operators

Field mountable models schematics

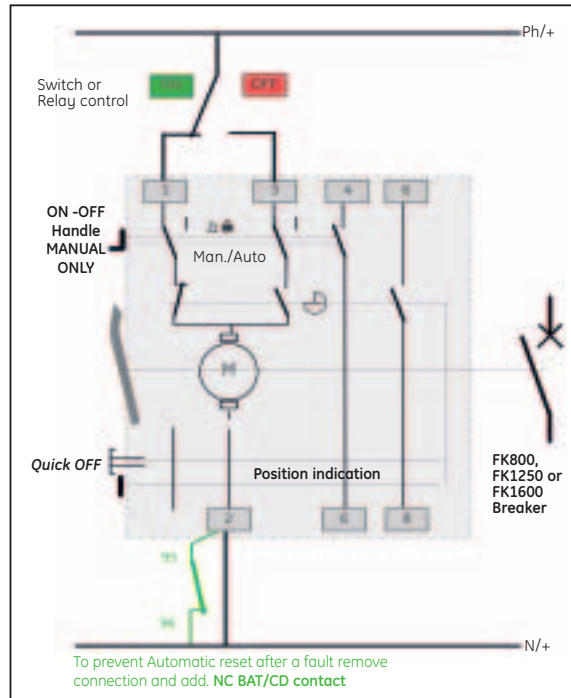
FG frame standard scheme

For use with NON Automatic breakers or in cases where no RESET functionality is required.



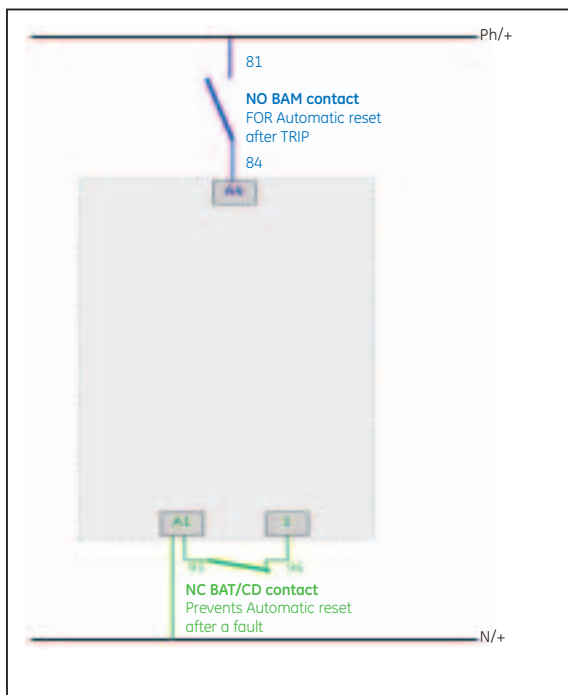
FK frame standard scheme for relay control

For use with NON Automatic breakers or in cases where no RESET functionality is required. Use alternate marked in green to black reset after a fault.



FG frame alternate options

One or both of the options (depicted in blue and green) can be added to create the indicated functionality.

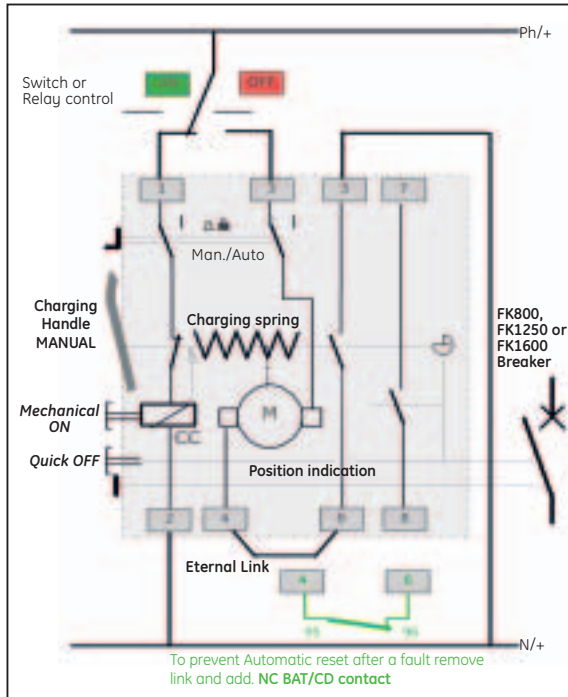


Electrical operators

Factory mountable models schematics

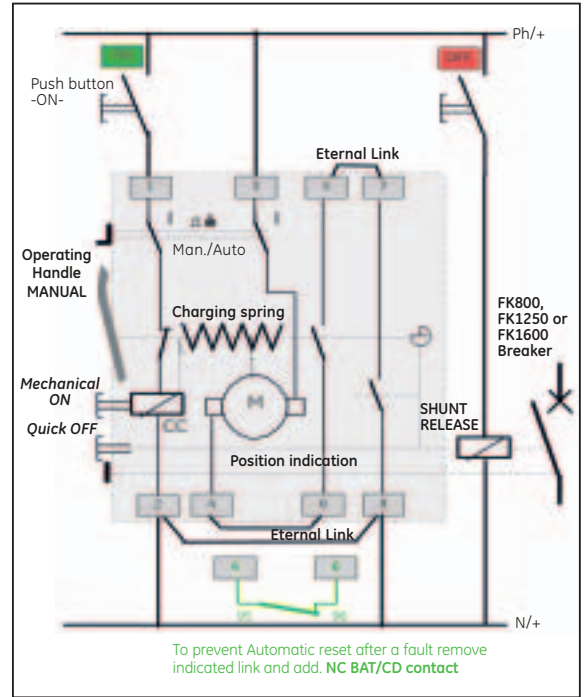
FK frame standard scheme for relay control

For use with NON Automatic breakers or in cases where no RESET functionality is required. Use alternate marked in green to black reset after a fault.



FK frame standard scheme for push button control

For use with NON Automatic breakers or in cases where no RESET functionality is required. Use alternate marked in green to black reset after a fault.



External accessories

Connectivity - 60 mm system
three and four pole

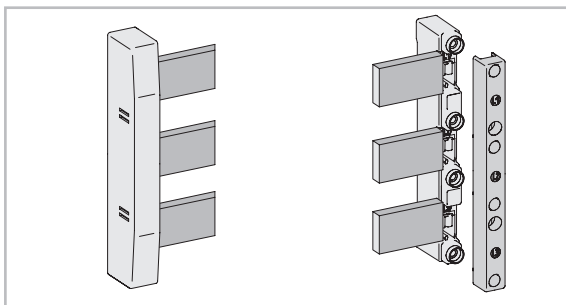
Record Plus™ circuit breakers have been designed to be installed easily and quickly with conventional means. The devices can be screw mounted to a mounting plate or clicked to a symmetrical DIN rail and connected with busbars, cables, flex-bars and ring terminals in a multitude of configurations. Connectivity allows the user to limit the breaker installation

to a few automateable tasks thus reducing the total costs. An adaptor device, specifically designed for the **Record Plus™** breaker line and incorporating all the connection hardware, is fitted to the breaker using a few simple screws. Once mounted the adaptor is then simply plugged on to a three or four pole busbar system already installed in the switchboard.

Busbar system

Based on the generally used 60mm bar spacing standard, a 3 or 4 pole support allow the use of copper bars of the following standardized dimensions.

- 20 x 5 mm; recommended for 250A
- 20 x 10 mm; recommended for 400A
- 30 x 5 mm; recommended for 400A
- 30 x 10 mm; recommended for 630A



The busbar supports are delivered for uses with copper bars of 30 x 5 mm. By carefully removing material or by using the supplied spacer(s) the other standardized dimensions can be used.

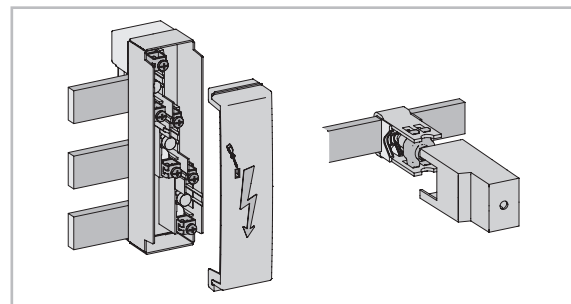
By varying the distance between the supports it is possible to build a three or four pole busbar system with the following short circuit ratings:

Busbar system

Support spacing	Busbar size (mm)	Peak withstand Ipk (kA)	Thermal withstand Icw (kA eff) 1 sec.
200 mm	20 x 5	46	21.9
	20 x 10	50	23.8
	30 x 5	58	27.6
300 mm	30 x 10	63	30.0
	20 x 5	40	19.0
	20 x 10	43	20.5
	30 x 5	52	24.8
400 mm	30 x 10	56	26.7
	20 x 5	35	16.7
	20 x 10	37	17.6
	30 x 5	47	22.4
	30 x 10	49	23.3

Mains connection

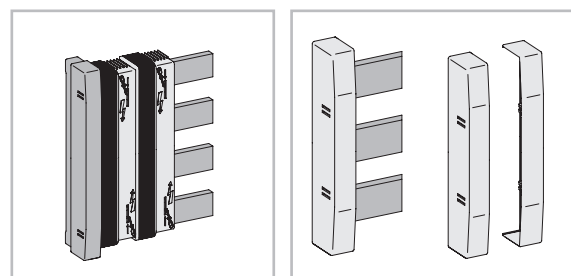
The system can be connected from the side or front. The front connection kit makes use of connection modules with connection lugs that are directly plugged on to the busbars. This module comes as a three and four pole unit and allows the connection of conductors from 1.5 to 70 mm². The side connection kit is made up of single pole connectors with terminal covers that allow for the connection of Cu conductors with a cross section of 25 to 300 mm².



Busbar finishing

Insulating covers are available to protect the user from inadvertent direct contact with the busbar system. These elements have a standard width of 50mm and can be coupled laterally offering variable width in order to cover the busbar not yet covered by breakers or feeding modules.

Endplate covers can be mounted to the busbar supports in order to provide complete protection against inadvertent contact to a busbar from the side.



Intro

A

B

C

D

E

F

G

X



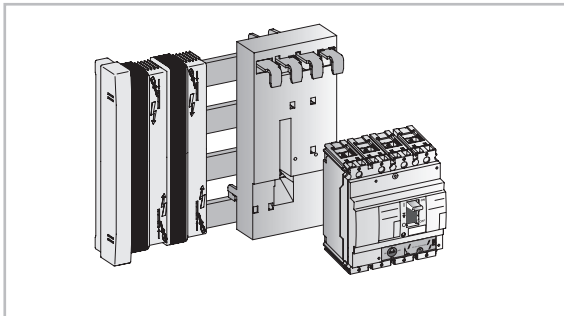
The system

For the **Record Plus™** FD and FE frame adaptors exist rated at 160A (FD) and 250A (FE) and in a 3 and 4 pole version. Designed to allow the use of the breaker at its full rated breaking capacity of 150kA at 415V each unit is equipped with a plug/hang on connection system allowing one to place it on the busbar system in one simple operation.

The adaptors have been tested to meet the most stringent requirements and are equipped with a mechanism allowing them to be removed as they were mounted. Each adaptor is supplied with the necessary fixation hardware and a terminal shield to cover the connection between the breaker and the adaptor.

Adaptor

The breaker and adaptor mounting is simple and easy. The length of the 4 pole adaptor also allows the use of a bottom mounted RCD.



System

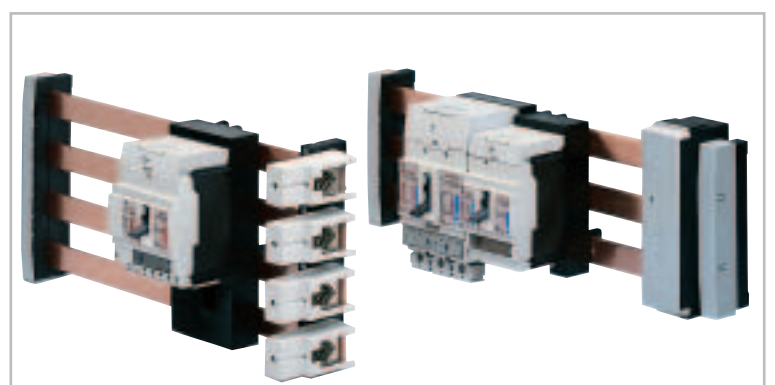
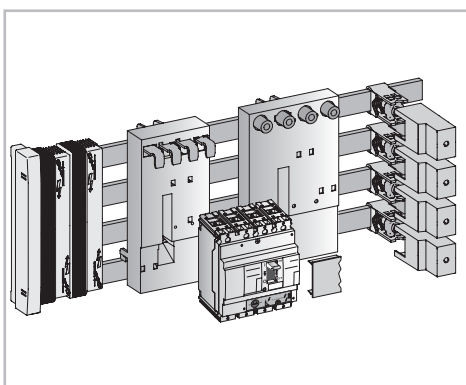
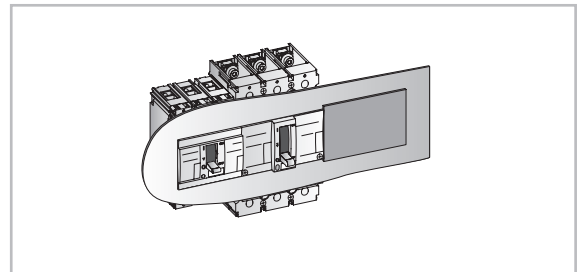
Each breaker is fixed on the adapter by means of two pretapped screws at the bottom and its main terminals at the top.

The breaker and adaptor combination is now quite simply plug/hung on to the busbars, connecting and fixing the breaker in one simple operation.

To allow for a flush-front finishing the adaptors have been designed to adapt to the difference in breaker depth and can be used with the standard FD and FE frame sizes (FD type without DIN-rail adaptor).

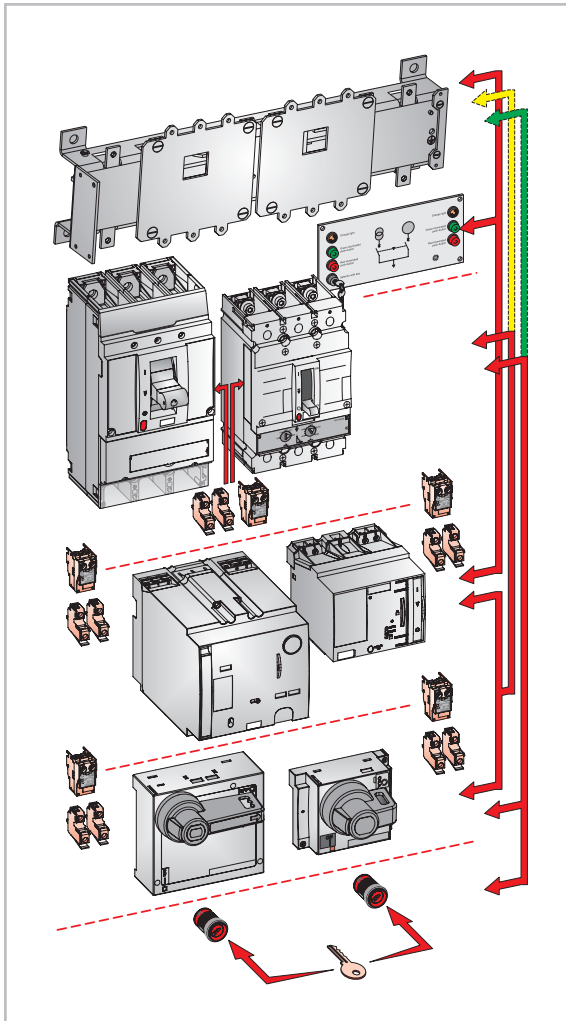
Finishing

The system can be finished with a cover/trim plate that can be found in the GE enclosure/systems catalogue. To allow for a standard cut-out within the cover/trim plate a filler piece is available in lengths of 1.2 m. This filler plate is adapted to the **Record Plus™** standard front cut-out of 64 mm.



External accessories

Interlocking systems

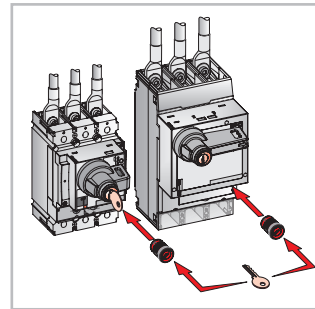


Mechanical interlocking

Record Plus™ circuit breaker are designed for use with a number of mechanical interlock systems suitable for use with thermal magnetic, magnetic only, non automatic and electronic circuit breakers. Each system only permits one of the two interlocked devices to be switched to the 'on' position.

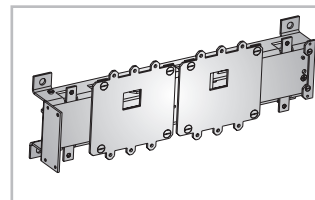
Two systems are available

Mechanical interlocking by equipping both devices with a rotary handle and cylinderlocks with the same key number (2 locks one key).



As all breakers use the same RONIS 1104B lock type all breaker combinations are possible.

The use of an interlock unit mounted behind the two devices, here the breakers are fitted on to pre-assembled adapter plates that allow the breaker to interface with the interlock unit.

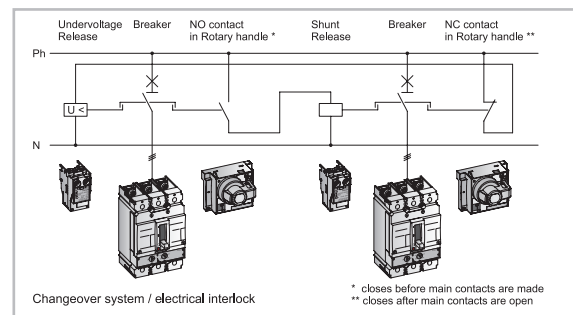


The device allows the interlocking of two breakers of equivalent or different frame sizes. The following combinations are possible:

- One 3 or 4 pole FE frame (10-250A)
+ One 3 or 4 pole FE frame (10-250A)
- One 3 or 4 pole FG frame (100-630A)
+ One 3 or 4 pole FG frame (100-630A)
- One 3 or 4 pole FK frame (320-1600A)
+ One 3 or 4 pole FK frame (320-1600A)
- One 3 or 4 pole FG frame (100-630A)
+ One 3 or 4 pole FE frame (10-250A)
- One 3 or 4 pole FK frame (320-1600A)
+ One 3 or 4 pole FG frame (100-630A)

Electrical interlocking

Two devices can be electrically interlocked by using a combination of shunt and/or undervoltage releases with auxiliary contacts of the early closing and breaking type. The **Record Plus™** undervoltage and shunt release are designed to allow their use as interlocking devices and use a twin coil actuator design. Rotary handle mechanisms are available with early closing and breaking auxiliary contacts.



Intro

A

B

C

D

E

F

G

X



Controllers

In order to use electrically and/or mechanically interlocked breakers in Automatic Transfer systems (ATS) two basic kinds of controllers are available. Each controller has a manual, automatic and locked position, a generator start up routine and a full set of pilot lights indicating the status of the system.

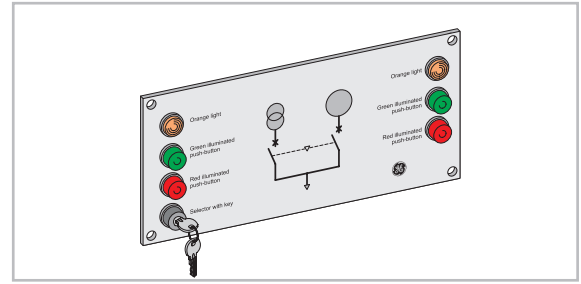
E model

Is available for change over systems with two devices. On a mains supply failure the mains device is disconnected and the secondary device switched on. When the mains supply returns, the controller keeps the secondary supply on line for a preset time of 10 seconds. It then opens the secondary breaker and closes the mains breaker. An emergency STOP order can be inputted on the terminals that will switch both the mains and secondary device to be switched OFF.

E plus model

Is available for changeovers with two devices. In addition to the standard E model features it allows for:

- Extra green pilot light indicates that the PLC is on line and functioning well.
- A generator start up command.
- An adjustable time delay on the generator start command initiation.
- Two connections allowing the input of a signal indicating that the supply of the generator set has reached it's nominal voltage. Only then will the mains device be disconnected and the secondary device switched on.
- An adjustable transfer and retransfer time between the different power supplies.
- Allows for the connection and disconnection of non priority loads when switching to the secondary supply.
- Built in communication.
- A terminal that allows the input of a start order of the generator set independent of the mains supply status. Here a change over cycle is initiated transferring from main to secondary supply.
- Adjustable cool down time of generator set.
- Remote retention of secondary supply
Used to prevent unwanted power transfers and to prevent these occurring a to high a frequency. A specific potential free contact is dedicated to this function.
- Transfer to secondary supply option
Used to start and keep the secondary supply on line independent of the presence of the mains voltage. A specific potential free contact is dedicated to this function.



Monitoring option

- Voltage monitoring relays
4 terminals are supplied that allow the connection of a contact indicating that the chosen supply is available and meets the standards set by the relay.

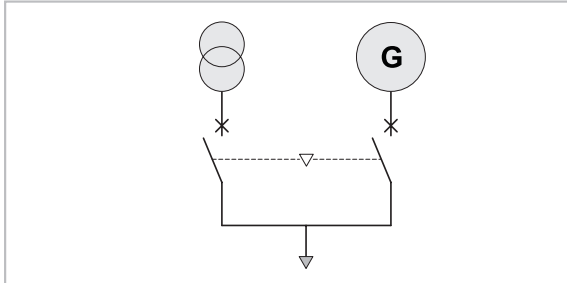
Controllers, performance

	E model	E plus model
Number of devices	2	2
Positions	Aut. - Man. - locked	Aut. - Man. - locked
Operating voltage	110 or 230V AC	110 or 230V AC
Power consumption	18VA	18VA
Mains voltage monitoring⁽¹⁾	Optional	Optional
Time delay on generator set start signal	No	Adjustable 0.1 to 60 sec.
Time delay on transfer command after mains return	Fixed 10 sec.	Adjustable 0.1 to 15 min.
Remote order stop	included	included
Remote transfer order	No	included
Remote retention of secondary supply order	No	included
Non priority load switching	No	included
Cool down time gen. Set.		Adjustable 0.1 to 60 min.
Communication		RS232 / RS485

(1) Optionally, a built-in net and/or generator voltage monitor can be delivered with the controller

Automatic changeover

To assure the continuity of electrical supply within a low voltage installation it is desirable that on a failure of the mains voltage supply a secondary power source takes over. An automatic changeover device transfers the power supply from the main power source to a secondary supply when a voltage monitoring device detects a failure in the mains voltage.



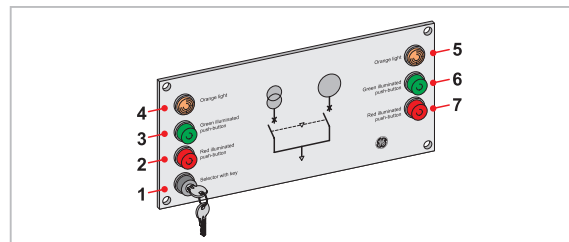
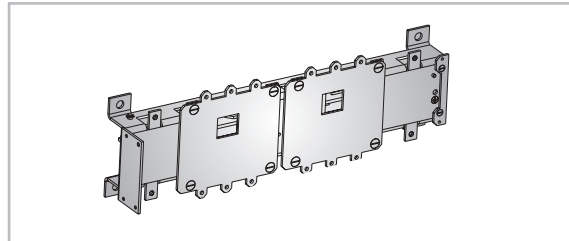
A two breaker system allows for a power transfer between a transformer and a generator set or two transformers.

Controller modes

A key operated switch (1) allows the selection of four different operational modes:

LOCKED	<ul style="list-style-type: none"> - All breakers remain in the position attained before this mode was initiated - The push buttons are disabled. - All automatic transfer functions are non functional.
MANUAL	<ul style="list-style-type: none"> - Taking the conditions normally applied to a transfer operation into account, the push buttons allow operation of the breakers. - Pressing the generator 'ON' push button will only result in an operation of the breaker if the mains breaker is open and the generator is on line (voltage present).
E model	
E plus model	<p><i>On use of the E plus controller, pressing the generator 'ON' push button will give the generator an order to start. If second voltage is available an automatic transfer will be initiated from mains to generator supply. This operation can be cancelled by depressing the generator 'OFF' or mains 'ON' push button.</i></p>
E model	<ul style="list-style-type: none"> - Pressing the mains 'ON' push button will only result in an operation of the breaker if the generator breaker is open and the mains is on line (voltage present).
E plus model	<p><i>On use of the E plus controller, pressing the mains 'ON' push button will initiate a automatic transfer from generator to mains supply. This operation can be cancelled by depressing the mains 'OFF' or generator 'ON' push button. If the mains voltage is not present, the cycle will not be carried out.</i></p>

The system consists of two electrically operated **Record Plus™** moulded case circuit breakers equipped with a walking beam mechanical interlock and a controller that can be mounted in the front of the door or cover in which the breakers are installed.



AUTOMATIC	<p>Depressing the push buttons that operate the breaker in the manual mode have no effect.</p>
E model and E plus model	<p>Mains supply fails</p> <p>The system remains in its standby mode in which the mains breaker is 'ON' and the secondary supply breaker (generator) is 'OFF'. As soon as a signal is received that the secondary supply voltage is available the mains breaker is opened and the secondary supply breaker closed. If the secondary supply breaker does not close on the first command, two further closing orders will be given. If the breaker is still unable to close a fault is indicated.</p>
E plus model	<p><i>Issues a start command to the secondary supply. This can be delayed up until 60 seconds after mains failure.</i></p>
E model	<p>Mains supply returns</p> <p>The system remains in its secondary mode. The secondary breaker (generator) is 'ON' and the mains supply breaker is 'OFF' for a period of 10 seconds. This delay is re-instated if the mains supply fails within this time frame. After this delay the secondary supply breaker is opened and the mains breaker closed. If the mains breaker does not close on the first command, two further closing orders will be given. If the breaker is still unable to close a fault is indicated.</p>
E plus model	<p><i>Basic operation is the same. However the 10 second delay is upgraded to one that is adjustable from 0 to 15 minutes.</i></p>

Pilot lights

ORANGE (4)	Mains voltage present.
ORANGE (5)	Secondary supply voltage available.

Push-buttons with pilot lights

GREEN (3)	<p>Constantly on: Mains breaker is 'OFF'</p> <p>Blinking:</p> <ul style="list-style-type: none"> Transfer to secondary supply underway <p>-OR-</p> <ul style="list-style-type: none"> Fault detected on closing mains breaker <p>When the key selector switch is in its manual position the push-button allows one to switch the mains breaker 'OFF'</p>
------------------	---

GREEN (6)	<p>Constantly on: Secondary supply breaker is 'OFF'</p> <p>Blinking:</p> <ul style="list-style-type: none"> Transfer to mains supply underway -OR- Fault detected on closing Secondary supply breaker <p>When the key selector switch is in its manual position the push-button allows one to switch the Secondary supply breaker 'OFF'</p>
------------------	--

RED (2)	<p>Constantly on: Mains breaker is 'ON'.</p> <p>Blinking: Mains breaker has tripped due to an overcurrent (fault mode).</p> <p>When the key selector switch is in its manual position the push-button allows one to switch the mains breaker 'ON'</p>
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RED (7)	<p>Constantly on: Secondary supply breaker is 'OF'.</p> <p>Blinking: Secondary supply breaker has tripped due to an overcurrent (fault mode).</p> <p>When the key selector switch is in its manual position the push-button allows one to switch the Secondary supply breaker 'ON'</p>
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System performance

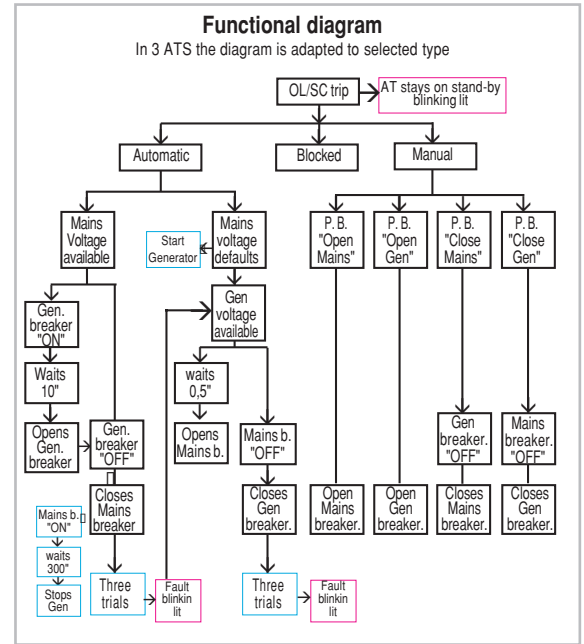
Breaker operation

Operating times (minimum)	FE frame	FG frame	FK frame
Opening (trip)	75 ms.	50 ms.	50 ms.
Closing (ON)	75 ms.	50 ms.	50 ms.
Reset plus OFF	2 sec.	5 sec.	12 sec.

Changeover operation

Operating times (minimum)

The sum of the operating times of the chosen breaker combination plus the time values of the controller.



Versions

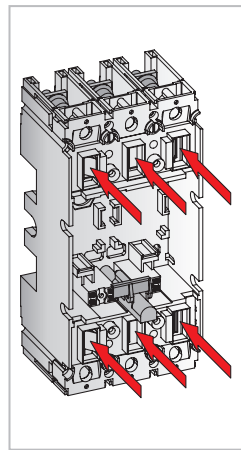
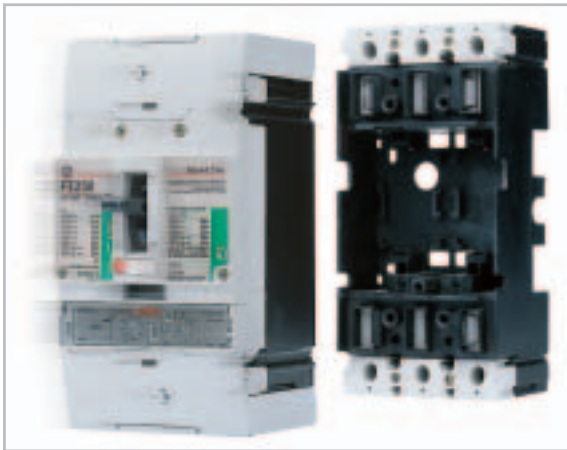
Plug-in

The **Record Plus™** plug-in version allows quick, safe and easy interchange of breakers. It is made up of a "standard" fixed-front-connection breaker, a set of plugs, a trip mechanism fitted to the breaker and a monoblock base into which the breaker is plugged. When the breaker is removed from the plug-in base it trips automatically (main contacts open) before the plug-in contacts in the base are disconnected. The breaker can be operated (closed and opened) when removed from the plug-in base. On attempted insertion of a breaker in the "On" position into the plug-in base, the **Record Plus™** breaker trips before the plug-in contacts in

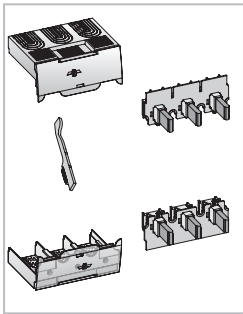
the base are connected.

The **Record Plus™** plug-in version is available for:
 FD frame sizes FD63/160 (maximum 125Amps)
 FE frame sizes FE160/250 (maximum 250Amps)
 FG frame sizes FG400/FG630 (maximum 630Amps)

FD and FE frame sizes equipped with "bottom mounted RCD unit" can also be transformed into the plug-in version. The mobile part of the plug-in version remains the same (plugs and trip mechanism do not change). The fixed plug-in base is of a different, elongated type and has a separate catalogue number.



Mobile part



The mobile part that is fitted to the breaker is made up of a multi-pole set of plugs that displace the standard front connection. It also includes a trip interlock, that, when mounted, trips the breaker on its removal from the base. To prevent re-insertion under fault condition the same system also trips the breaker on re-insertion.

The set is completed with Tamper free terminal shields to prevent access to live parts. The shields have specific areas designed to handle the device on insertion or removal.

Fixed part

A monoblock base that can be mounted to a backplate or on profiles and offers IPXXB protection for front access (FD - IP20, FE and FG - IP40).

It is designed to have exactly the same connection profile as the breaker it goes with, thus allowing the installation of all terminal shields and terminals that the standard breaker offers. These include rear and angular connectors, spreaders, customized ring terminal connectors and extenders.

The base is connected by re-utilising the nut inserts and connection bolts supplied with the breaker.

Spares

Kits are available containing a number of trip interlock mechanisms, breaker nut inserts and connection bolts. The kits can be used in cases where the bases must be connected and where breakers have not (yet) been supplied.

Accessories

Several optional accessories are available. To allow the use of internal accessories in a plug-in configuration the wiring can be connected through plug and socket combinations. To prevent the incorrect insertion of a breaker of one amp rating into a socket pre wired for another amp rating interchange prevention kits are available.

Please refer to page C.27.

Versions

Plug-in

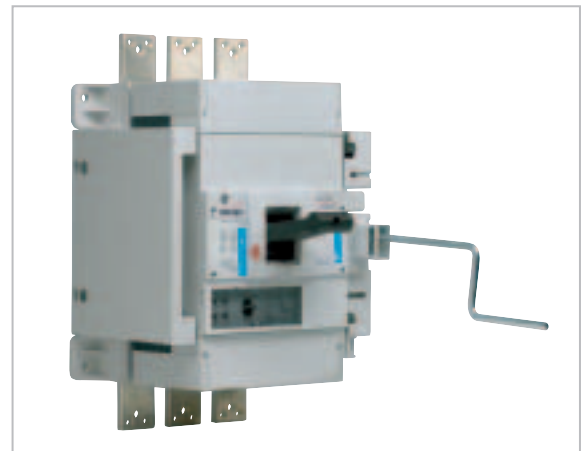
A draw-out version allows one to visibly and positively disconnect the mains supply from the installation. Like on the plug-in device, interchanging breakers quickly, safely and effectively is one of the key features of **Record Plus™** draw-out. It is made up of a breaker ("standard" fixed front connection version), a set of plugs and a trip mechanism that are fitted to the breaker, a monoblock base into which the breaker is plugged and a metal support cradle.

The cradle allows for placing the breaker in one of three positions:

Connected: Main and auxiliary contacts are fully connected to the base

Test/Disconnected: Main contacts are disconnected. Auxiliaries can be connected or disconnected. This allows for a complete test of the secondary wiring/functionality without having the mains connected.

Remove: Main and auxiliary contacts are fully disconnected from the metal support cradle and the plug-in base, the breaker can be removed.



FE frame (max. 250A) & FG frame (max. 630A)

The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type.

Each kit contains a sturdy metal chassis with plug-in base that serves as a fixed part and a kit allowing the conversion of a fixed front connected breaker.

The moving part makes use of metal side supports, multi pole plugs that displace the standard breaker front connection system and a trip interlock system. The Trip interlock system has a **unique safety feature** that trips the breaker on removal from its base and prevents re-insertion under fault condition by tripping the breaker. Two Tamper free terminal shields prevent access to live parts.

The fixed component of the kit includes an integrated standard plug-in base encapsulated in a sturdy metal chassis. The base is connected by re-utilising the nut inserts and connection bolts supplied with the breaker. All standard terminal shields terminals, rear connection facilities & lugs available for the standard fixed front connection breaker can be used with this plug-in base.

see page C.25 for more details.

FK frame (max. 800A) & FK frame (max. 1600A)

The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type.

Each kit contains a sturdy polyester I chassis with integrated plug-in base that serves as a fixed part and a kit allowing the conversion of a fixed front connected breaker.

The moving part makes use of metal side supports, multi pole plugs that displace the standard breaker front connection system and a trip interlock system. The Trip interlock system trips the breaker on removal from its base. Two Tamper free terminal shields prevent access to live parts.

The cradle and plug-in base are integrated to form one moulded part. Two types exist one with FRONT and one with REAR connections both allowing the use of the standard connection lugs used on the device in fixed execution.

The FK frame draw-out system is always supplied with a door frame suitable for use as a through door solution and including a position indication system. The door frame allows the locking of the device in draw-out position with one or two Ronis 1104 B locks.

See Page C.27 for more details



Versions

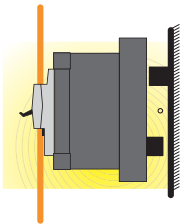
Draw-out, FE & FG frame

Standard draw-out device



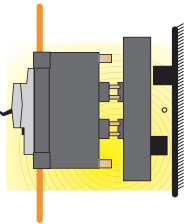
The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type. It includes a racking handle and can be used 'behind door' without any additional accessories.

Draw-out position...Withdrawn



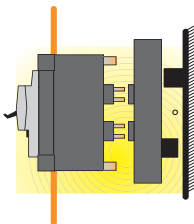
In this position the Mains and Auxiliary contacts are disconnected and the breaker can be removed from the chassis. Both the Mains and Auxiliary contacts are protected against inadvertent contact.

Draw-out position...TEST



In this position the Mains contacts are disconnected and isolated from the network. The Auxiliary contacts are connected thus allowing the breaker's secondary circuits to be tested. When a plug and socket is used an MCCB style TEST position is achieved, with 8 pole draw-out disconnects an ACB style TEST position.

Draw-out position...Inserted



In this position the Mains and Auxiliary contacts are connected. A protection degree of IP40 is possible.

Draw-out device Accessories. Through door euchenon



The F-WE kit the device allows the breaker to be mounted behind a door whilst the draw-out euchenon is located on the door front (three optional panel depths are possible).

The euchenon offers the following facilities:

- racking handle storage area
- position indication Inserted - test - Withdrawn
- padlocking facility for a max. of three 5-8 mm padlocks.
- keylocking facility allowing the use of two Ronis or Profalux lock types.

Draw-out device Accessories. Through door options



The F-WT kit the allows the toggle handle operator and the draw-out euchenon to be accessed on the door front. The kit includes an elongated toggle handle, an extension frame, a doorflange and the through door euchenon with it's locking and position indication features.



The F-WN kit allows the a through door Rotary handle operator and the draw-out euchenon to be accessed on the door front. The kit includes an extension frame, a doorflange and the through door euchenon with it's locking and position indication features.



The F-WM kit allows the operating panel of a Record Plus Electrical operator and the draw-out euchenon to be accessed on the door front. The kit includes an extension frame, a doorflange and the through door euchenon with it's locking and position indication features.

Draw-out device Accessories.

Door mounted Rotary handle option



The F-NRW kit allows the use of a door mounted rotary handle providing a depth adjustability between the inserted and withdrawn position. Combined with

the F-WE kit the draw-out euchenon and operating handle can be accessed on the door front.

Draw-out device Accessories.

Carriage Indication Contacts



Two different sets are available one with 1 NO indication contact per position (total 3 NO contacts) and a second with 1 NO and 1 NC contact per position (total 3 NO + 3 NC contacts).

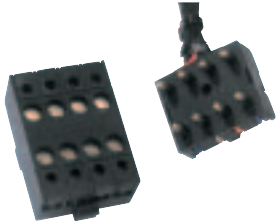
These sets come as easy to fit and connect field mountable kits.

Draw-out, FE & FG frame

Accessories

Auxiliary disconnect plugs and sockets⁽¹⁾

Plug-in FD, FE & FG frame 8 pole plug⁽¹⁾

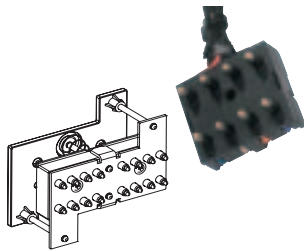


A set made up of a plug screwed to the breaker back (mobile part) and a socket that clicks into the plug-in base (fixed part). The socket comes with connected colour coded wiring which allows for an easy identification of the connection points.

The wiring can be passed through specifically designed channels that lead from the breaker rear into the accessory compartment. The socket part can be wired out from the base with wiring up to 2.5 mm² (front access). Each unit has a total of 8 poles. The number of connectors that can be used per breaker frame size is as follows:

Frame size	FD63/160	FE160/250	FG400/630
Nos of units	1	2	3
Pin Codes (per connector)	1 - 8	1 - 8	1 - 8
Connector coding	X	X & Y	X, Y & Z

Draw-out FE & FG frame 8 pole plug⁽¹⁾



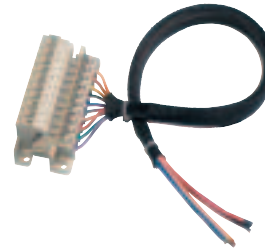
Meeting the same standard specifications as the 8 pole plug for the Plug-in version (see above) the kit now includes an adapted fixed part that allows an ACB TEST position to be created.

The accessory is available as 16 pole (2 - 8 pole units) or 24 pole kit (3 - 8 pole units). When mounted, this accessory allows the user to test the functionality of the installed accessories in the TEST position whilst allowing an easy connection and disconnection of the secondary circuits in the Inserted and Withdrawn position.

Frame size	FE160/250	FG400/630
Nos of units	2	3
Pin Codes (per connector)	1 - 8	1 - 8
Connector coding	X & Y	X, Y & Z

⁽¹⁾ In order to ensure a constant and traceable wiring diagram of all internal accessories in each frame sizes a standard scheme is included in the wiring diagram chapter F of this catalogue (use is optional).

FD, FE and FG frame - 10 pole type⁽¹⁾

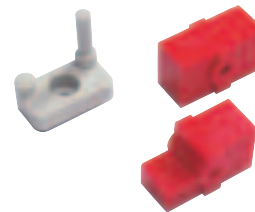


A set made up of a socket that can be attached to the plug-in base or a draw-out cradle and a plug with wiring that is connected to the accessories. The set is used to allow for a test position on a draw-out breaker of the FE and FG frame sizes and as a supplementary connector

for internal accessories on the FD and FE frame sizes. Each plug and socket has a total of 10 poles. The plug is fitted with supply wire, cross section 0.75 mm², length 60 cm. Maximum mounting per breaker size is:

Frame size	FD63/160	FE160/250	FG400/630
Nos of units	2	2	2
Pin Codes (per connector)	1 - 10	1 - 10	1 - 10
Connector coding	EL & ER	EL & ER	EL & ER

Rating interchange prevention system



When a number of plug-in or withdrawable breakers (same frame different ratings) are installed in the same panel, it becomes necessary to determine which rating fits into

which plug-in base. This to prevent overload in the cables/conductors connected to the base, the size of which are determined by the breaker trip unit value or setting.

A specifically designed **Record Plus™** accessory prevents misinsertion of a wrongly configured breaker/trip-unit combination in the base.

The accessory consists of two parts (one code per breaker), one fixed on the base, the other on the rear of breaker. Depending on the placing of the red part in the plug-in base and the pin the user breaks out on the white part, up to 4 breakers can be equipped with this mutual rejection feature.

Versions

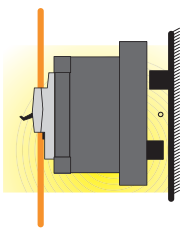
Draw-out, FK frame

Standard Draw-out device



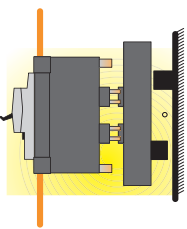
The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type. It includes a racking handle and can be used 'behind or through door' without any additional accessories. The draw-out device is available with front or Rear connections.

Draw-out position...Withdrawn



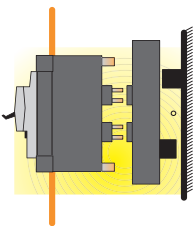
In this position the Mains and Auxiliary contacts are disconnected and the breaker can be removed from the chassis. Both the Mains and Auxiliary contacts are protected against inadvertent contact.

Draw-out position...TEST



In this position the Mains contacts are disconnected and isolated from the network. The Auxiliary contacts are connected thus allowing the breaker's secondary circuits to be tested. With the standard 6 pole auxiliary disconnects an ACB style TEST position is possible.

Draw-out position...Inserted



In this position the Mains and Auxiliary contacts are connected. A protection degree of IP40 is possible.

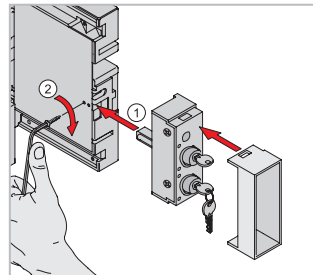
Operation

The standard device is supplied with a through door frame that with draw-out position indicators and the possibility of mounting one or two keylocks locking the device in it's drawn out position.



- 1.The Breaker is operated by an elongated toggle.(depicted)
- 2.The Breaker is operated by a Electrical Operator. For through door access of the electrical operator a door flange is required.
- 3.The Breaker is operated by a door or panel mounted Rotary Handle. A F-NRW kit allows the use of this handle providing a depth adjustability between the inserted and withdrawn position.

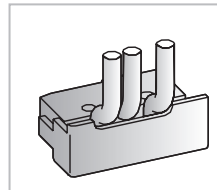
Eucheneon



Each draw-out device is supplied with a eucheneon, fitted on the right hand side of the door frame. The device allows for the through door use of the draw-out racking handle and is equipped with a padlocking device

allowing the user to lock the device in withdrawn position with up to three 5-8 mm padlocks. Optionally a keylock adaptor can be added allowing the uses of two keylocks offering the same locking facilities (recommended for behind door use).

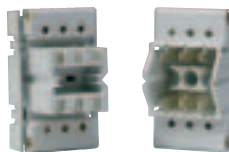
Carriage Indication Contacts



A maximum of two pre-wired change over contacts can be mounted in the fixed portion of the draw-out device One to indicate that the breaker is Withdrawn and a 2nd to indicate that the breaker is inserted.

Auxiliary Disconnect plugs and sockets 6 pole⁽¹⁾

A 6 pole plug and socket system is available and is used to allow the auxiliary circuits to be connected and disconnected in the same manner as the poles. The plug sits on the back of the breaker and the socket clicks into the base.



On withdrawing and inserting the breaker the 6 pole plug and socket system only disconnects and connects once the test position has been reached. This allowing

for a test position without a separate plug and socket. The FK socket part can be wired out from the base with wiring up to 1.5 mm² (front access).

Frame size	FK800/1600 3p	FK800/1600 4p
Nos. of units	4	5
Pin codes (per connector)	1 - 6	1 - 6
Connector coding	X, Y, Z & A	X, Y, Z, A & B

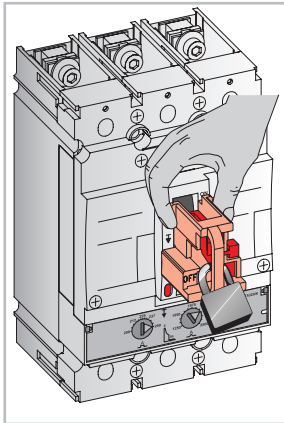
(1) In order to ensure a consistent and traceable wiring diagram of all internal accessories in each frame sizes a standard scheme is included in the wiring diagram chapter F of this catalogue (use is optional).

Installation

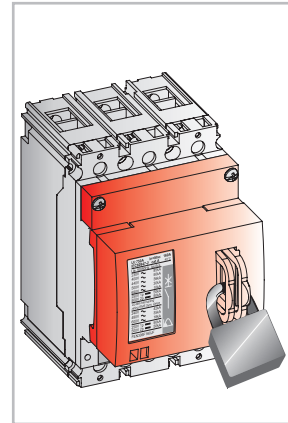
Padlocking device for toggle handle

To allow users to safely work on installations or installation segments protected by the **Record Plus™** moulded case circuit breakers it is possible to padlock the devices in their OFF position.

This ensures a complete and safe isolation of the installation or installation segment from the power supply. Two different padlocking devices are available.



The **Record Plus™** removable padlock is firmly attached to the breaker when it is padlocked and can be removed for use on another breaker when not in use. This accessory can be used with up to 3 padlocks of 5 to 8 mm. It is available in three different versions: one for the **Record Plus™** FD and FE frame, one for the FG frame and a third for the FK frame.



A padlocking facility that is screwed on to the breaker front and normally remains mounted. This device allows the breaker to be locked in the OFF position with up to three padlocks of 5 to 8 mm. The device also covers the push to trip knob. It is available in three different versions for the **Record Plus™** FD, FE and FG frame.

Keylocking devices

Record Plus™ moulded case circuit breakers can also be locked in their OFF position by the use of a Keylock. This to allow users to work on installations or installation

segments or to interlock one or more breakers. Keylocks are available for all Rotary handle devices, electrical operators and draw-out systems.

Pad- and Keylocking options, applicable for Record Plus Breakers

Overview	Frame size	Padlock		Standard Ronis key lock	Specifically numbered Ronis key lock	Profalux key lock
		Fixed	Removable			
Toggle operator Breaker locked in "OFF" position	FD Frame	A ⁽¹⁾	A			
	FE Frame	A ⁽¹⁾	A			
	FG Frame	A ⁽¹⁾	A			
	FK Frame	A ⁽¹⁾	A			
Directly mounted rotary handle Breaker locked in "OFF" position	FD Frame	S ⁽¹⁾		A	A	A
	FE Frame	S ⁽¹⁾		A	A	A
	FG Frame	S ⁽¹⁾		A	A	A
	FK Frame	S ⁽¹⁾		A	A	A
Through panel or door type of rotary handle Breaker locked in "OFF" position	FD Frame	S ⁽¹⁾		A	A	A
	FE Frame	S ⁽¹⁾		A	A	A
	FG Frame	S ⁽¹⁾		A	A	A
	FK Frame	S ⁽¹⁾		A	A	A
Panel or door mounted rotary handle Breaker locked in "OFF" position	FD Frame	S ⁽¹⁾		A	A	A
	FE Frame	S ⁽¹⁾		A	A	A
	FG Frame	S ⁽¹⁾		A	A	A
	FK Frame	S ⁽¹⁾		A	A	A
Electrical drive Breaker locked in "OFF" position	FD Frame	S		A		A
	FE Frame	S		A		A
	FG Frame	S		A		A
	FK Frame	S		A		A
Draw-out version Locked in Disconnected/Test ⁽²⁾ OR draw-out position	FE Frame	S		A		A
	FG Frame	S		A		A
	FK Frame	S		A		A

S= standard feature, A = accessory needed, empty box = not foreseen

(1) the explicitly removing of a plastic part directly beneath the handle operator allows one to padlock or keylock in ON position (special applications).

(2) FE and FG; Disconnected/test; FK Draw-out position.

Door flanges

In order to provide an IP40 protection degree of the breaker when mounted through a door or cover plate door flanges are used. A door flange also improves the aesthetics of the cut-out in the door and allows for higher tolerances within the cut-out.

The devices are available for cut-outs with the toggle area, breaker front face, motor drive front face or on RCD operating panels. A second type of flange is used for rotary handles through door/cover allowing interlocks on the device to function correctly.

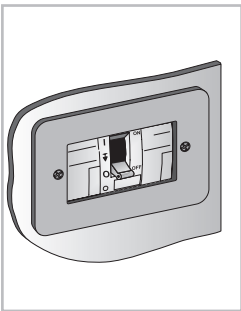
For **Record Plus™** breakers installed through doors, cover plates or panels the following door flanges are available:



Toggle area

Fixation via front with 2 or 4 screws, universal for 3 and 4 pole breakers.

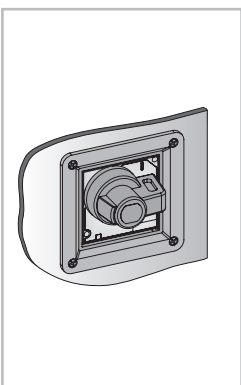
	Type
FE frame	FEFT
FG frame	FGFT
FK frame	FNFT



Front face

Fixation via front with 4 screws, available for 3 and 4 pole breakers

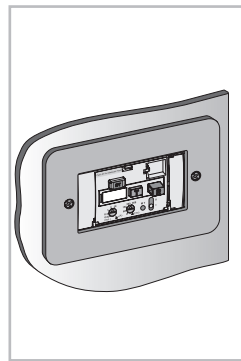
	Type
FD frame 3p	FDF3
FD frame 4p	FDF4
FE frame 3p	FEF3
FE frame 4p	FEF4



Rotary handle ⁽¹⁾

Fixation via front with 4 screws; is required to allow use of the door lock in ON position with the through door/panel rotary handle type. Is available for:

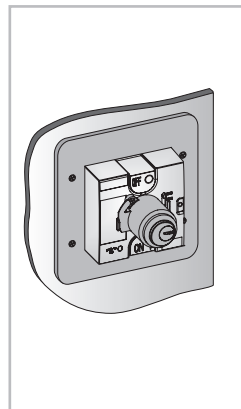
	Type
FD & FE frame	FDH
FG frame	FGH
FK frame	FNH



RCD bottom mounted type

(universal for FD, FE and FG)
Fixation via front with 4 screws

	Type
FD frame 3p	FDF3
FD frame 4p	FDF4
FE frame 3p	FEF3
FE frame 4p	FEF3
FG frame 3p	FDF3
FG frame 4p	FDF3



Electrical operator

Fixation via front with 4 screws. The FK type can be used with the draw-out system.⁽¹⁾

Available for:

	Type
FD frame	FDFE
FE frame	FEFE
FG frame	FGFE
FK frame	FNFE

(1) Please use specifically designed complete through door kits for the FE and FG frame draw-out system. (see page C.25)

Installation

Terminal shields

Terminal shields are installed on the incoming or outgoing side of the breaker thus achieving a heightened protection degree, independent of the type of connection used. For fixed breakers with rear connection or the plug-in or withdrawable versions of the **Record Plus™** breaker the installation of short terminal shields is mandatory and they are normally supplied as part of the kit.

Record Plus™ terminal shields are equipped with a tamper free sealing facility and come in sets of two. They are available in a short or a long version and have been designed for use on the standard fixed front connection breaker or on the base used for plug-in breakers. Each terminal shield is equipped with easy to remove breakouts to facilitate the connection of the breaker.

Short type⁽¹⁾

For use with internal box clamps and rear connection.



Long type⁽²⁾



Short terminal shields

	FD	FE	FG	FK
With two terminal shields mounted, Breaker height is increased by: (mm)	20	30	60	40

(1) The FK short type is only supplied with rear connection kit.

Long terminal shields

	FD	FE	FG ⁽²⁾	FK
With two terminal shields mounted, Breaker height is increased by: (mm)	97	122	83	160

(2) The FG type is of medium length. Special long and widened version available on request.

Finger protection caps

Available only for the D frame box terminals, the caps prevent inadvertent contact with the connection terminals, thus providing the terminal and breaker with an IPXXB protection.

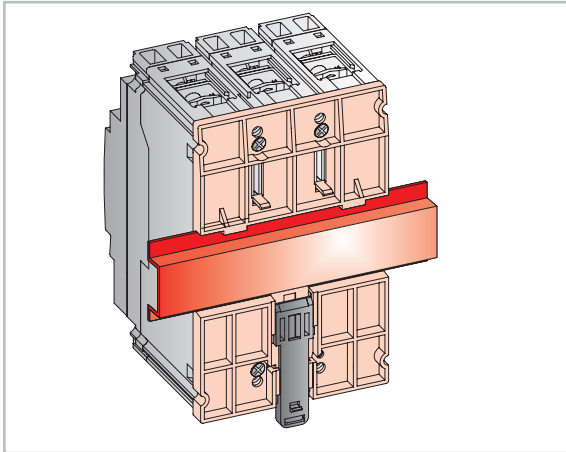
Finger protection caps come as standard with the magnetic only circuit breakers but they are also available in a set containing 12 pieces.



FD frame adaptors

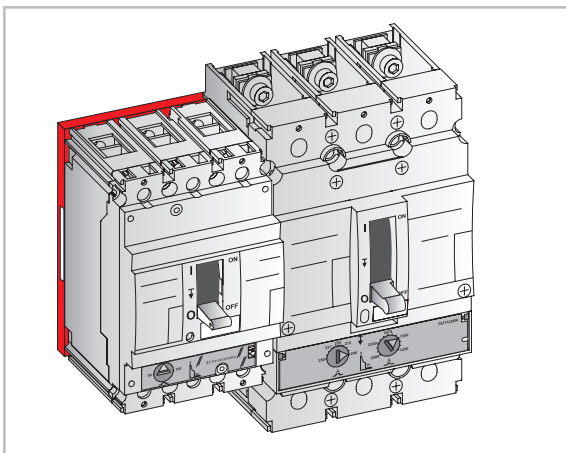
DIN-rail mounting

All **Record Plus™** FD frame breakers can be installed on a (symmetric) DIN profile (EN50022) by using an adaptor. The DIN-rail adaptor is normally supplied with most breaker types but can also be purchased separately.



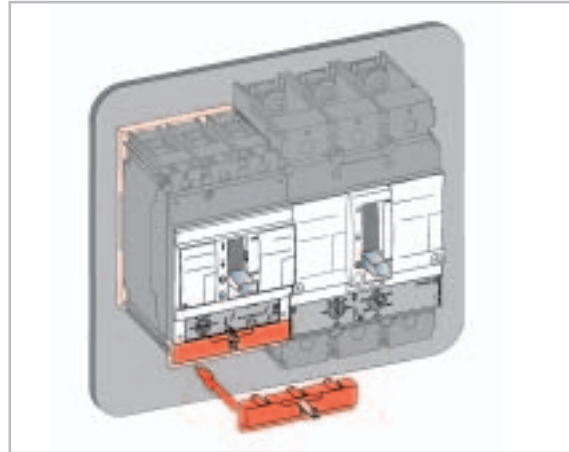
Side by side mounting with FE frame breakers

The FD frame DIN-rail adaptor has a second application: when mounted with its DIN-rail mounting feature facing the breaker rear it serves as a heightener. This change in depth of the D frame allows side by side mounting with E frames. When reversed the adaptor turns into a heightener that lifts the D frame, and all its cut-outs up to the E frame level. The 64 mm cut-out of the D and E frame now match up fully in height and depth.



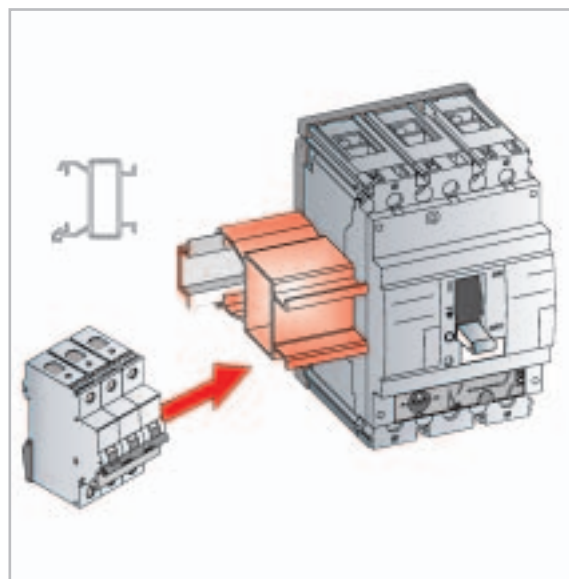
Adaptor - Cut-out filler

To use the cut-out with the breaker face and trip unit just apply the 'cut-out adaptor' to the D frame trip unit. This sealable cover matches the cut-out perfectly and offers an aesthetically pleasing blending of both breaker fronts.



Adaptor - Side by side mounting with ElfaPlus MCB's

The FD frame has a 45 mm cut-out allowing its use next to Elfa Plus MCB's and other modular devices. To bridge the difference in depth between the FD frame and the modular devices a special heightening kit is available in a standard length of 354 mm.

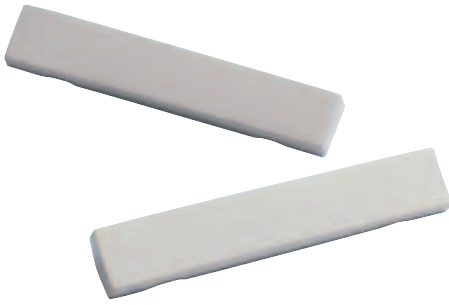


Installation

Finishing covers

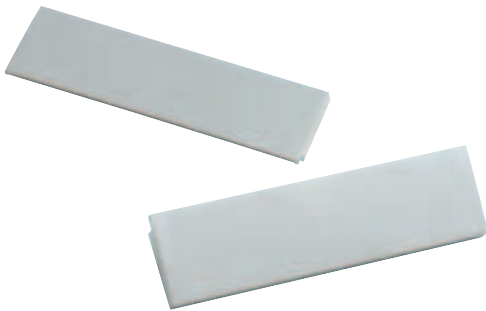
FD frame

For the **Record Plus™** FDS, FDN, FDH and FDL types the finishing covers are standard. By adding both these covers and the finger protection caps the breaker has a protection degree of IP40.



FE, FG and FK frame

All **Record Plus™** FE, FG and FK frame breakers come complete with finishing covers (for 3 or 4 pole versions). However, these covers are also available as separate items.

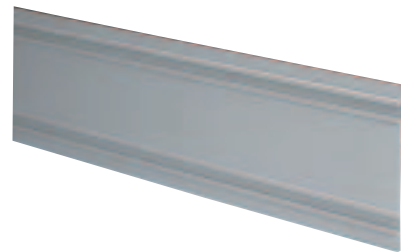


Circuit identification label

Located just under the toggle of every **Record Plus™** circuit breaker there is an area allocated specifically to click in a circuit identification label. A set contains 20 units that are common for all frame sizes.

Cut-out filler plate

The FD & FE frame sizes are designed for side by side mounting. The cut-out suited for use with both breaker types has a standard dimension of 64 mm. In order to fill in empty or reserve space in the trim/cover plate, a cut-out filler plate is available in a standardized length of 1.2 meters.



Intro

A

B

C

D

E

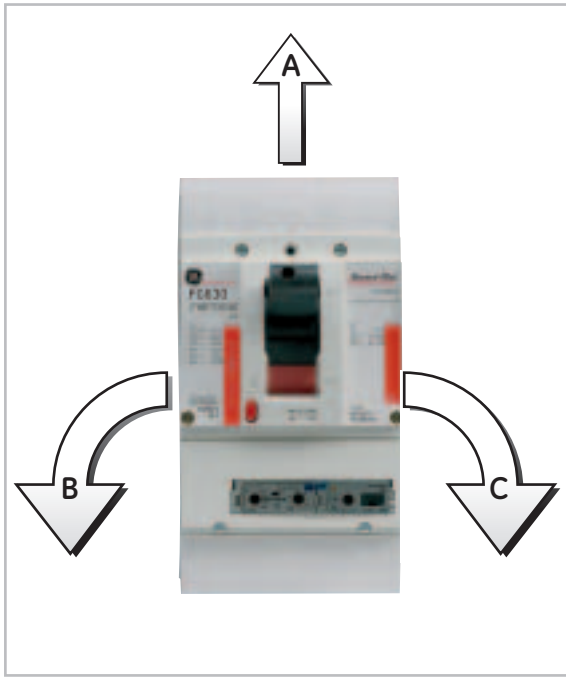
F

G

X

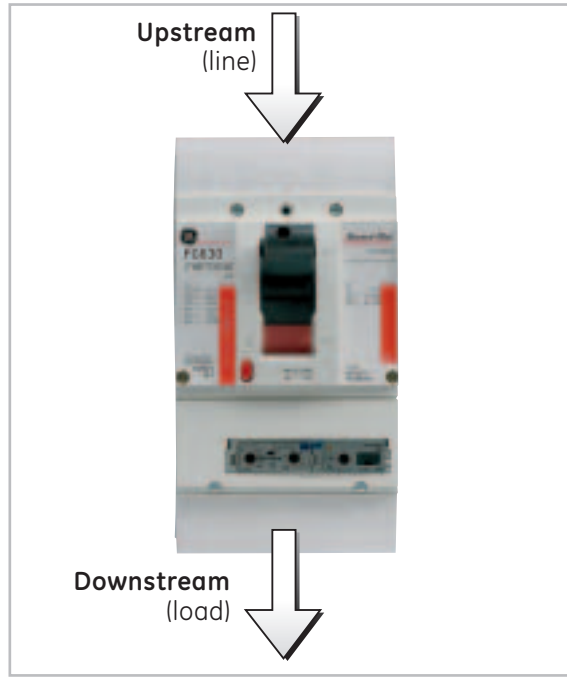
Mounting positions

Allowed mounting position per frame size



Breaker	Version	A	B	C
FD63/160	DIN rail	X	X	X
	Fix	X	X	X
	Plug-in	X	X	X
FE160 / FE250	Fix	X	X	X
	Plug-in	X	X	X
	Draw-out	X	X	X
	Draw-out	X	X	X
FG400 / FG630	Fix	X	X	X
	Plug in	X	X	X
	Draw-out	X	X	X
	Draw-out	X	X	X
FK800 / FK1600	Fix	X	X	X
	Draw-out	X	X	X

Breaker supply



Phase/phase voltage Un (AC/DC)	Supply side is:	FD63/160 C, E, S	FD63/160 N, H, L	FE160 FE250	FG400 FG630	FK800 FK1600
220/240V	Upstream	A	A	A	A	A
	Downstream	A	A	A	A	A
< 500 V	Upstream	A	A	A	A	A
	Downstream	A	A	A	A	A
≥ 500V	Upstream	P	P	P	P	P
	Downstream	P	PB ⁽¹⁾	PB ⁽²⁾	PB ⁽²⁾	P

A= Allowed

P= Use of phase separators is obligatory.

PB= Use of phase separators and backplate is obligatory.

(1) The use of the top cavity in the box terminal is mandatory.

(2) Applies for N type only; H & L types Upstream FEED ONLY

Connections

Standard connection terminals

The **Record Plus™** connection facilities have been designed with the user in mind. Easy access to the area where the conductor must be placed, their generous dimensions and their inherent

stability assure an easy connection. Each of the standard connection options described here applies to the fixed breaker, its plug-in or draw-out base and the RCD associated with the frame size.

FD frame

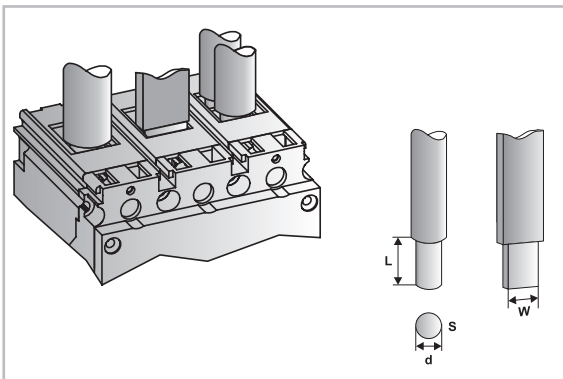
The FD frame is equipped with box clamps allowing the direct connection of one or two cables. The clamps can also be used with flat bars up to a width of 12 mm. All 'non standard' connection terminals as extenders, rear connections etc. are directly connected to these standard terminals. The breaker is always supplied with the clamps fully open, and they are equipped with a mechanism that prevents them from inadvertently closing whilst connecting.

FE frame

The FE frame size has a connection area specifically designed for the connection of busbars and/or cable lugs. The connection area is designed to allow for maximum access to the front of the terminal. Standard busbar sizes and cable lugs can be accommodated without accessories.

The connection pads have through holes and are supported by a simple slide-in fully insulated part that contains one steel nut per connection point. The connection bolts have an internal allen key profile allowing for ease of use in the relatively confined area just above the connection strap.

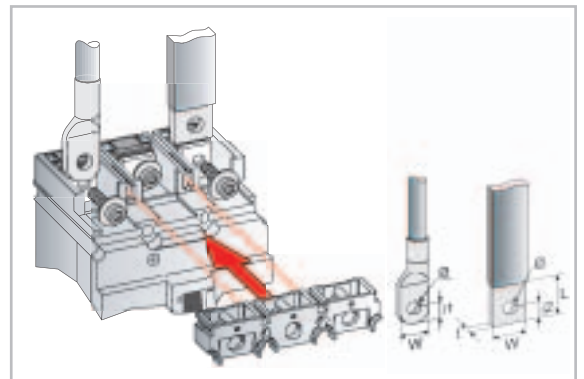
'Non-standard' connections as extenders are directly fitted onto the standard terminals. In other cases - like rear connections - the slide-in part is completely replaced.



FD frame box terminals⁽¹⁾

	FDC & FDE types ≤100A	All other FD types
Single cavity lug Connection capacity mm ²	2.5 - 70	
Dual cavity lug	-	
Top cavity only Connection capacity mm ²	-	2.5 - 95
Bottom cavity only Connect. capacity mm ²	-	4 - 70
Both cavities Top Connection capacity mm ²	-	2.5 - 35
Bottom Connect. capacity mm ²	-	4 - 35
Strippable length L (mm)	17.5	17.5
W max (mm)	12	12
Torque (Allen key in breaker) (Nm max.)	6	8

(1) For aluminium conductors use external box clamps.



FE frame with removable cover

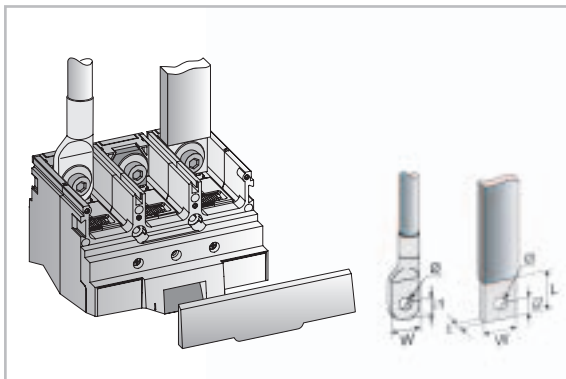
	FE
W max (mm)	25
t max (mm)	5
i1 max (mm)	11.5
i2 max (mm)	9.8
Ø max (mm)	9.5
L Distance to insulation (min.)	25
Torque (Allen key in breaker) (Nm max.)	25

W = Width of bar or ring terminal / lug
 t = Thickness of bar or lug
 Ø = Hole diameter

FG frame

The FG frame size has a connection area specifically designed for the connection of busbars and/or box clamps. The connection area is designed to allow for maximum access to the front of the terminal. The connection pads have through holes without screw thread and are supported by a simple slide-in fully insulated part that contains one steel nut per connection point. The connection bolts have an internal allen key profile allowing for ease of use in the relatively confined area just above the connection strap.

'Non-standard' connections as extenders are directly fitted onto the standard terminals. In other cases - like rear connections - the slide-in part is completely replaced.



FG frame with removeable cover

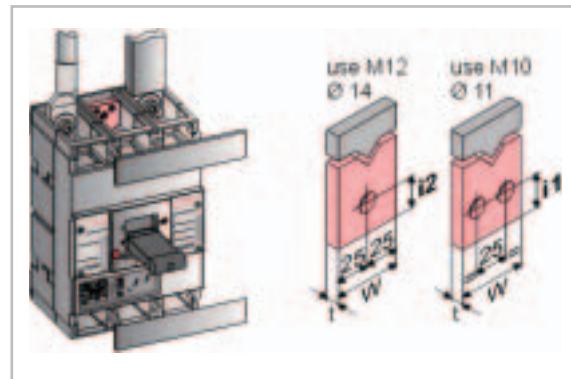
	FG
W max (mm)	32
t max (mm)	12
i1 max (mm)	19
i2 max (mm)	17.5
Ø max (mm)	11
L Distance to insulation (min.)	33
Torque (Allen key in breaker) (Nm max.)	42

W= Width of bar or ring terminal / lug
t = Thickness of bar or lug
Ø = Hole diameter

FK frame

The FK frame has a connection area specifically designed for the connection of busbars. For the FK800 and FK1250 sizes the standard connection pads offer a choice of the use of 2 M10 or 1 M12 bolt. The FK 1600 type can use the same connection facility, but the use of specifically designed extended connection pads is advised.

All 'non standard' connection options are fitted to the standard connection pads.



FK frame with removeable cover

	FK
W max (mm)	50
t max (mm)	20
i1 max using 2 x M10 (mm)	32
i2 max using 1 x M12 (mm)	23
Ø max (mm)	2 x 11 or 1 x 14
Torque (Allen key in breaker) (Nm max. M10)	42
Torque (Allen key in breaker) (Nm max. M12)	48

W= Width of bar or ring terminal / lug
t = Thickness of bar or lug
Ø = Hole diameter

Connections

Rear connection facilities

A rear connection kit changes the standard connection configuration of a fixed, plug-in or draw-out breaker from front to rear access. Delivered as a multi-pole set they allow an easy and quick change in configuration of the

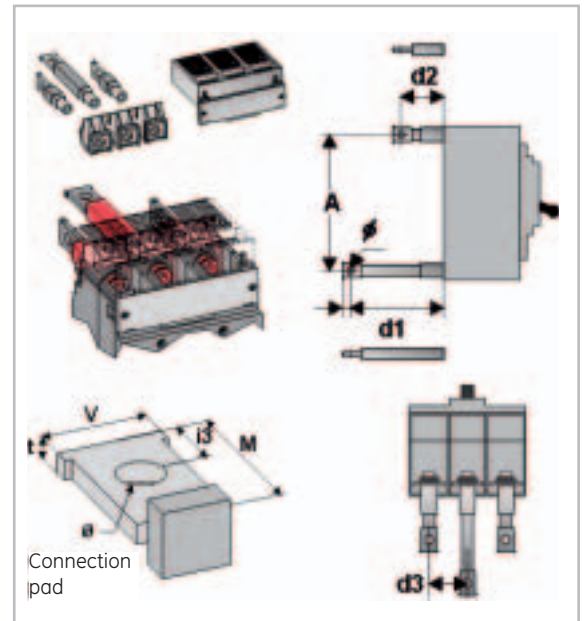
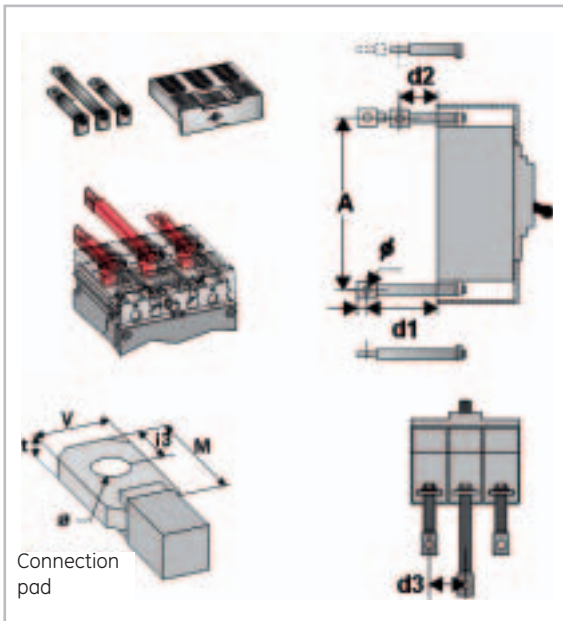
standard fixed-front connection breaker to a model where the connection is accessible from the rear. Each kit is supplied with a short terminal shield to warrant a IPXXB protection from the breaker front.

FD frame

Available as a three or four pole set allowing for the configuration of one side of the breaker. The kits are made up of single pole connectors that are fitted to the standard cage terminal (top cavity). The rear connections are configured for use with busbars and can be rotated at a ninety degree angle to allow for different incoming busbar configurations. The connectors can be used with standard external box clamps, with or without phase barriers, and are supplied with a short terminal shield.

FE frame

Before a **Record Plus™** FE frame size can be configured as a rear connected device, the front connection insulation part (nut plate) must be removed. The rear connection kit that consists of a multi-pole kit held in a rear connection support plate can then be simply slid into the room just vacated by the front connection part (nut plate). Available as a three or four pole set, it allows for the configuration of one side of the breaker. The rear connections are configured for use with busbars and can be rotated at a forty five or ninety degree angle to allow for different incoming busbar configurations. The connectors can be used with standard internal box clamps, with or without phase barriers, and are supplied with a short terminal shield.



FD frame rear connection

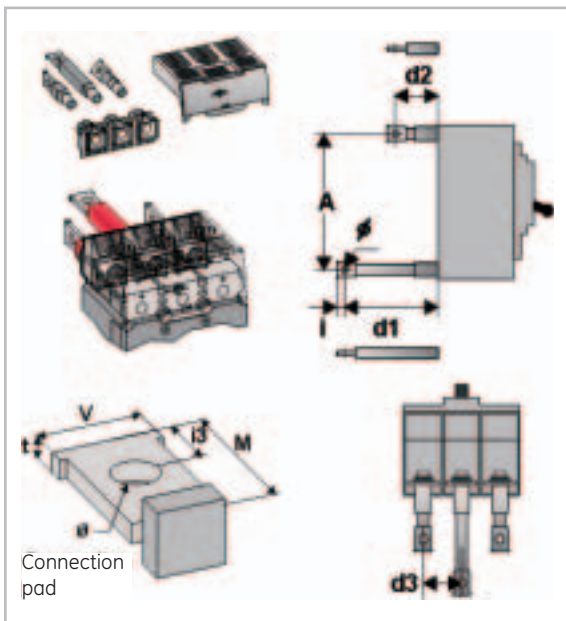
	FD
A = vertical distance between connections	150
d1 = breaker depth with long rear connections	90
d2 = breaker depth with short rear connections	45
d3 = pole spacing	27
V (mm)	14
t (mm)	4
i3 (mm)	10
M (mm)	22
∅ hole max (mm)	7
Torque (Allen key in breaker) (Nm max.)	8
Torque of connection bolt M6 (Nm max.)	8

FE frame rear connection

	FE
A = vertical distance between connections	140
d1 = breaker depth with long rear connections	98
d2 = breaker depth with short rear connections	48
d3 = pole spacing	35
V (mm)	17.4
t (mm)	4
i3 (mm)	13
M (mm)	30
∅ hole max (mm)	9
Torque (Allen key in breaker) (Nm max.)	15
Torque of connection bolt M8 (Nm max.)	25

FG frame

Before a **Record Plus™** FG frame can be configured as a rear connected device, the front connection isolation part (nut plate) must be removed. The rear connection kit that consists of a multi-pole kit held in a rear connection support plate can then be simply slid into the room just vacated by the front connection part. Available as a three or four pole set, it allows for the configuration of one side of the breaker. The rear connections are configured for use with busbars and can be rotated at a ninety degree angle to allow for different incoming busbar configurations. The connectors can be used with or without phase barriers, and are supplied with a short terminal shield.

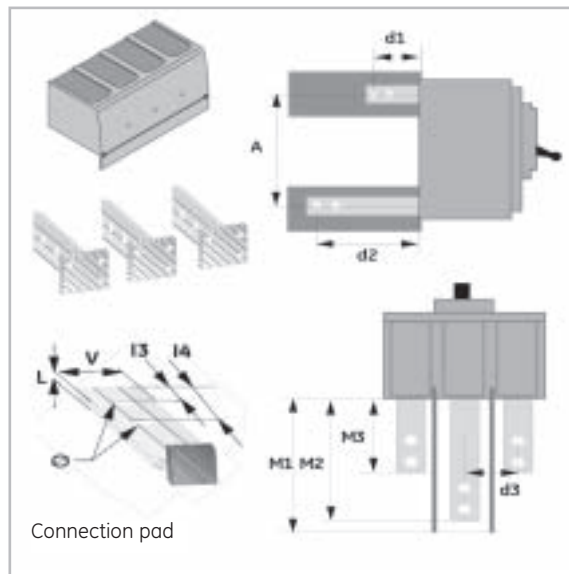


FG frame rear connection

	FG
A = vertical distance between connections	229
d1 = breaker depth with long rear connections	115
d2 = breaker depth with short rear connections	50
d3 = pole spacing	45
V (mm)	30
t (mm)	8
i3 (mm)	15
M (mm)	35
Ø hole max (mm)	13
Torque (Allen key in breaker) (Nm max.)	22
Torque of connection bolt M12 (Nm max.)	42

FK frame

Available as a three or four pole set allowing for the configuration of the load or line side of the breaker. The kits are made up of single pole connectors that are screwed to the underside of the standard connection pad. The rear connections are configured for use with busbars and allow for different incoming busbar configurations with a option of rotating them at a ninety degree angle for edgewise busbar connection. The connectors are supplied with phase separators and a short terminal shield.



FK frame rear connection

	FK
A - (mm) vertical distance between connections	273
M1 - (mm) additional breaker depth with Phase separators	188
M2 - (mm) add. breaker depth with LONG rear connections	163
M3 - (mm) add. breaker depth with SHORT rear connections	98
d1 - (mm) breaker rear to out connection hole .. short connect.	85
d2 - (mm) breaker rear to out connection hole .. long connect.	150
d3 - (mm) breaker pole spacing	70
V - (mm) connection pad width	40
L - (mm) connection pad thickness	12
i3 - (mm) rear of connection pad to hole 1	32
i4 - (mm) center of hole 1 to hole 2	32
Ø - (mm) connection hole size (diameter)	14
torque (Allen key in breaker Nm. max.)	14



Connections

Optional connection terminals

To allow for the different connection options in the different applications of the **Record Plus™** circuit breaker a large variety of different connection lugs, terminals and multiple connectors are available. These are available as a three or four pole set allowing for the configuration of

one side of the breaker. The kits are made up of single pole connectors that are fitted to the standard breaker terminal. The connectors are supplied with all the necessary connection and fixation hardware.

Extender

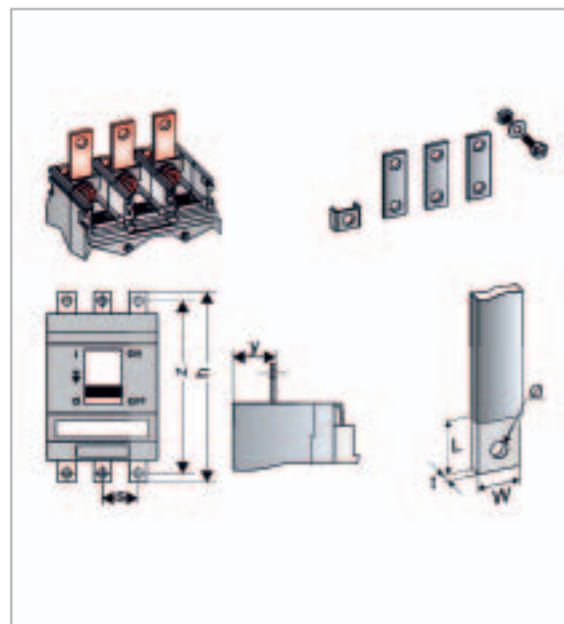
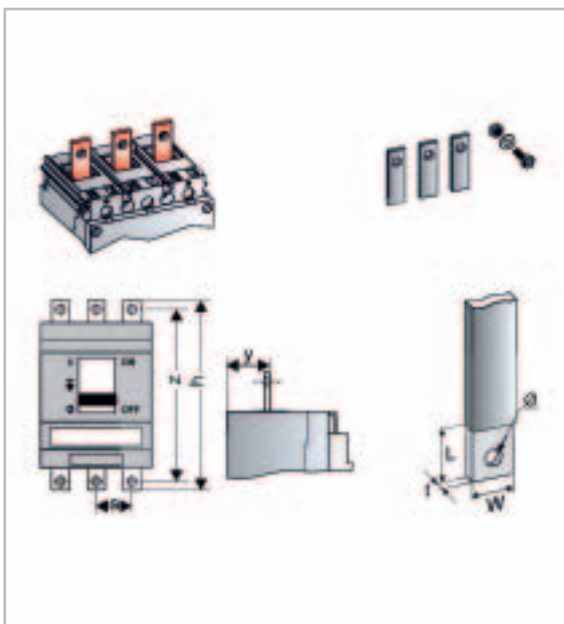
Extends the standard connection point to the exterior of the breaker body. **Record Plus™** extenders are normally used when the busbars and cables that are needed to connect the breaker exceed the possibilities of the standard connection facility or when the use of external box clamps is required.

FD frame & FE frame

The single pole connectors that are fitted to the standard terminal (FD frame top cavity of box clamp). The connectors can be used with standard external box clamps, with or without phase barriers.⁽¹⁾

FG frame & FK frame

The single pole connectors that are fitted to the standard terminal. The connectors can be used with standard external box clamps, with or without phase barriers.⁽¹⁾



FD & FE extenders

	FD	FE
h = height dimension of breaker with extenders at its top AND bottom.	190	230
z (mm)	170	212
s (mm)	27	35
y max (mm)	28.5	25.5
W max (mm)	14	20
t max (mm)	5	8
L max (mm)	16	18
Ø hole max (mm)	7	9
Torque (Allen key in breaker) (Nm max.)	8	25
Torque of connection bolt (Nm max.)	8	25

(1) Use is recommended

FG & FK extenders

	FG	FK
h = height dimension of breaker with extenders at its top AND bottom.	354	452
z (mm)	314	408
s (mm)	52.5	100
y max (mm)	29.5	56
W max (mm)	30	50
t max (mm)	12	20(10) ⁽³⁾
L max (mm)	32	-
Ø hole max (mm) ⁽²⁾	13	2 x 11
Torque (Allen key in breaker) (Nm max.)	42	M10-42
Torque of connection bolt (Nm max.)	42	M10-42

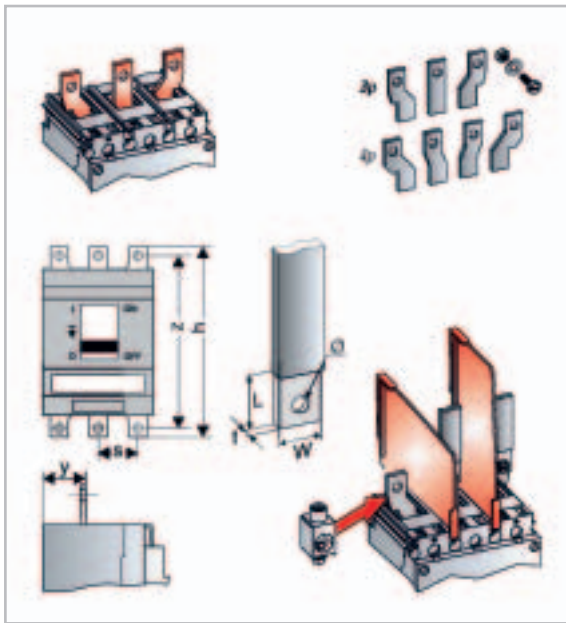
(1) Use is recommended
 (2) Two holes in each connection pad.
 (3) 1600A, parallel 10mm bus.

Spreaders

Increase the pole spacing of the breaker they are used to extend the standard connection points to the exterior of the breaker body. **Record Plus™** spreaders are normally used when the busbars and cables that are needed to connect the breaker exceed the possibilities of the standard connection facility or when external lugs are needed. Available for:

FD frame & FE frame

The single pole connectors that are fitted to the standard terminal (FD frame top cavity of box clamp). The connectors can be used with standard external lugs, with or without phase barriers.⁽¹⁾



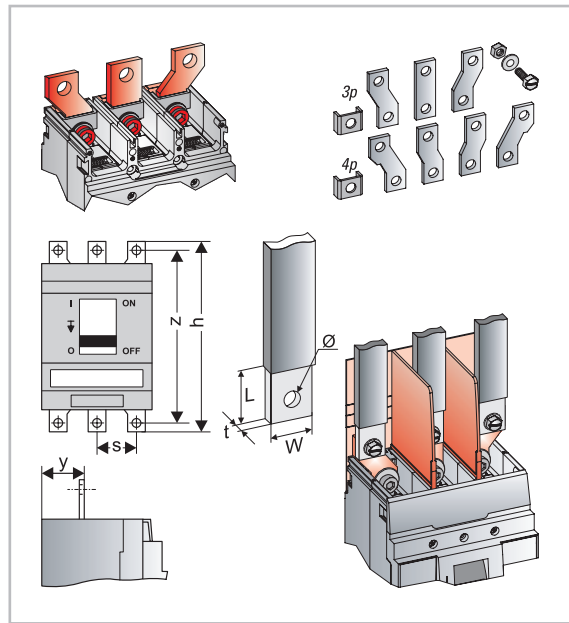
FD & FE spreaders

	FD	FE
h = heigth dimension of breaker with extenders at its top AND bottom.	190	230
z (mm)	170	212
s (mm)	27	35
y max (mm)	18.5	25.5
W max (mm)	14	18
t max (mm)	5	8
L max (mm)	16	18
Ø hole max (mm)	7	9
Torque (Allen key in breaker) (Nm max.)	8	25
Torque of connection bolt (Nm max.)	8	25

(1) Use is recommended

FG frame & FK frame

The single pole connectors that are fitted to the standard terminal. The connectors can be used with standard external lugs, with or without phase barriers.⁽¹⁾



FG & FK spreaders

	FG	FK
h = heigth dimension of breaker with extenders at its top AND bottom.	354	452
z (mm)	314	408
s (mm)	52.5	100
y max (mm)	29.5	56
W max (mm)	30	50
t max (mm)	12	20(10) ⁽³⁾
L max (mm)	32	-
Ø hole max (mm)⁽²⁾	13	2 x 11
Torque (Allen key in breaker) (Nm max.)	42	M10-42
Torque of connection bolt (Nm max.)	42	M10-42

(1) Use is recommended
 (2) Two holes in each connection pad.
 (3) 1600A, parallel 10mm bus.



Connections

Optional connection - box clamps

Record Plus™ breakers are designed to save space and time in mounting when compared to conventional switch gear. To achieve the same savings in the connecting process the **Record Plus™** line includes a series of lugs meeting the newest and highest standards in ease of

connection and durability.

The terminals are suitable for conductors of copper and aluminium and meet both the newest version of the EN 60497 standards and the relevant UL486a and b regulations.

Internal box clamps

Fit onto the breaker without changing its profile or external dimensions. Available as a three or four pole set allowing the line or load side of the breaker to be equipped. The set consists of multi-pole units that displace the standard connection configuration. The sets can also be used on the plug-in / draw-out base and RCD units.

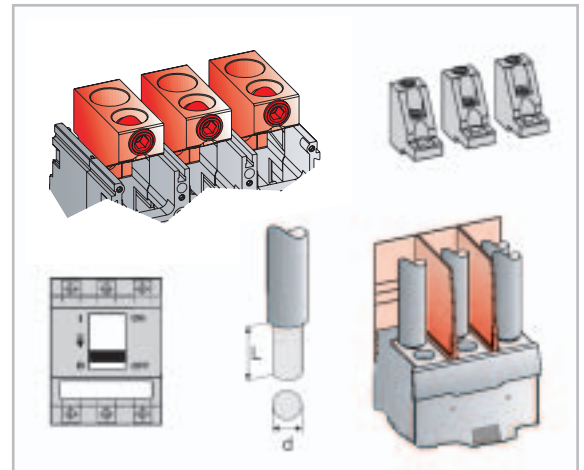
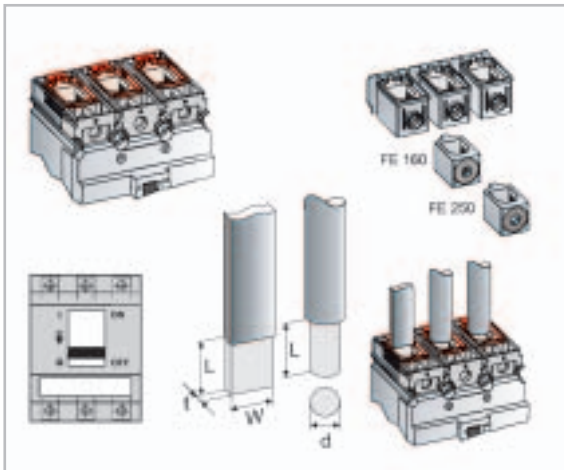
All clamps are suitable for copper and aluminium conductors.

FE frame (FE160 & FE250)

The set consists of basic 3 or 4 pole units that displace the standard connection configuration (FE frame nut plate). The internal box clamps are used in the same way on the plug-in / draw-out base and RCD units. All types can also be mounted to extenders, spreaders or rear connection pads.

FG frame & FK frame

The set consists of basic single pole units that displace are mounted above the standard connection pad (FG and FK frame). Each box terminal allows the connection of two to four cable cores per item. The internal lugs are used in the same way on the plug-in / draw-out base and RCD units. All types can also be mounted to extenders, spreaders or rear connection pads and can be used with or without phase barriers.



FE internal box clamps

	FE160	FE250
h = height dimension of breaker with box clamps mounted at top and bottom.	the same as breaker	
L max (mm)	18	18
d max (mm)	16	17.5 ⁽¹⁾
S max (mm²)	2.5 - 95	16 - 150
L = distance to insulation (min.)	21	25
Torque (Allen key on clamp) (Nm max.)	30	30

(1) Most standard 185 mm² cable sections will also fit into this lug (hole diameter 17.5 mm)

FG & FK internal box clamps

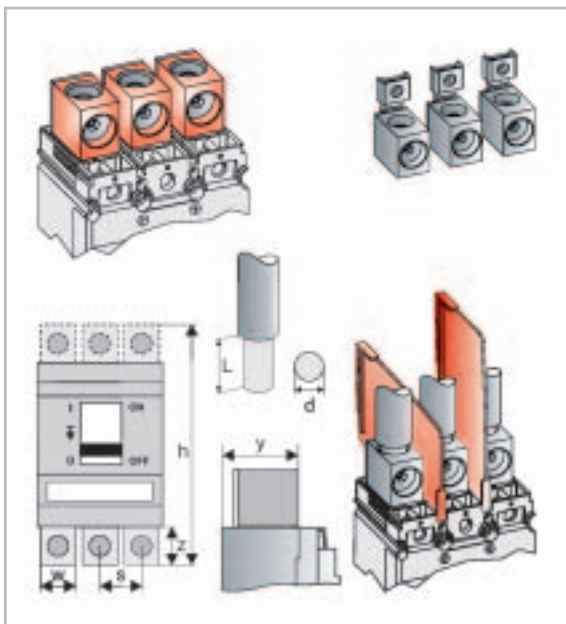
	FG	FK ⁽²⁾	FK ⁽³⁾
h = height dimension of breaker with box clamps mounted at top and bottom.	333	381	354
S max (mm²)	25 - 240 for L1 50 - 300 for L2	240	240
Hole L1 = distance to insulation L (min.)	22	-	-
Hole L2 = distance to insulation L (min.)	40	-	-
Distance to insulation L (min.)	-	27.5	36
Torque (Nm max.)	31(L ₁) 42(L ₂)	31	31

(2) Terminal for 3 cables

(3) Terminal for 4 cables

External box clamps

To accommodate for larger cross sections **Record Plus™** clamps can be used in combination with extenders and/or spreaders. They are available as a three or four pole set allowing the line or load side of the breaker to be equipped. Each set consists of basic single pole units with phase separators.

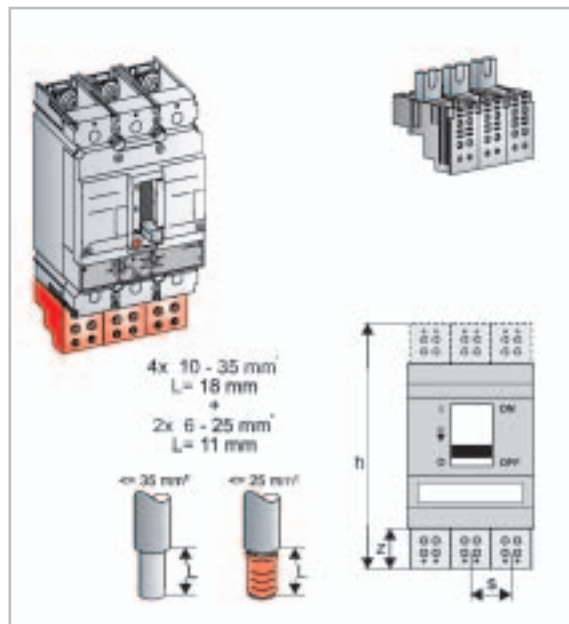


FD & FE external box clamps

	FD	FE
h = height dimension of breaker with box clamps mounted at top and bottom.	190	270
z (mm)	30	50
s (mm)	27	35
w (mm)	18.5	30
y (mm)	50	55.5
S max (mm ²)	4 - 95	70 - 185
L = distance to insulation (min.)	20	20
Torque (Allen key in breaker) (Nm max.)	8	25
Torque on connection bolt (Nm max.)	17	25

FE frame distribution terminal

Specifically designed to allow the use of the **Record Plus™** FE frame as a mains device with cables distributing the load over multiple outgoing circuits (or lines of multiple outgoing circuits). The lugs are available as a three or four pole set allowing the line or load side of the breaker to be equipped. The sets consist of a number of fully isolated single pole units that can be assembled into a multipole distribution block before they are mounted on the breaker. Each lug allows for a maximum of four 6-25 mm² or two 10-35 mm² copper conductors.



FE distribution terminal

	FE
h = height dimension of breaker with box clamps mounted at top and bottom.	250
z (mm)	60
s max (mm)	35
Torque (Allen key in breaker) (Nm max.)	25
L = distance to insulation (min.) - 35 mm ²	18
L = distance to insulation (min.) - 25 mm ²	11
Torque on connection bolt (Nm max.) - 35 mm ²	6
Torque on connection bolt (Nm max.) - 25 mm ²	3

Connections

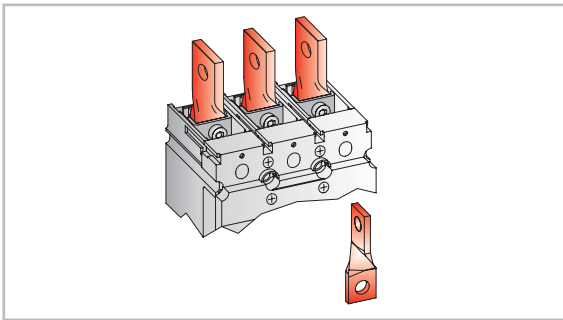
Optional connection terminals - extender variants

The **Record Plus™** circuit breaker can be equipped with several variants of the standard extender design. These are available as a three or four pole set allowing for the configuration of one side of the breaker. The kits are

made up of single pole connectors that are fitted to the standard breaker terminal. The connectors are supplied with all the necessary connection and fixation hardware.

Extender twisted

The twisted version extends the standard connection point to the exterior of the breaker body and 'twists' the connection area from horizontal to vertical. It is normally used when the connecting busbars are turned 90 degrees and with ring terminals.

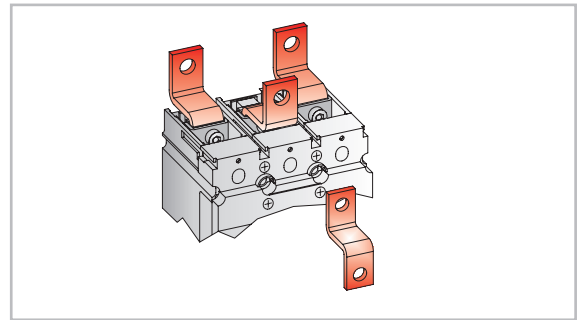


Twisted extenders

	FD	FE	FG
h = height dimension of breaker with extenders at its top AND bottom.	190	230	354
Ø hole max (mm)	7	9	13
Torque (Allen key in breaker) (Nm max.)	8	25	42

Extender heightened

Extends the standard connection points to the exterior of the breaker body and places them at different heights. **Record Plus™** extenders are normally used when the busbars and cables that are needed to connect the breaker exceed the possibilities of the standard connection facility, when external lugs are needed or to interconnect several breakers on the incoming side.

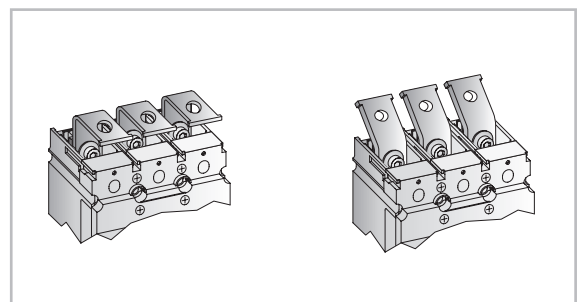


Heightened extenders

	FD	FE
h = height dimension of breaker with extenders at its top AND bottom.	190	230
Ø hole max (mm)	7	9
Torque (Allen key in breaker) (Nm max.)	8	25

Extender angled

Two more extender variants exist for the FE frame type only with a connection area set at forty five or ninety degrees. The hole dimensions and required torques are the same as those required for the heightened extenders.



Phase separators and Back plates

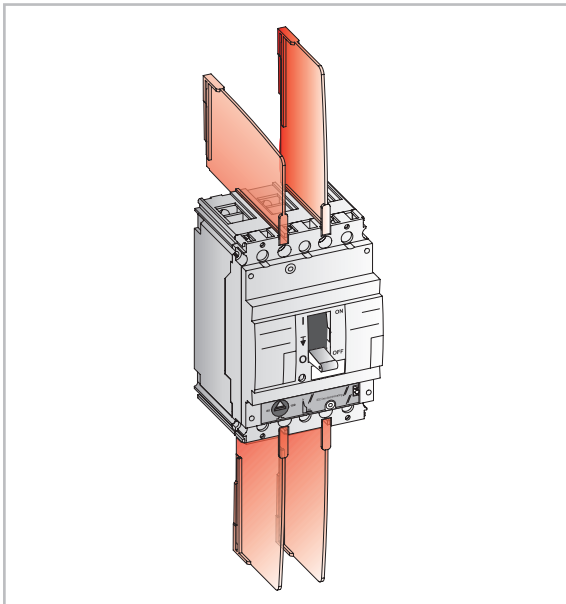
Phase separators

Depending on the rated voltage and the type of connector, the use of phase separators is preferable and in some cases mandatory.

Record Plus™ phase separators are simply slid into slots in the breaker housing. To allow for an easy installation of the connectors they are made of flexible material. They can be mounted in two ways, to allow for front and rear connection.

They ensure a correct dielectric separation of the different connection terminals.

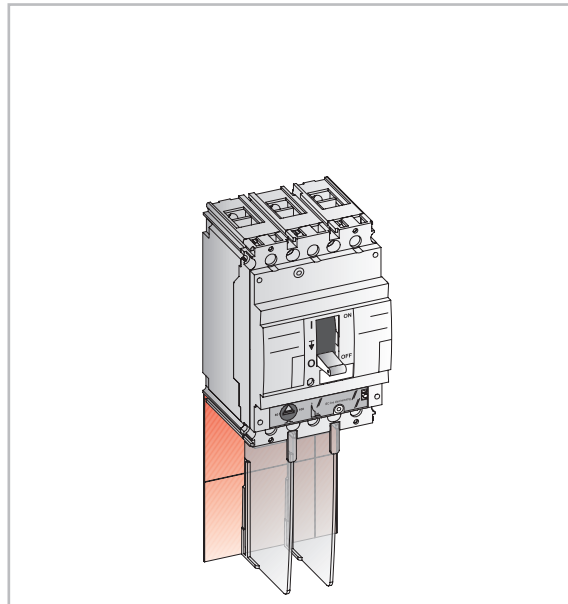
For the **Record Plus™** FD, FE, FG and FK frame, phase separators are available in one set containing 12 pieces.



Back plates

Back plates are always used in association with phase separators. Normally used at voltages above 500V they prevent breaker venting from leading to dielectric issues. They also can be used when externally mounted connectors no longer meet the required clearance distances to a metal back plate.

A back plate suitable for 3 and 4 pole breakers is available. The required size is easily achieved by breaking off parts along a pre-cut line.



Just rel

- D.2 Performance figures
- D.4 Power dissipation
- D.8 Derating at temperatures other than 40°C
- D.10 Clearances (minimum safety distances)
- D.11 Use in individually mounted enclosures
- D.12 Current limitation
- D.14 Limitation curves (Energy & Current)
- D.16 Environmental considerations
- D.18 Use in DC networks
- D.19 Use at frequencies other than 50/60 cycles

The breaker

Order codes

Trip units

Components & Accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

A

B

C

D

E

F

G

X

y on us





EN 60947-2 Standard

Circuit Breaker type	Denomination	FD160					FD160					FE160		
		N	H	C	E	S	N	H	L	L	N	H	L	
Poles	Number of	1					3,4					3,4		
Rated insulation voltage	Ui (Volts)	750					500					750		
Rated impulse withstand voltage	Uimp (Kilovolt)	3					6					8		
Rated operational voltage Ue	Volts AC	240					500					690		
	Volts DC	250					-					500		
Line Protection device														
Category of use		A					A					A		
Suitable for use as a isolator	Positive ON & OFF	yes					yes					yes		
Rated current Ith = Ie	A at 40°C	160					160					160		
Ultimate breaking capacity Icu (kA)	230/240V AC	25	50	25	40	50	85	100	200	85	100	200		
	400/415V AC	-	-	18	25	36	50	80	150	50	80	150		
	440V AC	-	-	14	14	25	30	65	130 ⁽⁴⁾	42	65	130		
	500V AC	-	-	10	12	18	22	36	50 ⁽⁴⁾	30	50	100		
	690V AC	-	-	-	4,5	6	8	10	12	10	22	75		
	250V DC Single pole	-	50	-	-	25	40	65	100	50	85	100		
	500V DC Two Pole	-	-	-	-	25	40	65 ⁽²⁾	100 ⁽²⁾	50	85 ⁽²⁾	100 ⁽²⁾		
Service breaking capacity Ics (%Icu)	≤ 500V	100%	100%	75%	75%	100%	100%	100%	100%	100%	100%	100%		
	690V AC	-	-	-	-	50%	50%	50%	100%	75%	25%			
Making capacity Icm (kA peak)	400/415V AC	-	-	36	52,5	75	110	176	330	110	176	330		
	500V AC	-	-	17	24	36	46	75	110	63	110	220		
Single phase breaking capacity I _{IT} (kA)	230V AC	25	50	16	25	30	50	80	150	50	80	150		
	400/415V AC	-	-	-	4,5	6	8	10	12	15	22	36		
Endurance (CO operations)	Mechanical	10000					10000					25000		
	Electrical at In	5000					5000					10000		
	Electrical at In/2	10000					10000					20000		
Endurance (On-Tripped operations)	Mechanical	4000					4000					10000		
	Trip Units	Interchangeable					no					yes		
	Thermal Magnetic line	no					no					yes		
	Thermal Magnetic generator	LTM					GTM					LTM		
	Thermal Magnetic discriminating	-					LTMD					LTMD		
	Magnetic Only	-					Mag Break™					Mag Break™		
	Electronic discriminating	-					-					SMR1		
	Electronic enhanced	-					-					-		

NEMA AB-1 Standard

3 ph, Interruption rating	240V AC	-	-	-	-	50	65	100	-	100	150	200
	480V AC	-	-	-	-	25	36	50	-	50	65	130
	600V AC	-	-	-	-	6	8	10	-	25	36	42

EN 60947-3 Standard

Non Automatic Circuit Breaker/Switch type		FD160			FE160		
Denomination		Y - 63A			Y - 160A		
Rated current In (class AC23)	220V AC to 690V AC	63			160		
Rated making capacity	Icm (kA peak)	1,7			2,8		
Short-term withstand current Icw (A)	Icw eff. 1 second	1,2			2		
	Icw eff. 3 seconds	1,2			2		

EN 60947-4 Standard

Use in motor circuits			
Rated current Ith	A at 65°C		125
Endurance (CO operations)	Mechanical		25000
	Electrical at In class AC23		10000
	Operations per hour		120
Protection	Short Circuit only (separate overload device)		Mag Break™
	Overload class 10 and Short circuit		Mag Break™
	Max In (A) class 10		100
	Max In (A) class 30		50
	Earth fault unit (differential)		Optional FDQ type

Installation

Circuit Breaker or Switch type		FD160			FE160	
Number of poles		1	3	4	3	4
Mounting	On symmetrical DIN Rail	yes	yes	yes	no	no
	Fixed	yes	yes	yes	yes	yes
	Plug-in	no	yes	yes	yes	yes
	Draw-out	no	no	no	yes	yes
Connection	Front	yes	yes	yes	yes	yes
	Rear	yes	yes	yes	yes	yes
Dimensions (w x h x d) mm	Fixed front connection	27x130	81x130	108x130	105x170	140x265
		x85	x85	x85	x95	x115
Weights (kg)	Fixed front connection	0,4	0,9	1,3	1,5	2

(1) N type only
(2) 3 poles are needed.

(3) 2 poles are needed
(4) The 160Amp current rating of the L type is limited to 65kA at 440v & 36kA at 500V.





V	FE250				FG400			FG630			FK800			FK1250			FK1600	
	N	H	L		N	H	L	N	H	L	N	H	L	N	H	L	N	H
	3,4				3,4			3,4			3,4			3,4			3,4	
690	750				750			750			1000			1000			1000	
8	8				8			8			8			8			8	
500	690				690			690			690			690			690	
250	500				500			500			500			500			500	
A																		
yes																		
250				400			630			800			1250			1600		
65	85	100	200	90	100	200	85	100	200	85	100	170	85	100	170	85	100	
36	50	80	150	50	80	150	50	80	150	50	80	100	50	80	100	50	80	
25	42	65	130	42	65	130	42	65	130	42	50	80	42	50	80	42	50	
18	30	50	100	30	50	100	30	50	100	36	42	50	36	42	50	36	42	
-	10	15	22	10	22	75 ⁽⁷⁾	10	22	40 ⁽⁷⁾	20	25	30	20	25	30	20	25	
-	50	85	100							50	80	100	50	80	100	-	-	
-	50	85 ⁽²⁾	100 ⁽²⁾							36	50	65	36	50	65	-	-	
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
-	100%	75%	50%	100%	75%	25%	100%	75%	50%	100%	100%	75%	100%	75%	50%	100%	75%	
75	110	176	330	110	176	330	110	176	330	110	176	220	110	176	220	110	176	
36	63	110	220	63	110	220	63	110	220	75	110	220	75,6	110	220	75	110	
36	50	80	150	50	80	150	50	80	150	50	80	150	50	80	150	50	80	
-	10	15	22	10	15	22	10	15	22	20	25	30	20	25	30	20	25	
10000	25000				20000			20000			10000			10000			10000	
5000	10000				7500			5000			4000			3000			2000	
10000	20000				15000			10000			8000			6000			4000	
4000	10000				8000			8000			4000			3000			2000	
yes																		
LTM																		
GTM																		
LTMD																		
Mag Break™																		
SMR1				SMR1			SMR1			SMR1			SMR1e			SMR1s & g		
SMR2				SMR2			SMR2			SMR2			SMR2			SMR2		

65	100	150	200	100	150	200	100	150	200	85	-	-	85	-	-	85	-
36	50	65	130	50	65	130	50	65	130	42	-	-	42	-	-	42	-
22	25	36	42	25	36	42	25	36	42	25	-	-	25	-	-	25	-

FE250				FG400			FG630			FK800			FK1250			FK1600	
Y				Y			Y			Y			Y			Y	
250				400			630			800			1250			1600	
5,7				7,1			9,2			14,1			21,2			28,3	
4				5			6,5			10			15			20	
4				5			6,5			10			15			20	

230	400	500	720	1000
25000	20000	20000	10000	10000
10000	7500	5000	4000	3000
120	120	60	60	60
Mag Break™	Mag Break™	Mag Break™	Mag Break™	Mag Break™
SMR1	SMR1 or SMR2	SMR1 or SMR2	SMR1	SMR1
225	400	500	720	1000
225	400	500	720	1000
Optional FEQ type	Optional FGQ type	Optional FGQ type		

FE250			FG400			FG630			FK800			FK1250			FK1600	
3	4		3	4		3	4		3	4		3	4		3	4
no	no		no	no		no	no		no	no		no	no		no	no
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
yes	yes		yes	yes		yes	yes		yes	yes		yes	yes		yes	yes
105x170	140x265	140x265	185x265	140x265	185x265	185x265	210x320	280x320	210x320	280x320	210x320	280x320	210x320	280x320	210x320	280x320
x95	x115	x115	x115	x115	x115	x115	x160	x160	x160	x160	x160	x160	x160	x160	x160	x160
1,5	2,0	4,5	6,0	4,5	6,0	6,0	12,2	15,1	18,0	18,0	23,4	18,0	23,4	18,0	23,4	

(5) Limited to 500Amp
 (6) Please contact your nearest GE Sales Office

(7) At a voltage of 690V the uses of a long widened
 Shield is mandatory (see page D.9)



Power dissipation

Standards

The standard for low voltage equipment is defined in the EN 60439-1, the EN 50298 and the IEC 60890. These provide a theoretical method to calculate the temperature rise within an enclosure. The main element in these calculations is the power dissipation of the equipment installed. By totalizing this value for all the installed devices, connections, cables and busbars it is possible to calculate the temperature rise within the enclosure. Here, for normal applications a temperature rise within the enclosure of 50 Kelvin is assumed.

The absolute value of this temperature may not exceed 70°C (the sum of the ambient temperature in Celsius and the temperature rise in Kelvin).



Use

An enclosure manufacturer can provide the exact data on the allowable power dissipation within a certain enclosure. The values depend on the enclosure type, the ventilation it offers and on where the components are located within this enclosure. The example here is based on the GE Modula 630 enclosure type. The table indicates the temperature rise within a certain enclosure dimension. This at the top and middle of the enclosure in function of the installed heat dissipation (products) in Watt.

Mounted on wall - Temperature rise (Kelvin)

DISSIPATION (Watt)	500x500		500x750		750x500		750x750		750x1000		750x1250		1000x500		1000x750		1000x1000		1000x1250		1250x750		1250x1000	
	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top	Middle	Top
10	4	5	4	4	4	5																		
20	8	9	7	7	6	8	5	6	4	5			5	7										
30	11	13																						
40	13	16	11	13	11	14	9	11	7	9	6	7	9	13	7	9	5	7	5	6	5	8		
50	16	19																						
60	19	22	16	18	16	19	12	16	10	12	8	10	12	18	10	13	7	10	6	8	8	11	6	8
70	21	25																						
80	23	28	20	23	20	24	15	20	12	16	10	12	16	22	12	16								
90	26	31																						
100	28	33	24	27	23	29	18	23	15	19	12	14	19	27	14	19	11	14	9	12	11	16	9	13
120	32	38	28	31	27	33	21	27	40	51	32	40	22	31	17	23								
140	37	44	31	35	31	38	24	31	19	24	15	19	25	35	19	26	15	19	12	16	15	21	12	16
160	41	48	35	39	34	42	27	34					27	39	21	28								
180	45	53	38	43	38	46	29	38	24	30	19	23	30	43	23	31	18	23	15	19	18	25	15	20
200	49	58	42	47	41	51	32	41					33	47	25	34								
220	53	63	45	51	44	55	34	44	28	35	22	27	35	50	27	37	21	27	18	23	21	30	18	24
240			48	55	47	58	37	47					38	54	29	39								
260			52	58	51	62	39	51	32	40	25	31	40	58	31	42	24	31	20	26	24	34	20	27
280							42	54					43	61	33	45								
300							44	57	36	45	28	35	45	65	35	47	27	35	23	29	27	38	23	30
350							50	64	40	51	32	40	51	73	40	53	30	39	26	33	31	43	25	34
400									45	57	36	44			44	59	34	44	29	37	34	48	28	38
450									49	62	39	48			48	65	37	48	32	40	38	53	31	42
500															53	71	40	53	34	44	41	58	34	46
550																	44	57	37	47	45	63	37	49
600																	47	61	40	51	48	67	39	53
650																	50	65	42	54	51	72	42	57
700																			45	57			45	60
750																			48	61			47	63
800																			50	64			50	67



Record Plus™ Power dissipation

The power dissipation tables included here indicate the DC resistance of the **Record Plus™** breakers in cold condition. The power dissipation per pole can be calculated with this value and the average current flowing within the circuit (formula I^2R).

The tables indicate the Watt loss per pole based on the maximum current load of the breaker. To calculate the total Watt loss for a three or four pole breaker these values are multiplied by three.*

* for circuits with a high 3rd harmonic content, please contact us

Power Dissipation - FD160 frame ≤63A

	In (A) ⁽¹⁾	Thermal magn. type (LTM, LTMD, GTM)							Mag Break™ (MO)						Switch (V)
		16	20	25	32	40	50	63	3	7	13	20	30	50	63
Fixed version	R in mΩ per pole	10.00	6.50	4.00	2.50	2.00	1.60	1.40	200.00	55.00	18.00	1.20	1.20	0.53	0.50
	Dissipation Watt single pole	2.56	2.60	2.50	2.56	3.20	4.00	5.56	1.80	2.70	2.81	0.48	1.08	1.33	1.98
	Dissipation Watt three poles	7.68	7.80	7.50	7.68	9.60	12.00	16.67	5.40	8.09	8.44	1.44	3.24	3.98	5.95
Plug-in version	R in mΩ per pole	10.07	6.57	4.07	2.57	2.07	1.67	1.47	200.07	55.07	18.07	1.27	1.27	0.60	0.57
	Dissipation Watt single pole	2.58	2.63	2.54	2.63	3.31	4.18	5.83	1.80	2.70	2.82	0.51	1.14	1.50	2.26
	Dissipation Watt three poles	7.73	7.88	7.63	7.90	9.94	12.53	17.50	5.40	8.10	8.47	1.52	3.43	4.50	6.79
Fixed version with RCD	R in mΩ per pole	10.08	6.58	4.08	2.58	2.08	1.68	1.48	200.08	55.08	18.08	1.28	1.28	0.61	0.58
	Dissipation Watt single pole	2.58	2.63	2.55	2.64	3.33	4.20	5.87	1.80	2.70	2.83	0.51	1.15	1.53	2.30
	Dissipation Watt three poles	7.74	7.90	7.65	7.93	9.98	12.60	17.62	5.40	8.10	8.48	1.54	3.46	4.58	6.91
Plug-in version with RCD	R in mΩ per pole	10.15	6.65	4.15	2.65	2.15	1.75	1.55	200.15	55.15	18.15	1.35	1.35	0.68	0.65
	Dissipation Watt single pole	2.60	2.66	2.59	2.71	3.44	4.38	6.15	1.80	2.70	2.84	0.54	1.22	1.70	2.58
	Dissipation Watt three poles	7.80	7.98	7.78	8.14	10.32	13.13	18.46	5.40	8.11	8.51	1.62	3.65	5.10	7.74

Power Dissipation - FD160 frame >63A

	In (A)	Thermal magn. type (LTM, LTMD, GTM)					Mag Break™ (MO)			Switch (V)
		80	100	125	160	80	100	160		
Fixed version	R in mΩ per pole	0.85	0.75	0.53	0.53	0.53	0.53	0.50		
	Dissipation Watt single pole	5.44	7.50	8.28	13.57	3.39	5.30	12.80		
	Dissipation Watt three poles	16.32	22.50	24.84	40.70	10.18	15.90	38.40		
Plug-in version	R in mΩ per pole	0.92	0.82	0.60	0.60	0.60	0.60	0.57		
	Dissipation Watt single pole	5.89	8.20	9.38	15.36	3.84	6.00	14.59		
	Dissipation Watt three poles	17.66	24.60	28.13	46.08	11.52	18.00	43.78		
Fixed version with RCD	R in mΩ per pole	0.93	0.83	0.61	0.61	0.61	0.61	0.58		
	Dissipation Watt single pole	5.95	8.30	9.53	15.62	3.90	6.10	14.85		
	Dissipation Watt three poles	17.86	24.90	28.59	46.85	11.71	18.30	44.54		
Plug-in version with RCD	R in mΩ per pole	1.00	0.90	0.68	0.68	0.68	0.68	0.65		
	Dissipation Watt single pole	6.40	9.00	10.63	17.41	4.35	6.80	16.64		
	Dissipation Watt three poles	19.20	27.00	31.88	52.22	13.06	20.40	49.92		

Power Dissipation - FE160 frame

	In (A)	Thermal magn. type (LTMD, GTM)									Switch (V)
		25	32	40	50	63	80	100	125	160	160
Fixed version	R in mΩ per pole	6.30	2.80	2.80	2.10	1.45	1.20	0.81	0.77	0.63	0.40
	Dissipation Watt single pole	3.94	2.87	4.48	5.25	5.76	7.68	8.10	12.03	16.00	10.24
	Dissipation Watt three poles	11.81	8.60	13.44	15.75	17.27	23.04	24.30	36.09	48.00	30.72
Plug-in version	R in mΩ per pole	6.37	2.87	2.87	2.17	1.52	1.27	0.88	0.84	0.70	0.47
	Dissipation Watt single pole	3.98	2.94	4.59	5.43	6.03	8.13	8.80	13.13	17.79	12.03
	Dissipation Watt three poles	11.94	8.82	13.78	16.28	18.10	24.38	26.40	39.38	53.38	36.10
Fixed version with RCD	R in mΩ per pole	6.38	2.88	2.88	2.18	1.53	1.28	0.89	0.85	0.71	0.48
	Dissipation Watt single pole	3.99	2.95	4.61	5.45	6.07	8.19	8.90	13.28	18.05	12.29
	Dissipation Watt three poles	11.96	8.85	13.82	16.35	18.22	24.58	26.70	39.84	54.14	36.86
Plug-in version with RCD	R in mΩ per pole	6.45	2.95	2.95	2.25	1.60	1.35	0.96	0.92	0.78	0.55
	Dissipation Watt single pole	4.03	3.02	4.72	5.63	6.35	8.64	9.60	14.38	19.84	14.08
	Dissipation Watt three poles	12.09	9.06	14.16	16.88	19.05	25.92	28.80	43.13	59.52	42.24

	In (A) ⁽¹⁾	Mag Break™ (MO)										FE160 frame electronic type (SMR1)			
		3	7	13	20	30	50	80	100	125	160	25	63	125	160
Fixed version	R in mΩ per pole	410.00	110.00	13.30	13.20	3.60	1.70	0.60	0.60	0.40	0.40	0.40	0.40	0.40	0.40
	Dissipation Watt single pole	3.69	5.39	2.08	5.28	3.24	4.25	3.84	6.00	6.25	6.25	0.25	0.25	1.59	6.25
	Dissipation Watt three poles	11.07	16.17	6.23	15.84	9.72	12.75	11.52	18.00	18.75	18.75	0.75	0.75	4.76	18.75
Plug-in version	R in mΩ per pole	410.07	110.07	13.37	13.27	3.67	1.77	0.67	0.67	0.47	0.47	0.47	0.47	0.47	
	Dissipation Watt single pole	3.69	5.39	2.09	5.31	3.30	4.43	4.29	6.70	7.34	7.34	0.29	0.29	1.87	7.34
	Dissipation Watt three poles	11.07	16.18	6.27	15.92	9.91	13.28	12.86	20.10	22.03	22.03	0.88	0.88	5.60	22.03
Fixed version with RCD	R in mΩ per pole	410.08	110.08	13.38	13.28	3.68	1.78	0.68	0.68	0.48	0.48	0.48	0.48	0.48	
	Dissipation Watt single pole	3.69	5.39	2.09	5.31	3.31	4.45	4.35	6.80	7.50	7.50	0.30	0.30	1.91	7.50
	Dissipation Watt three poles	11.07	16.18	6.27	15.94	9.94	13.35	13.06	20.40	22.50	22.50	0.90	0.90	5.72	22.50
Plug-in version with RCD	R in mΩ per pole	410.15	110.15	13.45	13.35	3.75	1.85	0.75	0.75	0.55	0.55	0.55	0.55	0.55	
	Dissipation Watt single pole	3.69	5.40	2.10	5.34	3.38	4.63	4.80	7.50	8.59	8.59	0.34	0.34	2.18	8.59
	Dissipation Watt three poles	11.07	16.19	6.30	16.02	10.13	13.88	14.40	22.50	25.78	25.78	1.03	1.03	6.55	25.78

(1) All 3A magnetic only ratings can be used at 3.5A



Power Dissipation - FE250 frame

	In (A)	Thermal magn. type (LTMD, GTM)				Switch (Y)
		125	160	200	250	
Fixed version	R in mΩ per pole	0.67	0.53	0.40	0.33	0.30
	Dissipation Watt single pole	10.47	13.57	16.00	20.63	18.75
	Dissipation Watt three poles	31.41	40.70	48.00	61.88	56.25
Plug-in version	R in mΩ per pole	0.73	0.59	0.46	0.39	0.36
	Dissipation Watt single pole	11.41	15.10	18.40	24.38	22.50
	Dissipation Watt three poles	34.22	45.31	55.20	73.13	67.50
Fixed version with RCD	R in mΩ per pole	0.74	0.60	0.47	0.40	0.37
	Dissipation Watt single pole	11.56	15.36	18.80	25.00	23.13
	Dissipation Watt three poles	34.69	46.08	56.40	75.00	69.38
Plug-in version with RCD	R in mΩ per pole	0.80	0.66	0.53	0.46	0.43
	Dissipation Watt single pole	12.50	16.90	21.20	28.75	26.88
	Dissipation Watt three poles	37.50	50.69	63.60	86.25	80.63

	In (A)	Mag Break™ (MO)			FE250 frame Electronic type (SMR1)			Switch (Y)
		160	200	250	125	160	250	
Fixed version	R in mΩ per pole	0.33	0.33	0.33	0.30	0.30	0.30	
	Dissipation Watt single pole	8.45	13.20	20.63	4.69	7.68	18.75	
	Dissipation Watt three poles	25.34	39.60	61.88	14.06	23.04	56.25	
Plug-in version	R in mΩ per pole	0.39	0.39	0.39	0.36	0.36	0.36	
	Dissipation Watt single pole	9.98	15.60	24.38	5.63	9.22	22.50	
	Dissipation Watt three poles	29.95	46.80	73.13	16.88	27.65	67.50	
Fixed version with RCD	R in mΩ per pole	0.40	0.40	0.40	0.37	0.37	0.37	
	Dissipation Watt single pole	10.24	16.00	25.00	5.78	9.47	23.13	
	Dissipation Watt three poles	30.72	48.00	75.00	17.34	28.42	69.38	
Plug-in version with RCD	R in mΩ per pole	0.46	0.46	0.46	0.43	0.43	0.43	
	Dissipation Watt single pole	11.78	18.40	28.75	6.72	11.01	26.88	
	Dissipation Watt three poles	35.33	55.20	86.25	20.16	33.02	80.63	

Power Dissipation - FG400 & FG 630 frame

	In (A)	FG400/630 frame electronic type (SMR1 & 2)				Mag Break™ (MO)		Switch (Y)	
		250	400	500	630	400	500	400	630
Fixed version	R in mΩ per pole	0.11	0.11	0.10	0.10	0.11	0.10	0.11	0.10
	Dissipation Watt single pole	6.88	17.60	25.00	39.69	17.60	23.75	17.60	39.69
	Dissipation Watt three poles	20.63	52.80	75.00	119.07	52.80	71.25	52.80	119.07
Plug-in/Draw-out version	R in mΩ per pole	0.13	0.13	0.12	0.12	0.13	0.12	0.13	0.12
	Dissipation Watt single pole	8.13	20.80	30.00	47.63	20.80	30.00	20.80	47.63
	Dissipation Watt three poles	24.38	62.40	90.00	142.88	62.40	90.00	62.40	142.88
Fixed version with RCD	R in mΩ per pole	0.16	0.16	0.15	0.15	0.16	0.15	0.16	0.15
	Dissipation Watt single pole	10.00	25.60	37.50	59.54	25.60	37.50	25.60	59.54
	Dissipation Watt three poles	30.00	76.80	112.50	178.61	76.80	112.50	76.80	178.61
Plug-in/Draw-out version with RCD	R in mΩ per pole	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
	Dissipation Watt single pole	10.31	26.40	41.25	65.49	26.40	41.25	26.40	65.49
	Dissipation Watt three poles	30.94	79.20	123.75	196.47	79.20	123.75	79.20	196.47

Power Dissipation - FK800, FK1250 & FK1600 frame

	In (A)	Thermal magn. type (LTM)				Mag Break™ (MO)		Switch (Y)		
		630	800	1000	1250	800	1250	800	1250	1600
Fixed version	R in mΩ per pole	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.02	0.01
	Dissipation Watt single pole	15.88	25.60	35.00	54.69	12.80	23.44	12.80	31.25	25.60
	Dissipation Watt three poles	47.63	76.80	105.00	164.06	38.40	70.31	38.40	93.75	76.80
Draw-out version	R in mΩ per pole	0.07	0.07	0.07	0.07	0.05	0.05	0.05	0.05	0.04
	Dissipation Watt single pole	27.78	44.80	65.00	101.56	32.00	70.31	32.00	78.13	102.40
	Dissipation Watt three poles	83.35	134.40	195.00	304.69	96.00	210.94	96.00	234.38	307.20

	In (A)	FK800, 1250-1600 frame electronic type (SMR1e, s & g)			
		800	1000	1250	1600
Fixed version	R in mΩ per pole	0.04	0.04	0.04	0.03
	Dissipation Watt single pole	25.60	35.00	54.69	76.80
	Dissipation Watt three poles	76.80	105.00	164.06	230.40
Draw-out version	R in mΩ per pole	0.07	0.07	0.07	0.06
	Dissipation Watt single pole	25.60	35.00	54.69	76.80
	Dissipation Watt three poles	76.80	105.00	164.06	230.40



Notes

Grid area for notes.

Power dissipation

Intro

A

B

C

D

E

F

G

X



Derating

Thermal magnetic trip units

The ambient temperature in the direct vicinity of a protective device has an influence on its current carrying properties.

The **Record Plus™** breakers with thermal magnetic and magnetic only protection units as the MO, LTM and LTMD types can be used at currents and temperatures as indicated in the table.

Maximum permissible current at an ambient temperature of

Type	In (A)	Fixed breaker							Plug-in or draw-out breaker						
		40°C	45°C	50°C	55°C	60°C	65°C	70°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C
FD160, FE160 & FE250	16	16.0	15.5	15.0	14.6	14.1	13.6	13.1	15.0	14.6	14.1	13.7	13.2	12.8	12.3
	25	25.0	24.3	23.5	22.8	22.0	21.3	20.5	23.5	22.8	22.1	21.4	20.7	20.0	19.3
	32	32.0	31.0	30.1	29.1	28.2	27.2	26.2	30.1	29.2	28.3	27.4	26.5	25.6	24.7
	40	40.0	38.8	37.6	36.4	35.2	34.0	32.8	37.6	36.5	35.3	34.2	33.1	32.0	30.8
	50	50.0	48.5	47.0	45.5	44.0	42.5	41.0	47.0	45.6	44.2	42.8	41.4	40.0	38.5
	63	63.0	61.1	59.2	57.3	55.4	53.6	51.7	59.2	57.4	55.7	53.9	52.1	50.3	48.6
FD160	80	80.0	77.6	75.2	72.8	70.4	68.0	65.6	75.2	72.9	70.7	68.4	66.2	63.9	61.7
	100	100	97.0	94.0	91.0	88.0	85.0	82.0	94.0	91.2	88.4	85.5	82.7	79.9	77.1
FE160 & FE250	125	125	121	118	114	110	106	103	118	114	110	107	103	100	96
	160	160	155	150	146	141	136	131	150	146	141	137	132	128	123
FK800 & FK1250	200	200	194	188	182	176	170	164	188	182	177	171	165	160	154
	250	250	243	235	228	220	213	205	235	228	221	214	207	200	193
	630	630	611	592	573	554	536	517	630	611	593	575	557	539	521
	800	800	776	752	728	704	680	656	800	760	714	692	669	646	623
FD63 & FD160 with RCD	1000	1000	970	940	910	880	850	820	1000	950	893	865	836	808	779
	1250	1250	1213	1175	1138	1100	1063	1025	1250	1188	1116	1081	1045	1009	974
FD160 with RCD	16	16.0	15.5	15.0	14.6	14.1	13.6	13.1	15.0	14.6	14.1	13.7	13.2	12.8	12.3
	25	25.0	24.3	23.5	22.8	22.0	21.3	20.5	23.5	22.8	22.1	21.4	20.7	20.0	19.3
	32	32.0	31.0	30.1	29.1	28.2	27.2	26.2	30.1	29.2	28.3	27.4	26.5	25.6	24.7
	40	40.0	38.8	37.6	36.4	35.2	34.0	32.8	37.6	36.5	35.3	34.2	33.1	32.0	30.8
	50	50.0	48.5	47.0	45.5	44.0	42.5	41.0	47.0	45.6	44.2	42.8	41.4	40.0	38.5
	63	63.0	61.1	59.2	57.3	55.4	53.6	51.7	59.2	57.4	55.7	53.9	52.1	50.3	48.6
FE160 & FE250 with RCD	80	80.0	77.6	75.2	72.8	70.4	68.0	65.6	75.2	72.9	70.7	68.4	66.2	63.9	61.7
	100	100	97.0	94.0	91.0	88.0	85.0	82.0	94.0	91.2	88.4	85.5	82.7	79.9	77.1
FD160 with RCD	125	119	115	110	108	104	101	97	110	107	104	101	97	94	91
	160	152	147	141	138	135	132	129	141	137	133	129	124	120	116
FE160 & FE250 with RCD	200	190	184	177	173	169	165	162	177	171	166	161	156	150	145
	250	238	230	221	216	211	207	202	221	214	208	201	194	188	181

Technical data

Intro

A

B

C

D

E

F

G

X



Derating

Electronic trip units

Electronic trip units are less sensitive to fluctuations in ambient temperature than thermal magnetic trip units. However, to prevent the device and its environment from exceeding their design values, certain limits must be taken

into account. The table indicates the maximum values to which the LT or overload protection of the electronic trip unit of the **Record Plus™** breaker can be set. This at ambient temperatures from 40 to 70°C.

Maximum permissible current at an ambient temperature of

Type	Is ⁽¹⁾ (A)	Fixed breaker							Plug in or draw-out breaker						
		40°C	45°C	50°C	55°C	60°C	65°C	70°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C
FE160	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	160	160	160	160	156	152	148	144	160	156	152	148	144	140	136
FE250	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	160	160	160	160	160	160	160	160	160	156	152	148	144	140	136
	250	250	250	250	244	238	231	225	250	244	238	231	225	219	213
FG400	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
	350	350	350	350	350	350	350	350	350	350	350	350	350	350	340
	400	400	400	400	390	380	370	360	400	390	380	370	360	350	340
FG630	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	500	500	500	500	500	500	500	500	500	500	500	500	500	500	481
	630	630	614	599	583	567	551	536	583	568	554	539	524	510	481
FK800	800	800	800	760	760	760	680	-	760	741	722	703	722	646	-
FK1250	1000	1000	1000	950	950	900	850	-	950	950	903	879	855	808	-
	1250	1250	1250	1188	1188	1125	1000	-	1188	1158	1128	1098	1069	950	-
FK1600	1600	1600	1600	1520	1440	1408	1280	-	1600	1536	1444	1408	1368	1216	-
FE160 with RCD	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
	125	125	125	125	125	125	125	125	125	125	125	125	125	125	106
FE250 with RCD	160	160	156	152	148	144	141	137	152	148	144	141	137	133	129
	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
FG400 with RCD	250	250	244	238	244	238	231	225	238	232	226	220	214	208	202
	250	250	250	250	250	250	250	250							
	350	350	350	350	341	333	324	315							
FG630 with RCD	400	400	370	360	350	340	330	320							
	400	400	400	400	400	400	400	400							
	500	500	500	500	500	500	481	468							
	630	568	554	539	524	510	481	468							

(1) Is = Sensor rating

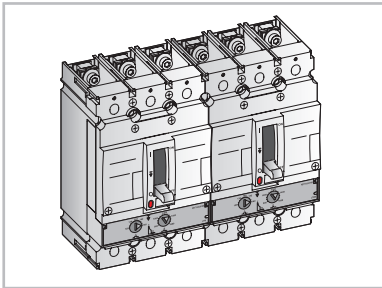


Clearances

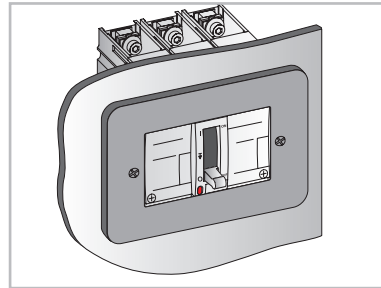
Minimum distances

A modern circuit breaker is designed to interrupt high short-circuit currents in a very limited time frame. In doing so the breaker vents gas and a limited amount of conductive fragments.

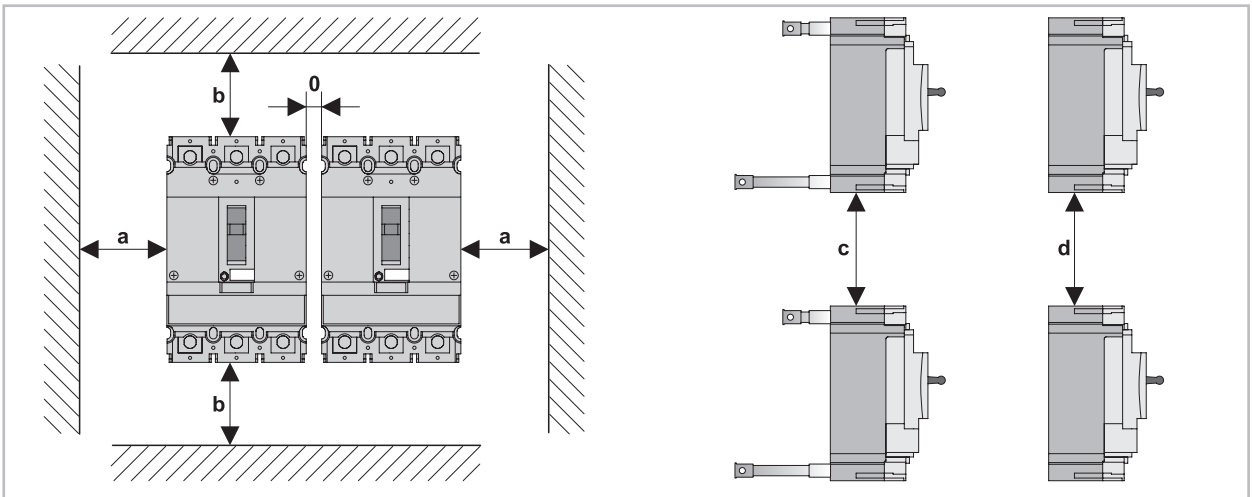
The **Record Plus™** circuit breaker has been designed to limit the venting phenomenon to a minimum. However, it is necessary to take the following minimum distances into account:



Minimum Distance between two side by side mounted **Record Plus™** Breakers = 0 mm



Minimum Distance to a front panel from a **Record Plus™** Breakers = 0 mm
Protection degree on breaker front = IP40



Minimum Distances

Type			Distances in mm			
			a	b	c	d
FD160	To painted metal, non conductive materials and isolated conductors. To unpainted metal		0	15		
		Voltage ≤ 480V	3	35		
		Voltage < 600V ⁽¹⁾ Voltage = 690V ⁽¹⁾	5 15	(2) (2)		
FE160 & FE250	To breaker housing To conductors protruding from breaker To painted metal, non conductive materials and isolated conductors. To unpainted metal				35	35
		Voltage ≤ 480V	5	35		
		Voltage < 600V ⁽¹⁾ Voltage = 690V ⁽¹⁾	10 20	(2) (2)		
FG400 & FG630	To breaker housing To conductors protruding from breaker To painted metal, non conductive materials and isolated conductors. To unpainted metal				35	35
		Voltage ≤ 480V	5	60		
		Voltage < 600V ⁽¹⁾ Voltage = 690V ⁽³⁾	10 20	(2) (2)		
FK800, FK 800 & FK1600	To breaker housing To conductors protruding from breaker To painted metal, non conductive materials and isolated conductors. To unpainted metal				60	60
		Voltage ≤ 480V	15	80		
		Voltage < 600V Voltage = 690V	20 30	80 80		
	To breaker housing To conductors protruding from breaker				140	140
					140	140

(1) The use of phase separators and back plates is obligatory.
(2) Size determined by phase separators.

(3) At 690Volts the FG400L & FG630L must have the power supply connected to the breaker ON side (Line). In this application the use of the widened terminal shield is compulsory.



Individual mounting of Record Plus™ in enclosures

Record Plus™ breakers can be placed in enclosures for use as individually wall mounted feeder units. In order to ensure a reliable and practical solution each of the combinations mentioned here have been defined by strenuous testing. Here the properties of all components, and their use as a combination have been taken into account. For all other application of the Record Plus™ in individually mounted enclosures, please contact us.



VMS, thermoplastic box IP65 with transparent cover.
The use of short or long terminal covers for the breaker is mandatory.

Breaker and terminal covers always have to be ordered separately.
Short-circuit rating: 20kA, 440V

VMS, thermoplastic housing IP65 with opaque cover

Record Plus Breaker ⁽¹⁾ In (A)	Breaker type	Rotary handle type	Housing		Ref. nr.
			Size	Type	
125A	FD160 with and without RCD	FDNRC	440 x 320 x 254	VMS43 + extension frame	855085
160A	FE160	FENRC	440 x 320 x 254	VMS43 + extension frame	855087
160A	FE160 with RCD	FENRC	640 x 320 x 254	VMS63 + extension frame	855088
250A	FE250	FENRC	440 x 320 x 254	VMS43 + extension frame	855087
250A	FE250 with RCD	FENRC	640 x 320 x 254	VMS63 + extension frame	855088
400A	FG400 or FG 630	FGNRC	(2)	(2)	(2)
630A	FG400 or FG630 with RCD	FGNRC	(2)	(2)	(2)

PolySafe, glass fibre reinforced Polyester, cabinet IP65 with door.

When using Record Plus™ Breaker in polyester cabinets for outdoor use we recommend encapsulating the

breaker in a VMS box.
Breaker, terminal covers and mounting plate for the external housing have to be ordered separately.
Short-circuit rating: 20kA, 440V⁽³⁾

PolySafe, glass fibre reinforced polyester cabinet IP65

Record Plus Breaker ⁽¹⁾ In (A)	Breaker type	Internal housing VMS		External housing Polysafe	
		Size	Ref. nr.	Size	Ref. nr.
125A	FD160 w/out RCD	440 x 320 x 254	855085 ⁽³⁾	750 x 500 x 320	883008
160A	FE160 w/out RCD	640 x 320 x 254	855087 / 855088 ⁽³⁾	750 x 500 x 320	883008
250A	FE250 w/out RCD	640 x 320 x 254	855087 / 855088 ⁽³⁾	750 x 500 x 320	883008
400A	FG400 or FG 630	FGNRC	(2)	(2)	(2)
630A	FG400 or FG630 with RCD	FGNRC	(2)	(2)	(2)

(1) Ambient temperature max. 30 degrees centigrade.

(2) Please contact us.

(3)The use of short or long terminal covers on the breaker is mandatory

Current limitation

A short-circuit is an overcurrent with a value only limited by the impedance of the fault circuit itself. This impedance is determined by a number of factors the main ones of which are the available power that a network can supply and the impedance of the conductors within the fault circuit.

In modern hi-power electrical distribution networks very high prospective fault levels of 100kA or more can occur. High prospective short-circuit current values can cause issues in a number of areas:

Electrodynamic forces

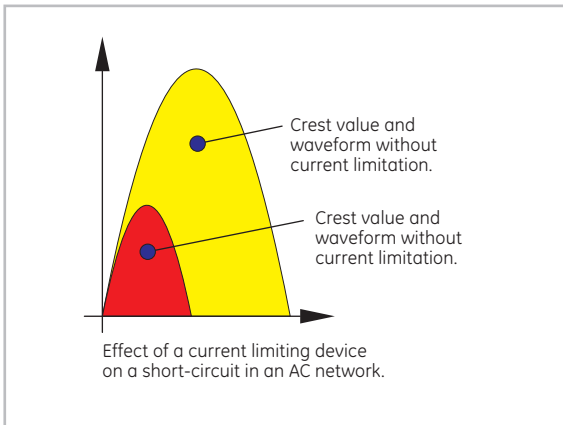
These are proportional to the square of the crest current value. The electrodynamic forces due to the crest current value can seriously damage equipment as busbar systems and their supports, downstream switchgear etc. Current limiting devices limit the crest value of the short-circuit current and thus reduce these forces.

Magnetic fields

A high level short-circuit produces magnetic fields that prevent electrical equipment as meters and computers from operating correctly.

Thermal stress (heat)

Thermal stress is proportional to the square of the effective current value. The thermal stress limit of cable isolation, busbar supports and other electrical equipment can be expressed as an A²S value. This electrical energy value must be kept within certain pre-defined limits to prevent overheating. To avoid or to limit the effects of these issues the use of current limiting devices is advisable.



Thermal stress in Electrical conductors

Cable have thermal stress limits normally expressed in a A²S value that depend on the cable's cross section and its isolation. They are limited to prevent the insulation conductor from exceeding their limit temperature. Clause 434.5.2 of the IEC 60364 4d. 03 - 2008 defines that for protection devices interrupting within 0.1 seconds (t<=0.1 second) and current limiting devices as Record Plus, the following formula applies:

$$K^2 \times S^2$$

K: factor provided in the standard; depends on the material that the conductor is made of and it's insulation
S: cross section of the conductor

If the protection device is NOT current limiting. Clause 434.5.2 of the IEC 60364 4d. 03 - 2008 applies. Here for interruption times up to 5 seconds, the regulation requires that the following formula is met.

$$t = (K * S/I)^2$$

Terminology

t: Duration of the short-circuit in seconds.
K: Factor provided by the standard; depending on the material the conductor is made of and it's insulation.
S: Cross Section of the conductor.
I: Effective short-circuit current. (r.m.s value)

K factors in accordance with the IEC 60364-4-43 ed.03

Insulation & maximum temperature	Copper (Cu)	Aluminium (Al)
PVC - 70° < 300 sq.mm	115	76
PVC - 70° ≥ 300 sq.mm	103	68
PVC - 90° < 300 sq.mm	100	86
PVC - 90° ≥ 300 sq.mm	86	57
XLPE & EPR 90°	143	94
Rubber 60°	141	93
Mineral, bare unsheathed 105°	135 or 115 ⁽¹⁾	-

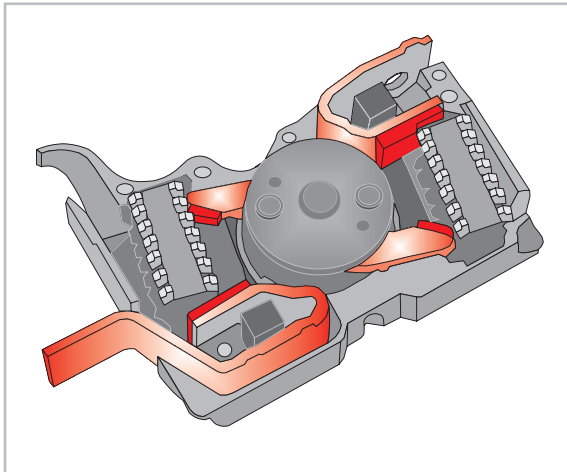
(1) The 115 value is be used for conductors exposed to touch.

Maximum permissible thermal stress in conductors

Insulation	Core	Cross section in sq. mm & maximum permissible thermal stress in A ² s															
		1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
PVC - 70°	Cu	x10 ⁴	x10 ⁴	x10 ⁴	x10 ⁴	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸
	Al	2.976	8.266	21.160	47.610	1.323	3.386	8.266	16.201	33.063	0.648	1.194	1.904	2.976	4.526	7.618	9.548
PVC - 90°	Cu	1.300	3.610	9.242	20.794	0.578	1.479	3.610	7.076	14.440	0.283	0.521	0.832	1.300	1.977	3.327	4.162
	Al	2.250	6.250	16.000	36.000	1.000	2.560	6.250	12.250	25.000	0.490	0.903	1.440	2.250	3.423	5.760	6.656
XLPE & EPR 90°	Cu	1.664	4.623	11.834	26.626	0.740	1.893	4.623	9.060	18.490	0.362	0.667	1.065	1.664	2.531	4.260	2.924
	Al	4.601	12.781	32.718	73.616	2.045	5.532	12.781	25.050	51.123	1.002	1.846	2.945	4.601	6.999	11.779	17.893
Rubber 60°	Cu	1.988	5.523	14.138	31.810	0.884	2.262	5.523	10.824	22.090	0.433	0.797	1.272	1.988	3.024	5.090	7.784
	Al	4.473	12.426	31.810	71.572	1.988	5.090	12.426	24.354	49.703	0.974	1.794	2.863	4.473	6.804	11.451	17.893
Mineral bare 105° k=135	Cu	1.946	5.406	13.838	31.136	0.865	2.214	5.406	10.595	21.623	0.424	0.781	1.245	1.946	2.960	4.982	7.784
	Al	4.101	11.391	29.160	65.610	1.823	4.666	11.391	22.326	45.563	0.893	1.645	2.624	4.101	6.238	10.498	16.403
Mineral bare 105° k=115	Cu	2.976	8.266	21.160	47.610	1.323	3.386	8.266	16.201	33.063	0.648	1.194	1.904	2.976	4.526	7.618	11.903
	Al																



Record Plus™ MCCB's revolutionary design is equipped with dual contacts placed in a rotary configuration that enables the device to provide the highest available interruption ratings in the smallest possible size. When the breaker reacts it does so with more than twice the speed and force of conventional breakers, thus providing excellent current limitation. This results in low peak current and energy values in the circuit and leads to lower electro-dynamic forces and thermal stress values in the protected electrical conductors, downstream protection devices and equipment.

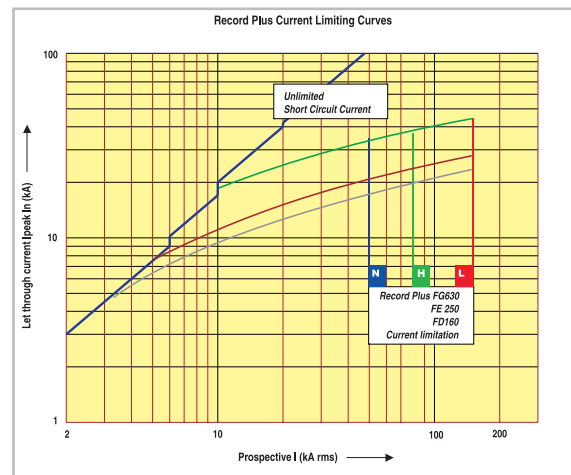


However, in some cases it is still necessary to check if the electrical conductors are protected correctly. This can be verified by taking the cable stress limits published on the previous page and comparing them with the let-through energy values found in the graphs. (page D.14 and D.15)

The limitation of electrodynamic forces and thermal stress by using back-up protection

Protection devices placed downstream from a protective device as a **Record Plus™** breaker must be able to withstand the thermal and electrodynamic effects that occur at its point of installation. Placing current limiting devices upstream limits these values and can allow the use of smaller and more economical devices than is possible without the use of current limitation.

Back-up protection with **Record Plus™** is described in the application data section of this catalogue. (page E.20)



Intro

A

B

C

D

E

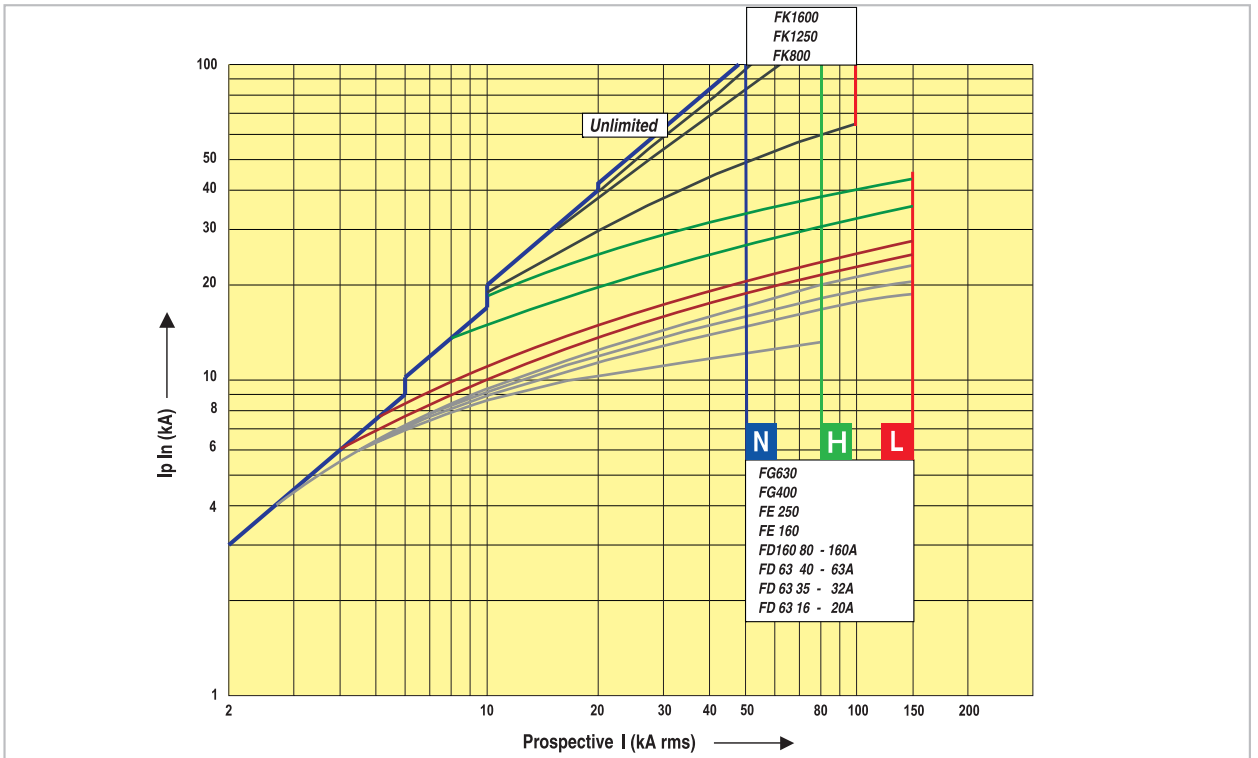
F

G

X

Current limitation data at 400/415V

Technical data



Thermal stress (Energy) Limitation data at 400/415V

Intro

A

B

C

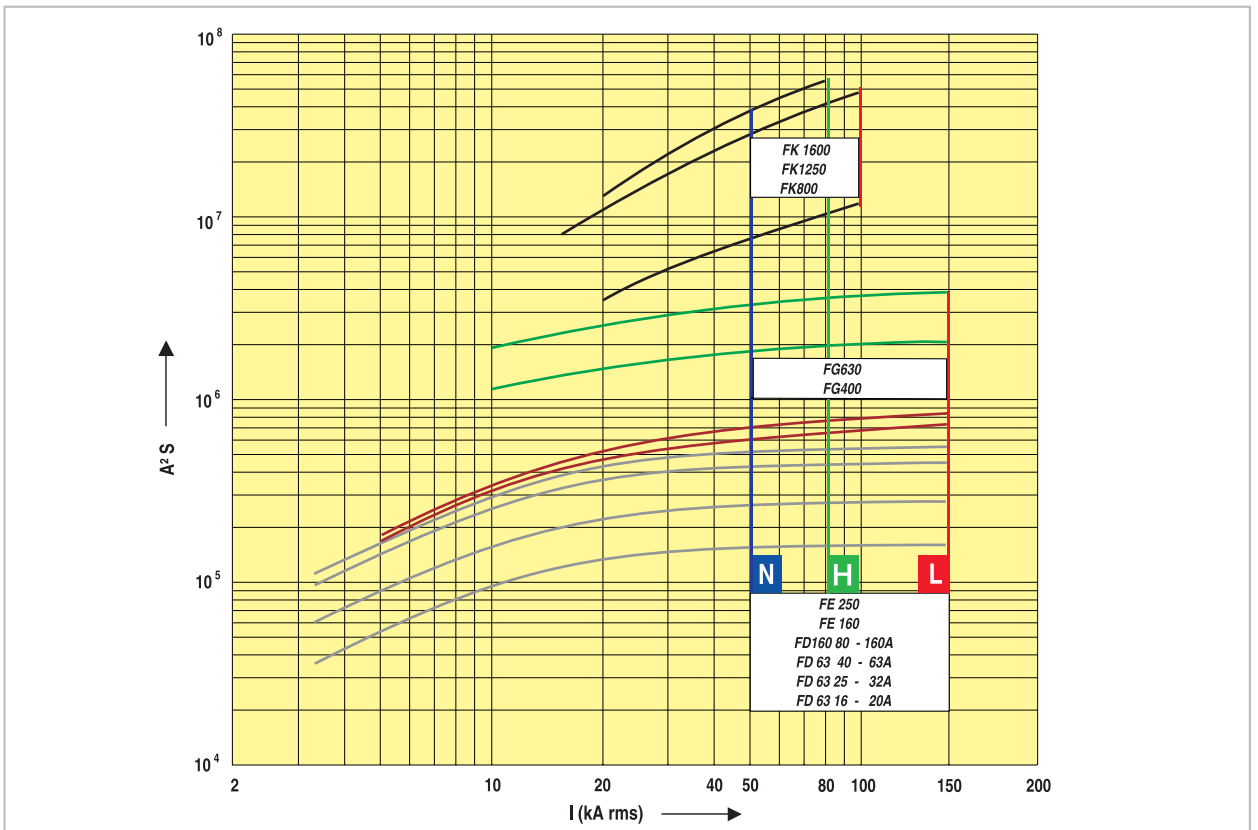
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E

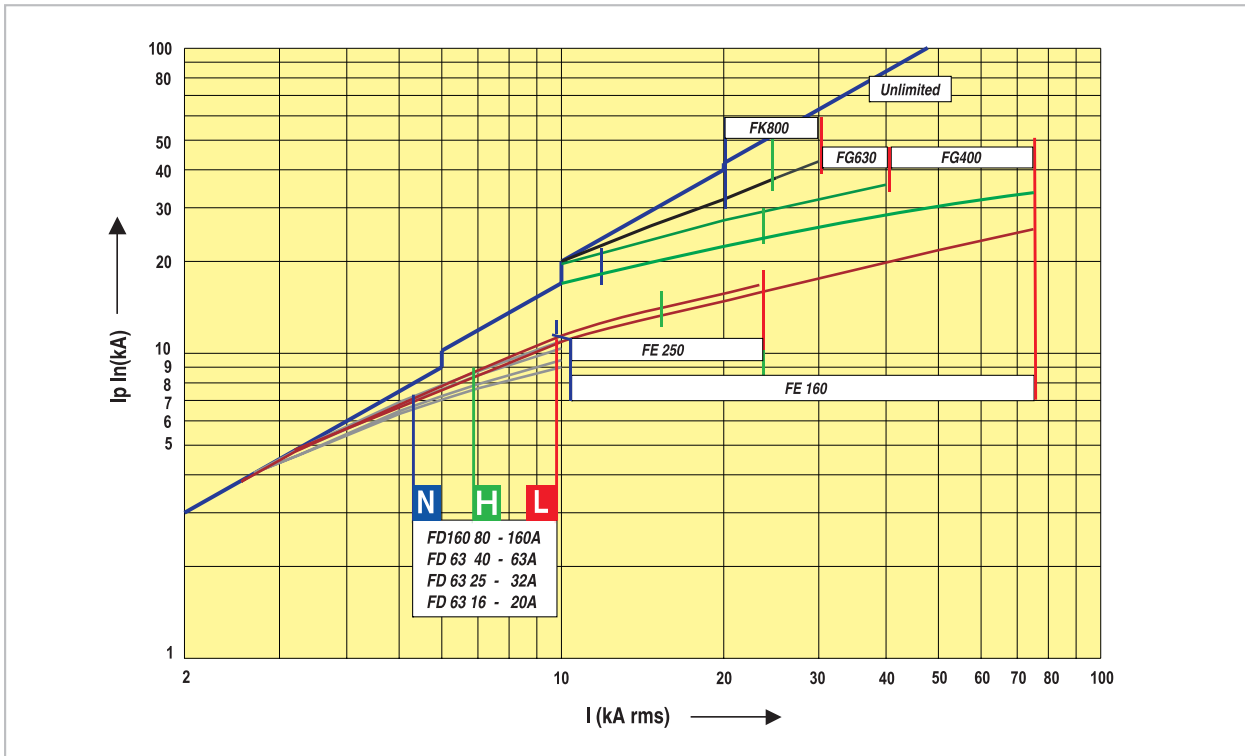
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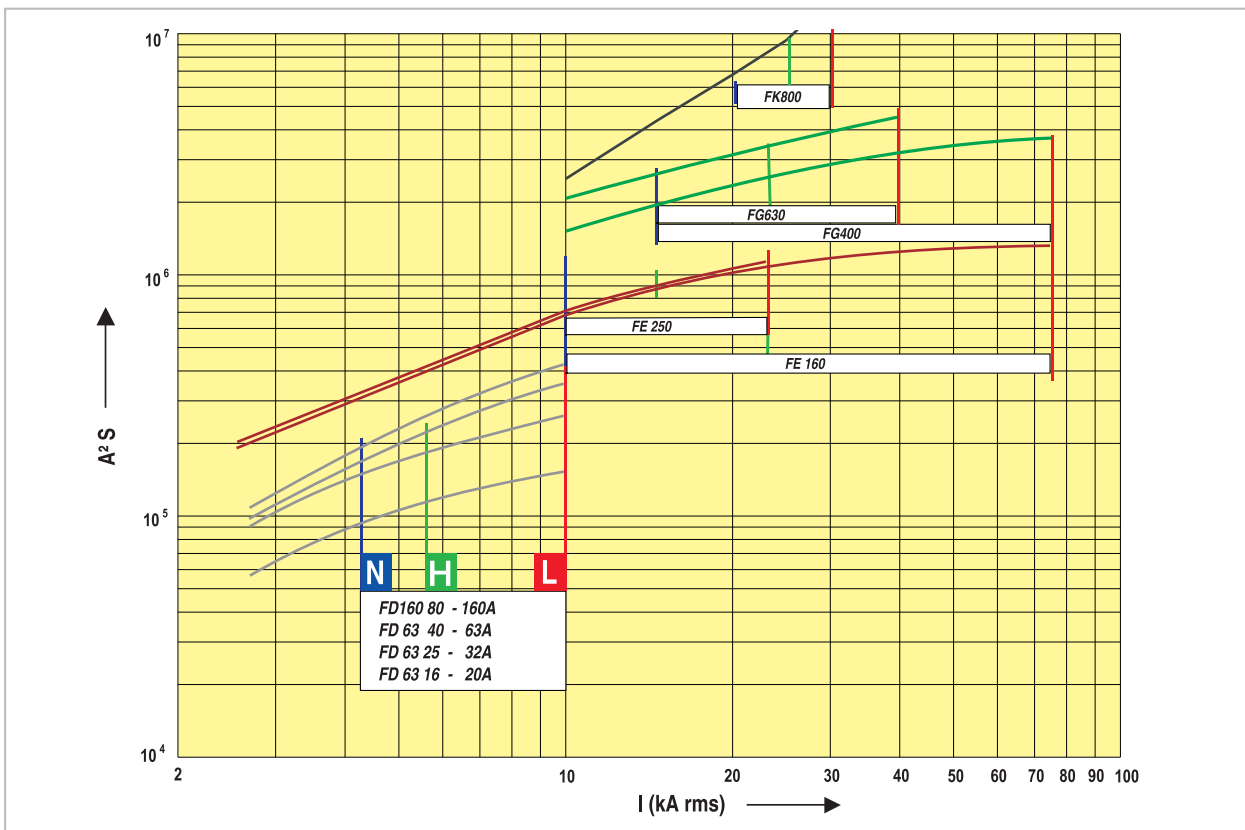
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Current limitation data at 690V



Thermal stress (Energy) Limitation data at 690V



Intro

A

B

C

D

E

F

G

X

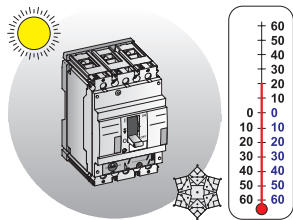


Environmental considerations

Ambient temperature

Record Plus™ breakers are designed to operate normally at temperatures of -20 degrees to +70°C. Above 40°C derating factors must be applied for two basic reasons:

- To prevent the materials used to construct the device from reaching temperatures that have an adverse effect on their mechanical and/or electrical properties.
- When the breakers is equipped with a thermal magnetic protection device the bimetal in the device will react to the heat generated by the current flowing through the device. Typical for this kind of device is that its reaction time speeds up at higher ambient temperatures.



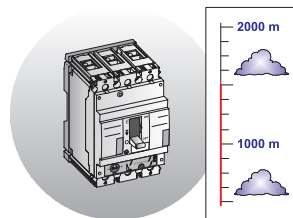
To achieve the same reaction time on a set current value it becomes necessary to derate.

The time current curves published in this catalogue are always valid for operating temperatures between 10 and 40°C.

Storage temperature

A **Record Plus™** breaker is able to withstand non-operational storage temperature ranges of -40 to +85°C.

Influence of altitude

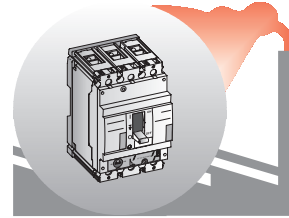


Up to altitudes of 2000 m above sea level no derating of breaker current or rated voltage is applicable. For altitudes above 2000 m the following factors apply:

Altitude

Altitude (meters)	3000m	4000m	5000m
Ue max. (Volts)	550V	480V	420V
Max. Thermal current at 40°C	0.98 x In	0.93 x In	0.9 x In

Other atmospheric conditions



The breaker is designed to operate at the temperatures and relative humidities defined in the EN 60947 clause 6.1.3.1. It also meets the following standards:

IEC 68-2-1	Cold
IEC 68-2-2	Dry heat
IEC 68-2-11	Salt
IEC 68-2-14	Change of temperature
IEC 68-2-27	Shock test
IEC 68-2-29	Bump
IEC 68-2-30	Damp heat cyclic
IEC 68-2-31	Drop
MIL810F	Humidity

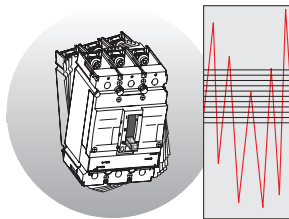
Shock & vibration

The **Record Plus™** line has been designed to withstand shock and vibration to the following standards:

IEC 68-2-6
Lloyd's Register of Shipping
Bureau Veritas
JIS 8370

More specifically: **Record Plus™** passed the following electro-mechanical tests:

Functions normally while being subjected to 30 minutes of random vibration with a power spectral density of 0.29g²/Hz in the range of 5Hz to 500Hz (3dB corner points, ±20dB/decade rolloff), this over three axes.



Functions normally while being subjected to sinusoidal vibration of 5g Peak from 10Hz to 500Hz using 30 minute sweeps with additional 30 minute dwells at the three greatest resonance points in this frequency range, this over three axes.

points in this frequency range, this over three axes.

The product is shock resitant and can withstand the following impacts in any possible orientation:

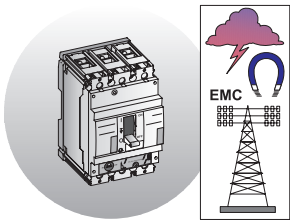
20g, 6ms, 10g, 11ms

Electromagnetic compatibility

Meets the most stringent requirement of the EN 60947-2 and IEC 1000-4. The breaker and electronic trip unit have passed the following tests.

Harmonics, current dips, interruptions and power frequency variations.

EN 60947-2 Annex F, Sub-clause F4.1 through 3
All requirements of non-sinusoidal currents resulting from harmonics are met i.e:



- Wave form consisting of a fundamental component + 3rd harmonic component at 50 and 60Hz
- Wave form consisting of a

fundamental component + a 5th harmonic component at 50 and 60Hz

- Composite wave form with a fundamental component + 3rd, 5th & 7th and a harmonic at 50 and 60Hz
- All current dips and current interruptions are met.
- Frequency variation test from 45Hz to 65Hz in 1Hz steps (required 50Hz to 60Hz in 1Hz steps)

Electrostatic discharge

EN 70947 Annex F, Sub-clause F6 and the IEC 1000-4-2 (basic standard)

- Passed level 4 air discharge 15kV

Radiated, radio frequency, electromagnetic field immunity test

EN 60947-2 Annex F, Sub-clause F7 and the IEC 1000-4-3 (basic standard)

- Passed higher than level 4.....field strength 30V/m

Electrical fast transient/burst

EN 60947-2 Annex F, Sub-clause F5 and the IEC 1000-4-4 (basic standard)

- Passed level 4 burst peak voltage 4kV

Surge immunity test

EN 60947-2 Annex F, Sub-clause F5 and the IEC 1000-4-5 (basic standard)

- Passed level 4 Voltage 1.2μs/50μs 6kV; current 8μs/20μs 3kA

Dry heat test

EN 60947-2 Annex F, Sub-clause F8

- Passed all test requirements

Thermal shock test

EN 60947-2 Annex F, Sub-clause F9

- No nuisance tripping within the 28-day temperature cycles

Use in DC networks

In both AC and DC networks protective devices are required to interrupt the prospective short-circuit current at the point where the device is installed. For circuit breakers as the **Record Plus™** this value is called the interruption or breaking capacity (I_{cu} or I_{cs}), a value dependent not only on the prospective fault current value but also on the system voltage rating. For DC networks the situation is basically the same as for AC networks.

However, the system voltage generally plays a greater role (is more difficult to interrupt) while the network defines how many poles need to participate in the interruption. The drawing below indicates the three possible DC networks with the "worst" short-circuit for each of them, the number of poles that must participate in the breaking operation and the voltage level that needs to be interrupted.

Use in DC networks

Network Type	Center point connected to earth (A)	One pole connected to earth (B)	Insulated from earth (C) ⁽¹⁾
Electrical schemes			
Maximum short-circuit current (I_{cc} max)	short-circuit A-B	short-circuit A-B or A-C	short-circuit A-B
Minimum poles needed	2 (one on each polarity)	1 (unearthed polarity)	2 (one on each pole)
Breaking capacity on each pole	I_{cc} max at $V/2$	I_{cc} max at V	I_{cc} max at V

(1) When a pole is grounded due to a first fault nothing happens, on a second fault the network behaves like a system with "one polarity connected to ground"

Record Plus™ FD, FE, FG and FK line breakers can be used in DC networks with standard thermal magnetic trip units.

For **Record Plus™** FG line breakers, please contact us. The nominal current rating of the device does not vary in AC or DC applications. The setting of the short-circuit or magnetic device needs to be multiplied by 1.2 to determine its threshold in a DC network.

The table indicates the nominal current, the breaking capacity ($I_{cu}=I_{cs}$) and the number of poles needed to participate in the interruption.

Example

Rated voltage 500V DC; Rated current 200A I_{cc} max 50kA

network A: center point connected to ground

FE250N 3x 250 - 1pole for each polarity

network B: one pole connected to ground

FE250N 3x 250 - 2poles on unearthed polarity.

network C: insulated network

FE250N 3 x 250 - 1 pole on each polarity

Use in DC networks with standard thermal magnetic trip units

Breaker	Rated current	110V DC	250V DC	440V DC	500V DC	Thermal threshold	Magnetic threshold
FD160S	16÷160	25 (1p)	25 (1p)	25 (3p)	-	= AC	1.2
FD160N	16÷160	40 (1p)	40 (1p)	40 (2p)	40 (2p)	= AC	1.2
FD160H	16÷160	65 (1p)	65 (1p)	65 (2p)	65 (3p)	= AC	1.2
FD160L	16÷160	100 (1p)	100 (1p)	100 (3p)	100 (3p)	= AC	1.2
FE160N	25÷160	50 (1p)	50 (1p)	50 (2p)	50 (2p)	= AC	1.2
FE160H	25÷160	85 (1p)	85 (1p)	85 (2p)	85 (3p)	= AC	1.2
FE160L	25÷160	100 (1p)	100 (1p)	100 (3p)	100 (3p)	= AC	1.2
FE250V	125÷250	25 (1p)	25 (1p)	25 (2p)	-	= AC	1.2
FE250N	125÷250	50 (1p)	50 (1p)	50 (2p)	50 (2p)	= AC	1.2
FE250H	125÷250	85 (1p)	85 (1p)	85 (2p)	85 (3p)	= AC	1.2
FE250L	125÷250	100 (1p)	100 (1p)	100 (3p)	100 (3p)	= AC	1.2
FG400N							
FG400H							
FG400L							
FK800N	500÷800	50 (1p)	50 (2p)	36 (3p)	36 (3p)	= AC	1.2
FK800H	500÷800	60 (1p)	60 (2p)	60 (3p)	60 (3p)	= AC	1.2
FK800L	500÷800	80 (1p)	80 (2p)	80 (3p)	80 (3p)	= AC	1.2
FK1250N	640÷1250	50 (1p)	50 (2p)	36 (3p)	36 (3p)	= AC	1.2
FK1250H	640÷1250	60 (1p)	60 (2p)	60 (3p)	60 (3p)	= AC	1.2
FK1250L	640÷1250	80 (1p)	80 (2p)	80 (3p)	80 (3p)	= AC	1.2

Use at frequencies other than 50/60 cycles

Performance characteristics of protective devices used in electrical distribution networks or systems vary according to the network's rated frequency. The **Record Plus™** family of circuit breakers is designed to offer their best performance at 50/60 Hz network.

The breakers can be used at 16 2/3 (applications in rail transport) and 400hz (aviation) if the following is taken into account:

- a) **The rated breaking capacity is decreased ⁽¹⁾**
- b) **The device trip unit settings are modified**

Here the correct setting of the trip unit is vital to ensure that the circuit breaker performs well in the electrical distribution network.

Thermal magnetic trip units

Record Plus™ breakers and their trip units can be used at 16 2/3 Hz and 400 Hz provided that the trip units are set accordingly. The table indicates the coefficients to be applied for 16 2/3 Hz and 400 Hz applications.

- Kt (for thermal)
- Km (for magnetic)

The current values for each environment can be calculated by multiplying the values set on the breaker by the coefficients mentioned in the tables.

Electronic (SMR1) trip units

The breakers and their trip units can be used at 400 Hz (aircraft) provided that the trip units are set accordingly.

The table indicates the coefficients to be applied for 16 2/3 Hz and 400 Hz applications.

- Kt (for LT)
- Km (for ST)

The current values for each environment can be calculated by multiplying the values set on the breaker by the coefficients mentioned in the tables.

Use in networks with a frequency of 16 2/3 and 400 cycles

Breaker	Rated current	Trip Unit type	Thermal or LT settings		Magnetic or ST settings	
			Kt ₁₆ (16 2/3Hz)	Kt ₄₀₀ (400 Hz)	Km ₁₆ (16 2/3Hz)	Km ₄₀₀ (400 Hz)
FD160N, H or L	3÷160	LTMD, GTM or MO	1	0.9	0.8	1.6
FE160N, H or L	8÷63	LTM, LTMD, GTM or MO	1	0.95	0.8	1.6
FE160N, H or L	64÷160	LTM, LTMD, GTM or MO	1	0.9	0.8	1.6
FE250N, H or L	80÷250	LTMD, GTM or MO	1	0.9	0.8	1.6
FE160N, H or L	10÷125	SMR1	1	1	1	1
FE160N, H or L	160	SMR1	1	0.9	1	1
FE250N, H or L	40÷125	SMR1	1	1	1	1
FE250N, H or L	64÷250	SMR1	1	0.9	1	1
FG400N, H or L	100÷400	SMR1	1	0.8	1	1
FG630N, H or L	160÷630	SMR1	1	0.8	1	1
FK800N, H or L	320÷800	LTM	1	0.6	1	1
FK1250N, H or L	400÷1250	LTM	1	0.6	1	1

Example

A FE160N with LTMD 160A trip unit in a 400 Hz network:
(from the table Kt₄₀₀ = 0.9 / Km₄₀₀ = 1.6)

If Ir is set at 160A and Im set at 1200A the real thermal threshold is 160 x 0.9 = 144A at 40°
Thus the current in the circuit may not exceed this value
Im = 1200 ≥
the real magnetic threshold is 1120 x 1.6 = 1920A

(1) Please consult us.



Just rel

- E.2 Introduction
- E.4 Protection against short-circuit
- E.8 Personnel protection (direct and indirect contact)
- E.16 Selectivity/Discrimination
- E.22 Back-up protection
- E.25 Selectivity Plus
- E.29 Coordination with loadbreak disconnect switches
- E.30 Protection of motor circuits (coordination type 2)
- E.38 Protection of LV/LV transformer
- E.39 Protection of capacitor banks

The breaker

Intro

Order codes

A

Trip units

B

Components & Accessories

C

Technical data

D

Application guide**E**

Wiring diagrams

F

Dimensions

G

Numerical Index

X

yon on us



Introduction

A protection device like the **Record Plus™** circuit breaker is used in a wide variety of environments to protect conductors, equipment and devices in low voltage distribution circuits. To use this product to its full potential it is necessary to verify that it functions correctly in the environment in which it is used and that it meets the Electrotechnical requirements of the circuit it protects.

Environment

Record Plus™ breakers function well in almost any industrial environment. The IEC 60947 defines the main aspects of what is meant by "industrial environment":

- Temperature:
- Relative humidity:
- Altitude:
- Pollution:
- Network harmonic content:
- Shock and vibration resistance:

For conditions other than the above mentioned please refer to page D.16 in which the effects of the environment are defined.

Maximum short-circuit current

Protective devices as the **Record Plus™** circuit breaker must be able to interrupt the maximum short-circuit current at the point where they are installed.

The interruption ratings or breaking capacities of these breakers can be found in section D of this catalogue. The short-circuit ratings at the point of installation of these devices can be determined by the use of software as Procera plus. A method to calculate these values conventionally is described on page E.4 and E.5 of this catalogue.

Design current of a circuit

The equipment and devices in an electrical circuit determines its current load. The electrical conductor cross sections that can be used in the circuit are determined by a number of factors i.e.

- The design current of the circuit (I_B).
- Conductor type and its insulation.
(current capacity = I_Z)
- Installation method.
- Temperature.
- Number of conductors mounted in each others vicinity.

The resulting combinations of current load and electrical conductor cross sections are beyond the scope of this catalogue, however a number of frequently used values are:

Conductor cross section	10mm ²	25mm ²	50mm ²	70mm ²	95mm ²
I_B with Cu conductors in A	50	90	130	170	210
I_B with AL conductors in A	35	70	100	130	160

(1) In certain specific cases deviations are allowed.

Phase and Neutral conductors

Clause 431.1⁽¹⁾ of the IEC 60364 states that overcurrent detection and disconnection shall be provided for all live conductors.

In TN & TT systems no neutral overcurrent protection is required if the neutral cross section is at least equivalent to that of the line conductors and the current is not expected to exceed that in the line conductors.

However, if this condition is not met a neutral current detection device is required that disconnects the line protection devices on the detection of a fault.

For IT systems where the neutral is distributed (NOT recommended) each circuit shall be provided with a line and neutral overcurrent protection and disconnection device.⁽¹⁾

Harmonic currents

Clause 431.2.3 of the IEC 60364 requires that if the harmonic content of the line currents is such that a current in the neutral is expected that exceeds the neutrals current carrying capacity, overcurrent detection is required. The detection shall be compatible with the nature of the current in the neutral and shall cause disconnection of the line conductors.

Breaker parameters

Record Plus™ breakers are available equipped with 3 or 4 pole overload detection, protection and interruption devices. Multiple Neutral protection modes being available. In 4 pole devices the neutral pole always operates simultaneously with those present in the phases.

Each breaker has a minimum of two protection devices:

- Overload Protection Device.
(In electronic devices - LT setting)
- Short Circuit Protection Device.
(In electronic devices - ST or I setting)

Electronic Trip Units have extended protection features including:

- LT or Overload Protection device.
 - ST or Time delayed Short Circuit Protection device.
 - I or Instantaneous Short Circuit Protection device.
- Optionally
- Gfsum. or Residual current operated protection device

All **Record Plus™** breakers can be equipped with an externally linked Residual Current device.

Overload or LT setting

Referred to as Ir in the IEC 60364 the setting is determined by the use of two following formulae.

$$I_B < I_r \leq I_Z$$

$$I_t \leq 1.45 \times I_Z$$

Terminology

- I_B = Circuit design current
- I_r = Current set on breaker
- I_Z = Current carrying capacity of electrical conductor
- I_t = Tripping current of the protection device
(**Record Plus™** MCCB $I_t \leq 1.3 \times I_r$)

Use of the above mentioned formulae and the **Record Plus™** characteristics give the following results:
Breaker setting $I_r \leq I_Z$ ($I_t \leq 1.3 \times I_Z$)
In practice I_r is generally set at a value equal to I_Z .



Magnetic setting (Im) or ST setting Protected Equipment

The magnetic or ST setting of a breaker (Im) is primarily defined by the characteristics of the equipment and devices in the circuit.

The **Record Plus™** device is equipped with trip units that react to fault currents when needed but are specifically designed not to react to most inrush-current profiles. The details included in this section on devices as LV/LV transformers and the time current curves of the breaker published elsewhere in this catalogue allow a definition of the **Im** value.

Instantaneous setting (I) on Electronic breakers

All Electronic **Record Plus™** breakers are equipped with this protection device that on detection of a short-circuit exceeding its set value trip the breaker immediately. The device has a fixed setting on all SMR1 devices and can be adjusted on all SMR2 trip unit types. It is primarily used to limit the electrical energy level in the circuit (vs. the timed short-circuit setting ST).

Magnetic setting (Im) or ST setting Protected Lines

On a short-circuit event the total circuit impedance determines the highest and the lowest current that can flow in the circuit. It is necessary not only to verify if the protective device can interrupt the maximum short-circuit value but also if the device protecting the circuit reacts and disconnects in time at the lowest possible short-circuit value.

Due to the fact that a major part of the circuit impedance is formed by electrical conductors like cables, busbar systems etc. within the circuit, this requirement has a limiting effect on the length of the conductors used in the circuit.

There are two conditions that have to be met:

- The weakest short-circuit current must be disconnected before the electrical conductors exceed their temperature limits.
 - A current to earth (fault current) must be disconnected before inadvertent contact to normally non-conductive parts causes injury.
- Please refer to the pages E.6 and E.13 for more details.

Ground Fault setting (GF) on Electronic breakers

All larger Electronic **Record Plus™** breakers can be optionally equipped with a GF sum device that operates on a Residual Current principle.

It 'sums' the values of the secondary circuits in the installed sensors in both the lines and Neutral pole and sends an alarm or trip signal when this value is \leq to zero and exceeds the adjusted values.

This device allows the user to set a 'fault' current value (Id) ranging from 0.2 to 1 times the breaker sensor rating and a trip time delay.

Where the standard breaker settings are insufficient a GFsum device allows the detection of low short-circuit values as the weakest short-circuit current and/or a current to earth (Fault Current).

IdN setting on Residual Current Devices

All **Record Plus™** breakers can be optionally equipped with a Residual Current Device (RCD). The device 'sums' the values of the primary circuits in both the lines and Neutral pole by using a summing CT placed around all live conductors and the neutral (when present). If the sum differs from zero and exceeds a pre-defined current value and time span the device trips the associated breaker.

This device can be set at a current value (IdN) of 30, 300, 1000, 3000 or 10000 mA and a trip time delay.

Where the standard breaker settings are insufficient an RCD can be used to detect low short-circuit values as the weakest short-circuit current and/or a current to earth (Fault Current).

Intro

A

B

C

D

E

F

G

X

Protection against short-circuits

Maximum short-circuit ratings

Protective devices as the **Record Plus™** circuit breaker must be able to interrupt the maximum short-circuit current at the point where they are installed.

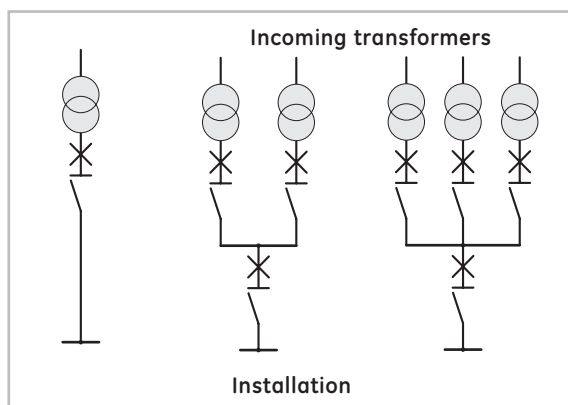
The interruption ratings of these breakers (breaking capacity) can be found elsewhere in this catalogue.

For the calculation of the short-circuit current at the point where the breaker is installed a pan-European document is now available in the form of the R064-003.

The values published here are based on this document.

Power supply

The values mentioned in table indicate the effective values of the highest three phase short-circuit current that is available at the connection terminals of the incoming transformer(s).



Formulas

Medium voltage impedance

$$Z_Q = \frac{(m \times U_0 \times \sqrt{3})^2}{S_{kQ}} \text{ m}\Omega$$

MV/LV transformer impedance

$$Z_r = \frac{(m \times U_0 \times \sqrt{3})^2}{S_{rT}} \times \frac{U_{kr}}{100\%} \text{ m}\Omega$$

Maximum short-circuit calculation

$$I_{k3max} = \frac{(C_{max} \times m \times U_0 \times \sqrt{3})^2}{\sqrt{R^2 + X^2}} \text{ kA}$$

Calculated maximum short-circuit values (3 phase 400V network)

MV/LV Transformer(s)	S _{rT} kVA	U _{kr} %	Medium Voltage power S _{kQ} in MVA					
			100	150	200	300	400	500
			Maximum short-circuit Values in kA (I _{k3max})					
100	4	3.5	3.6	3.6	3.6	3.6	3.6	3.6
160	4	5.6	5.7	5.7	5.7	5.7	5.7	5.8
250	4	8.5	8.7	8.8	8.9	8.9	8.9	9.0
315	4	10.6	10.9	11.0	11.1	11.1	11.2	11.2
400	4	13.2	13.6	13.8	14.0	14.2	14.2	14.2
500	4	16.2	16.8	17.1	17.4	17.6	17.7	17.7
630	4	19.8	20.7	21.2	21.7	22.0	22.2	22.2
630	5	16.3	16.9	17.2	17.6	17.7	17.8	17.8
630	6	13.8	14.3	14.5	14.7	14.8	14.9	14.9
800	6	17.1	17.8	18.2	18.5	18.7	18.8	18.8
1000	6	20.8	21.8	22.3	22.9	23.2	23.4	23.4
1250	6	25.1	26.6	27.4	28.3	28.7	29.0	29.0
1600	6	30.6	32.9	34.2	35.6	36.3	36.8	36.8
2000	6	36.4	39.7	41.6	43.6	44.7	45.4	45.4
2500	6	42.9	47.5	50.2	53.2	54.8	55.9	55.9
2 x 400	4	24.2	25.7	26.4	27.2	27.7	27.9	27.9
2 x 500	4	29.1	31.2	32.3	33.5	34.2	34.6	34.6
2 x 630	4	34.9	37.9	39.6	41.4	42.4	43.0	43.0
2 x 630	5	29.3	31.4	32.5	33.8	34.4	34.8	34.8
2 x 630	6	25.3	26.8	27.6	28.5	29.0	29.3	29.3
2 x 800	6	30.6	32.9	34.2	35.6	36.3	36.8	36.8
2 x 1000	6	36.4	39.7	41.6	43.6	44.7	45.4	45.4
2 x 1250	6	42.9	47.5	50.2	53.2	54.8	55.9	55.9
2 x 1600	6	50.7	57.3	61.3	65.9	68.4	70.0	70.0
2 x 2000	6	58.3	67.3	72.8	79.4	83.1	85.5	85.5
2 x 2500	6	66.3	78.1	85.7	94.9	100.3	103.9	103.9
3 x 400	4	33.6	36.4	37.9	39.6	40.5	41.1	41.1
3 x 500	4	39.7	43.7	45.9	48.5	49.8	50.7	50.7
3 x 630	4	46.8	52.3	55.6	59.4	61.4	62.7	62.7
3 x 630	5	40.0	43.9	46.2	48.8	50.2	51.0	51.0
3 x 630	6	34.9	37.9	39.6	41.4	42.4	43.0	43.0
3 x 800	6	41.6	46.0	48.5	51.3	52.8	53.8	53.8
3 x 1000	6	48.6	54.6	58.2	62.3	64.6	66.0	66.0
3 x 1250	6	56.1	64.3	69.3	75.3	78.6	80.8	80.8
3 x 1600	6	64.8	76.1	83.3	91.9	97.0	100.3	100.3
3 x 2000	6	72.9	87.5	97.2	109.2	116.4	121.2	121.2
3 x 2500	6	81.0	99.4	112.1	128.6	138.7	145.6	145.6

Terminology

S_{kQ} = short-circuit power of the medium/high voltage network
 S_{rT} = power rating of the MV/LV transformer
 U_{kr} = short-circuit voltage in %, according to HD 398

m = no load factor; 1.05 assumed
 C_{max} = voltage factor; 1.05 assumed
 U₀ = phase to neutral voltage
 I_{k3max} = maximum 3 phase short-circuit current
 X = total reactance
 X_Q = 0.995 × Z_Q
 X_T = 0.95 × Z_T
 R = total resistance
 R_Q = 0.1 × X_Q
 R_T = 0.31 × Z_T

Influence of cable runs

It is possible to calculate short-circuit values within circuits by determining the impedance, reactance and resistance of the power supply and by adding those of cable runs. These values are used here to calculate the maximum short-circuit levels at the end of a defined cable run.

Values used

Specific resistance of copper and aluminum at 20°C

$$\rho_0 = 18.51 \text{ m}\Omega \text{ mm}^2/\text{m. for copper cores}$$

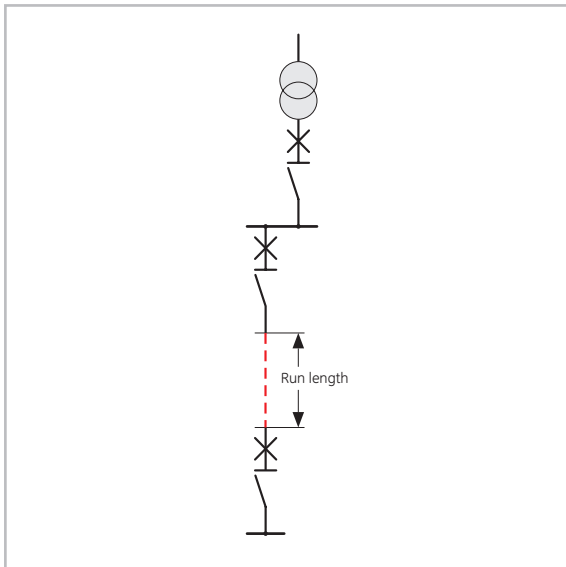
$$29.41 \text{ m}\Omega \text{ mm}^2/\text{m. for aluminum cores}$$

Reactance of multicore cables λ 0.08 m Ω /m.

Examples

$I_{k3 \text{ max.}}$ at cable run start 50kA
 54 meters of 185 mm² cable
 $I_{k3 \text{ max.}}$ at cable run end 22kA

$I_{k3 \text{ max.}}$ at cable run start 120kA
 12 meters of 185 mm² cable
 $I_{k3 \text{ max.}}$ at cable run end 80kA



Short-circuit values within circuits

$I_{k3 \text{ max.}}$ without cable run	$I_{k3 \text{ max.}}$ in kA at point where Record Plus™ MCCB is to be installed (This value must be $\leq I_{cu}$ or I_{cs})									
145	80	65	50	30	25	22	20	15	10	6
140	80	65	50	30	25	22	20	15	10	6
130	80	65	50	30	25	22	20	15	10	6
120	80	65	50	30	25	22	20	15	10	6
110	80	65	50	30	25	22	20	15	10	6
100	65	65	50	30	25	22	20	15	10	6
90	65	65	50	30	25	22	20	15	10	6
80	65	50	50	30	22	20	20	15	10	6
70	65	50	50	25	22	20	20	15	10	6
60	50	50	50	25	22	20	20	15	10	6
50	50	36	36	22	20	20	20	15	10	6
45	50	36	30	22	20	20	20	15	10	6
40	36	36	30	20	20	20	15	15	10	6
35	30	30	25	20	20	15	15	15	10	6
30	30	25	22	20	20	15	15	15	10	6
25	22	22	20	15	15	15	15	10	10	6
20	-	-	-	15	15	15	15	10	10	6
15	-	-	-	-	-	10	10	10	10	6
10	-	-	-	-	-	-	-	6	6	6

Cable cross section Cu mm ²	AL mm ²	Required minimum length in meters of cable run of the mentioned cross section to achieve the $I_{k3 \text{ max.}}$ mentioned above									
		0.5	0.5	0.5	1	1	1	1	1.5	2	3.5
1.5		0.5	0.5	0.5	1	1	1	1	1.5	2	3.5
2.5	4	0.5	0.5	0.5	1	1.5	1.5	1.5	2	3.5	5.5
4	6	0.5	0.5	1	1.5	2	2.5	2.5	4	5	9
6	10	1	1	1.5	2.5	3	3.5	3.5	5	8	13
10	16	1	2	2	4	5	5.5	6	8	13	21
16	25	1.5	2.5	3.5	6	8	9	10	13	20	35
25	35	2.5	4	5	9	12	13	15	20	32	55
35	50	3	4	7	13	16	18	20	28	42	70
50	70	4	6	9	18	22	25	29	39	60	100
70	95	6	8	12	24	30	35	40	55	85	135
2 x 35	2 x 50	6	8	13	25	32	36	40	55	85	140
95	150	7	11	16	32	39	46	51	70	110	180
2 x 50	2 x 70	8	12	18	35	44	52	58	80	120	200
120	185	9	13	19	38	48	55	62	85	130	220
150	240	10	15	23	46	58	66	75	100	155	255
2 x 70	2 x 95	11	16	24	50	60	70	80	110	170	270
185		12	18	27	54	65	76	84	116	180	300
240		14	21	32	62	78	88	98	135	210	340
2 x 95	2 x 150	14	21	32	65	80	95	105	140	220	360
300		16	24	35	70	85	100	110	150	230	380
2 x 120	2 x 185	17	27	42	80	95	110	125	170	260	430
2 x 150		20	30	48	91	115	135	150	200	310	510
3 x 95	3 x 150	21	33	51	95	120	140	155	210	320	540
2 x 185		23	35	53	105	130	155	170	235	360	590
3 x 120		25	38	57	115	145	165	185	255	390	645
2 x 240		28	41	62	125	155	180	200	270	410	675
3 x 150	3 x 240	30	45	68	140	170	200	220	300	460	765
3 x 185		35	53	79	160	195	230	255	350	530	880
3 x 240		41	60	125	185	230	265	295	410	620	

Intro

A

B

C

D

E

F

G

X



Protection against short-circuits

Weakest short-circuit current

It is necessary to verify that the permissible thermal stress in conductors is not exceeded at the maximum short-circuit level and at the weakest short-circuit level. Verification on the maximum short-circuit level is described on page E.4 of this catalogue. For the weakest short-circuit value it is necessary to verify that the protective devices as the **Record Plus™** circuit breaker trips before the conductors reach the mentioned limits, this for operating times of 0.1 to 5 seconds.

Permissible thermal stress in conductors

Clause 434.5.2 of the IEC 60364 4d. 03 - 2008 defines that for interruption times between 0.1 and 5 seconds, the following formula applies:

$$t = (k \cdot S / I)^2 \text{ or it's equivalent } k^2 S^2 = I^2 t$$

Terminology

- t** = duration of the short-circuit in seconds
- k** = factor provided by the standard; depending on the material the conductor is made of and its insulation
- S** = cross section of the conductor
- I** = effective short-circuit current. (r.m.s value)

The tables included here indicates the factor k for conductors with different insulation materials and the calculated energy values ($K^2 S^2$ values in A^2s).

Record Plus Circuit breaker application

To meet this condition it is necessary to verify if the I^2t value of the protection device is lower than or equal to the $K^2 S^2$ value of the used conductors for interruption times between 0.1 and 5 seconds.

K factors in accordance with the IEC 60364-4-43 ed.03

Insulation & maximum temperature	Copper (Cu)	Aluminium (Al)
PVC - 70° < 300 sq.mm	115	76
PVC - 70° ≥ 300 sq.mm	103	68
PVC - 90° < 300 sq.mm	100	86
PVC - 90° ≥ 300 sq.mm	86	57
XLPE & EPR 90°	143	94
Rubber 60°	141	93
Mineral, bare unsheathed 105°	135 or 115 ⁽¹⁾	-

(1) The 115 value is be used for conductors exposed to touch.

Under normal conditions it is assumed that the current setting of the Magnetic or ST device and the associated tripping time is used to verify if this condition is met. This current value can be used to verify if the breaker trips on the weakest short-circuit current.

In certain cases (specifically with Electronic Trip Units) a lower current level with an interruption time of 5 seconds can be assumed.

Weakest short-circuit current calculations

For the most commonly applied network configuration, 3 phase with neutral, the weakest short-circuit is the Phase to Neutral value.

The network configuration determines the value of this current. Cases where the Phase to Earth or two Phase value is the weakest are also commonplace.

Basically, the weakest short-circuit current is determined by the highest impedance loop in the circuit that the breaker is protecting.

The impedance of this loop is mainly determined by the conductors included in the circuit, thus their maximum length is limited. An approximation of the effect of the conductor or cable length on the weakest short-circuit is possible by using the following formula:

$$I_{kmin} = 0.8 \times \frac{C_{min} \times U_0}{\sqrt{R^2 + X^2}} \times k_1 \times k_2 \times k_3 \text{ Amp}$$

Terminology

- I_{kmin}** = Weakest short-circuit current
- 0.8** = Assumed factor for the impedance of the upstream network
- C_{min}** = Voltage factor; 0.95 assumed
- U₀** = Phase to neutral voltage
- X** = Reactance of the conductors or cables in the circuit
reactance of multi core cables X in mΩ/m 0.08
- R** = Resistance of the conductors or cables in the circuit based on the following basic data: (warm state)
22.069 mΩ mm²/m. for copper cores⁽²⁾
37.178 mΩ mm²/m. for aluminium cores⁽²⁾
- k₁, k₂ k₃** = Correction factors, see next page

(2) = 1.28 x 17.241 and 1.28 x 28.264 (see IEC 60364-4-43)

Maximum permissible thermal stress in Conductors for operating times from 0.1 to 5 seconds

Insulation	Core	Cross section in sq. mm & maximum permissible thermal stress in A ² s															
		1.5	2.5	4	6	10	16	25	35	50	70	95	120	150	185	240	300
		x10 ⁴	x10 ⁴	x10 ⁴	x10 ⁴	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁶	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸	x10 ⁸
PVC - 70°	Cu	2.976	8.266	21.160	47.610	1.323	3.386	8.266	16.201	33.063	0.648	1.194	1.904	2.976	4.526	7.618	9.548
	Al	1.300	3.610	9.242	20.794	0.578	1.479	3.610	7.076	14.440	0.283	0.521	0.832	1.300	1.977	3.327	4.162
PVC - 90°	Cu	2.250	6.250	16.000	36.000	1.000	2.560	6.250	12.250	25.000	0.490	0.903	1.440	2.250	3.423	5.760	6.656
	Al	1.664	4.623	11.834	26.626	0.740	1.893	4.623	9.060	18.490	0.362	0.667	1.065	1.664	2.531	4.260	2.924
XLPE & EPR 90°	Cu	4.601	12.781	32.718	73.616	2.045	5.532	12.781	25.050	51.123	1.002	1.846	2.945	4.601	6.999	11.779	17.893
	Al	1.988	5.523	14.138	31.810	0.884	2.262	5.523	10.824	22.090	0.433	0.797	1.272	1.988	3.024	5.090	7.784
Rubber 60°	Cu	4.473	12.426	31.810	71.572	1.988	5.090	12.426	24.354	49.703	0.974	1.794	2.863	4.473	6.804	11.451	17.893
	Al	1.946	5.406	13.838	31.136	0.865	2.214	5.406	10.595	21.623	0.424	0.781	1.245	1.946	2.960	4.982	7.784
Mineral bare 105° k=135	Cu	4.101	11.391	29.160	65.610	1.823	4.666	11.391	22.326	45.563	0.893	1.645	2.624	4.101	6.238	10.498	16.403
Mineral bare 105° k=115	Cu	2.976	8.266	21.160	47.610	1.323	3.386	8.266	16.201	33.063	0.648	1.194	1.904	2.976	4.526	7.618	11.903



Maximum conductor length

To meet the requirements the short-circuit device of the circuit breaker (Im) must react to the weakest short-circuit current. The table indicates the maximum cable length where this condition is still met.

The tolerances on the settings of the short-circuit device in the breaker are taken into account (factor included in calculations of 1.2).

Correction factors k

For a 3 phase circuit with no neutral and a voltage of 400V between phases:

$$k1 = 1.74$$

For a single phase circuit with neutral and a voltage of 230V between phase and neutral:

$$k1 = 1.00$$

For a 3 phase circuit with neutral, a voltage of 400V between phase and a neutral with 0.5 x the phase cross section:

$$k1 = 0.67$$

For a number of multi-core cables in parallel

$$k2 \text{ for 2 cores} = 2.00$$

$$k2 \text{ for 3 cores} = 2.65$$

For multicore cables with conductors made of aluminum:

Cu conductor Cross section S in mm ²	k3
= 4 ≤ 50	0.63
70	0.64
95	0.65
120	0.66
150	0.67
185	0.69
240	0.72
300	0.76

Maximum Cu conductor length in meters based on a Phase to Neutral voltage (Uo) of 230V and valid for multicore conductors with stress calculations based on a k of 100

(Areas in grey indicate that stress requirements are exceeded)

Cross section S in mm ²	Disconnection time (s)	Record Plus™ Im or ST setting in Amps & conductor length in Meters										
		50	75	100	125	150	175	200	250	300	350	400
1.5	0.10	99	66	50	40	33	28	25	20	17	14	12
2.5	0.10	165	110	83	66	55	47	41	33	28	24	21
4	0.10	264	176	132	106	88	75	66	53	44	38	33
6	0.10	396	264	198	158	132	113	99	79	66	57	49
10	0.10	660	440	330	264	220	188	165	132	110	94	82
16	0.10	1054	703	527	422	351	301	264	211	176	151	132
25	0.50	1643	1096	822	657	548	470	411	329	274	235	205
35	0.50	2292	1528	1146	917	764	655	573	458	382	327	286
50	0.50	3247	2165	1624	1299	1082	928	812	649	541	464	406
70	0.50	4479	2986	2239	5516	1493	1280	1120	896	746	640	560
95	1.05	5929	3953	2964	5295	1976	1694	1482	1186	988	847	741
120	1.05	7263	4842	3632	4900	2421	2075	1816	1453	1211	1038	908

Cross section S in mm ²	Disconnection time (s)	Record Plus™ Im or ST setting in Amps & conductor length in Meters										
		450	500	600	700	800	900	1000	1250	1500	1750	2000
2.5	0.10	18	17	14	12							
4	0.10	29	26	22	19	16	15	13				
6	0.10	44	40	33	28	25	22	20	16	13	11	
10	0.10	73	66	55	47	41	37	33	26	22	19	16
16	0.10	117	105	88	75	66	59	53	42	35	30	26
25	0.10	183	164	137	117	103	91	82	66	55	47	41
35	0.10	255	229	191	164	143	127	115	92	76	65	57
50	0.10	361	325	271	232	203	180	162	130	108	93	81
70	0.50	498	448	373	320	280	249	224	179	149	128	112
95	1.05	659	593	494	423	371	329	296	237	198	169	148
120	1.05	807	726	605	519	454	404	363	291	242	208	182
150	1.05	966	870	725	621	544	483	435	348	290	249	217
185	1.05	1127	1014	845	724	634	563	507	406	338	290	254
240	1.05	1328	1195	996	854	747	664	598	478	398	341	299
300	1.05	1489	1340	1117	957	838	745	670	536	447	383	335

Cross section S in mm ²	Disconnection time (s)	Record Plus™ Im or ST setting in Amps & conductor length in Meters										
		2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500
10	0.10	13	11	9								
16	0.10	21	18	15	13							
25	0.10	33	27	23	21	18	16	15	14	13	12	11
35	0.10	46	38	33	29	25	23	21	19	18	16	15
50	0.10	65	54	46	41	36	32	30	27	25	23	22
70	0.50	90	75	64	56	50	45	41	37	34	32	30
95	0.50	119	99	85	74	66	59	54	49	46	42	40
120	0.50	145	121	104	91	81	73	66	61	56	52	48
150	1.05	174	145	124	109	97	87	79	72	67	62	58
185	1.05	203	169	145	127	113	101	92	85	78	72	68
240	1.05	239	199	171	149	133	120	109	100	92	85	80
300	1.05	268	223	191	168	149	134	122	112	103	96	89

Cross section S in mm ²	Disconnection time (s)	Record Plus™ Im or ST setting in Amps & conductor length in Meters										
		8000	8500	9000	9500	10000	11000	12000	13000	14000	15000	16000
35	0.10	14	13	13	12	11	10					
50	0.10	20	19	18	17	16	15	14	12	12	11	
70	0.50	28	26	25	24	22	20	19	17	16	15	14
95	0.50	37	35	33	31	30	27	25	23	21	20	19
120	0.50	45	43	40	38	36	33	30	28	26	24	23
150	1.05	54	51	48	46	43	40	36	33	31	29	27
185	1.05	63	60	56	53	51	46	42	39	36	34	32
240	1.05	75	70	66	63	60	54	50	46	43	40	37
300	1.05	84	79	74	71	67	61	56	52	48	45	42

Notes

The disconnection time of 0.1 second is the lowest value defined in the standard and can be applied for the **Record Plus™** FD160, FE 160 and FE250 breaker types.

The 0.5 second disconnection times can be used for all **Record Plus™** breaker types FG400, FG630, FK800, FK1250 & FK1600. (with and without time setting). For cross sections >70 sq.mm the use of breakers with time a setting of 1 second as the EntelliGuard ACB is assumed. The resulting cable lengths also apply for Record Plus breakers.



Protection against Electric Shock

The 2001 edition of the IEC 60364-4-41 protection under normal conditions was referred to as 'direct contact and protection under fault conditions was referred to as 'Protection against indirect contact'.

In the 2005 edition of the same standard the general terminology 'Protection against Electrical shock' has been adapted whilst two new terms have been introduced:

- 1) Protection under normal conditions now designated:
Basic Protection
- 2) Protection under fault conditions now designated:
Fault protection

Basic protection being provided by basic insulation of live parts, barriers or enclosures whilst fault protection is provided by protective equipotential bonding and automatic disconnection in case of a fault in TN, TT and IT systems.

The Protective measure:

automatic disconnection of the power supply

being described in paragraph 411.

(Replacing paragraph 413 of the 2001 edition)

Generally, the required automatic disconnection time depends on the configuration of the system and the nominal voltage between line and earth (U_0). It is defined in clause 411.3.2.2 and table 41.1 of which an extract can be found on this page.

In addition to this table the following general requirements are put forward:

In TN systems, a disconnection time not exceeding 5 seconds is permitted for distribution circuits and circuits larger than 32A. (Not applicable in Belgium where table 41.1 applies generally)

In TT systems, a disconnection time not exceeding 1 second is permitted for distribution circuits and circuits larger than 32A.

In IT systems an automatic disconnection of the supply is generally not required on the first fault (Except in Norway). On a second fault, depending on the systems configuration, a disconnection time not exceeding **1 second or 5 seconds** is permitted for distribution circuits and circuits larger than 32A.

If the automatic disconnection times cannot be achieved in the required time supplementary protective equipotential bonding shall be provided.

In all network configurations it is necessary to ensure that the protective device will interrupt the circuit within the defined automatic disconnection times. Verification being necessary for the worst case scenario taking into account the Phase to Earth voltage, the fault current and the characteristics of the protection device.

Record Plus™ Circuit breakers

As moulded case circuit breakers the Record Plus meet a number of the requirements of basic protection.

The double isolated casing offering a so called class II protection. The device when installed with cover plates and accessories as terminal shields offers a protection degree of up to IP40 or IP54.

When used for fault protection to automatically disconnect the supply Record Plus meet the required automatic disconnection times across a broad, adjustable current range. Where this current range does not suffice an RCD device can be added to breakers with ratings up to 630A whilst the GFsum option using a Residual Current Principle can be applied on larger breakers.

Maximum disconnection times for final AC circuits not exceeding 32A

System	Maximum disconnection times in seconds			
	50V < U_0 ≤ 120V AC	120V < U_0 ≤ 230V AC	230V < U_0 ≤ 400V AC	U_0 > 400V AC ⁽³⁾
TN ⁽¹⁾	0,80	0,40	0,20	0,10
TT ⁽²⁾	0,30	0,20	0,07	0,04

Notes to table

Where disconnection is provided by an RCD the above mentioned disconnection times relate to residual fault currents that are much higher than the rated residual operating current (typically $5 \times I_{dn}$). In Belgium, China and the Netherlands local regulations are more extensive.

- (1) Also applies to IT systems with a distributed or non distributed neutral or mid point conductor
- (2) Also applies to IT systems in which the exposed-conductive parts are earthed in groups or individually.
- (3) In Belgium, above 400V the Belgian safety curves apply. (see local Wiring rules)



Intro

A

B

C

D

E

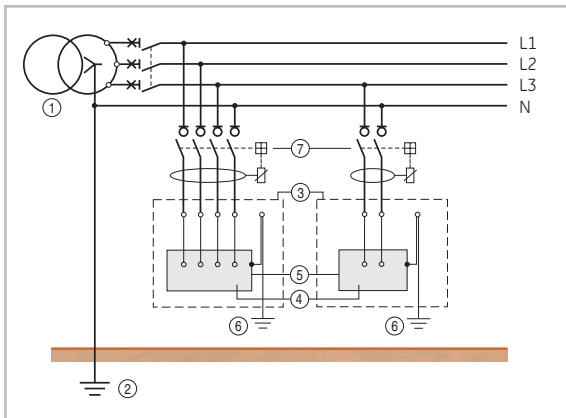
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G

X

TT system characteristics

One point of the power supply is connected to earth whilst all conductive parts in the installation are connected to electrically independent earth electrodes.



- ① Power supply.
- ② Power supply earthing (R_N)
- ③ Low voltage installation, consumer portion.
- ④ Equipment present in installation.
- ⑤ Exposed conductive parts/surfaces.
- ⑥ Installation earthing. (R_A)
- ⑦ Recommended RCD device.

Under fault conditions disconnection of the supply may be assured by an overcurrent device as **Record Plus™** provided a suitably low value of the fault circuit impedance Z_s is reliably assured. The following condition shall then be fulfilled:

$$Z_s \times I_a \leq U_0$$

where:

Z_s = the impedance in Ω of the fault loop comprising

- the Source
- the line conductor up to the point of the fault
- the protective conductor of the exposed parts
- the earthing conductor
- the earth electrode of the installation (R_A)
- the earth electrode of the source (R_N)

I_a = the current in A causing the protection device to disconnect within the time as specified in table 41.1 (see excerpt on page E.8) or within 1 second depending on the stipulated requirements

U_0 = the nominal a.c. or d.c. line to earth voltage

Generally under fault conditions the disconnection of the supply is assured by a residual current device (RCD). The device must disconnect within the time as specified in table 41.1 (see excerpt on page E.8) or within 1 second depending on the stipulated requirements and the following condition shall be fulfilled:

$$R_a \times I_{\Delta n} \leq 50V$$

where:

R_a = the resistance in Ω of the protective conductor of exposed parts and that of the earth electrode

$I_{\Delta n}$ = the rated residual operating current of the RCD in A

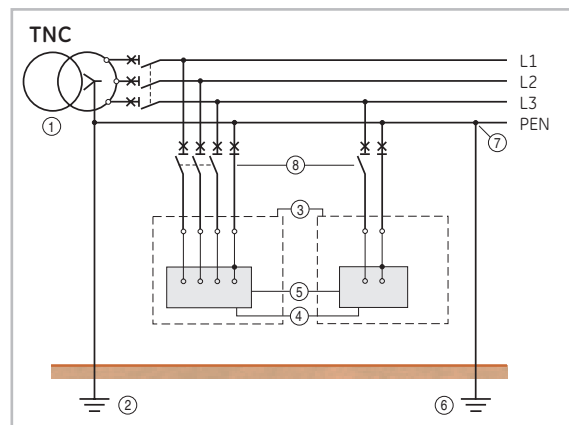
Notes

Where R_a is unknown it may be replaced by Z_s . The disconnection times mentioned in table 41.1 (see excerpt on page E.8) apply to residual fault currents that are much higher than the rated residual operating current (typically $5 \times I_{\Delta n}$).

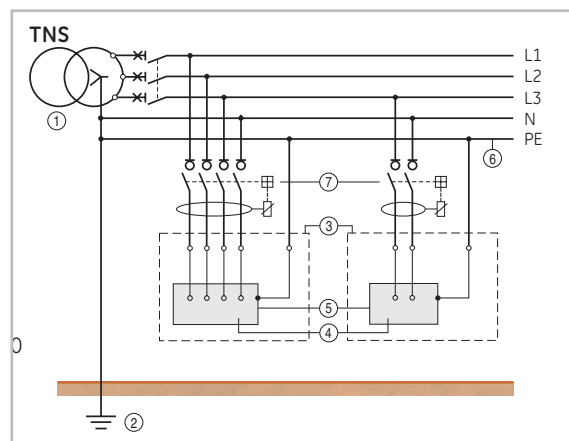
TN system characteristics

One or more points of the power supply are connected to earth whilst all conductive parts in the installation are electrically connected to this point by protective conductors. (PE or PEN conductors). The system exits in three main variants:

- TNC** The neutral and protective conductor are combined. (PEN)
- TNS** The neutral(N) and protective conductor (PE) are separate.
- TNCS** The supply is configured as a TNC, the system changes to a TNS system at a pre-defined point in the LV installation.



- ① Power supply.
- ② Power supply earthing.
- ③ Low voltage installation, consumer portion.
- ④ Equipment present in installation.
- ⑤ Exposed conductive parts/surfaces.
- ⑥ Additional supply earthing.
- ⑦ Protective conductor combined with the neutral.
- ⑧ Protective device.



- ① Power supply.
- ② Power supply earthing.
- ③ Low voltage installation, consumer portion.
- ④ Equipment present in installation.
- ⑤ Exposed conductive parts/surfaces.
- ⑥ Protective conductor.
- ⑦ Protective device.

Remark: a TNCS system is not depicted

TN system Characteristics (ct'd)

Under fault conditions disconnection of the supply may be assured by overcurrent devices as Record Plus or by residual current devices (RCDs). Where RCD's are used the circuit should also be protected by an overcurrent protection device.

In TN-C systems the use of RCDs is prohibited whilst in TN-CS systems a PEN conductor must be connected to the line or source side of the RCD.

The following condition shall then be fulfilled:

$$Z_s \times I_a \leq U_0$$

where:

Z_s = the impedance in Ω of the fault loop comprising

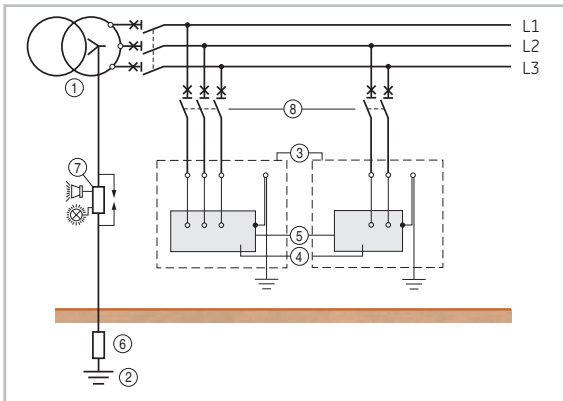
- the Source
- the line conductor up to the point of the fault
- the protective conductor of the exposed parts

I_a = the current in A causing the protection device to disconnect within the time as specified in table 41.1 (see excerpt on page E.8) or within 5 seconds depending on the stipulated requirements.

U_0 = the nominal a.c. or d.c. line to earth voltage.

IT system characteristics

The supply is isolated from earth or connected to earth by means of an impedance of a relatively high value. The conductive parts in the installation are connected to earth electrodes.



- ① Power supply.
- ② Power supply earthing.
- ③ Low voltage installation, consumer portion.
- ④ Equipment present in installation.
- ⑤ Exposed conductive parts/surfaces.
- ⑥ Impedance for insulation from earth.
- ⑦ Insulation monitoring device + surge protection
- ⑧ Protective device.

On a first fault to earth is is not required that an automatic disconnection of the supply takes place provided that the exposed conductive parts are earthed meeting the following condition:

$$R_A \times I_d \leq 50V$$

where:

R_A = the resistance in Ω of the protective conductor of exposed parts and that of the earth electrode.

I_d = the fault current between line and exposed conductive parts in A of the first fault taking into account leakage currents and the total earthing impedance of the installation.

It is recommended that the first fault to earth is eliminated as soon as possible. To indicate the first fault between a live part to exposed conductors or earth insulation monitoring devices shall be provided.

If the supply of the first fault event is not interrupted by a protection device a residual current monitoring device or insulation fault location system can also be used. These devices produce a visible and/or audible signal persisting for as long as the fault exists.

After the occurrence of a first fault a second fault on a different live conductor shall result in an automatic disconnection of the supply.

Where exposed conductive parts are interconnected by a protective conductor collectively linked to the same earthing system an IT is very similar to a TN system to which the following conditions apply.

Disconnection of the supply may be assured by overcurrent devices as Record Plus or by residual current devices (RCDs). Where RCD's are used the circuit should also be protected by an overcurrent protection device.

If the neutral or mid point conductor **is not** distributed the following condition must be fulfilled:

$$2 \times Z_s \times I_a \leq U$$

If the neutral or mid point conductor **is** distributed the following condition must be fulfilled:

$$2 \times Z'_s \times I_a \leq U_0$$

where:

Z_s = the impedance in Ω of the fault loop comprising

- the line conductor and the protective conductor of the circuit.

Z'_s = the impedance in Ω of the fault loop comprising

- the neutral conductor and the protective conductor of the circuit.

I_a = the current in A causing the protection device to disconnect within the time as specified in table 41.1 for TN systems (see excerpt on page E.8) or within 5 seconds depending on the stipulated requirements.

U = the nominal a.c. or d.c. line to line voltage.

U_0 = the nominal a.c. or d.c. line to neutral or mid -point conductor voltage.

Where the exposed conductive parts are earthed in groups or individually the supply must be disconnected within the time as specified in table 41.1 for TT systems (see excerpt on page E.8) or within 1 second depending on the stipulated requirements and the following condition shall be fulfilled:

$$R_A \times I_d \leq 50V$$

where:

R_A = the sum of resistances in Ω of the earth electrode and the protective conductor to the exposed conductive parts.

I_d = the current in A causing the protection device to disconnect within the time as specified in table 41.1 for TT systems (see excerpt on page E.8) or within 1 second depending on the stipulated requirements.

Notes

When residual current devices (RCDs) are used the disconnection times mentioned in table 41.1 (see excerpt on page E.8) apply to residual fault currents much higher than the rated residual operating current (typically $5 \times I_{dn}$).

Required Calculations

In order to meet the safety requirements under fault conditions where disconnection of the supply is required it is necessary to verify that the protective device will disconnect the supply within the defined connection times.

In all three systems, TT, TN & IT, the use of an overcurrent protective device, a residual current device or a combination of both is required

A Record Plus moulded case circuit breaker is an over-current protection device in accordance with the IEC 60947. The product line includes Residual current devices that sum the residual current with one summing current transformer (RCD block) and a GFsum device using the secondary current transformers placed in the Phase and Neutral conductors in the same manner.

For all three devices the current at which the protective device interrupts the supply under fault conditions (I_a) at the interruption time required in table 41.1 and at 1 and 5 seconds is provided here. Also tabulated is the applicable R_A value in TT networks when RCDs are used. Using the most common line to earth voltage U_0 the maximum allowable Z_S and Z'_S values for a circuit protected by these devices have been calculated and indicated in a number of tables included here.

Tables

The table on this page can be used for Record Plus breakers with thermal magnetic trip units and the associated line of add on Residual current devices.

On pages E.12 and E.13 the tables indicate the values that can be used for Record Plus circuit breakers with electronic trip units whilst those on page E.14 contain the values for electronic devices with an integrated GF sum protection.

Disconnection times, the associated current levels and calculated Z_S & Z'_S values meeting IEC 60364-4-41 clause 411
Record Plus Circuit breakers: FD160, FE160, FE250, FK800 & FK1250 with LTM & LTMD type Trip Units

Magnetic setting I_m (A)	I_a current (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
63	75.6	0.06	1.680	2.910	3.042	3.307	5.291
160	192	0.06	0.661	1.146	1.198	1.302	2.083
200	240	0.06	0.529	0.917	0.958	1.042	1.667
250	300	0.06	0.423	0.733	0.767	0.833	1.333
320	384	0.06	0.331	0.573	0.599	0.651	1.042
400	480	0.06	0.265	0.458	0.479	0.521	0.833
500	600	0.06	0.212	0.367	0.383	0.417	0.667
600	720	0.06	0.176	0.306	0.319	0.347	0.556
630	756	0.06	0.168	0.291	0.304	0.331	0.529
650	780	0.06	0.163	0.282	0.295	0.321	0.513
700	840	0.06	0.151	0.262	0.274	0.298	0.476
750	900	0.06	0.141	0.244	0.256	0.278	0.444
800	960	0.06	0.132	0.229	0.240	0.260	0.417
900	1080	0.06	0.118	0.204	0.213	0.231	0.370
1000	1200	0.06	0.106	0.183	0.192	0.208	0.333
1250	1500	0.06	0.085	0.147	0.153	0.167	0.267
1500	1800	0.06	0.071	0.122	0.128	0.139	0.222
1750	2100	0.06	0.060	0.105	0.110	0.119	0.190
2000	2400	0.06	0.053	0.092	0.096	0.104	0.167
2250	2700	0.06	0.047	0.081	0.085	0.093	0.148
2500	3000	0.06	0.042	0.073	0.077	0.083	0.133
3000	3600	0.06	0.035	0.061	0.064	0.069	0.111
4000	4800	0.04	0.026	0.046	0.048	0.052	0.083
4500	5400	0.04	0.024	0.041	0.043	0.046	0.074
5000	6000	0.04	0.021	0.037	0.038	0.042	0.067
5500	6600	0.04	0.019	0.033	0.035	0.038	0.061
6000	7200	0.04	0.018	0.031	0.032	0.035	0.056
6500	7800	0.04	0.016	0.028	0.029	0.032	0.051
7000	8400	0.04	0.015	0.026	0.027	0.030	0.048
7500	9000	0.04	0.014	0.024	0.026	0.028	0.044
8000	9600	0.04	0.013	0.023	0.024	0.026	0.042
8500	10200	0.04	0.012	0.022	0.023	0.025	0.039
9000	10800	0.04	0.012	0.020	0.021	0.023	0.037
9500	11400	0.04	0.011	0.019	0.020	0.022	0.035
10000	12000	0.04	0.011	0.018	0.019	0.021	0.033
11000	13200	0.04	0.010	0.017	0.017	0.019	0.030
12000	14400	0.04	0.009	0.015	0.016	0.017	0.028
12500	15000	0.04	0.008	0.015	0.015	0.017	0.027

Record Plus with add on Residual Current devices type FDQ, FEQ & FGQ. Values in grey background and red font do not meet the requirements of table 41.1. Values in grey background and orange font do not meet the requirements of table 41.1 in TT systems.

$I_{\Delta n}$ setting I_m (A)	Time setting (ms)	I_a current (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of					
				220	230	250	400		
0.03	inst	0.15	0.04	847	1467	1533	1667	2667	
0.3	inst	1.5	0.04	84.67	147	153	167	267	
		60	1.5	0.1	84.67	147	153	167	267
		150	1.5	0.2	84.67	147	153	167	267
		300	1.5	0.4	84.67	147	153	167	267
		600	1.5	0.8	84.67	147	153	167	267
1	inst	5	0.04	25.40	44.00	46.00	50.00	80.00	
		60	5	0.1	25.40	44.00	46.00	50.00	80.00
		150	5	0.2	25.40	44.00	46.00	50.00	80.00
		300	5	0.4	25.40	44.00	46.00	50.00	80.00
		600	5	0.8	25.40	44.00	46.00	50.00	80.00
3	inst	15	0.04	8.47	14.67	15.33	16.67	26.67	
		60	15	0.1	8.47	14.67	15.33	16.67	26.67
		150	15	0.2	8.47	14.67	15.33	16.67	26.67
		300	15	0.4	8.47	14.67	15.33	16.67	26.67
		600	15	0.8	8.47	14.67	15.33	16.67	26.67
10	inst	50	0.04	2.54	4.40	4.60	5.00	8.00	
		60	50	0.1	2.54	4.40	4.60	5.00	8.00
		150	50	0.2	2.54	4.40	4.60	5.00	8.00
		300	50	0.4	2.54	4.40	4.60	5.00	8.00
		600	50	0.8	2.54	4.40	4.60	5.00	8.00

R_A values in TT & IT networks with add on Residual current devices type FDQ, FEQ & FGQ meeting IEC 60364-4-41 clause 411

$I_{\Delta n}$ setting in A	0.03	0.30	1	3	10
R_A values in Ω	1667	166.67	50	16.67	5



Disconnection times, current levels and calculated Z_S & Z'_S values for Record Plus Circuit

Breaker FE160 with SMR1 Trip Unit $I_n = 25A, I_r = 25A^{(1)}$ meeting table 41.1

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						
			127	220	230	250	250	400	
			TT & TN	TT & TN	TT & TN	TT & TN	TT ⁽²⁾	TN	
2	60	0.10	2.117	3.667	3.833	4.167	-	6.667	-
2.5	75	0.10	1.693	2.933	3.067	3.333	-	5.333	-
3	90	0.10	1.411	2.444	2.556	2.778	-	4.444	-
4	120	0.10	1.058	1.833	1.917	2.083	-	3.333	-
5	150	0.10	0.847	1.467	1.533	1.667	-	2.667	-
6	180	0.10	0.706	1.222	1.278	1.389	-	2.222	-
8	240	0.07	0.529	0.917	0.958	1.042	1.042	1.667	1.667
10	300	0.07	0.423	0.733	0.767	0.833	0.833	1.333	1.333
12	360	0.07	0.353	0.611	0.639	0.694	0.694	1.111	1.111
13	385	0.04	0.330	0.571	0.597	0.649	0.649	1.039	1.039

Breaker FE160 with SMR1 trip unit $I_n = 63A, I_r = 32A^{(1)}$ meeting table 41.1

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						
			127	220	230	250	250	400	
			TT & TN	TT & TN	TT & TN	TT & TN	TT ⁽²⁾	TN	
2	77	0.10	1.654	2.865	2.995	3.255	-	5.208	-
2.5	96	0.10	1.323	2.292	2.396	2.604	-	4.167	-
3	115	0.10	1.102	1.910	1.997	2.170	-	3.472	-
4	154	0.10	0.827	1.432	1.497	1.628	-	2.604	-
5	192	0.10	0.661	1.146	1.198	1.302	-	2.083	-
6	230	0.10	0.551	0.955	0.998	1.085	-	1.736	-
8	307	0.07	0.413	0.716	0.749	0.814	0.814	1.302	1.302
10	384	0.07	0.331	0.573	0.599	0.651	0.651	1.042	1.042
12	461	0.07	0.276	0.477	0.499	0.543	0.543	0.868	0.868
13	499	0.04	0.254	0.441	0.461	0.501	0.501	0.801	0.801

Breaker FE160 with SMR1 type trip unit $I_n = 63A, I_r = 63A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of					Line mode
			127	220	230	250	400	
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN	
2	151	0.10	0.840	1.455	1.521	1.653	2.646	
2.5	189	0.10	0.672	1.164	1.217	1.323	2.116	
3	227	0.10	0.560	0.970	1.014	1.102	1.764	
4	302	0.10	0.420	0.728	0.761	0.827	1.323	
5	378	0.10	0.336	0.582	0.608	0.661	1.058	
6	454	0.10	0.280	0.485	0.507	0.551	0.882	
8	605	0.07	0.210	0.364	0.380	0.413	0.661	
10	756	0.07	0.168	0.291	0.304	0.331	0.529	
12	907	0.07	0.140	0.243	0.254	0.276	0.441	
Ir = 63A	378	5.000	0.336	0.582	0.608	0.661	1.058	mode

Breaker FE160 with SMR1 type trip unit $I_n = 125A, I_r = 125A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of					Line mode
			127	220	230	250	400	
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN	
2	300	0.20	0.423	0.733	0.767	0.833	1.333	
2.5	375	0.20	0.339	0.587	0.613	0.667	1.067	
3	450	0.20	0.282	0.489	0.511	0.556	0.889	
4	600	0.20	0.212	0.367	0.383	0.417	0.667	
5	750	0.10	0.169	0.293	0.307	0.333	0.533	
6	900	0.10	0.141	0.244	0.256	0.278	0.444	
8	1200	0.10	0.106	0.183	0.192	0.208	0.333	
10	1500	0.10	0.085	0.147	0.153	0.167	0.267	
12	1800	0.07	0.071	0.122	0.128	0.139	0.222	
Ir = 125A	750	5.000	0.169	0.293	0.307	0.333	0.533	mode

Breaker FE160 with SMR1 type trip unit $I_n = 160A, I_r = 160A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of					Line mode
			127	220	230	250	400	
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN	
2	384	0.20	0.331	0.573	0.599	0.644	1.042	
2.5	480	0.20	0.265	0.458	0.479	0.511	0.833	
3	576	0.20	0.220	0.382	0.399	0.444	0.694	
4	768	0.20	0.165	0.286	0.299	0.333	0.521	
5	960	0.10	0.132	0.229	0.240	0.266	0.417	
6	1152	0.10	0.110	0.191	0.200	0.222	0.347	
8	1536	0.10	0.083	0.143	0.150	0.166	0.260	
10	1920	0.10	0.066	0.115	0.120	0.133	0.208	
12	2304	0.07	0.055	0.095	0.100	0.111	0.174	
Ir = 160A	960	5.000	0.132	0.229	0.240	0.266	0.417	mode

(1) For other settings please refer to table:
 "Multiplication factors for Z_S values" on page E.13
 (2) In IT systems the lowest Z_S setting can also be used for Ist settings lower than 8 x Ir

Breaker FE250 with SMR1 type trip unit $I_n = 125A, I_r = 125A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						Line mode
			127	220	230	250	400		
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN		
2	300	0.20	0.423	0.733	0.767	0.833	1.333		
2.5	375	0.20	0.339	0.587	0.613	0.667	1.067		
3	450	0.20	0.282	0.489	0.511	0.556	0.889		
4	600	0.20	0.212	0.367	0.383	0.417	0.667		
5	750	0.20	0.169	0.293	0.307	0.333	0.533		
6	900	0.20	0.141	0.244	0.256	0.278	0.444		
8	1200	0.10	0.106	0.183	0.192	0.208	0.333		
10	1500	0.10	0.085	0.147	0.153	0.167	0.267		
12	1800	0.10	0.071	0.122	0.128	0.139	0.222		
Ir = 125A	750	5.000	0.169	0.293	0.307	0.333	0.533	mode	

Breaker FE250 with SMR1 type trip unit $I_n = 160A, I_r = 160A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						Line mode
			127	220	230	250	400		
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN		
2	384	0.13	0.331	0.573	0.599	0.651	1.042		
2.5	480	0.13	0.265	0.458	0.479	0.521	0.833		
3	576	0.13	0.220	0.382	0.399	0.434	0.694		
4	768	0.13	0.165	0.286	0.299	0.326	0.521		
5	960	0.12	0.132	0.229	0.240	0.260	0.417		
6	1152	0.12	0.110	0.191	0.200	0.217	0.347		
8	1536	0.10	0.083	0.143	0.150	0.163	0.260		
10	1920	0.10	0.066	0.115	0.120	0.130	0.208		
12	2304	0.10	0.055	0.095	0.100	0.109	0.174		
Ir = 160A	960	5.000	0.132	0.229	0.240	0.260	0.417	mode	

Breaker FE250 or FG400 with SMR1 type trip unit $I_n = 250A, I_r = 250A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						Line mode
			127	220	230	250	400		
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN		
2	600	0.18	0.212	0.367	0.383	0.417	0.667		
2.5	750	0.18	0.169	0.293	0.307	0.333	0.533		
3	900	0.18	0.141	0.244	0.256	0.278	0.444		
4	1200	0.18	0.106	0.183	0.192	0.208	0.333		
5	1500	0.15	0.085	0.147	0.153	0.167	0.267		
6	1800	0.15	0.071	0.122	0.128	0.139	0.222		
8	2400	0.13	0.053	0.092	0.096	0.104	0.167		
10	3000	0.13	0.042	0.073	0.077	0.083	0.133		
12	3600	0.13	0.035	0.061	0.064	0.069	0.111		
Ir = 250A	1500	5.000	0.085	0.147	0.153	0.167	0.267	mode	

Breaker FG400 with SMR1 type trip unit $I_n = 400A, I_r = 400A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						Line mode
			127	220	230	250	400		
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN		
2	960	0.18	0.132	0.229	0.240	0.260	0.417		
2.5	1200	0.18	0.106	0.183	0.192	0.208	0.333		
3	1440	0.18	0.088	0.153	0.160	0.174	0.278		
4	1920	0.18	0.066	0.115	0.120	0.130	0.208		
5	2400	0.15	0.053	0.092	0.096	0.104	0.167		
6	2880	0.15	0.044	0.076	0.080	0.087	0.139		
8	3840	0.13	0.033	0.057	0.060	0.065	0.104		
10	4800	0.13	0.026	0.046	0.048	0.052	0.083		
12	5760	0.13	0.022	0.038	0.040	0.043	0.069		
Ir = 400A	2400	5.000	0.053	0.092	0.096	0.104	0.167	mode	

Breaker FG630 with SMR1 type trip unit $I_n = 630A, I_r = 630A^{(1)}$ Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting (x Ir)	I_a (A)	Max. time (s)	Z_S value in Ω at a U_0 in Volts a.c. of						Line mode
			127	220	230	250	400		
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN		
2	1512	0.20	0.084	0.146	0.152	0.165	0.265		
2.5	1890	0.20	0.067	0.116	0.122	0.132	0.212		
3	2268	0.20	0.056	0.097	0.101	0.110	0.176		
4	3024	0.20	0.042	0.073	0.076	0.083	0.132		
5	3780	0.19	0.034	0.058	0.061	0.066	0.106		
6	4536	0.19	0.028						

Breakers meeting IEC 60364-4-41 clause 411 and table 41.1

Breaker FG400 with SMR2 type trip unit In = 400A, Ir = 250A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
2	600	0.50	0.212	0.367	0.383	0.417	0.667	
2.5	750	0.50	0.169	0.293	0.307	0.333	0.533	
3	900	0.50	0.141	0.244	0.256	0.278	0.444	
			TT	TT	TT	TT	TT	
4	1200	0.50	0.106	0.183	0.192	0.208	0.333	
5	1500	0.50	0.085	0.147	0.153	0.167	0.267	
6	1800	0.50	0.071	0.122	0.128	0.139	0.222	
8	2400	0.50	0.053	0.092	0.096	0.104	0.167	
10	3000	0.50	0.042	0.073	0.077	0.083	0.133	
12	3600	0.50	0.035	0.061	0.064	0.069	0.111	
			TN	TN	TN	TN	TN	
Ir = 250A	900	5.000	0.141	0.244	0.256	0.278	0.444	Class 1.25
	1350	5.000	0.094	0.163	0.170	0.185	0.296	Class 2.5
	1800	5.000	0.071	0.122	0.128	0.139	0.222	Class 5

Breaker FG400 with SMR2 type trip unit In = 400A, Ir = 400A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
2	960	0.50	0.132	0.229	0.240	0.260	0.417	
2.5	1200	0.50	0.106	0.183	0.192	0.208	0.333	
3	1440	0.50	0.088	0.153	0.160	0.174	0.278	
			TT	TT	TT	TT	TT	
4	1920	0.50	0.066	0.115	0.120	0.130	0.208	
5	2400	0.50	0.053	0.092	0.096	0.104	0.167	
6	2880	0.50	0.044	0.076	0.080	0.087	0.139	
8	3840	0.50	0.033	0.057	0.060	0.065	0.104	
10	4800	0.50	0.026	0.046	0.048	0.052	0.083	
12	5760	0.50	0.022	0.038	0.040	0.043	0.069	
			TN	TN	TN	TN	TN	
Ir = 400A	1440	5.000	0.088	0.153	0.160	0.174	0.278	Class 1.25
	2160	5.000	0.059	0.102	0.106	0.116	0.185	Class 2.5
	2880	5.000	0.044	0.076	0.080	0.087	0.139	Class 5

Breaker FG630 with SMR2 type trip unit In = 630A, Ir = 630A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
2	1512	0.50	0.084	0.146	0.152	0.165	0.265	
2.5	1890	0.50	0.067	0.116	0.122	0.132	0.212	
3	2268	0.50	0.056	0.097	0.101	0.110	0.176	
			TT	TT	TT	TT	TT	
4	3024	0.50	0.042	0.073	0.076	0.083	0.132	
5	3780	0.50	0.034	0.058	0.061	0.066	0.106	
6	4536	0.50	0.028	0.049	0.051	0.055	0.088	
8	6048	0.50	0.021	0.036	0.038	0.041	0.066	
10	7560	0.50	0.017	0.029	0.030	0.033	0.053	
12	9072	0.50	0.014	0.024	0.025	0.028	0.044	
			TN	TN	TN	TN	TN	
Ir = 630A	2268	5.000	0.056	0.097	0.101	0.110	0.176	Class 1.25
	3402	5.000	0.037	0.065	0.068	0.073	0.118	Class 2.5
	4536	5.000	0.028	0.049	0.051	0.055	0.088	Class 5

Breaker FK800 with SMR1e or 1s type trip unit In = 800A, Ir = 800A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
1.5	1440	0.40	0.088	0.153	0.160	0.174	0.278	
2	1920	0.40	0.066	0.115	0.120	0.130	0.208	
2.5	2400	0.40	0.053	0.092	0.096	0.104	0.167	
3	2880	0.40	0.044	0.076	0.080	0.087	0.139	
4	3840	0.40	0.033	0.057	0.060	0.065	0.104	
5	4800	0.40	0.026	0.046	0.048	0.052	0.083	
6	5760	0.40	0.022	0.038	0.040	0.043	0.069	
			TT	TT	TT	TT	TT	
8	7680	0.40	0.017	0.029	0.030	0.033	0.052	
10	9600	0.40	0.013	0.023	0.024	0.026	0.042	
			TN	TN	TN	TN	TN	
Ir = 800A	5760	5.000	0.022	0.038	0.040	0.043	0.069	SMR1e
	5760	5.000	0.022	0.038	0.040	0.043	0.069	SMR1s class 5

Breaker FK1250 with SMR1e or 1s type trip unit In = 1000A, Ir = 1000A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
1.5	1800	0.40	0.071	0.122	0.128	0.139	0.222	
2	2400	0.40	0.053	0.092	0.096	0.104	0.167	
2.5	3000	0.40	0.042	0.073	0.077	0.083	0.133	
3	3600	0.40	0.035	0.061	0.064	0.069	0.111	
4	4800	0.40	0.026	0.046	0.048	0.052	0.083	
5	6000	0.40	0.021	0.037	0.038	0.042	0.067	
6	7200	0.40	0.018	0.031	0.032	0.035	0.056	
			TT	TT	TT	TT	TT	
8	9600	0.40	0.013	0.023	0.024	0.026	0.042	
10	12000	0.40	0.011	0.018	0.019	0.021	0.033	
			TN	TN	TN	TN	TN	
Ir = 1000A	7200	5.000	0.018	0.031	0.032	0.035	0.056	SMR1e
	7200	5.000	0.018	0.031	0.032	0.035	0.056	SMR1s class 5

Breaker FK1250 with SMR1e or 1s type trip unit In = 1000A, Ir = 1000A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
1.5	2250	0.40	0.056	0.098	0.102	0.111	0.178	
2	3000	0.40	0.042	0.073	0.077	0.083	0.133	
2.5	3750	0.40	0.034	0.059	0.061	0.067	0.107	
3	4500	0.40	0.028	0.049	0.051	0.056	0.089	
4	6000	0.40	0.021	0.037	0.038	0.042	0.067	
5	7500	0.40	0.017	0.029	0.031	0.033	0.053	
6	9000	0.40	0.014	0.024	0.026	0.028	0.044	
			TT	TT	TT	TT	TT	
8	12000	0.40	0.011	0.018	0.019	0.021	0.033	
10	15000	0.40	0.008	0.015	0.015	0.017	0.027	
			TN	TN	TN	TN	TN	
Ir = 1250A	9000	5.000	0.014	0.024	0.026	0.028	0.044	SMR1e
	9000	5.000	0.014	0.024	0.026	0.028	0.044	SMR1s class 5

Breaker FK1600 with SMR1e or 1s type trip unit In = 1600A, Ir = 1600A^[1]
 Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Short time setting I _a (x Ir)	I _a (A)	Max. time (s)	Z _s value in Ω at a U ₀ in Volts a.c. of					
			127	220	230	250	400	
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN	
1.5	2880	0.40	0.044	0.076	0.080	0.087	0.139	
2	3840	0.40	0.033	0.057	0.060	0.065	0.104	
2.5	4800	0.40	0.026	0.046	0.048	0.052	0.083	
3	5760	0.40	0.022	0.038	0.040	0.043	0.069	
4	7680	0.40	0.017	0.029	0.030	0.033	0.052	
5	9600	0.40	0.013	0.023	0.024	0.026	0.042	
6	11520	0.40	0.011	0.019	0.020	0.022	0.035	
			TT	TT	TT	TT	TT	
8	15360	0.40	0.008	0.014	0.015	0.016	0.026	
10	19200	0.40	0.007	0.011	0.012	0.013	0.021	
			TN	TN	TN	TN	TN	
Ir = 1600A	11520	5.000	0.011	0.019	0.020	0.022	0.035	SMR1e
	11520	5.000	0.011	0.019	0.020	0.022	0.035	SMR1s class 5

Multiplication factors for Z_s values applicable for LT settings < Ir.

For Rating Plugs; I _e = 0.64 x breaker In									
Setting x I _e	0.625	0.650	0.675	0.700	0.725	0.750	0.775	0.800	
Factor for Z _s	2.50	2.40	2.31	2.23	2.16	2.08	2.02	1.95	
Setting x I _e	0.825	0.850	0.875	0.900	0.925	0.950	0.975	1.000	
Factor for Z _s	1.89	1.84	1.79	1.74	1.69	1.64	1.60	1.56	
For Rating Plugs; I _e = 1 x breaker In									
Setting x In	0.625	0.650	0.675	0.700	0.725	0.750	0.775	0.800	
Factor for Z _s	1.60	1.54	1.48	1.43	1.38	1.33	1.29	1.25	
Setting x Ir	0.825	0.850	0.875	0.900	0.925	0.950	0.975	1.000	
Factor for Z _s	1.21	1.18	1.14	1.11	1.08	1.05	1.03	1.00	
FK frame types with trip units types SMR1e, s & g									
Setting x In	0.40	0.50	0.60	0.70	0.80	0.90	0.95	1.00	
Factor for Z _s	2.50	2.00	1.67	1.43	1.25	1.11	1.05	1.00	



Disconnection times, current levels and calculated Z_s & Z'_s values for Record Plus Circuit Breakers meeting IEC 60364-4-41 clause 411 and table 41.1

Breaker FG400 with SMR2 type trip unit $I_n = 250A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	60	0.50	2.117	3.667	3.833	4.167	6.667
0.25	75	0.50	1.693	2.933	3.067	3.333	5.333
0.3	90	0.50	1.411	2.444	2.556	2.778	4.444
0.4	120	0.50	1.058	1.833	1.917	2.083	3.333
0.5	150	0.50	0.847	1.467	1.533	1.667	2.667
0.6	180	0.50	0.706	1.222	1.278	1.389	2.222
0.7	210	0.50	0.605	1.048	1.095	1.190	1.905
0.8	240	0.50	0.529	0.917	0.958	1.042	1.667

Breaker FG400 & FG630 with SMR2 type trip unit $I_n = 400A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	96	0.50	1.323	2.292	2.396	2.604	4.167
0.25	120	0.50	1.058	1.833	1.917	2.083	3.333
0.3	144	0.50	0.882	1.528	1.597	1.736	2.778
0.4	192	0.50	0.661	1.146	1.198	1.302	2.083
0.5	240	0.50	0.529	0.917	0.958	1.042	1.667
0.6	288	0.50	0.441	0.764	0.799	0.868	1.389
0.7	336	0.50	0.378	0.655	0.685	0.744	1.190
0.8	384	0.50	0.331	0.573	0.599	0.651	1.042

Breaker FG630 with SMR2 type trip unit $I_n = 630A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	151	0.50	0.840	1.455	1.521	1.653	2.646
0.25	189	0.50	0.672	1.164	1.217	1.323	2.116
0.3	227	0.50	0.560	0.970	1.014	1.102	1.764
0.4	302	0.50	0.420	0.728	0.761	0.827	1.323
0.5	378	0.50	0.336	0.582	0.608	0.661	1.058
0.6	454	0.50	0.280	0.485	0.507	0.551	0.882
0.7	529	0.50	0.240	0.416	0.435	0.472	0.756
0.8	605	0.50	0.210	0.364	0.380	0.413	0.661

Breaker FG630 with SMR2 type trip unit $I_n = 630A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	96	0.50	1.323	2.292	2.396	2.604	4.167
0.25	120	0.50	1.058	1.833	1.917	2.083	3.333
0.3	144	0.50	0.882	1.528	1.597	1.736	2.778
0.4	192	0.50	0.661	1.146	1.198	1.302	2.083
0.5	240	0.50	0.529	0.917	0.958	1.042	1.667
0.6	288	0.50	0.441	0.764	0.799	0.868	1.389
0.7	336	0.50	0.378	0.655	0.685	0.744	1.190
0.8	384	0.50	0.331	0.573	0.599	0.651	1.042

Breaker FK800 with SMR2 type trip unit $I_n = 800A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	192	0.60	0.661	1.146	1.198	1.302	2.083
0.3	288	0.60	0.441	0.764	0.799	0.868	1.389
0.4	384	0.60	0.331	0.573	0.599	0.651	1.042
0.5	480	0.60	0.265	0.458	0.479	0.521	0.833
0.6	576	0.60	0.220	0.382	0.399	0.434	0.694
0.6	576	0.60	0.220	0.382	0.399	0.434	0.694
0.8	768	0.60	0.165	0.286	0.299	0.326	0.521
1.0	960	0.60	0.132	0.229	0.240	0.260	0.417

Breaker FK1250 with SMR2 type trip unit $I_n = 1000A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	240	0.60	0.529	0.917	0.958	1.042	1.667
0.3	360	0.60	0.353	0.611	0.639	0.694	1.111
0.4	480	0.60	0.265	0.458	0.479	0.521	0.833
0.5	600	0.60	0.212	0.367	0.383	0.417	0.667
0.6	720	0.60	0.176	0.306	0.319	0.347	0.556
0.6	720	0.60	0.176	0.306	0.319	0.347	0.556
0.8	960	0.60	0.132	0.229	0.240	0.260	0.417
1.0	1200	0.60	0.106	0.183	0.192	0.208	0.333

Breaker FK1250 with SMR2 type trip unit $I_n = 1250A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	300	0.60	0.423	0.733	0.767	0.833	1.333
0.3	450	0.60	0.282	0.489	0.511	0.556	0.889
0.4	600	0.60	0.212	0.367	0.383	0.417	0.667
0.5	750	0.60	0.169	0.293	0.307	0.333	0.533
0.6	900	0.60	0.141	0.244	0.256	0.278	0.444
0.6	900	0.60	0.141	0.244	0.256	0.278	0.444
0.8	1200	0.60	0.106	0.183	0.192	0.208	0.333
1.0	1500	0.60	0.085	0.147	0.153	0.167	0.267

Breaker Fk1600 with SMR2 type trip unit $I_n = 1600A$ with Groundfault sum. Disconnection time ≤ 1 sec. (TT & TN)

GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
0.2	384	0.60	0.331	0.573	0.599	0.651	1.042
0.3	576	0.60	0.220	0.382	0.399	0.434	0.694
0.4	768	0.60	0.165	0.286	0.299	0.326	0.521
0.5	960	0.60	0.132	0.229	0.240	0.260	0.417
0.6	1152	0.60	0.110	0.191	0.200	0.217	0.347
0.6	1152	0.60	0.110	0.191	0.200	0.217	0.347
0.8	1536	0.60	0.083	0.143	0.150	0.163	0.260
1.0	1920	0.60	0.066	0.115	0.120	0.130	0.208



Notes

Grid area for notes.

Intro

A

B

C

D

E

F

G

X



Selectivity/Discrimination

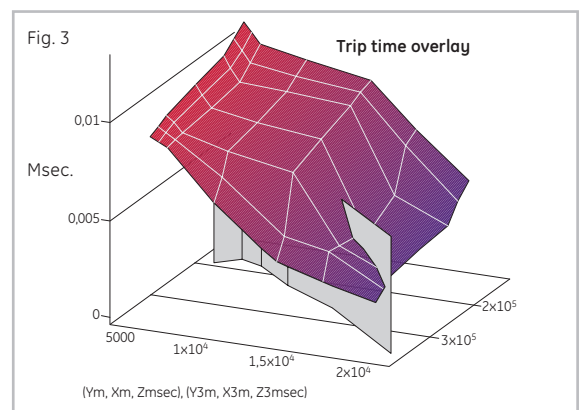
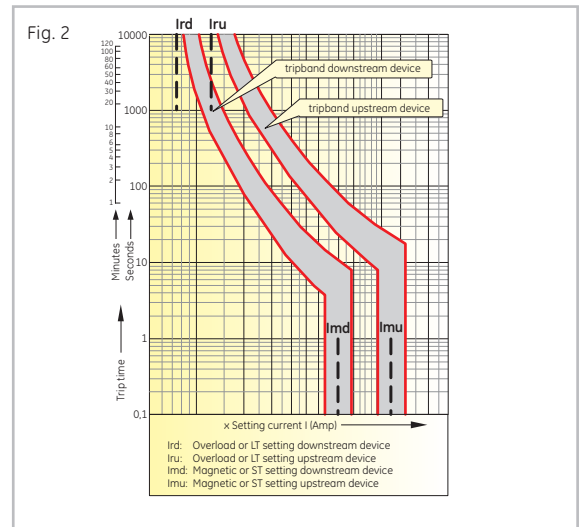
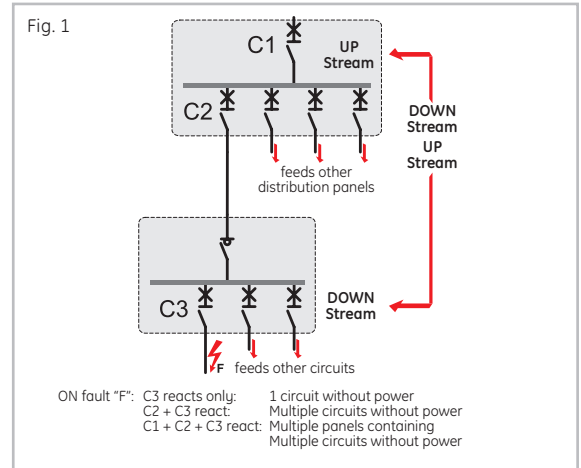
Fig. 1 depicts a typical distribution network. Here outgoing circuits are designed for the current load and the characteristics of the equipment within the circuit. Outgoing circuits that protect a certain area are placed together in panels or form groups within panels. Typically this group of circuits is protected by a second, similar device, the characteristics of which are determined in the same manner. This system can be extended to a multiple level distribution network. In case of a fault it is necessary that the device nearest to the fault reacts while all others remain closed. This capability is called discrimination (UK) or selectivity (USA and Europe). If this requirement is not met, a fault (F) in one arm of the distribution system will cause a number of upstream protection devices wired in series to trip. Thus a minor fault in a socket outlet of a circuit can cause whole floors, buildings or building complexes to be cut off from the power supply.

Record Plus™ breakers are specifically designed to discriminate. By introducing **Record Plus™**, GE sets a new standard in circuit breakers by offering total selectivity for all normally proportioned distribution systems.

EN 60947-2 amendment 1, app. A defines under "Coordination" that discrimination/selectivity may be partial up to a pre-defined current limit (Is). Discrimination is considered total when the current limit is equal to the rated short-circuit breaking capacity (Icu or Ics) of the downstream device. Discrimination/Selectivity is determined by comparing the time it takes an upstream device to react at a specific current value and - again - comparing this to the time it takes a downstream device to clear the fault at the same current level. (see Fig. 2) The comparison of these two time spans can be used to define whether discrimination is present or not. We have simplified this comparison by applying a multiplication factor between downstream and upstream devices. With the values indicated in the table we can guarantee discrimination. (see page E.15)

Selectivity Plus

Record Plus™ circuit breakers limit the electrical energy and peak current of a short-circuit event extremely effectively and limit the time span involved to the utter minimum. The downstream breaker limits the magnitude of the fault so effectively that the upstream, time delayed, Record Plus breaker is only exposed to a relatively low level short-circuit current that does not trip the breaker. Fig.3 depicts this three dimensional selectivity technique that allows for the selective interruption of a short-circuit event making use of all the events' parameters **Current**, **Energy** and **Time**.



How to determine discrimination/ selectivity with Record Plus™ (and associated devices)

Table D1 to D5 (page E.18 to E.21) indicate the discrimination levels that can be achieved with **Record Plus™** and associated devices. Where discrimination is partial the selectivity limits in kA (Is) are mentioned in kA. Where a "T" is found in the tables, this indicates

total discrimination up to the highest breaking capacity of the devices at a voltage of 400/415V. These discrimination/selectivity limits are only valid if the ratio between the current settings, ratings or time settings of the upstream and downstream breaker are equal or higher than the factor indicated here.

Selectivity/Discrimination

Downstream device		Upstream device			
		Record Plus™ MCCB			
		LTM or LTMD	SMR1, 1e, 1s or 1g		SMR2
Redline & Hti MCB	B, C & D curve	I _r factor 1.6	I _r factor 2	I _r factor *	1.6
Surion Manual Motor Starter	Thermal mag or Mag. Only	I _m factor 2	I _{st} factor 1.5	I _{st} factor *	1.5
Record Plus™ MCCB	LTM or LTMD	I _r factor 3	I _r factor 2	I _r factor *	1.6
		I _m factor 3	I _{st} factor 1.5	I _{st} factor *	1.5
		I _r factor 1.6	I _r factor 2	I _r factor *	1.6
Record Plus™ MCCB	SMR1	I _m factor 1.5	I _{st} factor 1.5	I _{st} factor *	1.5
		I _r factor 1.6	I _r factor 1.6	I _r factor *	1.6
		I _m factor 1.5	I _{st} factor 1.5	I _{st} factor *	1.5
Record Plus™ MCCB	SMR1s SMR2	SMR1, 1e, 1s or 1g		SMR2	
		I _r factor 1.6	I _r factor 1.6	I _r factor	1.6
		LTD set at one class higher	LTD set at one class higher	LTD set at one class higher	
		I _{st} factor 1.5	I _{st} factor 1.5	I _{st} factor	1.5
		STD Set at one band higher	STD Set at one band higher	Inst. factor	1.5
Record Plus™ MCCB	SMR1	EntelliGuard™ Power Circuit Breaker			
		GTU E, S N or HI "OFF"		GTU E, S N or HI "ON"	
		I _r factor 1.5	I _r factor 1.5	I _r factor	1.5
		I _{st} factor 1.4	I _{st} factor 1.4	LTD Class	20
		STD timing 0.2	STD timing 0.2	I _{st} factor	1.4
Record Plus™ MCCB	SMR1s SMR2			STD timing	0.2
		I _r factor 1.5	I _r factor 1.5	I _{st} factor	1.5
		I _{st} factor 1.4	I _{st} factor 1.4	LTD set at one class higher	
		STD Set at one band higher	STD Set at one band higher	I _{st} factor	1.4
				Inst. factor	1.5

* LTD set at class 20

Terminology	
LTM	Thermal magnetic Trip Unit I _r = Overload setting
LTMD	Selective Thermal magnetic Trip Unit I _r = Overload setting
Mag. Break™	Magnetic Only Trip Unit I _m = Magnetic setting
SMR1 & SMR1e	Selective Electronic Trip unit I _r = Setting on LT device
SMR1s, g and SMR2 MPRO 17, 20, 30 & 40	Enhanced Electronic Trip unit Mpack Electronic Trip Units I _r = Setting on LT device
	LTD class, time setting at 7.2 x I _r
	STD Delay setting on ST device
	A ² S Cropped short time device delay setting
	Inst. = Setting on I (Instantaneous) device

(1) 5kA - FD160
7kA - FE160
9kA - FE250
14kA - FG400
18kA - FG630



Table D1 - Selectivity/Discrimination

Upstream	Downstream	In(A)	Record Plus™ type																							
			FDC & FDE 160 LTM					FDS 160 LTMD					FDN, H & L 160 LTMD													
			40	50	63	80	100	125	160	40	50	63	80	100	125	160	40	50	63	80	100	125	160			
Selectivity limit in kA*																										
Redline	≤16	0.6	2.5	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
EPC 30	20	0.6	2.5	3	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
G30	25	-	0.8	1.2	T	T	T	1.6	3.5	T	T	T	T	T	1.6	3.5	T	T	T	T	T	T	T			
B/C curve	32	-	-	1.2	3	T	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
	40	-	-	-	3	T	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
Redline	≤16	0.6	2.5	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
EPC 45	20	0.6	2.5	3	T	T	T	3.5	T	T	T	T	T	T	3.5	T	T	T	T	T	T	T	T			
G45	25	-	0.8	1.2	T	T	T	1.6	3.5	T	T	T	T	T	1.6	3.5	T	T	T	T	T	T	T			
B/C curve	32	-	-	1.2	3	T	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
	40	-	-	-	3	4	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
Redline	≤16	0.6	2.5	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
EPC 60	20	0.6	2.5	3	6	T	T	3.5	T	T	T	T	T	T	3.5	T	T	T	T	T	T	T	T			
DME60	25	-	0.8	1.2	6	6	T	1.6	3.5	T	T	T	T	T	1.6	3.5	T	T	T	T	T	T	T			
B/C curve	32	-	-	1.2	3	6	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
	40	-	-	-	3	4	6	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
Redline	≤16	0.6	2.5	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
DM & DMT60	20	0.6	2.5	3	6	8	T	3.5	T	T	T	T	T	T	3.5	T	T	T	T	T	T	T	T			
DM & DMT100	25	-	0.8	1.2	6	6	T	1.6	3.5	T	T	T	T	T	1.6	3.5	T	T	T	T	T	T	T			
B/C curve	32	-	-	1.2	3	6	8	-	-	10	T	T	T	T	-	-	10	T	T	T	T	T	T			
	40	-	-	-	3	4	6	-	-	-	T	T	T	T	-	-	-	T	T	T	T	T	T			
	50	-	-	-	1.2	1.5	6	-	-	-	3.5	T	T	T	-	-	-	3.5	T	T	T	T	T			
	63	-	-	-	-	1.5	2	-	-	-	8	T	T	T	-	-	-	-	-	-	8	T	T			
Redline	≤16	0.6	2.5	6	6	10	T	10	10	T	T	T	T	T	10	10	T	T	T	T	T	T	T			
G60	20	0.6	2.5	3	6	8	T	3.5	10	T	T	T	T	T	3.5	10	T	T	T	T	T	T	T			
DME100	25	-	0.8	1.2	6	6	T	1.6	3.5	T	T	T	T	T	1.6	3.5	T	T	T	T	T	T	T			
B/C curve	32	-	-	1.2	3	6	8	-	-	10	10	T	T	T	-	-	10	10	T	T	T	T	T			
	40	-	-	-	3	4	6	-	-	-	10	T	T	T	-	-	-	-	-	-	10	T	T			
	50	-	-	-	1.2	1.5	6	-	-	-	3.5	10	T	T	-	-	-	-	-	-	3.5	10	T			
	63	-	-	-	-	1.5	2	-	-	-	8	T	T	T	-	-	-	-	-	-	8	T	T			
Redline	≤16	0.6	2.5	6	6	10	T	10	10	T	T	T	T	T	10	10	T	T	T	T	T	T	T			
G100 & GT25	20	0.6	2.5	3	6	8	T	3.5	10	T	T	T	T	T	3.5	10	T	T	T	T	T	T	T			
B/C curve	25	-	0.8	1.2	6	6	T	1.6	3.5	15	T	T	T	T	1.6	3.5	15	T	T	T	T	T	T			
	32	-	-	1.2	3	6	8	-	-	10	10	T	T	T	-	-	10	10	T	T	T	T	T			
	40	-	-	-	3	4	6	-	-	-	10	15	T	T	-	-	-	-	-	-	10	15	T			
	50	-	-	-	1.2	1.5	6	-	-	-	3.5	10	T	T	-	-	-	-	-	-	3.5	10	T			
	63	-	-	-	-	1.5	2	-	-	-	8	T	T	T	-	-	-	-	-	-	8	T	T			
Redline	80	-	-	-	-	-	1.9	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5			
Series HTI C curve	100	-	-	-	-	-	1.9	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	2.5			
Redline	≤25	-	0.8	0.9	1.2	1.5	1.9	-	1	1.2	1.5	1.5	1.5	-	1	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
Series S90	32	-	-	0.9	1.2	1.5	1.9	-	-	1.2	1.5	1.5	1.5	-	-	1.2	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
	40	-	-	-	1.2	1.5	1.9	-	-	-	1.5	1.5	1.5	-	-	-	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
	50	-	-	-	1.2	1.5	1.9	-	-	-	1.5	1.5	1.5	-	-	-	1.5	1.5	1.5	1.5	1.5	1.5	1.5			
	63	-	-	-	-	1.5	1.9	-	-	-	-	1.5	1.5	-	-	-	-	-	-	-	1.5	1.5	1.5			
	80	-	-	-	-	-	1.9	-	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	1.5			
	100	-	-	-	-	-	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	-	-	1.5			
Surion	≤20	0.6	2.5	6	6	10	T	10	10	T	T	T	T	T	10	10	T	T	T	T	T	T	T			
GPS1BS & GPS1MS	25	-	1	1.2	6	6	T	-	3.5	15	15	T	T	T	-	3.5	15	15	T	T	T	T	T			
GPS2BS & GPS2MS	32	-	-	1.2	3	6	10	-	-	6	6	T	T	T	-	-	6	6	T	T	T	T	T			
	40	-	-	-	3	4	6	-	-	6	6	T	T	T	-	-	6	6	T	T	T	T	T			
	50	-	-	-	1.2	1.6	6	-	-	-	3.5	T	T	T	-	-	-	-	-	-	3.5	T	T			
	63	-	-	-	-	1.6	2	-	-	-	8	T	T	T	-	-	-	-	-	-	8	T	T			
Surion	≤20	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
GPS1BH & GPS1MH	25	-	2.5	15	15	T	T	-	3.5	T	T	T	T	T	-	3.5	T	T	T	T	T	T	T			
GPS2BH & GPS2MH	32	-	-	6	6	8	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
	40	-	-	-	6	8	T	-	-	T	T	T	T	T	-	-	T	T	T	T	T	T	T			
	50	-	-	-	6	8	T	-	-	-	3.5	T	T	T	-	-	-	-	-	-	3.5	T	T			
	63	-	-	-	-	-	T	-	-	-	8	T	T	T	-	-	-	-	-	-	8	T	T			
Record Plus™	≤25	0.4	0.5	0.6	0.8	1	1.3	0.6	0.8	0.9	1.2	1.5	3.5	0.6	0.8	0.9	1.2	1.5	3.5	0.6	0.8	0.9	1.2	1.5	3.5	
FD160E	32	-	0.5	0.6	0.8	1	1.3	-	0.8	0.9	1.2	1.5	3.5	-	0.8	0.9	1.2	1.5	3.5	-	0.8	0.9	1.2	1.5	3.5	
LTM	40	-	-	-	0.8	1	1.3	-	-	-	1.2	1.5	3.5	-	-	-	-	1.2	1.5	3.5	-	-	-	1.2	1.5	3.5
	50	-	-	-	0.8	1	1.3	-	-	-	1.2	1.5	3.5	-	-	-	-	1.2	1.5	3.5	-	-	-	1.2	1.5	3.5
	63	-	-	-	-	1	1.3	-	-	-	-	1.5	3.5	-	-	-	-	-	-	-	-	-	-	1.5	3.5	
	80	-	-	-	-	-	1.3	-	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-	-	-	3.5	

* Where T is mentioned Selectivity is full up until the Icu of the downstream device
 Remark; For MCB's with D type Curve assume a C curve type with a one step higher rating.
 E.G. Selectivity FD160 80Amp LTM with downstream C Curve 40A MCB = 3kA, for D curve 40A, take the value mentioned for 50A C curve, here 1.2kA



Table D3 - Selectivity/Discrimination

Upstream	Downstream	In (A)	Record Plus™ type															
			FE160N, H&L - SMR1			FE250N, H&L - LTMD				FE250N, H&L - SMR1			FG400, H&L - SMR1 & SMR2			FG630N, H&L - SMR1 & SMR2		
			63	125	160	125	160	200	250	125	160	250	250	350	400	400	500	630
			Selectivity limit in kA*															
Redline		<20	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
EPC 30, 45 & 60N		25	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
G30, 45, 60 & 100		32	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GT25, DME60		40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
DM (T)60, &100		50	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
B/C curve		63	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Redline		80	-	T	T	-	T	T	T	T	T	T	T	T	T	T	T	T
Series HTI C curve		100	-	-	T	-	T	T	-	T	T	T	T	T	T	T	T	T
		125	-	-	-	-	-	T	-	T	T	T	T	T	T	T	T	T
Redline		<40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Series S90		50	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		63	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		80	-	T	T	-	T	T	T	T	T	T	T	T	T	T	T	T
		100	-	-	T	-	T	T	-	T	T	-	T	T	-	T	T	T
Surion		<40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GPS1BS & GPS1MS		50	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GP2BS & GPS2MS		63	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Surion		<40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GPS1BH & GPS1MH		50	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
GP2BH & GPS2MH		63	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Record Plus™		<40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
FD160 E		50	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
LTM		63	-	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		80	-	-	T	-	T	T	T	T	T	T	T	T	T	T	T	T
		100	-	-	T	-	-	T	-	T	T	T	T	T	T	T	T	T
		125	-	-	-	-	-	T	-	-	T	T	T	T	T	T	T	T
		160	-	-	-	-	-	-	-	-	T	T	T	T	T	T	T	T
Record Plus™		<40	36	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
FD160 S, N, H & L		50	-	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
LTMD/MO/GTM		63	-	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
		80	-	-	36	42	42	42	50	50	50	T	T	T	T	T	T	T
		100	-	-	36	-	42	42	-	50	50	T	T	T	T	T	T	T
		125	-	-	-	-	42	42	-	-	50	T	T	T	T	T	T	T
		160	-	-	-	-	-	42	-	-	50	T	T	T	T	T	T	T
Record Plus™		<40	36	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
FE160 N, H & L		50	-	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
LTMD/MO/GTM		63	-	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
		80	-	36	36	42	42	42	50	50	50	T	T	T	T	T	T	T
		100	-	-	36	-	42	42	-	50	50	T	T	T	T	T	T	T
		125	-	-	-	-	42	42	-	-	50	T	T	T	T	T	T	T
		160	-	-	-	-	-	42	-	-	50	T	T	T	T	T	T	T
Record Plus™		<40	0,8	1,8	2,2	1,3	1,6	2,5	1,8	2,2	3,5	T	T	T	T	T	T	T
FE160 N, H & L		63	-	1,8	2,2	1,3	1,6	2,5	1,8	2,2	3,5	T	T	T	T	T	T	T
LTMD/SMR1		80	-	1,8	2,2	1,3	1,6	2,5	1,8	2,2	3,5	T	T	T	T	T	T	T
		100	-	-	2,2	-	1,6	2,5	-	2,2	3,5	T	T	T	T	T	T	T
		125	-	-	-	-	-	2,5	-	-	3,5	T	T	T	T	T	T	T
		160	-	-	-	-	-	2,5	-	-	3,5	T	T	T	T	T	T	T
Record Plus™		125	-	-	-	-	-	-	-	-	-	3,5	10	15	T	T	T	T
FE250 N, H & L		160	-	-	-	-	-	-	-	-	-	3,5	10	15	T	T	T	T
LTMD/SMR1		200	-	-	-	-	-	-	-	-	-	-	10	15	T	T	T	T
		250	-	-	-	-	-	-	-	-	-	-	10	15	T	T	T	T
Record Plus™		250	-	-	-	-	-	-	-	-	-	-	5	6	5	7	7	7
FG400 N, H & L		400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7

Application guide

Intro

A

B

C

D

E

F

G

X



Table D4 - Selectivity/Discrimination

Downstream	Upstream	In (A)	Record Plus™ type			
			FK800N, H & L SMR1	FK1250N, H & L SMR1		FK1600N, H & L SMR1
			800	1000	1250	1600
Selectivity limit in kA*						
Redline						
EPC 30, 45 & 60N / G30, 45, 60 & 100 / GT25 / DME60 DM(T)60, & 100	B/C curve	All	T	T	T	T
Redline						
Series HTI & S90	C curve	All	T	T	T	T
Surion						
GPS1BS, GPS1MS, GPS2BS, GPS2MS GPS1BH, GPS1MH, GPS2BH & GPS2MH		All	T	T	T	T
Record Plus™						
FD160E, S, N, H & L types LTM/LTMD/MO/GTM		All	15	T	T	T
Record Plus™						
FE160 N, H & L types LTM/LTMD/MO/GTM/SMR1	Trip Units	All	T	T	T	T
Record Plus™						
FE250 V, N, H & L types LTM/LTMD/MO/GTM/SMR1	Trip Units	All	T	T	T	T
Record Plus™						
FG400 N, H & L types SMR1/SMR2	Trip Units	All	T	T	T	T
Record Plus™						
FG630 N, H & L types SMR1/SMR2	Trip Units	400A	15	T	T	T
		500A	15	T	T	T
		630A	15	T	T	T
Record Plus™						
FK800 N, H & L types LTM/MO/SMR1e, s & g	Trip Units	All	-	15	15	25
Record Plus™						
FK1250 N, H & L types LTM/MO/SMR1e, s & g	Trip Units	1000A	-	-	-	25
		1250A	-	-	-	25

* Where T is mentioned Selectivity is full up until the Icu of the downstream device

Table D5 - Selectivity/Discrimination

Downstream Device	Trip Unit	Upstream EntelliGuard™ G device and Selectivity limit Is ⁽¹⁾								
		GG04S to GG20S	GG04N to GG20N	GG25N to GG40N	GG04E to GG20E	GG(H)25H to GG(H)40H	GG(H)25M to GG(H)40M	GG32G to GG40G	GG40M to GG64M	GG40L to GG64L
Redline										
EPC 30, 45 & 60N / G30, 45, 60, 100 / GT25 / DME60 / DM(T)60, & 100 B/C curve	All	T	T	T	T	T	T	T	T	T
Redline										
Series HTI & S90	C curve	All	T	T	T	T	T	T	T	T
Surion Manual Motor starters										
GPS1BS & GPS1MS GP2BS & GPS2MS	All	T	T	T	T	T	T	T	T	T
Surion Manual Motor starters										
GPS1BH & GPS1MH GP2BH & GPS2MH	All	T	T	T	T	T	T	T	T	T
Record Plus™										
FD& FE frame C, E, V, S tiers	All	T	T	T	T	T	T	T	T	T
FD& FE frame N tier	All	T	T	T	T	T	T	T	T	T
FD& FE frame H tier	All	T	T	T	T	T	T	T	T	T
FD& FE frame L tier	All	T	T	T	T	T	T	T	T	T
FG frame N tier	All	T	T	T	T	T	T	T	T	T
FG frame H tier	All	T	T	T	T	T	T	T	T	T
FG frame L tier	All	T	T	T	T	T	T	T	T	T
FK frame N tier	All	T	T	T	T	T	T	T	T	T
FK frame H tier	All	T	T	T	T	T	T	T	T	T
FK frame L tier	All	T	T	T	T	T	T	T	T	T
EntelliGuard										
GG04S to GG20S	All	50kA ⁽²⁾	T	T	T	T	T	T	T	T
GG04N to GG20N	All	50kA ⁽²⁾	65kA ⁽²⁾	65kA ⁽²⁾	T	T	T	T	T	T
GG04E to GG20E	All	50kA ⁽²⁾	65kA ⁽²⁾	65kA ⁽²⁾	85kA ⁽²⁾	85kA ⁽²⁾	85kA ⁽²⁾	T	T	T
GG(H)25H to GG(H)40H	All	-	-	65kA ⁽²⁾	-	85kA ⁽²⁾	85kA ⁽²⁾	T	T	T
GG(H)25M to GG(H)40M	All	-	-	65kA ⁽²⁾	-	85kA ⁽²⁾	85kA ⁽²⁾	T	T	T
GG(H)40M to GG(H)64M	All	-	-	-	-	-	-	100kA ⁽²⁾	100kA ⁽²⁾	100kA ⁽²⁾
GG(H)40L to GG(H)64L	All	-	-	-	-	-	-	100kA ⁽²⁾	100kA ⁽²⁾	100kA ⁽²⁾
Industrial fuses⁽³⁾										
GL/Gg type	-	T	T	T	T	T	T	T	T	T

(1) T = Full selectivity until the Icu of the downstream or upstream device (the lowest of the two)

(2) Indicated values apply with I (Instantaneous) ON, If Off reduce by 10%

(3) Conditions for selectivity: Fuse rating = Breaker LT rating /2; Other minimum breaker settings: LTDB: F20, ST = 8 x Ir, STDB band 5, Inst = 12 x Ie.

Intro

A

B

C

D

E

F

G

X



Back-up protection

One of the operational requirements for a protective device is that its rated short-circuit breaking capacity I_{cu} or I_{cs} is either equal or greater than the prospective short-circuit current at the point where it is installed. EN 60384 defines one exception to this in clause 434:

The upstream device must possess the necessary rated short-circuit breaking capacity at its point of installation. The upstream device must coordinate with the downstream device in a manner that will limit the energy and short-circuit values to levels that the downstream device can handle.

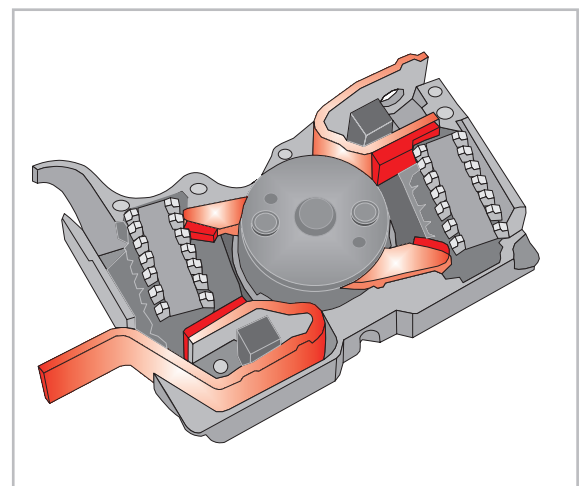
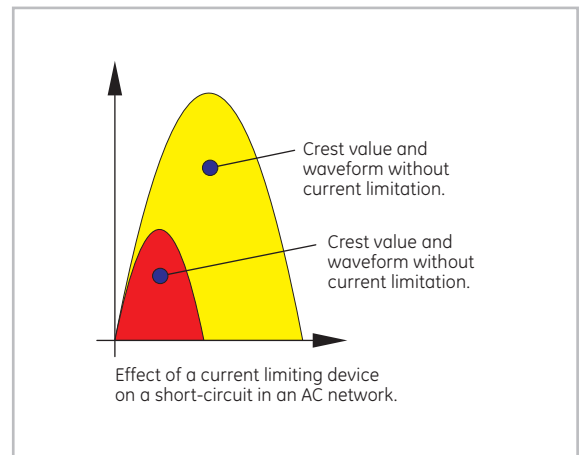
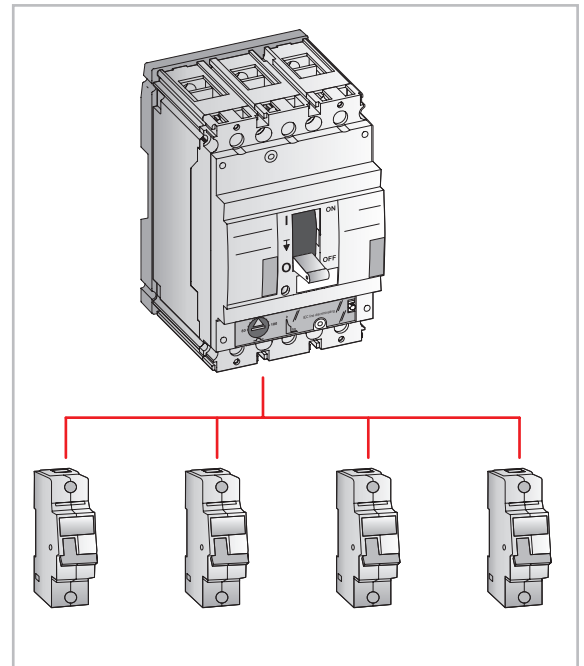
Use of current limitation

Installing an upstream device that limits the prospective short-circuit values will enable the user to place a downstream device with a lower breaking capacity. The coordination between the two devices allows excellent breaking capacity at a low cost.

Record Plus™

The **Record Plus™** rotating dual contact configuration limits the energy and current values of prospective faults to extremely low values. This key design feature allows the use of cost-effective downstream devices while maintaining overall system protection. Back-up protection is inherently „unselective“ or „non-discriminating“. That means that the upstream device must react first in order to protect the downstream device. However, the **Record Plus™** devices are so current limiting that the current and energy values present in the circuit do not trip the upstream breaker. Please refer to the details on „Selectivity Plus“ for a description of this technique.

The tables B1 and B2 are in complete accordance with the EN 60947-2 requirements and have been verified through experiment where necessary. They provide data for the **Record Plus™** breaker and the other GE Industrial Systems product lines. The values are only applicable for the devices mentioned.



- Intro
- A
- B
- C
- D
- E**
- F
- G
- X

Table B1 - Back-up protection at 230/240V

Upstream Downstream	Icu (kA)	Record Plus™ type																										
		FD160C	FD160E	FD160S	FD160N	FD160H	FD160L	FD160N	FE160H	FE160L	FE250V	FE250N	FE250H	FE250L	FG400N	FG400H	FG400L	FG630N	FG630H	FG630L	FK800N	FK800H	FK800L	FK1250N	FK1250H	FK1250L	FK1600N	FK1600H
		Icu of the combination in kA																										
Redline																												
EPC30	3	15	15	15	15	15	15	12	12	12	10	10	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPC451N / EPC45	6	15	18	18	18	18	18	15	15	15	12	12	12	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DME60	6	15	18	22	22	22	22	18	18	18	15	15	15	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPC61N / EPC60	7.5	16	20	23	23	23	23	20	20	20	16	16	16	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM60 & DMT60	10	22	25	30	36	85	85	36	85	85	30	36	65	65	16	16	16	14	14	14	-	-	-	-	-	-	-	-
DME100	10	18	22	25	25	25	25	22	22	22	18	18	18	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DM100 & DMT100	15	25	36	42	50	100	100	42	100	100	30	36	65	65	18	18	18	16	16	16	-	-	-	-	-	-	-	-
G30	15	25	36	42	50	100	100	42	100	100	30	36	65	65	18	18	18	16	16	16	-	-	-	-	-	-	-	-
G45	10	22	25	30	36	85	85	36	85	85	30	36	65	65	16	16	16	14	14	14	-	-	-	-	-	-	-	-
G60	20	25	36	42	50	100	100	50	100	100	36	42	85	85	22	22	22	18	18	18	-	-	-	-	-	-	-	-
G100	30	-	42	50	65	100	100	65	100	100	42	50	85	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GT25 ≤25A	50	-	-	-	65	100	100	65	100	100	-	65	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GT25 32 & 40A	40	-	-	50	65	100	100	65	100	100	42	50	85	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GT25 50 & 63A	30	-	42	50	65	100	100	65	100	100	42	50	85	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redline																												
Hti	15	22	36	42	50	100	100	50	100	100	36	42	80	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redline																												
S90	25	-	36	42	85	100	100	85	100	100	36	50	85	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surion																												
GPS1BS ≤16A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1BS >16A	50	-	-	-	85	100	150	-	100	150	-	-	100	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1BH all	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2BS ≤16A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2BS >16A	50	-	-	-	85	100	150	-	100	150	-	-	100	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2BH all	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Record Plus™																												
FD160C	18	-	30	36	42	50	65	42	50	65	36	42	50	65	42	50	65	42	50	65	-	-	-	-	-	-	-	-
FD160E	36	-	-	50	65	85	100	65	85	100	50	65	85	100	65	85	100	65	85	100	-	-	-	-	-	-	-	-
FD160S	50	-	-	-	-	85	100	-	85	100	-	-	85	100	-	85	100	-	85	100	-	-	-	-	-	-	-	-
FD160N	85	-	-	-	-	100	200	-	100	200	-	-	100	200	-	100	200	-	100	200	80	100	150	80	100	150	80	100
FD160H	100	-	-	-	-	200	-	-	200	-	-	-	200	-	-	200	-	-	200	-	200	-	100	150	-	100	150	-
FE160N	85	-	-	-	-	-	-	-	100	200	-	-	100	200	-	100	200	-	100	200	80	100	150	80	100	150	80	100
FE160H	100	-	-	-	-	-	-	-	200	-	-	-	200	-	-	200	-	-	200	-	200	-	100	150	-	100	150	-
FE250N	85	-	-	-	-	-	-	-	-	-	-	-	100	200	-	100	200	-	100	200	80	100	150	80	100	150	80	100
FE250H	100	-	-	-	-	-	-	-	-	-	-	-	200	-	-	200	-	-	200	-	200	-	100	150	-	100	150	-
FG400N	85	-	-	-	-	-	-	-	-	-	-	-	-	100	200	-	100	200	-	100	200	80	100	150	80	100	150	80
FG400H	100	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	200	-	200	-	200	-	100	150	-	100	150	-
FG630N	85	-	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	200	-	100	200	80	100	150	80	100	150	80
FG630H	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	-	-	200	-	200	-	100	150	-	100	150	-
FK800N	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	100	150	80	100	150	80	100
FK800H	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	170	-	100	170	-	100
FK1250N	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	100	170	80	100	170	80	100
FK1250H	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	170	-	100	170	-	100

Back-up protection

Intro

A

B

C

D

E

F

G

X



Table B2 - Back-up protection at 400/415V

	Upstream Downstream	Icu (kA)	Record Plus™ type																											
			FD160C	FD160E	FD160S	FD160N	FD160H	FD160L	FD160N	FE160H	FE160L	FE250V	FE250N	FE250H	FE250L	FG400N	FG400H	FG400L	FG630N	FG630H	FG630L	FK800N	FK800H	FK800L	FK1250N	FK1250H	FK1250L	FK1600N	FK1600H	
			Icu of the combination in kA																											
Redline																														
EPC30		5	15	18	22	25	30	36	25	30	36	18	22	25	30	12	12	12	10	10	10	-	-	-	-	-	-	-	-	-
EPC452, 453 & 454		6	15	18	22	25	30	36	25	30	36	18	22	25	30	12	12	12	10	10	10	-	-	-	-	-	-	-	-	-
EPC62, 63 & 64		7.5	16	20	23	25	34	40	28	34	40	20	25	30	32	15	15	15	10	10	10	-	-	-	-	-	-	-	-	-
G32, 33 & 34		3	15	18	22	25	30	36	25	30	36	18	22	25	30	12	12	12	10	10	10	-	-	-	-	-	-	-	-	-
G452, 453 & 454		5	15	18	22	25	30	36	25	30	36	18	22	25	30	12	12	12	10	10	10	-	-	-	-	-	-	-	-	-
G60 & GT10		10	18	22	25	30	36	42	30	36	42	22	30	36	36	16	16	16	12	12	12	-	-	-	-	-	-	-	-	-
GT100		15	18	25	30	36	42	50	36	42	50	25	30	36	36	22	22	22	16	16	16	-	-	-	-	-	-	-	-	-
GT25	≤25A	25	-	-	36	42	50	65	42	50	65	-	36	42	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GT25	32 & 40A	20	-	-	30	36	42	50	36	42	50	-	36	42	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GT25	50 & 63A	15	18	25	30	36	42	50	36	42	50	25	30	36	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redline																														
Series Hti		10	15	18	25	30	36	42	30	36	42	18	30	36	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redline																														
Series S90		15	18	25	30	36	42	50	36	42	50	25	36	42	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surion																														
GPS1BS	≤10A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1B/MS	12.5A	50	-	-	-	-	80	150	-	80	150	-	-	80	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1B/MS	≥16A	25	-	-	-	42	50	65	42	50	65	-	42	50	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1B/MH	≤12.5A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS1B/MH	>12.5A	50	-	-	-	-	80	150	-	80	150	-	-	80	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2B/MS	10A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2B/MS	>10A	25	-	-	-	42	50	65	42	50	65	-	42	50	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2B/MH	10A	100	-	-	-	-	150	-	-	150	-	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GPS2B/MH	>10A	50	-	-	-	-	80	150	-	80	150	-	-	80	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Record Plus™																														
FD160C		18	-	22	25	30	36	42	30	36	42	22	30	36	42	30	36	42	30	36	42	-	-	-	-	-	-	-	-	-
FD160E		25	-	-	30	36	42	50	36	42	50	-	36	42	50	36	42	50	36	42	50	-	-	-	-	-	-	-	-	-
FD160S		36	-	-	-	42	50	65	42	50	65	-	42	50	65	42	50	65	42	50	65	-	-	-	-	-	-	-	-	-
FD160N		50	-	-	-	-	80	150	-	80	150	-	-	80	150	-	80	150	-	80	150	-	80	100	-	80	100	-	80	-
FD160H		80	-	-	-	-	150	-	-	150	-	-	-	150	-	-	150	-	150	-	150	-	100	100	-	100	100	-	100	-
FE160N		50	-	-	-	-	-	-	-	80	150	-	-	80	150	-	80	150	-	80	150	-	80	100	-	80	100	-	80	-
FE160H		80	-	-	-	-	-	-	-	150	-	-	-	150	-	-	150	-	150	-	150	-	100	100	-	100	100	-	100	-
FE250N		50	-	-	-	-	-	-	-	-	-	-	80	150	-	80	150	-	80	150	-	80	100	-	80	100	-	80	100	-
FE250H		80	-	-	-	-	-	-	-	-	-	-	150	-	-	150	-	150	-	150	-	100	100	-	100	100	-	100	-	
FG400N		50	-	-	-	-	-	-	-	-	-	-	-	-	-	80	150	-	80	150	-	80	100	-	80	100	-	80	100	-
FG400H		80	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	150	-	150	-	100	100	-	100	100	-	100	-	
FG630N		50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	150	-	80	150	-	80	100	-	80	100	-	
FG630H		80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	150	-	100	100	-	100	100	-	100	-	
FK800N		50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	100	-	80	100	-	80	100	-
FK800H		80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	100	-	100	100	-	100	-	
FK1250N		50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	100	-	80	100	-	80	100	-
FK1250H		80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	100	-	100	100	-	100	-	



Application guide Selectivity Plus

Back-up protection requires an upstream device to open in order to protect the downstream device(s) before the downstream devices can be damaged. For continuity of service it is desirable that the upstream device remains closed and that only the downstream device closest to the fault reacts. The **Record Plus™** family of breakers resolves this paradox: the breakers are so current limiting that let-through energy and current are not sufficient to operate the upstream breaker. The result discrimination to current levels that are higher

than the rated short-circuit breaking capacity of the downstream breaker. Tables DB1 to DB5 provide the data for the **Record Plus™** breaker line used in combination with the ElfaPlus, Surion and MPact protection devices. The values in the table are in kA and indicate the results of the Selectivity Plus technique. Before the slash the discrimination limit in kA, after the slash the back-up protection value at 400V in kA (e.g. 50/80).

Table DB1 - Selectivity Plus

Upstream	Downstream	In (A)	Record Plus™ type																										
			FDC 63/160 LTM				FDE 63/160 LTM				FDS 63/160 LTMD				FDN 63/160 LTMD				FDH 63/160 LTMD				FDL 63/160 LTMD						
			63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	63	80
Selectivity limit in kA / Maximum Icu of combination at 400/415V AC																													
Redline G & EPC30/45 B/C curve	≤16	6/15	6/15	10/15	15/15	6/18	6/18	10/18	18/18	22/22	22/22	22/22	22/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36
	20	3/15	6/15	8/15	15/15	3/18	6/18	8/18	18/18	22/22	22/22	22/22	22/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36
	25	-	6/15	6/15	15/15	-	6/18	6/18	18/18	15/22	15/22	22/22	22/22	15/25	15/25	25/25	25/25	15/30	15/30	30/30	30/30	30/30	30/30	30/30	30/30	15/36	15/36	15/36	30/36
	32	-	3/15	6/15	15/15	-	3/18	6/18	18/18	10/22	10/22	22/22	22/22	10/25	10/25	25/25	25/25	10/30	10/30	30/30	30/30	30/30	30/30	30/30	30/30	10/36	10/36	10/36	36/36
	40	-	3/15	4/15	15/15	-	3/18	4/18	18/18	3.5/22	10/22	15/22	22/22	3.5/25	10/25	15/25	25/25	3.5/30	10/30	15/30	25/30	3.5/36	10/36	15/36	25/36	3.5/42	10/42	15/42	22/42
Redline G60 B/C curve	≤16	6/18	6/18	10/18	18/18	6/22	6/22	10/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	
	20	3/18	6/18	8/18	18/18	3/22	6/22	8/22	22/22	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	
	25	-	6/18	6/18	18/18	-	6/22	6/22	22/22	15/25	15/25	25/25	25/25	15/30	15/30	30/30	30/30	15/36	15/36	30/36	30/36	15/42	15/42	30/42	30/42	15/42	15/42	15/42	30/42
	32	-	3/18	6/18	18/18	-	3/22	6/22	22/22	10/25	10/25	25/25	25/25	10/30	10/30	30/30	30/30	10/36	10/36	30/36	30/36	10/42	10/42	30/42	30/42	10/42	10/42	10/42	30/42
	40	-	3/18	4/18	18/18	-	3/22	4/22	22/22	3.5/25	10/25	15/25	25/25	3.5/30	10/30	15/30	25/30	3.5/36	10/36	15/36	25/36	3.5/42	10/42	15/42	25/42	3.5/42	10/42	15/42	25/42
	50	-	-	1.5/18	6/18	-	-	1.5/22	6/22	-	3.5/25	10/25	22/25	-	3.5/30	10/30	22/30	-	3.5/36	10/36	22/36	-	3.5/42	10/42	22/42	-	3.5/42	10/42	22/42
	63	-	-	-	-	-	-	-	-	-	8/25	22/25	-	-	8/30	22/30	-	-	8/36	22/36	-	-	8/42	22/42	-	-	8/42	22/42	
	Redline G100 B/C curve	≤16	6/18	6/18	10/18	18/18	6/25	6/25	10/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42
20		3/18	6/18	8/18	18/18	3/25	6/25	8/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	36/42	
25		-	6/18	6/18	18/18	-	6/25	6/25	25/25	15/30	30/30	30/30	30/30	15/36	36/36	30/36	30/36	15/42	36/42	36/42	36/42	15/50	15/50	15/50	15/50	30/50	30/50	30/50	
32		-	3/18	6/18	18/18	-	3/25	6/25	25/25	10/30	10/30	30/30	30/30	10/36	10/36	30/36	30/36	10/42	10/42	30/42	30/42	10/50	10/50	30/50	30/50	10/50	10/50	30/50	
40		-	3/18	4/18	18/18	-	3/25	4/25	25/25	3.5/30	10/30	15/30	25/30	3.5/36	10/36	15/36	25/36	3.5/42	10/42	15/42	25/42	3.5/50	10/50	15/50	25/50	3.5/50	10/50	15/50	
50		-	-	1.5/18	6/18	-	-	6/25	-	3.5/30	10/30	22/30	-	3.5/36	10/36	22/36	-	3.5/42	10/42	22/42	-	3.5/50	10/50	22/50	-	3.5/50	10/50	22/50	
Redline GT25 B/C curve	≤20	-	-	-	-	-	-	-	-	-	-	-	-	36/36	36/36	36/36	36/36	36/42	36/42	36/42	36/42	36/50	36/50	36/50	36/50	36/65	36/65	36/65	
	25	-	-	-	-	-	-	-	-	-	-	-	-	15/36	15/36	30/36	30/36	15/42	15/42	30/42	30/42	15/50	15/50	30/50	30/50	15/65	15/65	30/65	
	32	-	-	-	-	-	-	-	-	-	-	-	-	10/30	10/30	36/30	30/30	10/36	10/36	36/36	30/36	10/42	10/42	36/42	30/42	10/50	10/50	36/50	
	40	-	-	-	-	-	-	-	-	-	-	-	-	3.5/30	10/30	15/30	25/30	3.5/36	10/36	15/36	25/36	3.5/42	10/42	15/42	25/42	3.5/50	10/50	15/50	
	50	-	-	-	-	-	-	-	-	-	-	-	-	3.5/30	10/30	22/30	-	3.5/36	10/36	22/36	-	3.5/42	10/42	22/42	-	3.5/50	10/50	22/50	
	63	-	-	-	-	-	-	-	-	-	-	-	-	8/30	22/30	-	-	8/36	22/36	-	-	8/42	22/42	-	-	8/50	22/50	-	
Surion GPS1BS & GPS1MS	≤10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	16/20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	25/32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Surion GPS2BS & GPS2MS	≤10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	16/20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	25/32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Surion GPS1BH & GPS1MH GPS2BH & GPS2MH	≤10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	16/20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	25/32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table DB1a - Selectivity Plus

Upstream	Downstream	In (A)	Selectivity limit in kA / Maximum Icu of combination at 230/240V AC																									
			63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	63	80	100	125	160	
Redline EPC30 & 45 B/C curve	≤16	6/15	6/15	10/15	10/15	6/15	6/15	10/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	
	20	3/15	6/15	8/15	10/15	3/15	6/15	8/15	10/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	
	25	-	6/15	6/15	10/15	-	6/15	6/15	10/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	
	32	-	3/15	6/15	10/15	-	3/15	6/15	10/15	10/15	10/15	15/15	15/15	10/15	10/15	15/15	15/15	10/15	10/15	15/15	15/15	10/15	10/15	15/15	15/15	10/15	10/15	15/15
	40	-	3/15	4/15	10/15	-	3/15	4/15	10/15	3.5/15	10/15	15/15	15/15	3.5/15	10/15	15/15	15/15	3.5/15	10/15	15/15	15/15	3.5/15	10/15	15/15	15/15	3.5/15	10/15	15/15
Redline DME60 EPC61N & EPC60 B/C curve	≤16	6/15	6/15	10/15	10/15	6/18	6/18	10/18	10/18	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	
	20	3/15	6/15	8/15	10/15	3/18	6/18	8/18	10/18	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	22/22	
	25	-	6/15	6/15	10/15	-	6/18	6/18	10/18	15/22	22/22	22/22	22/22	15/22	22/22	22/22	22/22	15/22	22/22	22/22	22/22	15/22	22/22	22/22	15/22	22/22	22/22	
	32	-	3/15	6/15	10/15	-	3/18	6/18	10/18	10/22	10/22	22/22																

Table DB3 - Selectivity Plus

Upstream	Record Plus™ type																					
	FE160N-LTMD			FE160H-LTMD			FE160L-LTMD			FE250N-LTMD				FE250H-LTMD				FE250L-LTMD				
	In (A)	100	125	160	100	125	160	100	125	160	125	160	200	250	125	160	200	250	125	160	200	250
Downstream	Selectivity limit in kA / Maximum Icu of combination at 400/415V AC																					
Record Plus™																						
LTM, LTMD, GTM & MO																						
FD160C	≤63	30/30	30/30	30/30	30/36	30/36	30/36	30/42	30/42	30/30	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42
FD160E	≤63	30/36	30/36	30/36	30/42	30/42	30/42	30/50	30/50	30/50	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	42/50	42/50	42/50	42/50
FD160S	≤63	30/42	30/42	30/42	30/50	30/50	30/50	30/65	30/65	30/65	42/42	42/42	42/42	42/42	42/50	42/50	42/50	42/50	42/65	42/65	42/65	42/65
FD160N	≤63	30/50	30/50	30/50	30/80	30/80	30/80	30/150	30/150	30/150	42/50	42/50	42/50	42/50	42/80	42/80	42/80	42/80	42/150	42/150	42/150	42/150
FD160H	≤63	-	-	-	30/80	30/80	30/80	30/150	30/150	30/150	-	-	-	-	42/80	42/80	42/80	42/80	42/150	42/150	42/150	42/150
LTM, LTMD, GTM & MO																						
FDC160	≤100	-	-	30/30	-	-	30/36	-	-	30/42	-	30/30	30/30	30/30	-	36/36	36/36	36/36	-	42/42	42/42	42/42
FDE160	≤100	-	-	30/36	-	-	30/42	-	-	30/50	-	36/36	36/36	36/36	-	42/42	42/42	42/42	-	42/50	42/50	42/50
FDS160	≤100	-	-	30/42	-	-	30/50	-	-	30/65	-	42/42	42/42	42/42	-	42/50	42/50	42/50	-	42/65	42/65	42/65
FDN160	≤100	-	-	30/50	-	-	30/80	-	-	30/150	-	42/50	42/50	42/50	-	42/80	42/80	42/80	-	42/150	42/150	42/150
FDH160	≤100	-	-	-	-	-	30/80	-	-	30/150	-	-	-	-	-	42/80	42/80	42/80	-	42/150	42/150	42/150
LTM, LTMD & GTM																						
FDC160	125	-	-	-	-	-	-	-	-	-	-	30/30	30/30	-	-	36/36	36/36	-	-	42/42	42/42	
FDE160	125	-	-	-	-	-	-	-	-	-	-	36/36	36/36	-	-	42/42	42/42	-	-	42/50	42/50	
FDS160	125	-	-	-	-	-	-	-	-	-	-	42/42	42/42	-	-	42/50	42/50	-	-	42/65	42/65	
FDN160	125	-	-	-	-	-	-	-	-	-	-	42/50	42/50	-	-	42/80	42/80	-	-	42/150	42/150	
FDH160	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42/80	42/80	-	-	42/150	42/150	
LTM, LTMD & GTM																						
FDC160	160	-	-	-	-	-	-	-	-	-	-	30/30	-	-	-	36/36	-	-	-	-	42/42	
FDE160	160	-	-	-	-	-	-	-	-	-	-	36/36	-	-	-	42/42	-	-	-	-	42/50	
FDS160	160	-	-	-	-	-	-	-	-	-	-	42/42	-	-	-	42/50	-	-	-	-	42/65	
FDN160	160	-	-	-	-	-	-	-	-	-	-	42/50	-	-	-	42/80	-	-	-	-	42/150	
FDH160	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42/80	-	-	-	-	42/150	

Table DB4 - Selectivity Plus

Upstream	Record Plus™ type																					
	FE160N-SMR1			FE160H-SMR1			FE160L-SMR1			FE250N-SMR1				FE250H-SMR1				FE250L-SMR1				
	In (A)	100	125	160	100	125	160	100	125	160	125	160	200	250	125	160	200	250	125	160	200	250
Downstream	Selectivity limit in kA / Maximum Icu of combination at 400/415V AC																					
Record Plus™																						
LTM, LTMD, GTM & MO																						
FD160C	≤63	-	30/30	30/30	-	30/36	30/36	-	36/42	36/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42
FD160E	≤63	-	36/36	36/36	-	30/42	30/42	-	36/50	36/50	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50
FD160S	≤63	-	36/42	36/42	-	30/50	30/50	-	36/65	36/65	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	50/65	50/65	50/65	50/65
FD160N	≤63	-	36/50	36/50	-	30/80	30/80	-	36/150	36/150	50/50	50/50	50/50	50/50	50/80	50/80	50/80	50/80	50/150	50/150	50/150	50/150
FD160H	≤63	-	-	-	-	30/80	30/80	-	36/150	36/150	-	-	-	-	50/80	50/80	50/80	50/80	50/150	50/150	50/150	50/150
LTM, LTMD, GTM & MO																						
FDC160	≤100	-	-	30/30	-	-	30/36	-	-	36/42	-	30/30	30/30	30/30	-	36/36	36/36	36/36	-	42/42	42/42	42/42
FDE160	≤100	-	-	36/36	-	-	30/42	-	-	36/50	-	36/36	36/36	36/36	-	42/42	42/42	42/42	-	50/50	50/50	50/50
FDS160	≤100	-	-	36/42	-	-	30/50	-	-	36/65	-	42/42	42/42	42/42	-	50/50	50/50	50/50	-	50/65	50/65	50/65
FDN160	≤100	-	-	36/50	-	-	30/80	-	-	36/150	-	50/50	50/50	50/50	-	50/80	50/80	50/80	-	50/150	50/150	50/150
FDH160	≤100	-	-	-	-	-	30/80	-	-	36/150	-	-	-	-	-	50/80	50/80	50/80	-	50/150	50/150	50/150
LTM, LTMD & GTM																						
FDC160	125	-	-	-	-	-	-	-	-	-	-	30/30	30/30	-	-	36/36	36/36	-	-	42/42	42/42	
FDE160	125	-	-	-	-	-	-	-	-	-	-	36/36	36/36	-	-	42/42	42/42	-	-	50/50	50/50	
FDS160	125	-	-	-	-	-	-	-	-	-	-	42/42	42/42	-	-	50/50	50/50	-	-	50/65	50/65	
FDN160	125	-	-	-	-	-	-	-	-	-	-	50/50	50/50	-	-	50/80	50/80	-	-	50/150	50/150	
FDH160	125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50/80	50/80	-	-	50/150	50/150	
LTM, LTMD & GTM																						
FDC160	160	-	-	-	-	-	-	-	-	-	-	30/30	-	-	-	36/36	-	-	-	-	42/42	
FDE160	160	-	-	-	-	-	-	-	-	-	-	36/36	-	-	-	42/42	-	-	-	-	50/50	
FDS160	160	-	-	-	-	-	-	-	-	-	-	42/42	-	-	-	50/50	-	-	-	-	50/65	
FDN160	160	-	-	-	-	-	-	-	-	-	-	50/50	-	-	-	50/80	-	-	-	-	50/150	
FDH160	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50/80	-	-	-	-	50/150	

Intro

A

B

C

D

E

F

G

X



Table DB5 - Selectivity Plus

Upstream In (A)	Record Plus™ type											
	FG400N-SMR1		FG400H-SMR1		FG400L-SMR1		FG630N-SMR1		FG630H-SMR1		FG630L-SMR1	
	250	400	250	400	250	400	400	500 - 630	400	500 - 630	400	500 - 630
Downstream	Selectivity limit in kA / Maximum Icu of combination at 400/415V AC											
Record Plus™												
LTM, LTMD, GTM & MO												
FDC160	30/30	30/30	36/36	36/36	42/42	42/42	30/30	30/30	36/36	36/36	42/42	42/42
FDE160	36/36	36/36	42/42	42/42	50/50	50/50	36/36	36/36	42/42	42/42	50/50	50/50
FDS160	42/42	42/42	50/50	50/50	65/65	65/65	42/42	42/42	50/50	50/50	65/65	65/65
FDN160	50/50	50/50	80/80	80/80	150/150	150/150	50/50	50/50	80/80	80/80	150/150	150/150
FDH160	-	-	80/80	80/80	150/150	150/150	-	-	80/80	80/80	150/150	150/150
LTM, LTMD, GTM, MO& SMR1												
FEN160	50/50	50/50	80/80	80/80	150/150	150/150	50/50	50/50	80/80	80/80	150/150	150/150
FEH160	-	-	80/80	80/80	150/150	150/150	-	-	80/80	80/80	150/150	150/150
FEN250	-	-	80/80	80/80	150/150	150/150	50/50	50/50	80/80	80/80	150/150	150/150
FEH250	-	-	80/80	80/80	150/150	150/150	-	-	80/80	80/80	150/150	150/150

Table DB6 - Selectivity Plus

Upstream In (A)	Record Plus™ type										
	FK800N-SMR	FK800H-SMR	FK800L-SMR	FK1250N-SMR		FK1250H-SMR		FK1250L-SMR		FK1600N-SMR	FK1600H-SMR
	800	800	800	1000	1250	1000	1250	1000	1250	1600	1600
Downstream	Selectivity limit in kA / Maximum Icu of combination at 400/415V AC										
Record Plus™											
LTM, LTMD, GTM & MO											
FDN160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FDH160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
LTM, LTMD, GTM, MO & SMR1											
FEN160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FEH160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FEN250	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FEH250	-	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
SMR1 & SMR2											
FGN400	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FGH400	50/50	80/80	100/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FGN630	15/50	15/80	15/100	50/50	50/50	80/80	80/80	100/100	100/100	50/50	80/80
FGH630	-	15/80	15/100	-	-	80/80	80/80	100/100	100/100	50/50	80/80
SMR1											
FKN800	-	-	-	15/50	15/50	15/80	15/80	15/100	15/100	25/50	25/80
FKH800	-	-	-	-	-	15/80	15/80	15/100	15/100	25/50	25/80
FKN1250	-	-	-	-	-	-	-	-	-	25/50	25/80

Intro

A

B

C

D

E

F

G

X

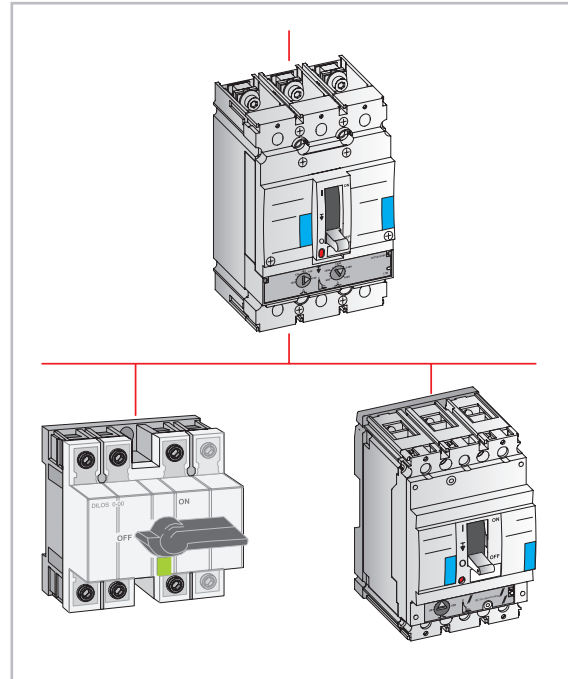


Coordination with loadbreak disconnect switches

Record Plus™ circuit breakers excel in their characteristics as current and energy limiting devices. This allows one to use lighter and more economical downstream busbar systems and switchgear.

A frequently used combination is that of a **Record Plus™** breaker, used as a protection and switching device in the mains switchboard, and a Dilos loadbreak switch, as an in-comer, in a downstream, secondary switchboard. In this application the Dilos needs to be able to withstand the current and energy values on a short-circuit event, this taking the limiting effects of the upstream breaker into account.

The table indicates the maximum prospective short-circuit that the combination of an upstream **Record Plus™** and a downstream Dilos or **Record Plus™** in its switch disconnect variant (type Y) can withstand.



Protection of Switch Disconnectors (Dilos or Record Plus) with Record Plus circuit breakers - Valid for 400/415V AC

Upstream Record Plus™ circuit breaker	Breaking capacity, I _{cu} =I _{cs} (kA eff.)	Downstream Dilos switch	Maximum allowable short-circuit (kA eff.) of combination	Downstream Record Plus™ switch	Maximum allowable short-circuit (kA eff.) of combination
FD160S	36	Dilos 1 & 1H	18	FD63Y	36
FD160N	50	Dilos 2	18	FD160Y	36
FD160H	80	Dilos 1 & 1H	25	FD63Y	50
FD160L	150	Dilos 2	25	FD160Y	50
FE160N	50	Dilos 1 & 1H	30	FD63Y	80
FE160H	80	Dilos 2	30	FD160Y	80
FE160L	150	Dilos 1 & 1H	36	FD63Y	150
FE250N	50	Dilos 2	36	FD160Y	150
FE250H	80	Dilos 1 & 1H	25	FD63Y	50
FE250L	150	Dilos 2	25	FD160Y	50
FG400N	50	Dilos 1 & 1H	30	FD63Y	80
FG400H	80	Dilos 2	30	FD160Y	80
FG400L	150	Dilos 1 & 1H	36	FD63Y	150
FG630N	50	Dilos 2	36	FD160Y	150
FG630H	80	Dilos 3	50	FE250Y	50
FG630L	150	Dilos 4	80	FE250Y	80
FK800N	50	Dilos 3	150	FE250Y	150
FK800H	80	Dilos 4	50	FG400Y	50
FK1250N	50	Dilos 4	80	FG400Y	80
FK1250H	80	Dilos 4	150	FG400Y	150
FK1600N	50	Dilos 4	50	FG630Y	50
FK1600H	80	Dilos 4	80	FG630Y	80
		Dilos 6	150	FG630Y	150
		Dilos 6	50	FK800Y	50
		Dilos 6	80	FK800Y	80
		Dilos 6	50	FK1250Y	50
		Dilos 6	80	FK1250Y	80
		Dilos 7	50	FK1600Y	50
		Dilos 7	80	FK1600Y	80

Protection of motor circuits

General

In a circuit that provides power to a motor a number of protective and control devices are normally present. The combination of these devices must be coordinated to ensure the efficiency and an optimal protection of the motor. Here, the protection of such circuits strongly depends on the operational requirements, as the application for which the motor is used, the required starting frequency, the required service level and the applicable safety standards.

Protection of the electrical circuit

The motor circuit must provide the following functionality:

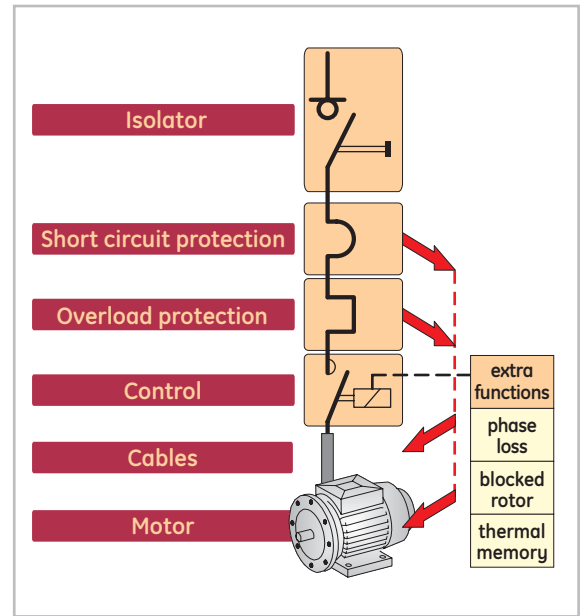
- Isolate the circuit from the network for maintenance.
- Protect against short-circuits in the equipment, the starter and the cables within the circuit.
- Protect against overloads in the equipment, the starter and the cables within the circuit.
- Protect against faults specific to the motor within it's application.

Control of the motor in question, this covering starting, stopping, speed control etc.

Standards

The requirements for circuits supplying a motor, in general called "motor starters", can be found in the IEC 60947-4-1. To define the components for isolation, overload and short-circuit protection the following elements must be defined:

- Depending on the type of electrical motor and it's operational requirements, four motor utilization categories have been defined. These have an impact on the characteristics of the control element within the circuit. These so called AC classes are depicted in the table on the right.
- The required trip curve class of the overload protection, this depending on the motor application, the classes 10A, 10, 20 and 30 are normally used, the requirements for which are indicated in the table.
- Isolation and safety during maintenance. Use of the **Record Plus™** breaker here provides an enhancement of the present standard requirement for **POSITIVE OFF** adding in a **POSITIVE ON** indication.



Category	Load type	Contactor usage
AC1	Non Inductive motors	Energization
AC2	Slip ring motors	Starting Switching off whilst running Regenerative breaking Inching
AC3	Squirrel-cage motors	Energization Switching off whilst running
AC4	Squirrel-cage motors (cos phi = 0.45 ≤ 100A) (cos phi = 0.35 > 100A)	Starting Switching off whilst running Regenerative breaking Plugging Inching

Trip class	Required tripping times at		
	1.2 x I _n	1.5 x I _n	7.2 x I _n
10A	t < 2 hours	t < 2 min.	2 ≤ t ≤ 10 sec.
10	t < 2 hours	t < 4 min.	4 ≤ t ≤ 10 sec.
20	t < 2 hours	t < 8 min.	6 ≤ t ≤ 20 sec.
30	t < 2 hours	t < 12 min.	9 ≤ t ≤ 30 sec.



Coordination

The standards require tests to define the coordination between the devices within the motor starter. Depending on the state of the components after the test two coordination classes 1 and 2 have been defined.

The unique properties of the **Record Plus™** breaker allow GE to offer solutions meeting the highest standards. For this reason all tables published here only refer to **coordination type 2**.

This entails that the GE equipment meets the following standards

- No or minor weldings of the contactors after testing; contact separation is simple and easy
- The switchgear and controlgear are fully operational after the tests indicated here.

Solutions with the Record Plus™ breaker

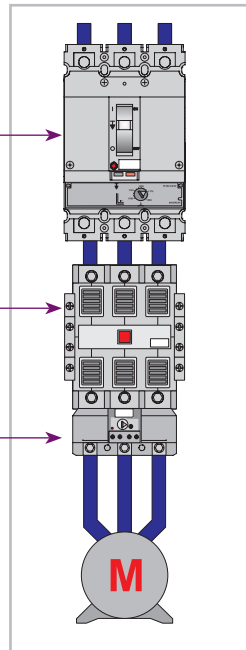
Motor starters are compiled with a number of GE components. This is to offer the required functionality of the motor starter circuit and to allow a choice in the execution thereof.

Option 1

Magnetic only circuit breaker as the short-circuit protection device.

Contactor for control purposes.

Separate thermal relay for class 10 or class 30 as overload protection.



Coordination type 2 test sequence

Motor current I_e (AC3)	Test with current "I"
$I_e \leq 16A$	1 kA
$16 < I_e \leq 63A$	3 kA
$63 < I_e \leq 125A$	5 kA
$125 < I_e \leq 315A$	10 kA
$315 < I_e \leq 630A$	18 kA

- After this test the original characteristics of the contactor and thermal relay **MUST** remain unchanged.
- After this test the short-circuit protection must trip within 10 ms at a fault current $\geq 15 \times I_n$.

Short-circuit test

This value which is generally $\leq 50kA$ is used to check the coordination of the devices used in the motor starter circuit. For each combination with **Record Plus™** breakers this value is mentioned in the tables on pages E.31, E.32, E.33, E.34 and E.35.

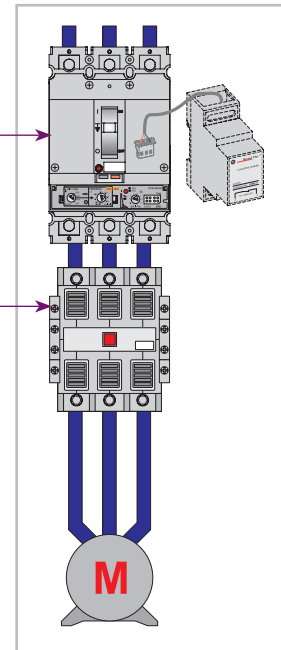
After a test with this current the following conditions must be met:

- No or minor weldings of the contactors after testing; contact separation is simple and easy
- The switchgear and controlgear are fully operational after the test.

Option 2

Electronic circuit breaker as the short-circuit and Overload protection device.

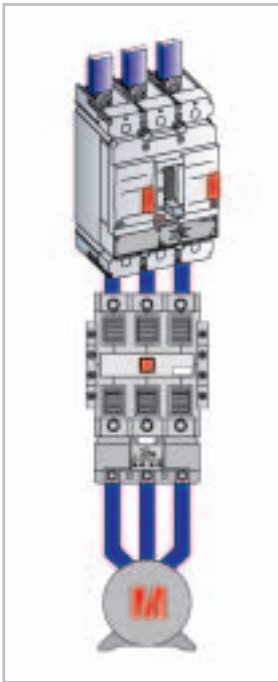
Contactor for control purposes.



After power is disconnected (circuit interruption after a fault) the breaker has no thermal memory function. This implies that after an overload, immediate breaker reset and re-energization of the circuit is possible. In order to prevent this a Long time module can be utilized that closes a contact on an overload just before the breaker trips. This allowing the contactor in the circuit to be de-energized and a external thermal memory to be initialized, before the breaker trips.

The sketch here depicts the long time module as an optional add on in the circuit diagram. Here the breaker is the short-circuit protection device **AND** a backup overload protection. If the contactor fails to open on a long time module signal the breaker will trip.

Coordination type II - EN 60947-4 - Class 10 protection



Short-circuit Protection by means of Magnetic Only MCCB.

Overload Protection by means of a direct heated electromechanical thermal relay

Phase Loss protection (Thermal relay feature)

Control by GE contactor

Upstream Record Plus™ Breaker selection							
Type	N	H	L	Type	N	H	L
	Icc values in kA Ue=230V AC				Icc values in kA Ue=400/415V AC		
FD160	85	100	130	FD160	50	80	130
FE160/250	85	100	130	FE160/250	50	80	130
FG 400/630	85	100	130	FG 400/630	50	80	130
FK 800/1250	85	100	130	FK 800/1250	50	80	100

Selection of associated components ⁽¹⁾											
Motor		Breaker details			Contactor	Motor		Breaker details			Contactor
P(kw)	In	Type	Ie	Im	Type+O.R.	P(kw)	In	Type	Ie	Im	Type
0.37	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT1J						
0.55	2.8	FD/FE160	3 ⁽²⁾	36	CL25+RT1K						
0.75	3.5	FD/FE160	3 ⁽²⁾	70	CL25+RT1K	0.75	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT1J
1.1	5.0	FD/FE160	7	70	CL03+RT12L	1.1	2.6	FD/FE160	3 ⁽²⁾	33	CL25+RT1K
1.5	6.1	FD/FE160	7	80	CL03+RT1M	1.5	3.6	FD/FE160	7	70	CL03+RT1K
2.2	8.7	FD/FE160	12.5 ⁽³⁾	125	CL06+RT2AN	2.2	5.0	FD/FE160	7	80	CL03+RT12L
3	11.5	FD/FE160	12.5 ⁽³⁾	150	CL06+RT2AN	3	6.6	FD/FE160	7	86	CL03+RT1M
4	14.5	FD/FE160	20 ⁽³⁾	200	CL06+RT2B	4	8.3	FD/FE160	12.5 ⁽³⁾	125	CL06+RT2AN
5.5	20.0	FD/FE160	20 ⁽³⁾	260	CL06+RT2C	5.5	11.5	FD/FE160	12.5 ⁽³⁾	150	CL06+RT2AN
7.5	28	FD/FE160	30 ⁽⁴⁾	364	CL06+RT2D	7.5	16.1	FD/FE160	20 ⁽³⁾	200	CL06+RT2B
10	36	FD/FE160	50	500	CL06+RT2E	10	21	FD/FE160	30 ⁽⁴⁾	300	CL06+RT2C
11	39	FD/FE160	50	507	CL06+RT2E	11	22	FD/FE160	30 ⁽⁴⁾	300	CL06+RT2C
15	50	FD/FE160	50	650	CL06+RT2G	15	30	FD/FE160	30 ⁽⁴⁾	390	CL06+RT2D
18.5	64	FD/FE160	80 ⁽⁵⁾	832	CL09+RT2J	18.5	37	FD/FE160	50	478	CL06+RT2E
22	75	FD/FE160	80 ⁽⁵⁾	975	CL09+RT2J	22	43	FD/FE160	50	561	CL06+RT2G
25	85	FD/FE160	100	1020	CL09+RT2L	25	49	FD/FE160	50	635	CL06+RT2G
30	100	FD160	100	1300	CL09+RT2M	30	58	FD/FE160	80 ⁽⁵⁾	800	CL09+RT2H
30	100	FE160	100	1300	CK75C+RT2M	37	72	FD/FE160	80 ⁽⁵⁾	934	CL09+RT2J
37	125	FE160	125	1625	CK85B+RT3E	45	86	FD160	100	1121	CL09+RT2L
45	150	FE160	160	1950	CK85B+RT3F	45	86	FE160	100	1121	CK75C+RT2L
55	180	FE250	250	2500	CK95B+RT3F	55	104	FE160	125	1346	CK85B+RT3E
75	250	FG400	250	3250	CK10B+RT4P	75	144	FE160	160	1869	CK85B+RT3F
90	312	FG400	400	4056	CK10B+RT5C	90	179	FE250	250	2500	CK95B+RT4N
110	360	FG400	400	4680	CK12B+RT5C	110	207	FE250	250	2691	CK10B+RT4P
132	430	FG630	500	5590	CK12B+RT5D	132	247	FG400	250	3214	CK10B+RT4R
160	520	FK800	800	6760	CK13B+RT5E	160	300	FG400	400	3900	CK10B+RT5C
200	630	FK800	800	6930	CK13B+RT5E	200	360	FG400	400	4680	CK12B+RT5C
-	-	-	-	-	-	220	400	FG630	500	5200	CK12B+RT5D
-	-	-	-	-	-	250	462	FG630	500	6004	CK12B+RT5D
-	-	-	-	-	-	300	560	FK800	800	6720	CK13B+RT5E
-	-	-	-	-	-	315	582	FK800	800	6985	CK13B+RT5C
-	-	-	-	-	-	335	619	FK800	800	6810	CK13B+RT5C

(1) The contactor has a breaking capacity that is sufficient to operate the specified motor up to the specified magnetic setting of the breaker

(2) The 3Amp device is designed to operate at a current level up to 3.5Amps

(3) FD160 type; contactor size can be reduced to CL04

(4) FD160 type; contactor size can be reduced to CL45

(5) FD160 type; contactor size can be reduced to CL08

Coordination type II - EN 60947-4 - Class 10 protection

Upstream Record Plus™ Breaker selection											
Type	N	H	L	Type	N	H	L	Type	N	H	L
Icc values in kA Ue=440V AC				Icc values in kA Ue=500/525V AC				Icc values in kA Ue=690V AC			
FD160	30	50	80	FD160	-	36	50	FD160	-	6	-
FE160/250	42	65	130	FE160/250	-	50	80	FE160/250	-	22	Tests pending
FG 400/630	42	65	130	FG 400/630	-	50	80	FG 400/630	-	22	
FK 800/1250	42	65	80	FK 800/1250	-	36	50	FK 800/1250	-	22	

Selection of associated components ⁽¹⁾																				
Motor			Breaker details			Contactor	Motor			Breaker details			Contactor	Motor			Breaker details			Contactor
P(kw)	In		Type	le	Im	Type+O.R.	P(kw)	In	Type	le	Im	Type+O.R.	P(kw)	In	Type	le	Im	Type+O.R.		
0.8	1.9		FD/FE160	3 ⁽²⁾	30	CL25+RT1J	0.8	1.5	FD/FE160	3 ⁽²⁾	30	CL25+RT1H								
1.1	2.5		FD/FE160	3 ⁽²⁾	30	CL25+RT1K	1.1	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT1J	1.5	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT1J		
1.5	3.4		FD/FE160	3 ⁽²⁾	70	CL25+RT1K	1.5	2.6	FD/FE160	3 ⁽²⁾	40	CL25+RT1K	2.2	2.9	FD/FE160	3 ⁽²⁾	38	CL25+RT1K		
2.2	4.6		FD/FE160	7	70	CL03+RT12L	2.2	3.8	FD/FE160	7	70	CL03+RT12L	3	3.5	FD/FE160	3 ⁽²⁾	70	CL25+RT1K		
3	6.0		FD/FE160	7	78	CL03+RT1M	3	5.0	FD/FE160	7	70	CL03+RT1M	3.7	4.6	FD/FE160	7	70	CL03+RT12L		
4	7.6		FD/FE160	12.5 ⁽³⁾	100	CL06+RT2AN	4	6.5	FD/FE160	7	85	CL03+RT1M	4	5.0	FD/FE160	7	70	CL03+RT12L		
5.5	10.5		FD/FE160	12.5 ⁽³⁾	136	CL03+RT2AN	5.5	9.0	FD/FE160	12.5 ⁽³⁾	125	CL06+RT2AN	5.5	7.0	FD/FE160	7	91	CL03+RT12M		
7.5	14.6		FD/FE160	20 ⁽³⁾	200	CL06+RT2B	7.5	12.0	FD/FE160	12.5 ⁽³⁾	156	CL06+RT2BP	7.5	9.0	FD/FE160	12.5 ⁽³⁾	125	CL07+RT2AN		
10	18.8		FD/FE160	20 ⁽³⁾	245	CL06+RT2B	10	15.0	FD/FE160	20 ⁽³⁾	200	CL06+RT2B	11	12.5	FD/FE160	12.5 ⁽³⁾	163	CL07+RT2BP		
11	20		FD/FE160	30 ⁽⁴⁾	300	CL06-RT2C	11	18.4	FD/FE160	20 ⁽³⁾	300	CL06-RT2B	13	16.0	FD/FE160	20 ⁽³⁾	208	CL07+RT2B		
15	27		FD/FE160	30 ⁽⁴⁾	355	CL06-RT2D	15	23	FD/FE160	30 ⁽⁴⁾	300	CL06-RT2C	15	18.0	FD/FE160	20 ⁽³⁾	234	CL07+RT2B		
18.5	33		FD/FE160	50	500	CL06+RT2E	18.5	29	FD/FE160	30 ⁽⁴⁾	371	CL06-RT2D	18.5	23	FD/FE160	30 ⁽⁴⁾	300	CL09+RT2C		
22	39		FD/FE160	50	510	CL06+RT2E	22	33	FD/FE160	50	500	CL06+RT2E	22	25	FD/FE160	30 ⁽⁴⁾	325	CL09+RT2D		
25	44		FD/FE160	50	578	CL06+RT2G	-	-	-	-	-	-	-	-	-	-	-	-	-	
30	52		FD/FE160	80	680	CL09+RT2H	30	45	FD/FE160	50	585	CL06+RT2G	30	35	FD/FE160	50	500	CL09+RT2E		
37	65		FD/FE160	80	849	CL09+RT2J	37	55	FD/FE160	80 ⁽⁵⁾	800	CL09+RT2J	37	42	FD/FE160	50	546	CL09+RT2E		
45	78		FD/FE160	80	1019	CL09+RT2J	45	65	FD/FE160	100	1000	CL09+RT2J	45	49	FD/FE160	50	637	CL09+RT2G		
55	86		FD160	100	1223	CL09+RT2L	55	80	FD160	100	1100	CL09+RT2S	55	60	FD/FE160	80 ⁽⁵⁾	800	CL09+RT2J		
55	94		FE160	100	1223	CK75C+RT2L	55	80	FE160	100	1100	CK75C+RT2J	75	80	FD/FE160	80 ⁽⁵⁾	1040	CL09+R2TL		
75	131		FE160	160	1699	CK85B+RT3E	75	110	FE160	125	1430	CK85B+RT3D	90	100	FD160	100	1300	CL09+R2TL		
90	163		FE250	250	2500	CK95B+RT3F	90	130	FE160	160	1690	CK95B+RT3E	90	100	FE160	100	1300	CK85B+RT2M		
110	188		FE250	250	2500	CK95B+RT4P	110	156	FE160	160	2028	CK95B+RT3F	110	120	FE160	125	1560	CK85B+RT3E		
132	225		FE250	250	2922	CK95B+RT4R	132	190	FE250	250	2500	CK95B+RT4P	132	140	FE160	160	1820	CK95B+RT3F		
160	300		FG400	400	3900	CK10B+RT5C	160	228	FE250	250	2964	CK95B+RT4R	160	175	FE250	250	2100	CK95B+RT4N		
200	360		FG400	400	4680	CK12B+RT5C	200	281	FG400	400	3653	CK10B+RT5C	200	220	FE250	250	2860	CK10B+RT4R		
220	400		FG630	500	5200	CK12B+RT5D	220	310	FG400	400	4030	CK10B+RT5C	220	240	FG400	250	3120	CK10B+RT4R		
250	462		FG630	500	6004	CK12B+RT5D	-	-	-	-	-	-	250	270	FG400	400	3510	CK10B+RT5C		
300	509		FK800	800	6619	CK13B+RT5E	-	-	-	-	-	-	-	-	-	-	-	-	-	
315	529		FK800	800	6880	CK13B+RT5E	315	445	FG630	500	5785	CK12B+RT5D	-	-	-	-	-	-	-	
335	563		FK800	800	6754	CK13B+RT5E	335	460	FG630	500	5980	CK12B+RT5D	335	335	FG400	400	4355	CK10B+RT5C		
355	596		FK800	800	6560	CK13B+RT5E	355	500	FK800	800	6500	CK13B+RT5E	-	-	-	-	-	-	-	
375	630		FK800	800	6930	CK13B+RT6A	375	530	FK800	800	6890	CK13B+RT5E	375	400	FG630	500	5200	CK12B+RT5D		
-	-		-	-	-	-	400	570	FK800	800	6840	CK13B+RT5E	-	-	-	-	-	-	-	
-	-		-	-	-	-	450	630	FK800	800	7560	CK13B+RT6A	450	480	FG630	500	6240	CK12B+RT5D		
-	-		-	-	-	-	-	-	-	-	-	-	500	530	FK800	800	6360	CK13B+RT5E		
-	-		-	-	-	-	-	-	-	-	-	-	560	580	FK800	800	6380	CK13B+RT5E		

Protection of motor circuits

Intro

A

B

C

D

E

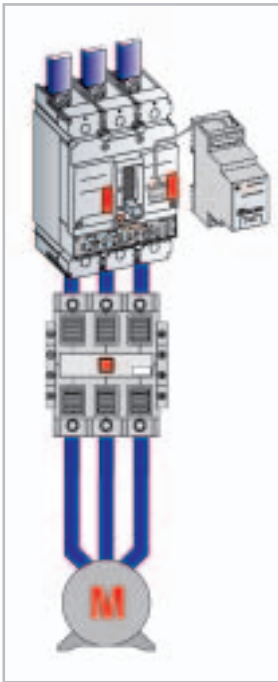
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X



Coordination type II - EN 60947-4 - Class 10 protection (with SMR2 other classes possible)



Short-circuit and Overload protection by means of Electronic MCCB.
Phase Loss protection (in MCCB)

Overload backup protection, and overload alarm on use of LT module.
Control by GE contactor

Upstream Record Plus™ Breaker selection							
Type	N	H	L	Type	N	H	L
	Icc values in kA Ue=230V AC				Icc values in kA Ue=400/415V AC		
FE160/250	85	100	130	FE160/250	50	80	130
FG 400/630	85	100	130	FG 400/630	50	80	130

Selection of associated components ⁽¹⁾											
Motor		Breaker details			Contactor	Motor		Breaker details			Contactor
P(kw)	In	Type	Ie	Ist	Type	P(kw)	In	Type	Ie	I _m	Type
3	11.5	FE160	25	150	CL08	-	-	-	-	-	-
4	14.5	FE160	25	189	CL08	-	-	-	-	-	-
5.5	20	FE160	25	260	CL08	5.5	11.5	FE160	25	150	CL08
7.5	28	FE160	63	364	CL09	7.5	16.1	FE160	25	200	CL08
10	36	FE160	63	468	CL09	10	21	FE160	25	300	CL08
11	39	FE160	63	507	CL09	11	22	FE160	25	300	CL08
15	50	FE160	63	650	CL09	15	30	FE160	63	390	CL09
18.5	64	FE160	125	832	CK85B	18.5	37	FE160	63	478	CL09
22	75	FE160	125	975	CK85B	22	43	FE160	63	561	CL09
25	85	FE160	125	1105	CK85B	25	49	FE160	63	635	CL09
30	100	FE160	125	1300	CK85B	30	58	FE160	63	800	CL09
37	125	FE160	160	1625	CK95B	37	72	FE160	125	934	CK85B
45	150	FE160	160	1950	CK95B	45	86	FE160	125	1121	CK85B
55	180	FE250	250	2340	CK95B	55	104	FE160	125	1346	CK85B
75	250	FG400	250	3000	CK95B	75	144	FE160	160	1869	CK85B
90	312	FG400	400	4056	CK10C	90	179	FE250	250	2500	CK95B
110	360	FG400	400	4680	CK12B	110	207	FE250	250	2691	CK95B
132	430	FG630	500	5590	CK12B	132	247	FG400	250	2967	CK95B
-	-	-	-	-	-	160	300	FG400	400	3900	CK10C
-	-	-	-	-	-	200	360	FG400	400	4680	CK12B
-	-	-	-	-	-	220	400	FG630	500	5200	CK12B
-	-	-	-	-	-	250	462	FG630	500	6004	CK12B

(1) The contactor has a breaking capacity that is sufficient to operate the specified motor up to the specified magnetic setting of the breaker

Coordination type II - EN 60947-4 - Class 10 protection (with SMR2 other classes possible)

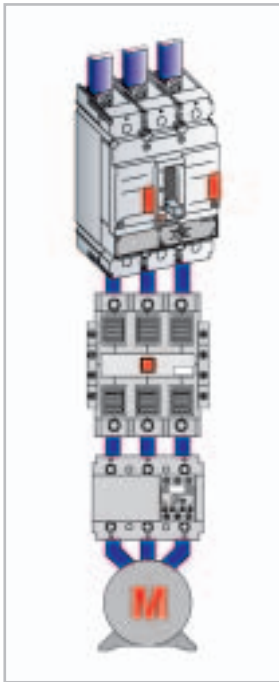
Upstream Record Plus™ Breaker selection											
Type	N	H	L	Type	N	H	L	Type	N	H	L
Icc values in kA Ue=440V AC								Icc values in kA Ue=690V AC			
FE160/250	42	65	130	FE160/250	-	50	80	FE160/250	-	22	50
FG 400/630	50	65	130	FG 400/630	-	50	80	FG 400/630	-	22	50

Selection of associated components ⁽¹⁾																				
Motor			Breaker details			Contactor	Motor			Breaker details			Contactor	Motor			Breaker details			Contactor
P(kw)	In		Type	Ie	Im	Type	P(kw)	In	Type	Ie	Im	Type	P(kw)	In	Type	Ie	Im	Type		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5.5	10.5	FE160	25	136	CL08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7.5	14.6	FE160	25	200	CL08	7.5	12.0	FE160	25	156	CL09	-	-	-	-	-	-	-	-	
10	18.8	FE160	25	245	CL08	10	15.0	FE160	25	200	CL09	10	11.5	FE160	25	150	CK85B	-		
11	20	FE160	25	265	CL08	11	18.4	FE160	25	300	CL09	-	-	-	-	-	-	-	-	
15	27	FE160	63	355	CL09	15	23	FE160	25	300	CL09	15	17.1	FE160	25	223	CK85B	-		
18.5	33	FE160	63	500	CL09	18.5	29	FE160	63	371	CL10	18.5	20	FE160	25	260	CK85B	-		
22	39	FE160	63	510	CL09	22	33	FE160	63	423	CL10	-	-	-	-	-	-	-	-	
25	44	FE160	63	578	CL09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
30	52	FE160	63	680	CL09	30	45	FE160	63	585	CL10	30	35	FE160	63	500	CK85B	-		
37	65	FE160	125	849	CK85B	37	55	FE160	63	800	CL10	37	42	FE160	63	546	CK85B	-		
45	78	FE160	125	1019	CK85B	-	-	-	-	-	-	45	49	FE160	63	637	CK85B	-		
55	94	FE160	125	1223	CK85B	55	80	FE160	125	1040	-	55	60	FE160	63	800	CK85B	-		
75	131	FE160	160	1699	CK85B	75	110	FE160	125	1430	CK85B	75	80	FE160	125	1040	CK85B	-		
90	163	FE250	250	2500	CK95B	90	130	FE160	160	1690	CK85B	90	100	FE160	125	1300	CK85B	-		
110	188	FE250	250	2500	CK95B	110	156	FE160	160	2028	CK85B	110	120	FE160	125	1560	CK85B	-		
132	225	FE250	250	2922	CK95B	132	190	FE250	250	2500	CK95B	132	140	FE160	160	1820	CK85B	-		
160	300	FG400	400	3900	CK10C	160	228	FE250	250	2964	CK95B	160	175	FE250	250	2275	CK10C	-		
200	360	FG400	400	4680	CK12B	200	281	FG400	400	3653	CK10C	200	220	FE250	250	2860	CK10C	-		
220	400	FG630	500	5200	CK12B	220	310	FG400	400	4030	CK10C	220	240	FG400	250	3120	CK10C	-		
250	462	FG630	500	6004	CK12B	-	-	-	-	-	-	250	270	FG400	400	3510	CK10C	-		
-	-	-	-	-	-	315	445	FG630	500	5785	CK12B	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	335	460	FG630	500	5980	CK12B	335	335	FG400	400	4355	CK10C	-	-	
-	-	-	-	-	-	355	500	FG630	500	6500	CK12B	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	375	400	FG630	500	5200	CK12B	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	-	-	-	450	480	FG630	500	6240	CK12B	-	-	

(1) The contactor has a breaking capacity that is sufficient to operate the specified motor up to the specified magnetic setting of the breaker



Coordination type II - EN 60947-4 - Class 20⁽³⁾ protection



Short-circuit Protection by means of Magnetic Only MCCB.
Overload Protection by means of a electromechanical thermal relay.

Phase Loss protection (Thermal relay feature)

Control by GE contactor

Upstream Record Plus™ Breaker selection							
Type	N	H	L	Type	N	H	L
	Icc values in kA Ue=230V AC				Icc values in kA Ue=400/415V AC		
FD160	85	100	130	FD160	50	80	130
FE160/250	85	100	130	FE160/250	50	80	130
FG 400/630	85	100	130	FG 400/630	50	80	130
FK 800/1250	85	100	130	FK 800/1250	50	80	100

Selection of associated components ⁽¹⁾											
Motor		Breaker details			Contactor	Motor		Breaker details			Contactor
P(kw)	In	Type	Ie	Im	Type+O.R.	P(kw)	In	Type	Ie	Im	Type+O.R.
0.37	2.0	FD/FE160	3 ⁽²⁾	35	CL25+RT12J	0.75	2.0	FD/FE160	3 ⁽²⁾	35	CL25+RT12J
0.55	2.8	FD/FE160	3 ⁽²⁾	35	CL25+RT12K	1.1	2.6	FD/FE160	3 ⁽²⁾	35	CL25+RT12K
0.75	3.5	FD/FE160	3 ⁽²⁾	46	CL25+RT12K	1.5	3.6	FD/FE160	7	70	CL03+RT12K
1.1	5.0	FD/FE160	7	70	CL03+RT12L	2.2	5.0	FD/FE160	7	80	CL03+RT12L
1.5	6.1	FD/FE160	7	80	CL03+RT12M	3	6.6	FD/FE160	7	86	CL03+RT12M
2.2	8.7	FD/FE160	12.5 ⁽⁴⁾	125	CL06+RT2AN	4	8.3	FD/FE160	12.5 ⁽⁴⁾	125	CL06+RT2AN
3	11.5	FD/FE160	12.5 ⁽⁴⁾	150	CL06+RT2AN	5.5	11.5	FD/FE160	12.5 ⁽⁴⁾	150	CL06+RT2AN
4	14.5	FD/FE160	20 ⁽⁴⁾	200	CL06+RT2B	7.5	16.1	FD/FE160	20 ⁽⁴⁾	200	CL06+RT2B
5.5	20.0	FD/FE160	20 ⁽⁴⁾	260	CL06+RT2C	10	21	FD/FE160	30 ⁽⁵⁾	300	CL06+RT2C
7.5	28	FD/FE160	30 ⁽⁵⁾	364	CL06+RT2D	11	22	FD/FE160	30 ⁽⁵⁾	300	CL06+RT2C
10	36	FD/FE160	50	500	CL06+RT2E	15	30	FD/FE160	30 ⁽⁵⁾	390	CL06+RT2D
11	39	FD/FE160	50	507	CL06+RT2E	18.5	37	FD/FE160	50	478	CL06+RT2E
15	50	FD/FE160	50	650	CL06+RT2G	22	43	FD/FE160	50	561	CL06+RT2G
18.5	64	FD/FE160	80 ⁽⁶⁾	832	CL09+RT2J	25	49	FD/FE160	50	635	CL06+RT2G
22	75	FD/FE160	80 ⁽⁶⁾	975	CL09+RT2J	30	58	FD/FE160	80 ⁽⁶⁾	800	CL09+RT2H
25	85	FD/FE160	100	1020	CL09+RT2L	37	72	FD/FE160	80 ⁽⁶⁾	934	CL09+RT2J
30	100	FD160	100	1300	CL09+RT2M	45	86	FD160	100	1121	CL09+RT2L
30	100	FE160	100	1300	CL09+RT2M	45	86	FE160	100	1121	CK75C+RT2L
37	125	FE160	125	1625	CK85B+RT3ZE	55	104	FE160	125	1346	CK85B+RT3ZE
45	150	FE160	160	1950	CK85B+RT3ZF	75	144	FE160	160	1869	CK85B+RT3ZF
55	180	FE250	250	2500	CK95B+RT3ZF	90	179	FE250	250	2500	CK95B+RT3ZF
75	250	FG400	250	3250	CK10B+RT5LB	110	207	FE250	250	2691	CK10B+RT5LB
90	312	FG400	400	4056	CK10B+RT5LB	132	247	FG400	250	3214	CK10B+RT5LB
110	360	FG400	400	4680	CK12B+RT5LC	160	300	FG400	400	3900	CK10B+RT5LB
132	430	FG630	500	5590	CK12B+RT5LD	200	360	FG400	400	4680	CK12B+RT5LC
160	520	FK800	800	6760	CK13B+RT5LE	220	400	FG630	500	5200	CK12B+RT5LD
200	630	FK800	800	6930	CK13B+RT5LE	250	462	FG630	500	6004	CK12B+RT5LD
-	-	-	-	-	-	300	560	FK800	800	6720	CK13B+RT5LE
-	-	-	-	-	-	315	582	FK800	800	6985	CK13B+RT5LE
-	-	-	-	-	-	335	619	FK800	800	6810	CK13B+RT5LE

- (1) The contactor has a breaking capacity that is sufficient to operate the specified motor up to the specified magnetic setting of the breaker.
- (2) The 3Amp device is designed to operate at a current level up to 3.5Amps.
- (3) Class 30 on request.
- (4) FD160 type; contactor size can be reduced to CL04
- (5) FD160 type; contactor size can be reduced to CL45
- (6) FD160 type; contactor size can be reduced to CL08

Coordination type II - EN 60947-4 - Class 20⁽³⁾ protection

Upstream Record Plus™ Breaker selection											
Type	N	H	L	Type	N	H	L	Type	N	H	L
Icc values in kA Ue=440V AC			Icc values in kA Ue=500/525V AC			Icc values in kA Ue=690V AC					
FD160	30	50	80	FD160	-	36	50	FD160	-	6	10
FE160/250	42	65	130	FE160/250	-	50	80	FE160/250	-	22	50
FG 400/630	42	65	130	FG 400/630	-	50	80	FG 400/630	-	22	50
FK 800/1250	42	65	80	FK 800/1250	-	36	50	FK 800/1250	-	22	30

Selection of associated components ⁽¹⁾																		
Motor		Breaker details			Contactor	Motor		Breaker details			Contactor	Motor		Breaker details			Contactor	
P(kw)	In	Type	Ie	Im	Type+O.R.	P(kw)	In	Type	Ie	Im	Type+O.R.	P(kw)	In	Type	Ie	Im	Type+O.R.	
0.75	1.9	FD/FE160	3 ⁽²⁾	30	CL25+RT12J	0.75	1.5	FD/FE160	3 ⁽²⁾	30	CL25+RT12H	-	-	-	-	-	-	-
1.1	2.5	FD/FE160	3 ⁽²⁾	30	CL25+RT12K	1.1	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT12J	-	-	-	-	-	-	-
1.5	3.4	FD/FE160	3 ⁽²⁾	70	CL25+RT12K	1.5	2.6	FD/FE160	3 ⁽²⁾	40	CL25+RT12K	1.5	2.0	FD/FE160	3 ⁽²⁾	30	CL25+RT12J	-
2.2	4.6	FD/FE160	7	70	CL03+RT12L	2.2	3.8	FD/FE160	7	70	CL03+RT12L	2.2	2.9	FD/FE160	3 ⁽²⁾	38	CL25+RT12K	-
3	6.0	FD/FE160	7	78	CL03+RT12M	3	5.0	FD/FE160	7	70	CL03+RT12M	3	3.5	FD/FE160	3 ⁽²⁾	46	CL25+RT12K	-
4	7.6	FD/FE160	12.5 ⁽⁴⁾	100	CL06+RT2AN	4	6.5	FD/FE160	7	85	CL03+RT12M	3.7	4.6	FD/FE160	7	70	CL03+RT12L	-
5.5	10.5	FD/FE160	12.5 ⁽⁴⁾	136	CL06+RT2AN	5.5	9.0	FD/FE160	12.5 ⁽⁴⁾	125	CL06+RT2AN	4	5.0	FD/FE160	7	70	CL03+RT12L	-
7.5	14.6	FD/FE160	20 ⁽⁴⁾	200	CL06+RT2B	7.5	12.0	FD/FE160	12.5 ⁽⁴⁾	156	CL06+RT2BP	5.5	7.0	FD/FE160	7	91	CL03+RT12M	-
10	18.8	FD/FE160	20 ⁽⁴⁾	245	CL06+RT2B	10	15.0	FD/FE160	20 ⁽⁴⁾	200	CL06+RT2B	7.5	9.0	FD/FE160	12.5 ⁽⁴⁾	125	CL07+RT2AN	-
11	20	FD/FE160	30 ⁽⁵⁾	300	CL06+RT2C	11	18.4	FD/FE160	20 ⁽⁴⁾	300	CL06+RT2B	11	12.5	FD/FE160	12.5 ⁽⁴⁾	163	CL07+RT2BP	-
15	27	FD/FE160	30 ⁽⁵⁾	355	CL06+RT2D	15	23	FD/FE160	30 ⁽⁵⁾	300	CL06+RT2C	13	16.0	FD/FE160	20 ⁽⁴⁾	208	CL07+RT2B	-
18.5	33	FD/FE160	50	500	CL06+RT2E	18.5	29	FD/FE160	30 ⁽⁵⁾	371	CL06+RT2D	15	18.0	FD/FE160	20 ⁽⁴⁾	234	CL07+RT2B	-
22	39	FD/FE160	50	510	CL06+RT2E	22	33	FD/FE160	50	500	CL06+RT2E	18.5	23	FD/FE160	30 ⁽⁵⁾	300	CL09+RT2C	-
25	44	FD/FE160	50	578	CL06+RT2G	-	-	-	-	-	-	22	25	FD/FE160	30 ⁽⁵⁾	325	CL09+RT2D	-
30	52	FD/FE160	80 ⁽⁶⁾	680	CL09+RT2H	30	45	FD/FE160	50	585	CL06+RT2G	-	-	-	-	-	-	-
37	65	FD/FE160	80 ⁽⁶⁾	849	CL09+RT2J	37	55	FD/FE160	80 ⁽⁶⁾	800	CL09+RT2J	30	35	FD/FE160	50	500	CL09+RT2E	-
45	78	FD/FE160	80	1019	CL09+RT2J	45	65	FD/FE160	100	1000	CL09+RT2J	37	42	FD/FE160	50	546	CL09+RT2F	-
55	94	FD160	100	1223	CL09+RT2L	55	80	FD160	100	1000	CL09+RT2J	45	49	FD/FE160	50	637	CL09+RT2G	-
55	94	FE160	100	1223	CK75C+RT2L	55	80	FE160	100	1100	CK75C+RT2J	55	60	FD/FE160	80 ⁽⁶⁾	800	CL09+RT2J	-
75	131	FE160	160	1699	CK85B+RT3E	75	110	FE160	125	1430	CK85B+RT3D	75	80	FD/FE160	80 ⁽⁶⁾	1040	CL09+RT2L	-
90	163	FE250	250	2500	CK95B+RT3F	90	130	FE160	160	1690	CK95B+RT3E	90	100	FD/FE160	100	1300	CK85B+RT2M	-
110	188	FE250	250	2500	CK95B+RT5LB	110	156	FE160	160	2028	CK95B+RT3F	110	120	FE160	125	1560	CK85B+RT3E	-
132	225	FE250	250	2922	CK95B+RT5LB	132	190	FE250	250	2500	CK95B+RT5LB	132	140	FE160	160	1820	CK95B+RT3F	-
160	300	FG400	400	3900	CK10B+RT5LC	160	228	FE250	250	2964	CK95B+RT5LB	160	175	FE250	250	2100	CK95B+RT3F	-
200	360	FG400	400	4680	CK12B+RT5LD	200	281	FG400	400	3653	CK10B+RT5LC	200	220	FE250	250	2860	CK10B+RT5LB	-
220	400	FG630	500	5200	CK12B+RT5LD	220	310	FG400	400	4030	CK10B+RT5LC	220	240	FG400	250	3120	CK10B+RT5LB	-
250	462	FG630	500	6004	CK12B+RT5LE	-	-	-	-	-	-	250	270	FG400	400	3510	CK10B+RT5LC	-
300	509	FK800	800	6619	CK13B+RT5LE	-	-	-	-	-	-	-	-	-	-	-	-	-
315	529	FK800	800	6880	CK13B+RT5LE	315	445	FG630	500	5785	CK12B+RT5LD	-	-	-	-	-	-	-
335	563	FK800	800	6754	CK13B+RT5LE	335	460	FG630	500	5980	CK12B+RT5LD	335	335	FG400	400	4355	CK10B+RT5LC	-
355	596	FK800	800	6560	CK13B+RT5LE	355	500	FK800	800	6500	CK13B+RT5LE	-	-	-	-	-	-	-
375	630	FK800	800	6930	CK13B+RT5LE	375	530	FK800	800	6890	CK13B+RT5LE	375	400	FG630	500	5200	CK12B+RT5LD	-
-	-	-	-	-	-	400	570	FK800	800	6840	CK13B+RT5LE	-	-	-	-	-	-	-
-	-	-	-	-	-	450	630	FK800	800	7560	CK13B+RT5LE	450	480	FG630	500	6240	CK12B+RT5LD	-
-	-	-	-	-	-	-	-	-	-	-	-	500	530	FK800	800	6360	CK13B+RT5LE	-
-	-	-	-	-	-	-	-	-	-	-	-	560	580	FK800	800	6380	CK13B+RT5LE	-

Protection of motor circuits

Intro

A

B

C

D

E

F

G

X



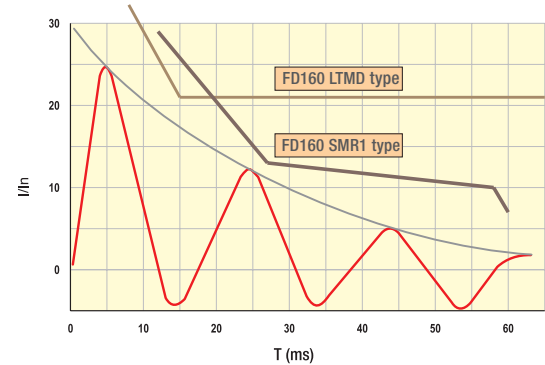
Protection of LV/LV transformers

Transformers generally produce a very high inrush current. The crest value of the first half cycle may reach values of 15 to 25 times the effective rated current.

For a protective device capable of protecting these units this must be taken into account. Manufacturers data and tests have indicated that a protective device feeding a transformer must be capable of carrying the following current values without tripping (see graph insert).

Transformer value	Maximum crest inrush values		
	1st period 5 ms	2nd period 25 ms.	after 3 periods 45 ms.
< 50 kVA	25 x I _n	12 x I _n	5 x I _n
≥ 50 kVA	15 x I _n	8 x I _n	3.5 x I _n

Record Plus™ circuit breakers have been designed to cope with this kind of phenomena. The adjacent table indicates the types to select, based on the breaker characteristics, the transformer ratings and the above mentioned inrush current prognoses.



Protection of LV/LV transformers with Record Plus circuit breakers

Transformer ratings						Record Plus breaker choice		
1ph 230V		3ph 230V 1ph 400V		3ph 400V		Type	Trip unit type & rating	Ist *
kVA	I _n	kVA	I _n	kVA	I _n			
2.5	10	4	10	6.3	9	FD160N,FD160H or L	LTMD-25	250
4	11	5	12	8	12	FD160N,FD160H or L	LTMD-25	250
5	17	6.3	16	10	14	FD160N,FD160H or L	LTMD-32	320
		8	20	12.5	18	FD160N,FD160H or L	LTMD-32	320
6.3	27	10	24	16	23	FD160N,FD160H or L	LTMD-40	400
8	34	12.5	30	20	28	FD160N,FD160H or L	LTMD-50	500
10	42	16	39	25	35	FD160N,FD160H or L	LTMD-63	630
12.5	53	20	49	31.5	44	FD160N,FD160H or L	LTMD-80	800
		25	61	40	56	FD160N,FD160H or L	LTMD-100	1000
16	68			50	70	FD160N,FD160H or L	LTMD-125	1250
20	84	31.5	77			FD160N,FD160H or L	LTMD-125	1250
		40	98	63	89	FE160N, H or L	SMR1-125	
25	105	50	122	80	113	FE160N, H or L	SMR1-125	
31.5	133	63	154	100	141	FE160N, H or L	SMR1-160	
40	169	80	195	125	176	FE250N, H or L	SMR1-250	
50	211	100	244	160	225	FE250N, H or L	SMR1-250	
63	266	125	305	200	287	FG400N, H or L	SMR1-350	
80	338	160	390	250	352	FG400N, H or L	SMR1-350	
100	422			315	444	FG630N, H or L	SMR1-500	
125	528			400	563	FG630N, H or L	SMR1-630	
160	675			500	704	FK800N or H	SMR- 800	
				630	887	FK1250N or H	SMR-1000	
				800	1126	FK1250N or H	SMR-1250	
				1000	1408	FK1600N or H	SMR-1600	

* Magnetic threshold of breaker

Protection of capacitor banks (power factor improvement units)

For circuit breakers and particularly for the **Record Plus™** device, designed to offer high making and breaking capacities under adverse conditions, the switching of capacitor banks has little to no effect on the breaker, its characteristics as a protective device, or on its lifespan.

However, the current flowing in the circuit can trip a circuit breaker and a capacitor load displays certain anomalies. In a circuit with capacitors the maximum current flow in the circuit cannot be assumed to be the calculated capacitor current only. The effective value must be increased due to harmonic content (a factor normally taken as 30%) and an allowance for the tolerances in the capacitance of the unit itself. (10% assumed).

In order to protect these devices without running into regular nuisance tripping due to overloads please refer to the adjacent table in which the correct **Record Plus™** breaker is specified to protect and switch the indicated capacitor banks at several different voltages.

Un = 230V (phase to phase voltage)

Capacitor rating (kVAr)	Record Plus breaker	I _r setting (min)
5	FD160N, FD160H or L	18 A
7.5	FD160N, FD160H or L	27 A
10	FD160N, FD160H or L	36 A
12.5	FD160N, FD160H or L	45 A
15	FD160N, FD160H or L	54 A
20	FD160N, FD160H or L	72 A
25	FD160N, FD160H or L	90 A
30	FD160N, FD160H or L	108 A
35	FD160N or FE160N, H or L	126 A
40	FE160N, H or L	144 A
45	FE250N, H or L	162 A
50	FE250N, H or L	179 A
60	FE250N, H or L	215 A
75	FG400N, H or L	269 A
90	FG400N, H or L	323 A
100	FG400N, H or L	359 A
120	FG630N, H or L	431 A
150	FG630N, H or L	538 A
180	FK800N or H	646 A

Un = 400V (phase to phase voltage)

Capacitor rating (kVAr)	Record Plus breaker	I _r setting (min)
10	FD160N, FD160H or L	21 A
15	FD160N, FD160H or L	31 A
20	FD160N, FD160H or L	41 A
25	FD160N, FD160H or L	52 A
30	FD160N, FD160H or L	62 A
35	FD160N, FD160H or L	72 A
40	FD160N, FD160H or L	83 A
45	FD160N, FD160H or L	93 A
50	FD160N, FD160H or L	103 A
60	FD160N, FD160H or L	124 A
70	FD160N or FE160N, H or L	144 A
80	FE250N, H or L	165 A
90	FE250N, H or L	186 A
100	FE250N, H or L	206 A
120	FE250N, H or L	248 A
140	FG400N, H or L	289 A
160	FG400N, H or L	330 A
180	FG400N, H or L	372 A
200	FG630N, H or L	413 A
250	FG630N, H or L	516 A
300	FG630N, H or L	619 A
350	FK800N or H	722 A

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- F.2 FE frame, plug-in & draw-out device (8 & 10 pole connectors)
- F.3 FG frame, plug-in & draw-out device (8 & 10 pole connectors)
- F.4 FK frame, 3 pole & 4 pole draw-out device (6 pole connectors)
- F.5 FG frame, SMR 2 trip unit connection

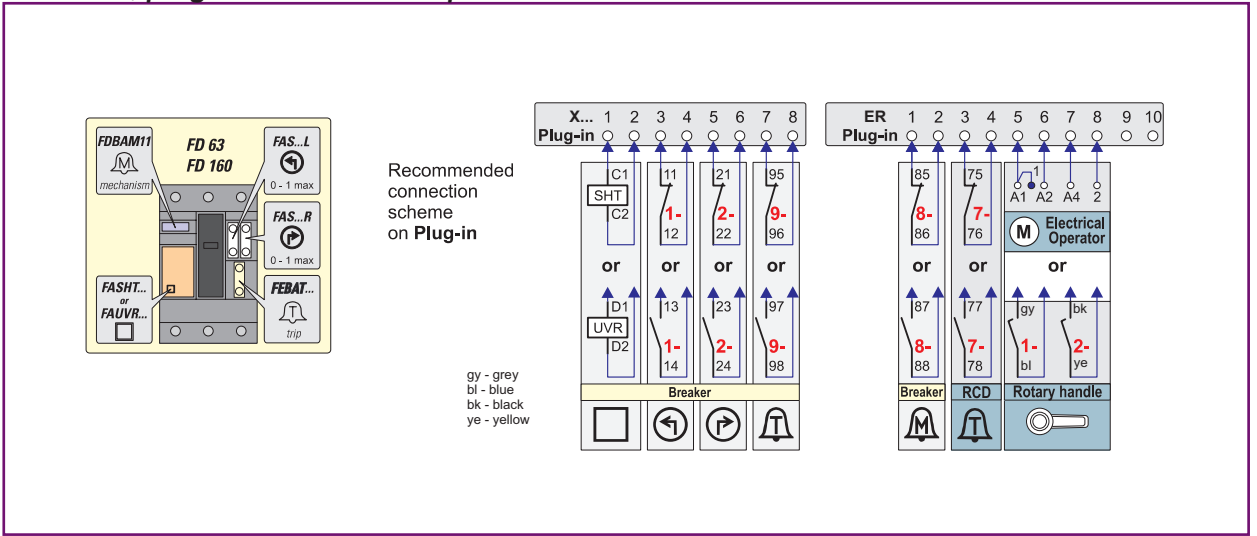
The breaker	Intro
Order codes	A
Trip units	B
Components & Accessories	C
Technical data	D
Application guide	E
Wiring diagrams	F
Dimensions	G
Numerical Index	X

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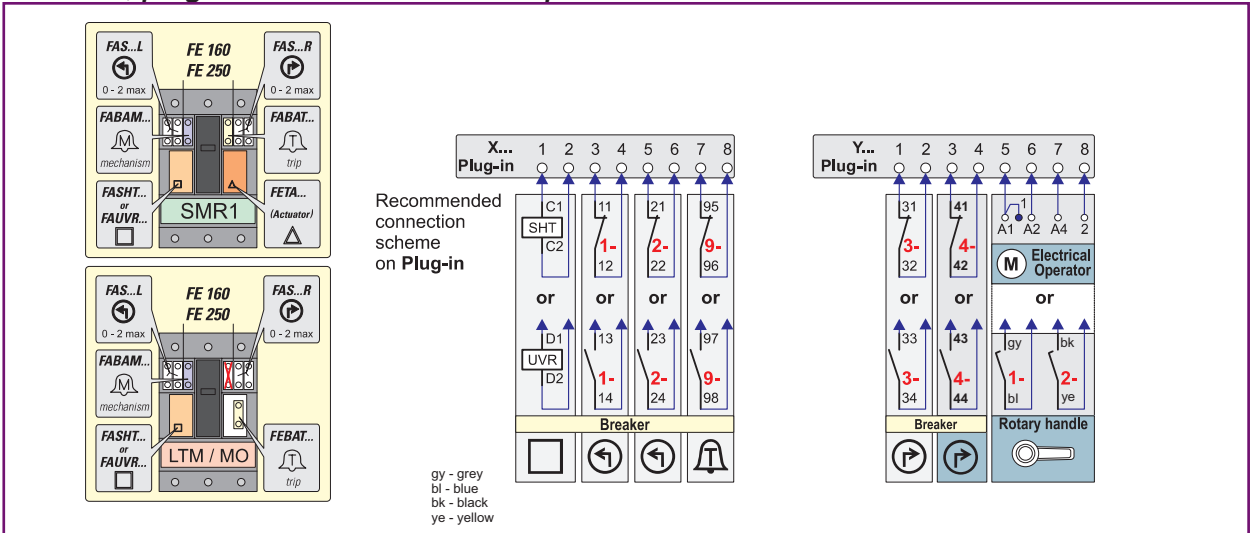


Recommended wiring diagrams

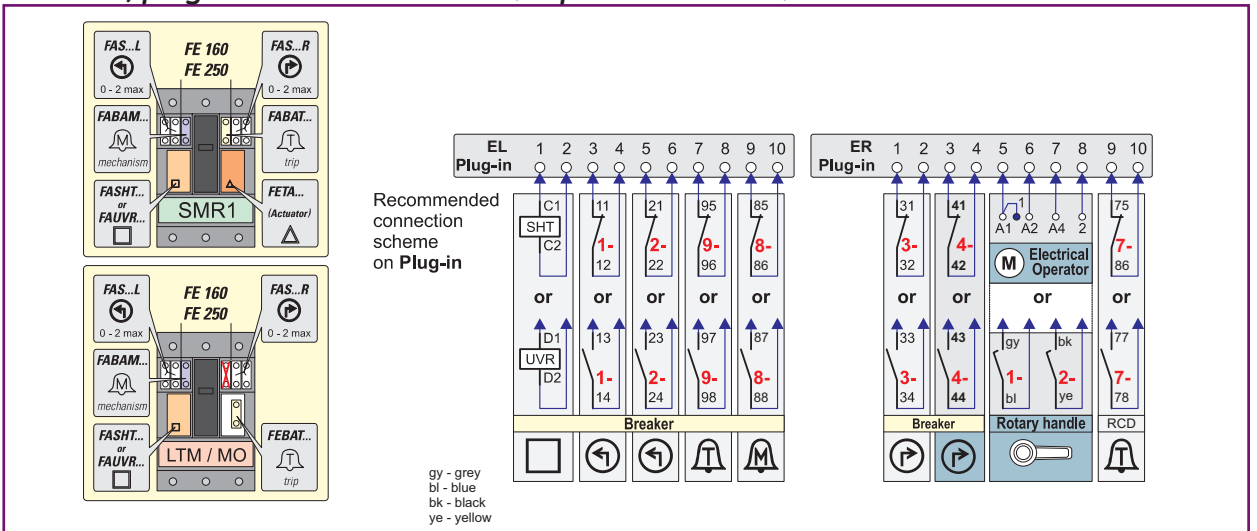
FD frame, plug in device (8 & 10 pole connectors)



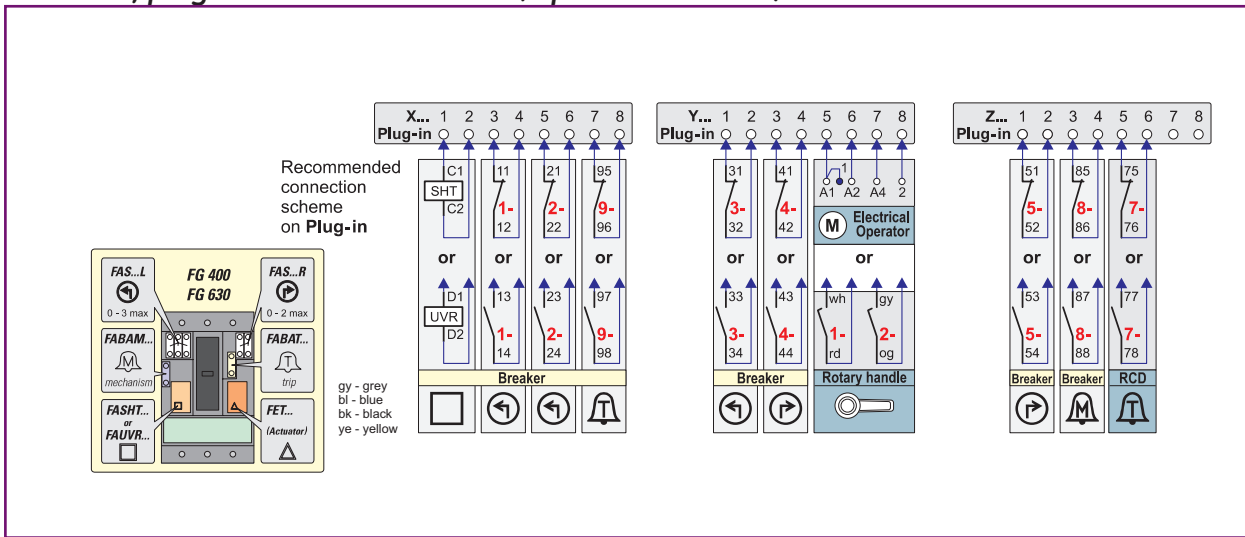
FE frame, plug-in & draw-out device (8 pole connectors)



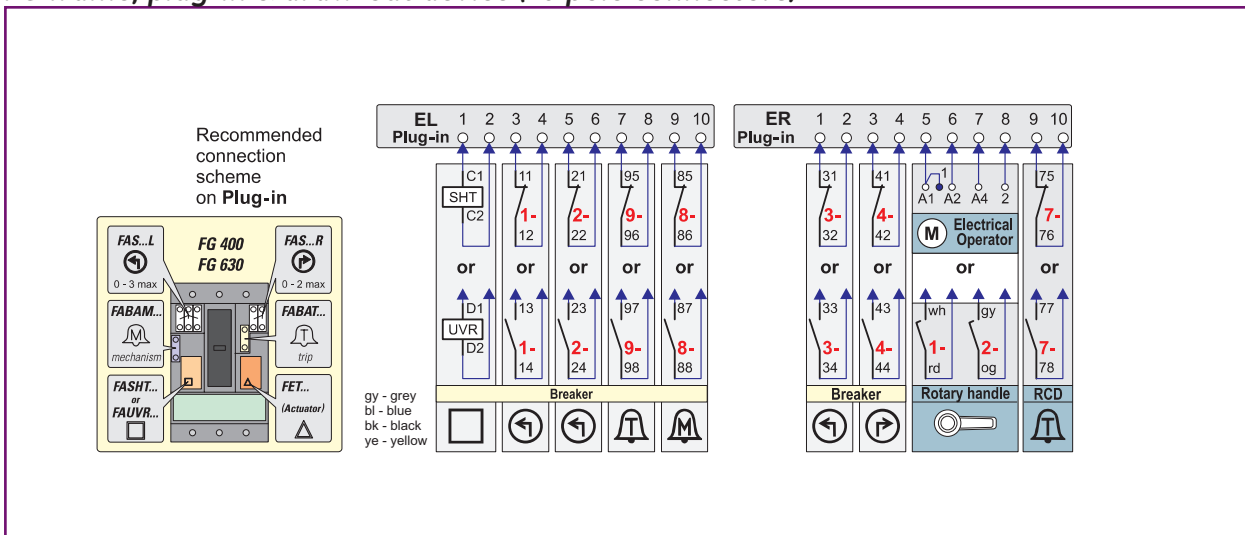
FE frame, plug-in & draw-out device (10 pole connectors)



FG frame, plug-in & draw-out device (8 pole connectors)



FG frame, plug-in & draw-out device (10 pole connectors)



Intro

A

B

C

D

E

F

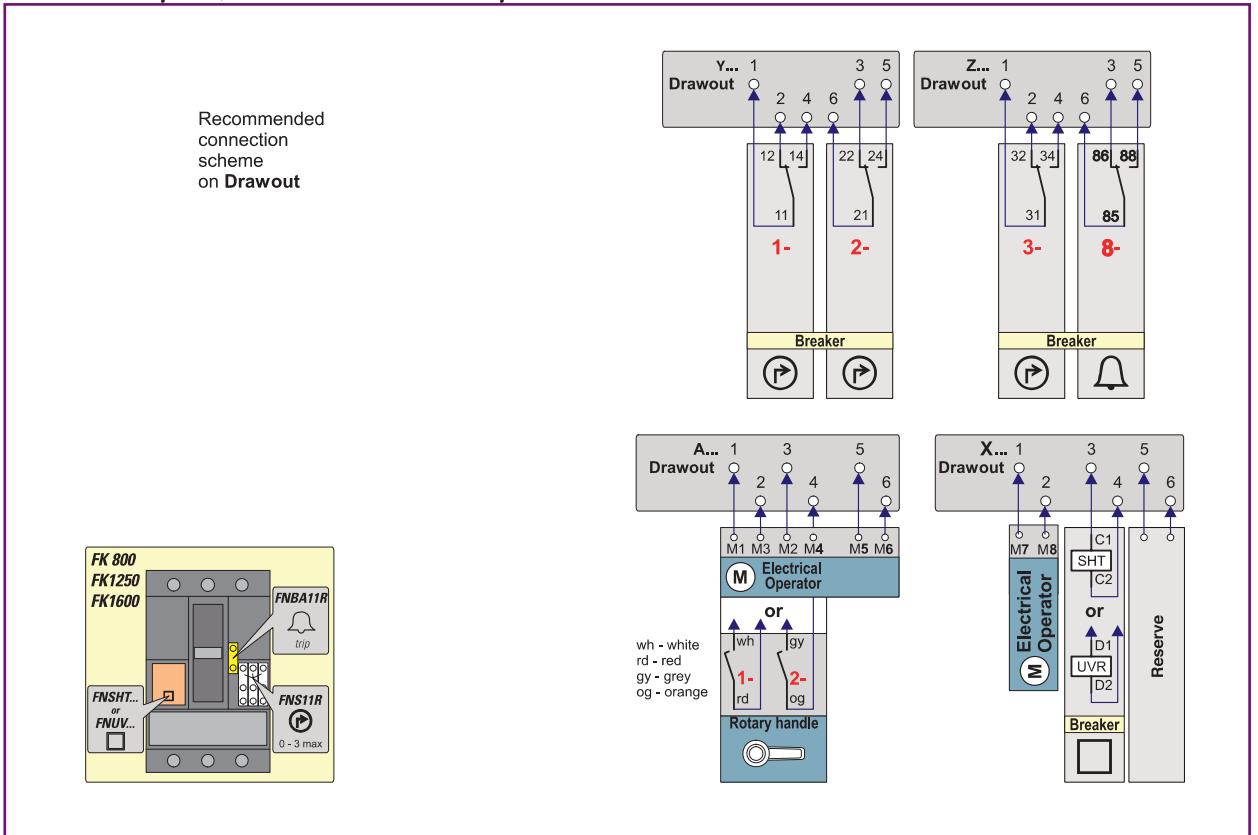
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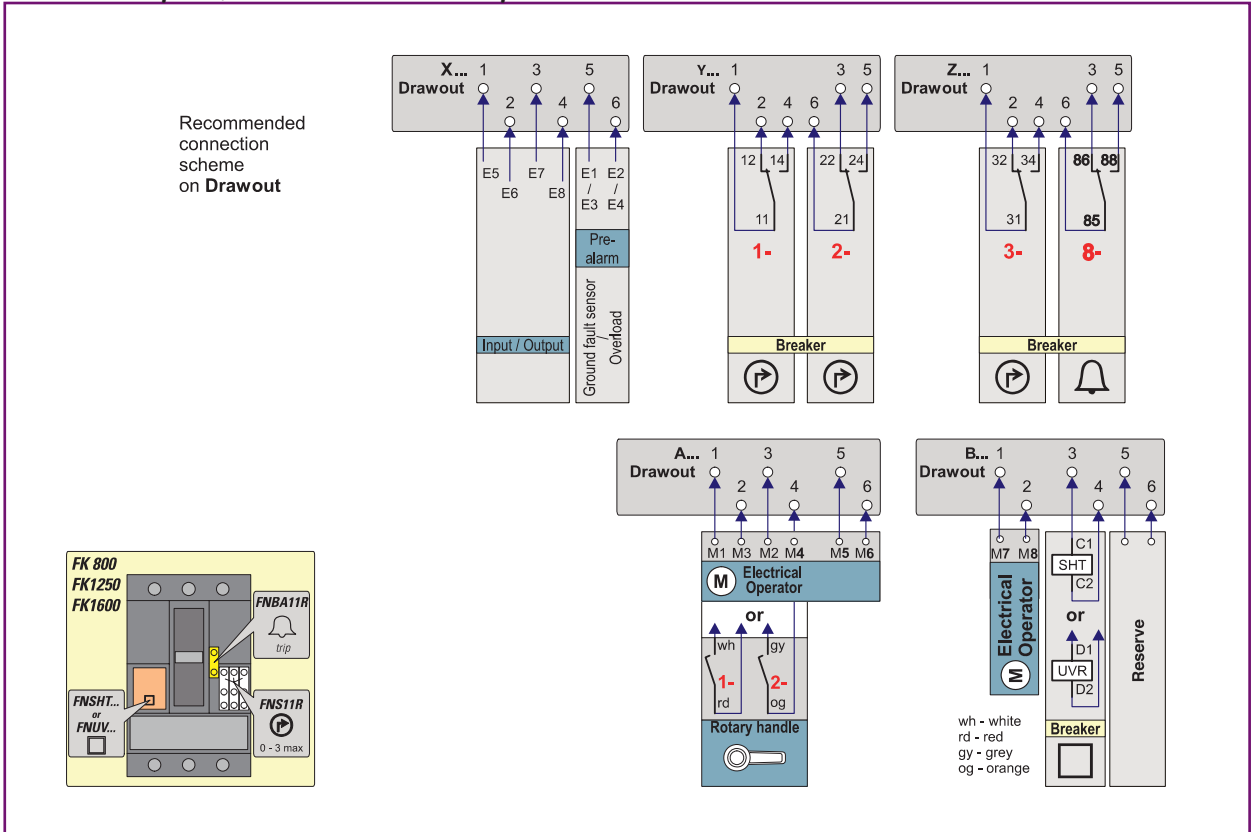


Recommended Wiring diagrams

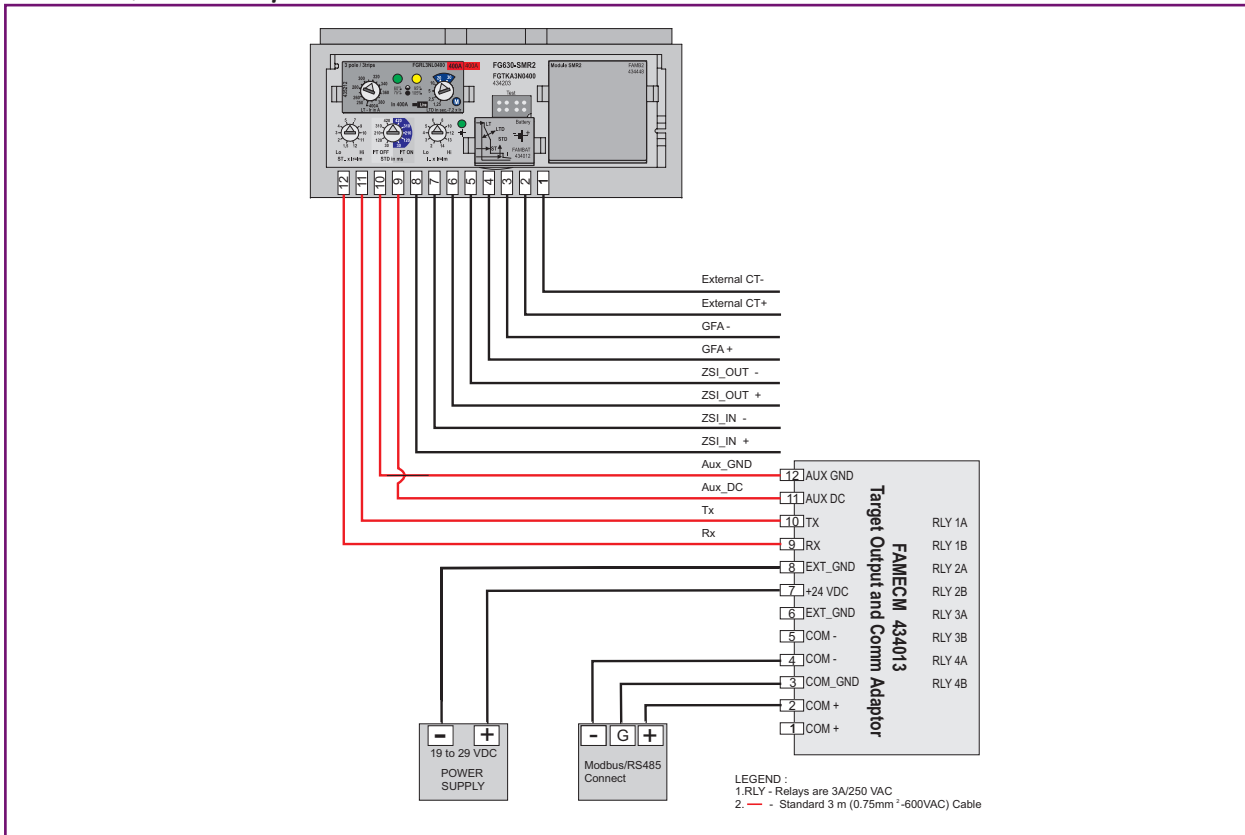
FK frame 3 pole, draw out device (6 pole connectors)



FK frame 4 pole, draw out device (6 pole connectors)



FG frame, SMR 2 trip unit connection



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FD & FE frame

- G.2 Breakers
- G.3 Phase separators
- G.3 Residual current devices RCD's
- G.5 Electrical operators
- G.6 Rotary handles
- G.8 Plug-in version
- G.9 Draw-out version FE frame
- G.10 Mechanical Interlock FE frame
- G.10 Door flanges
- G.11 Padlock fixed
- G.12 Backplates
- G.13 Terminal shields

FG frame

- G.15 Breakers
- G.15 Residual current devices RCD's
- G.16 Electrical operators
- G.16 Rotary handles
- G.17 Plug-in version
- G.18 Draw-out version
- G.19 Mechanical interlock
- G.20 Door flanges
- G.21 Padlocking fixed
- G.21 Backplate
- G.22 Terminal shields

FK frame

- G.24 Breakers
- G.24 Electrical operators
- G.25 Rotary handles
- G.26 Draw-out version
- G.26 Phase separators
- G.27 Door flanges
- G.28 Mechanical interlock
- G.29 Terminal shields

Other accessories

- G.30 Connectivity-60 mm system FD and FE frames
- G.32 FG & FK frame, external groundfault sensors
- G.32 FE, FG & FK frame, Controller for changeover device
- G.33 FG frame SMR2, Trip unit accessory; FACM module
- G.33 Relay RD5 and RD6
- G.33 Rectangular sensor
- G.33 Circular sensor

The breaker

Order codes

Trip units

Components & Accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

A

B

C

D

E

F

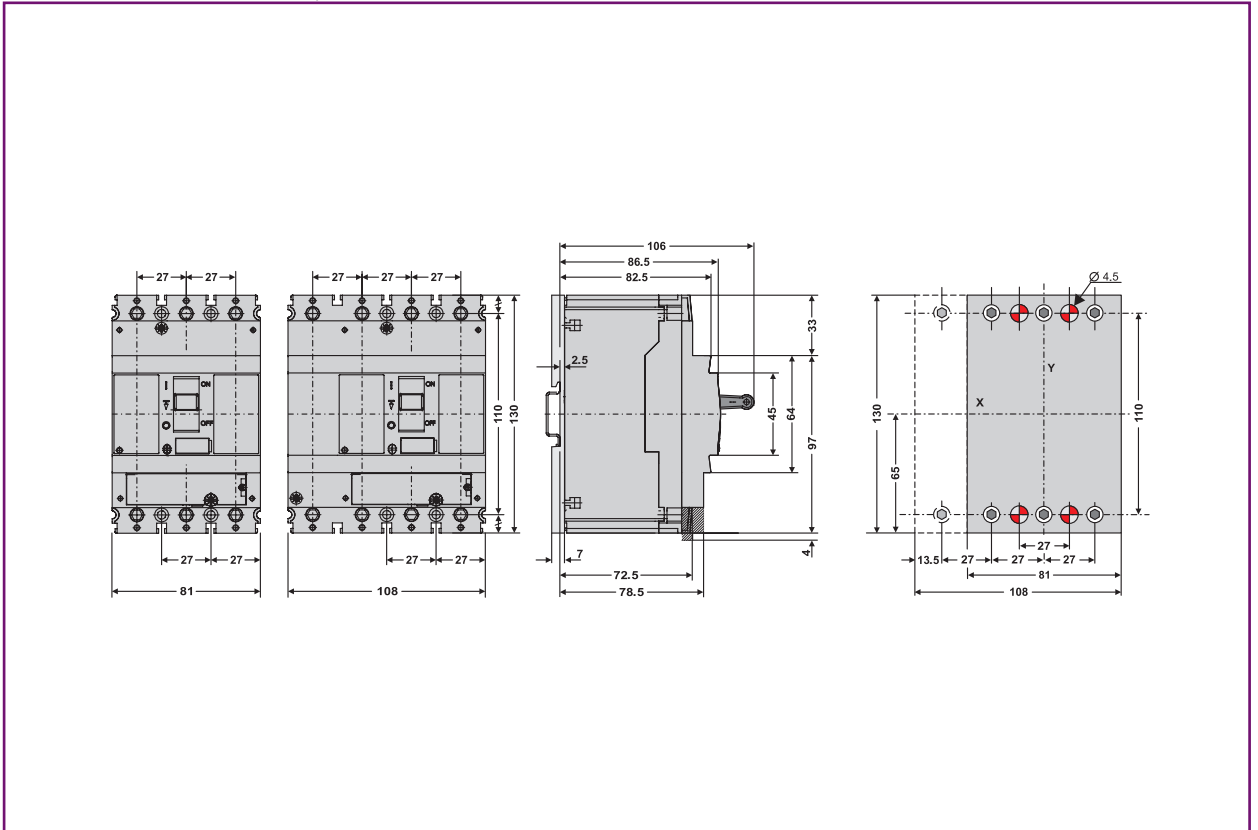
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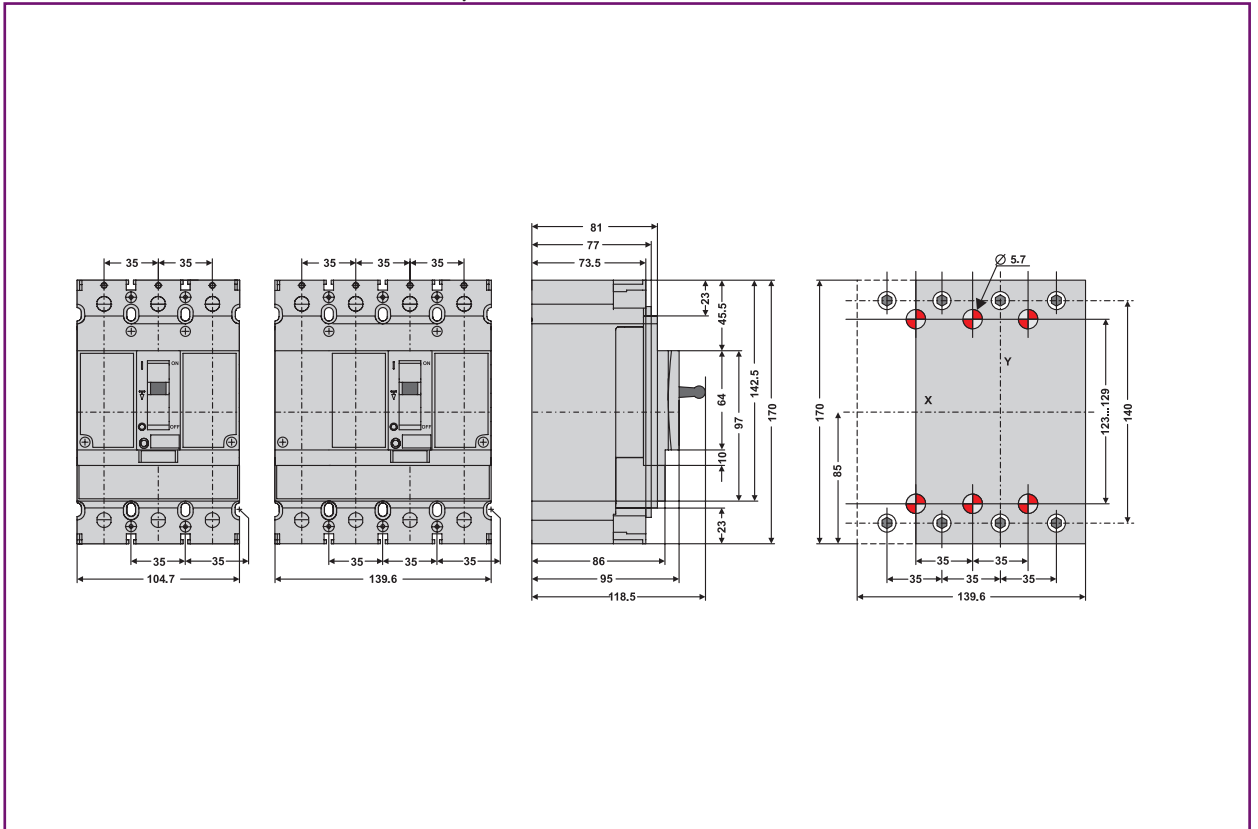


Dimensional Drawings

Breakers - FD160 fixed, front connected



Breakers - FE160 and FE250 fixed, front connected



Dimensions

Intro

A

B

C

D

E

F

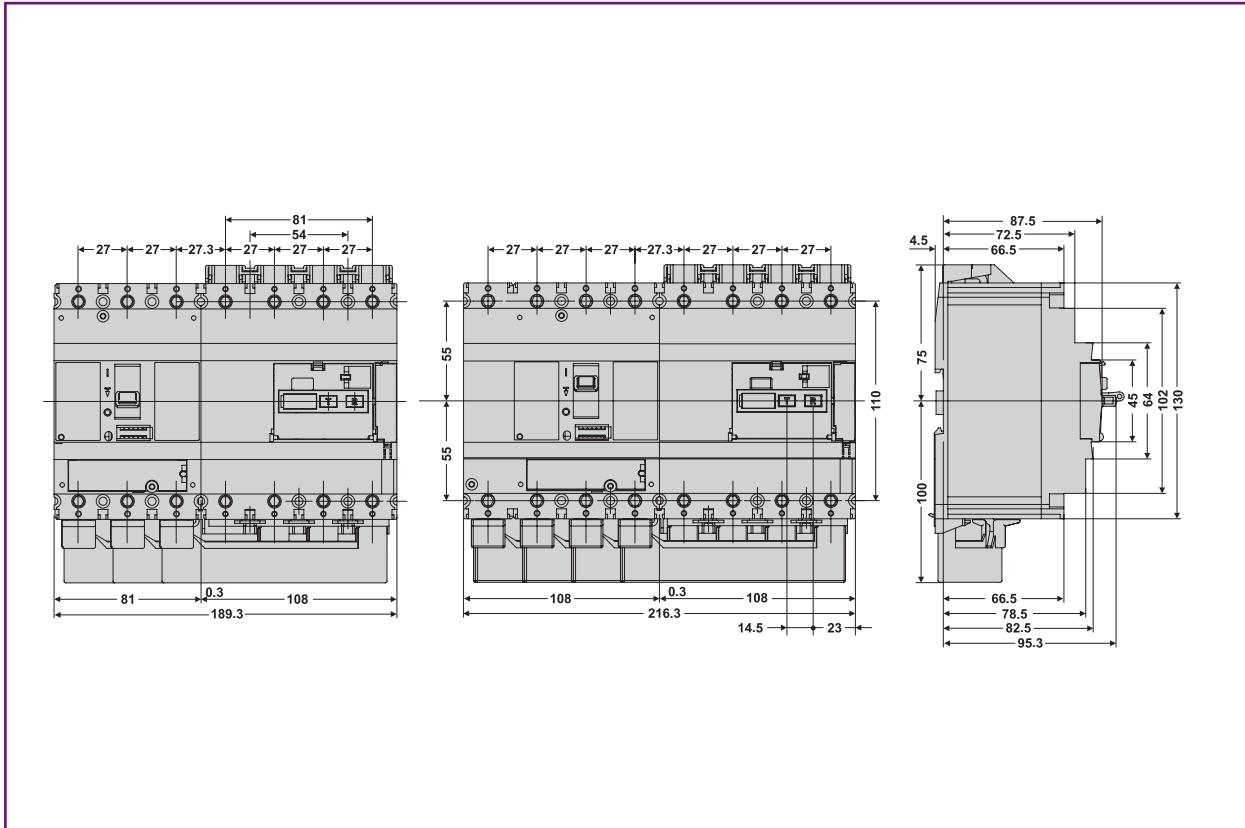
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Dimensional Drawings

RCD side mounted - FD160



FD & FE frame

Intro

A

B

C

D

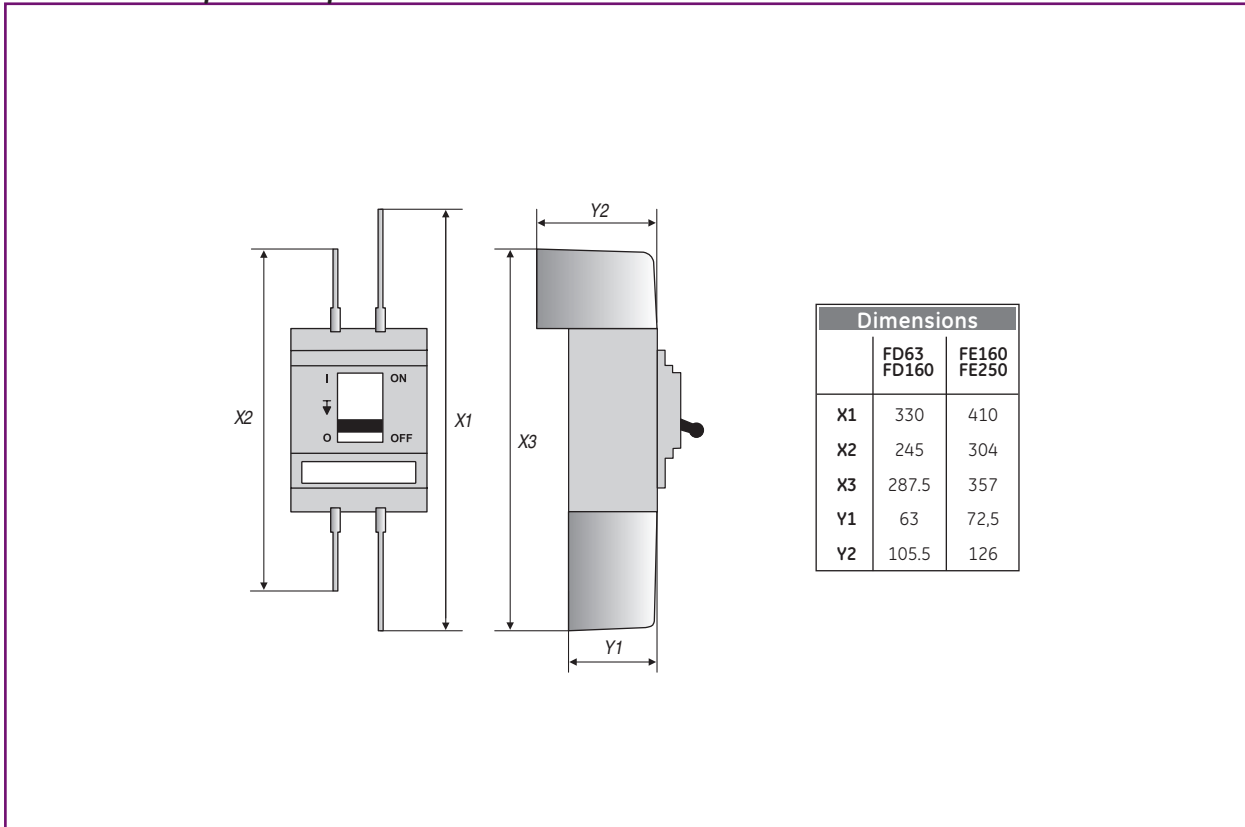
E

F

G

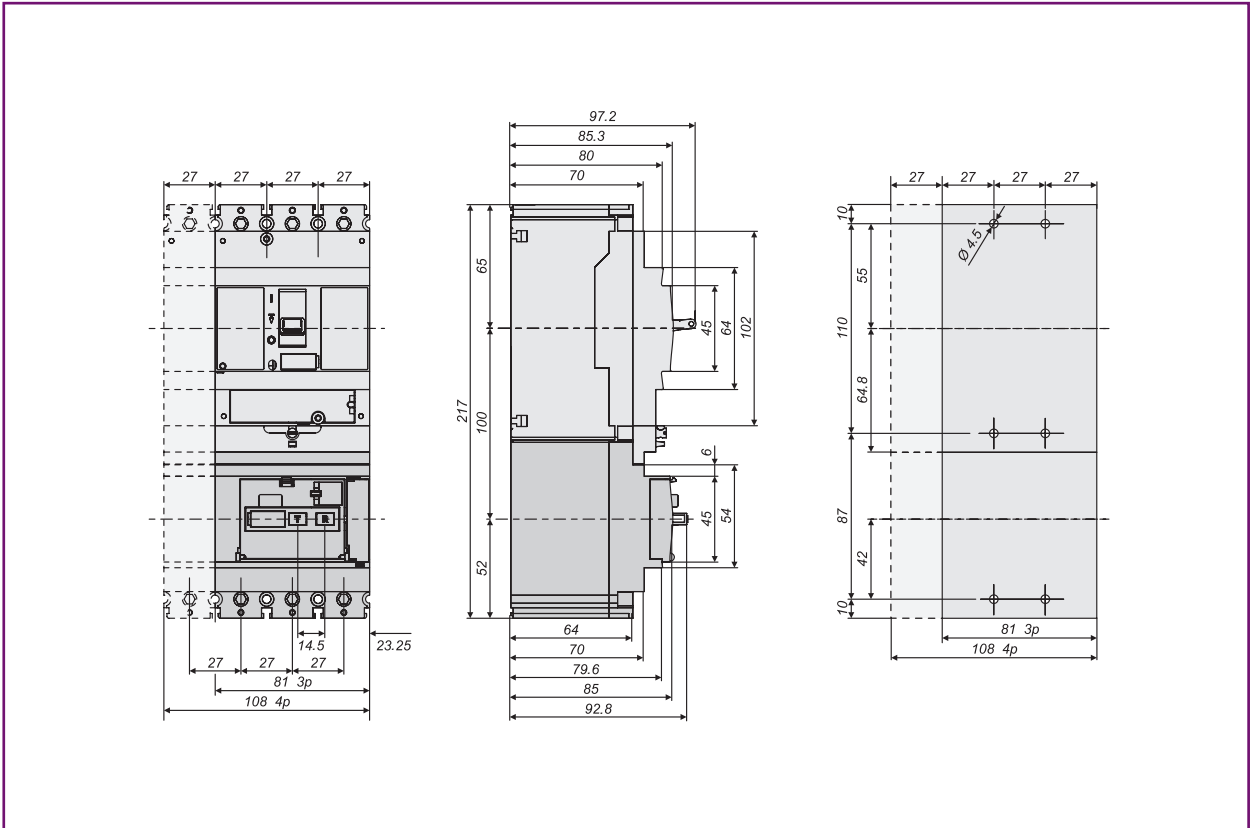
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Breakers with phase separator - FD and FE frames

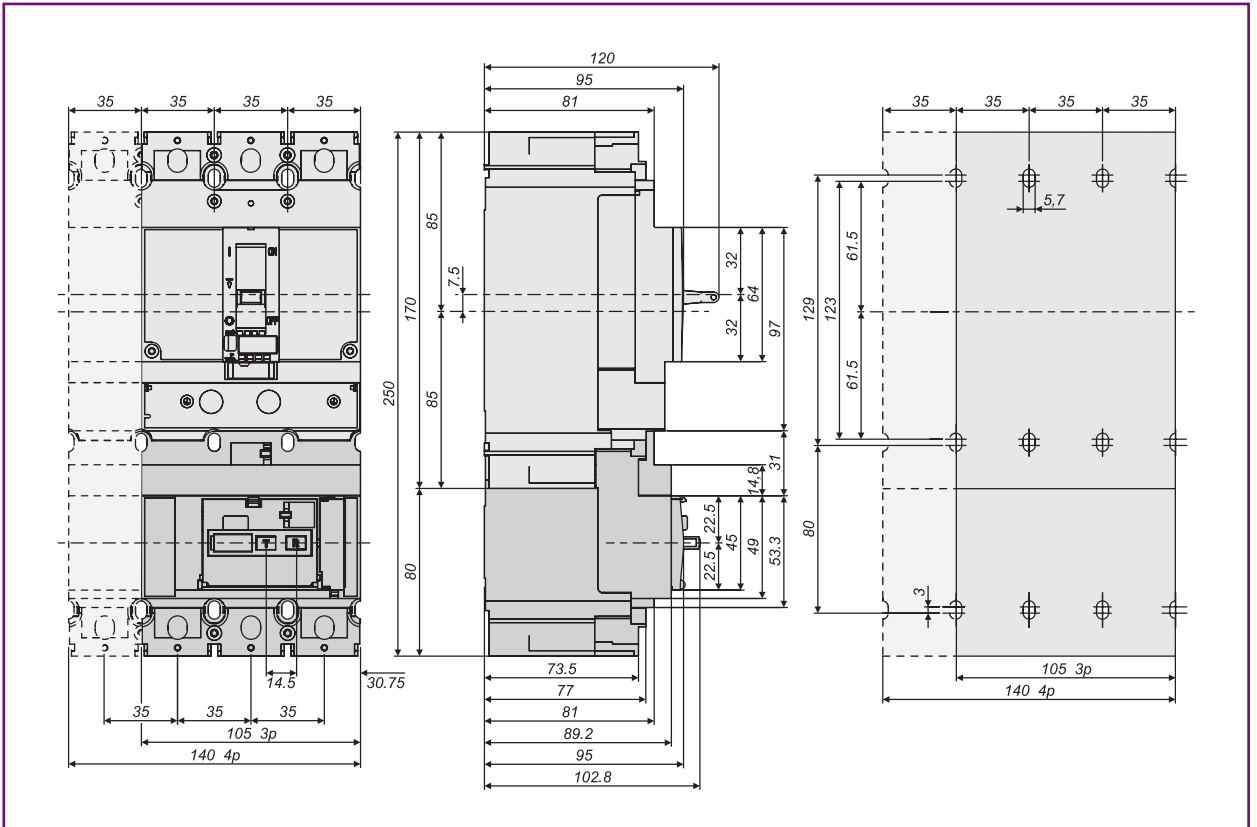


Dimensional Drawings

RCD bottom mounted - FD160



RCD bottom mounted - FE160 and FE250



Dimensions

A

B

C

D

E

F

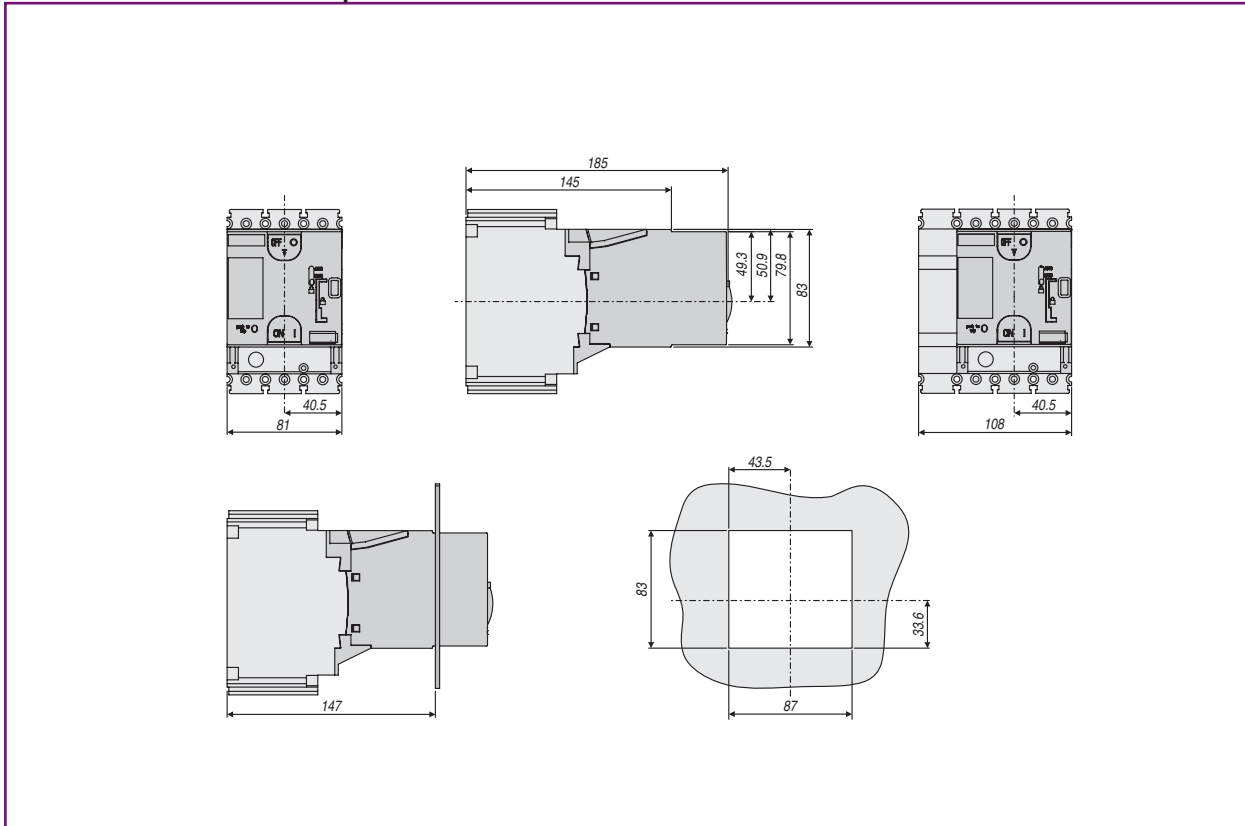
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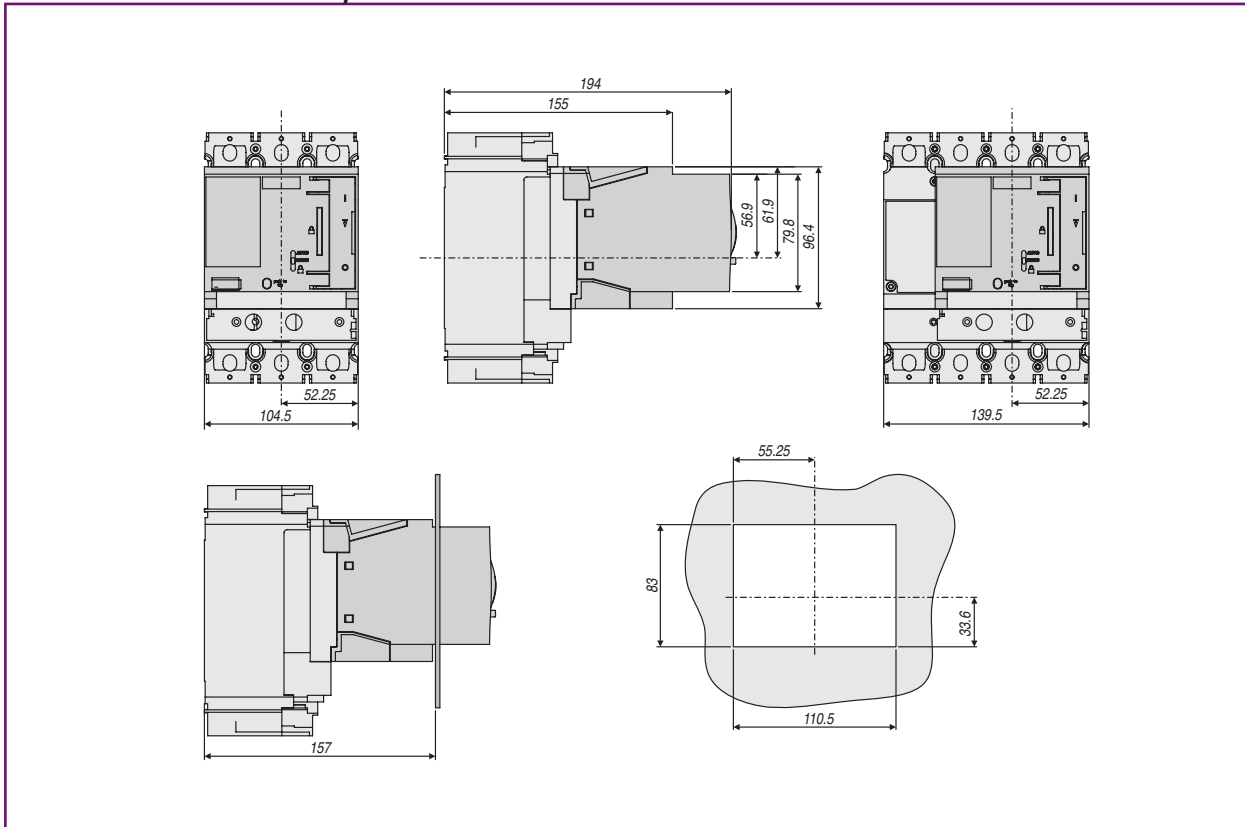


Dimensional Drawings

Breaker with electrical operator - FD160



Breaker with electrical operator - FE160 and FE250



FD & FE frame

Intro

A

B

C

D

E

F

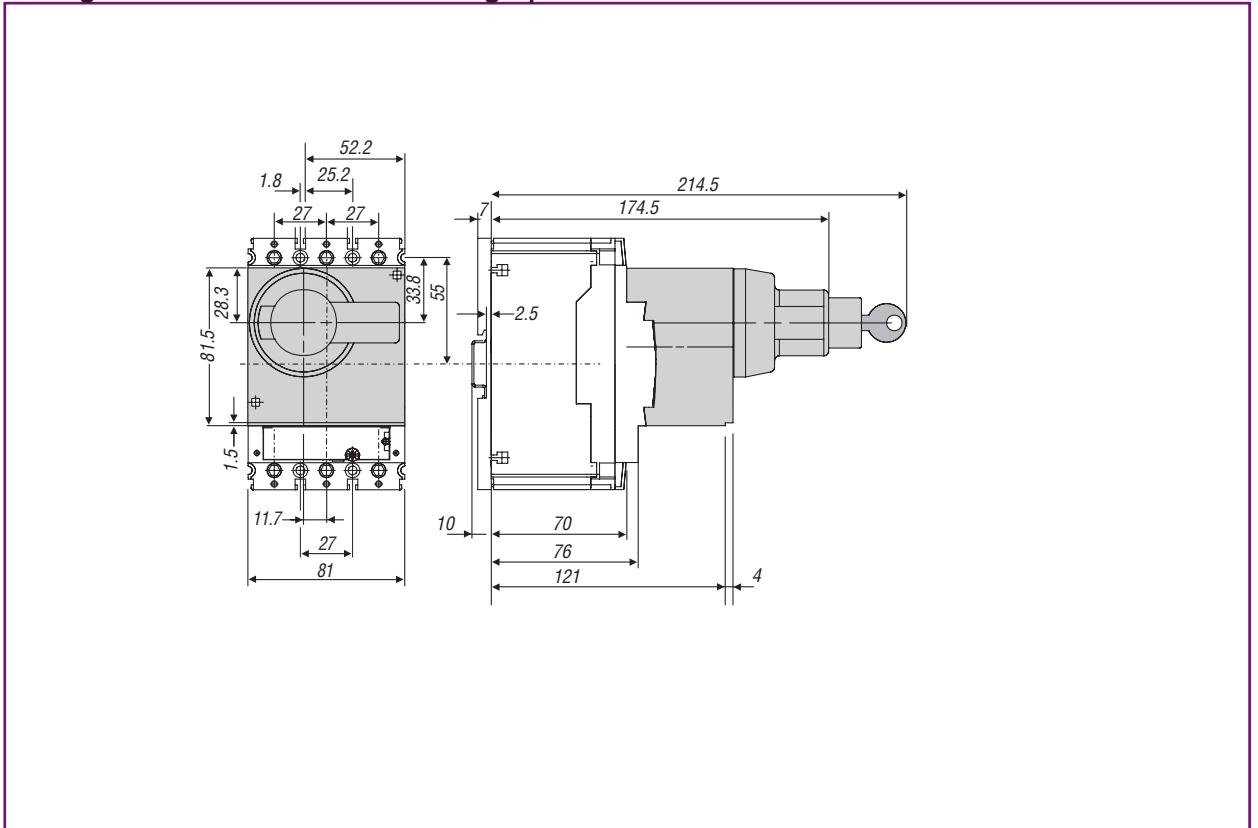
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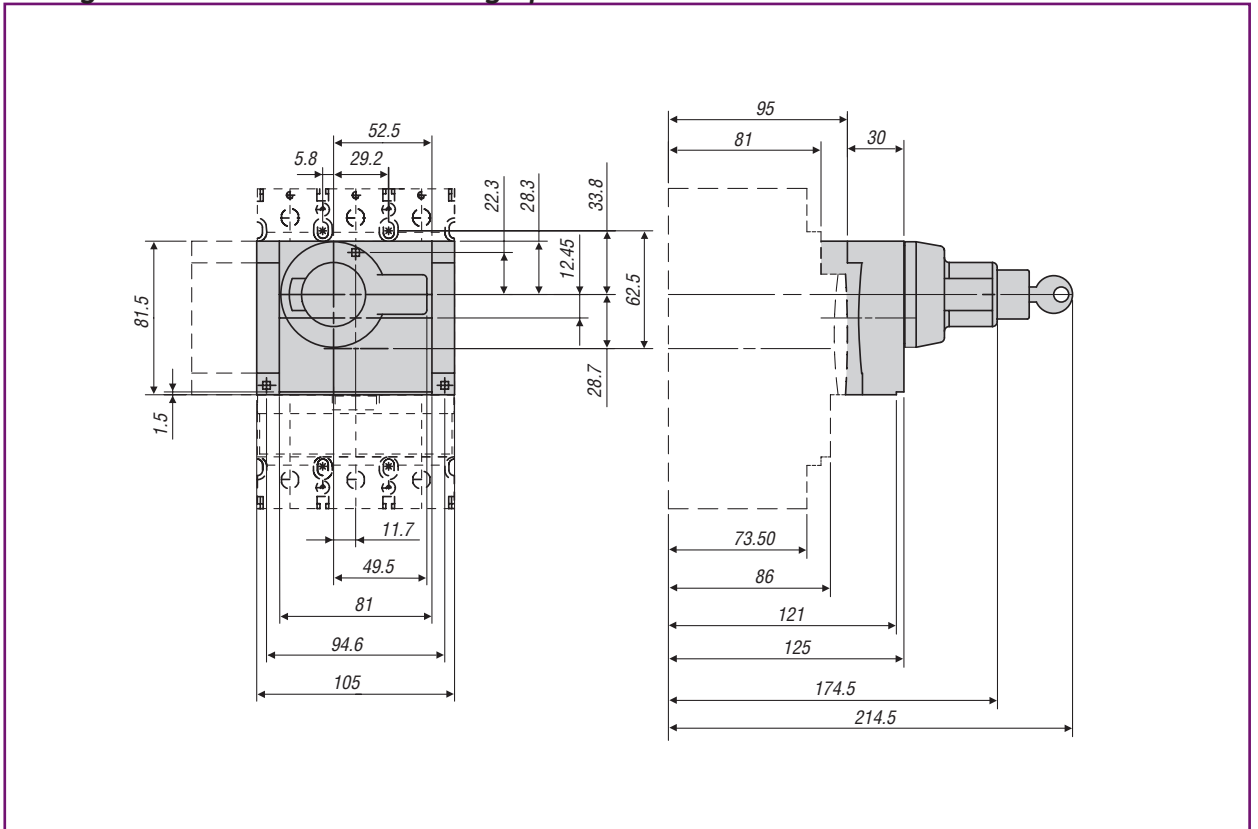


Dimensional Drawings

Rotary handle - Breaker and through panel mounted - FD160



Rotary handle - Breaker and through panel mounted - FE160 and FE250



Dimensions

Intro

A

B

C

D

E

F

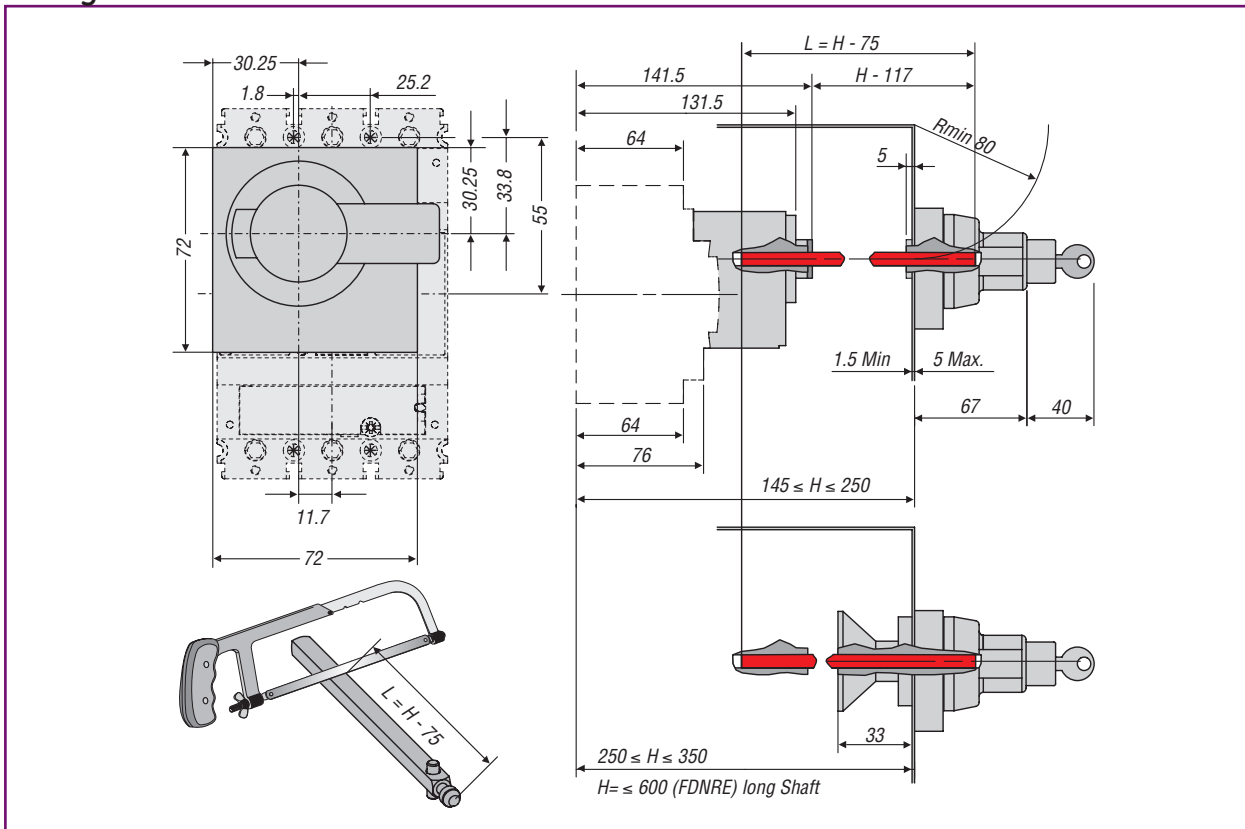
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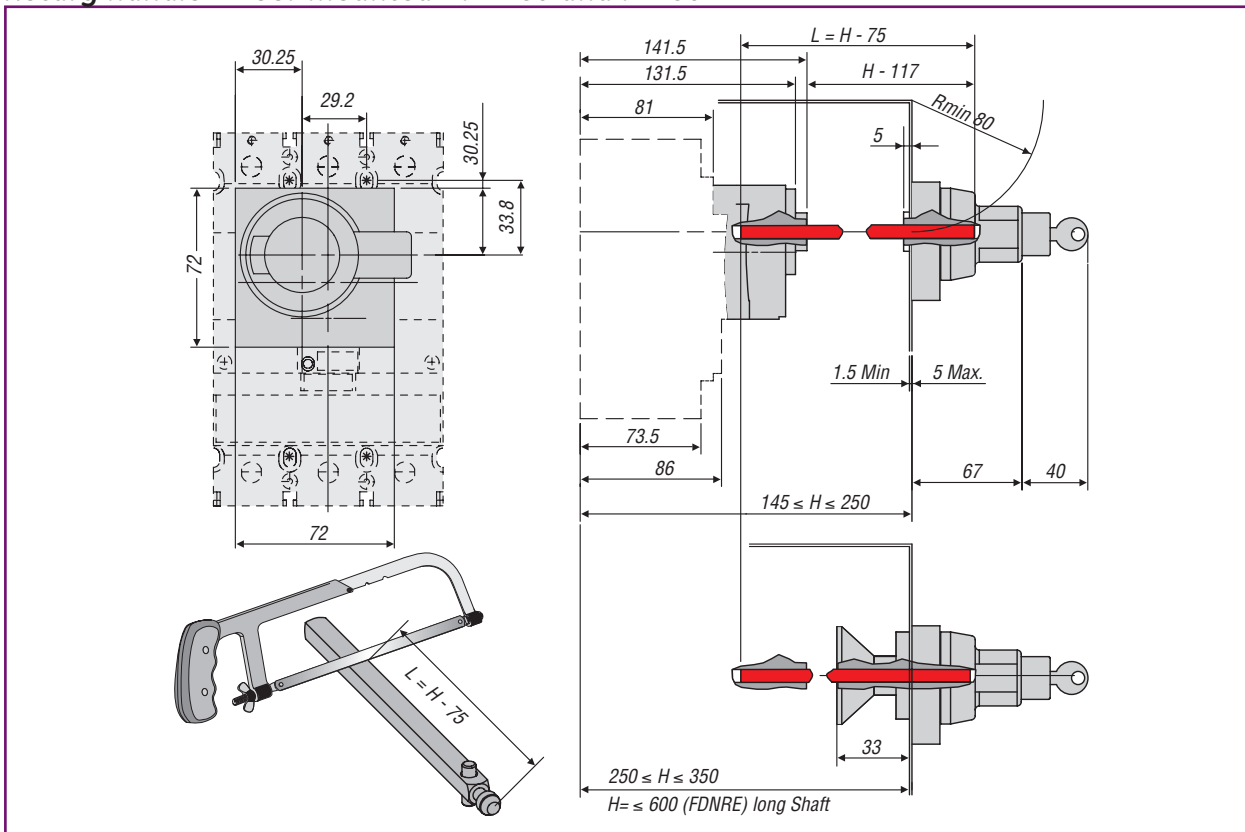


Dimensional Drawings

Rotary handle - Door mounted FD160



Rotary handle - Door mounted - FE 160 and FE250



FD & FE frame

Intro

A

B

C

D

E

F

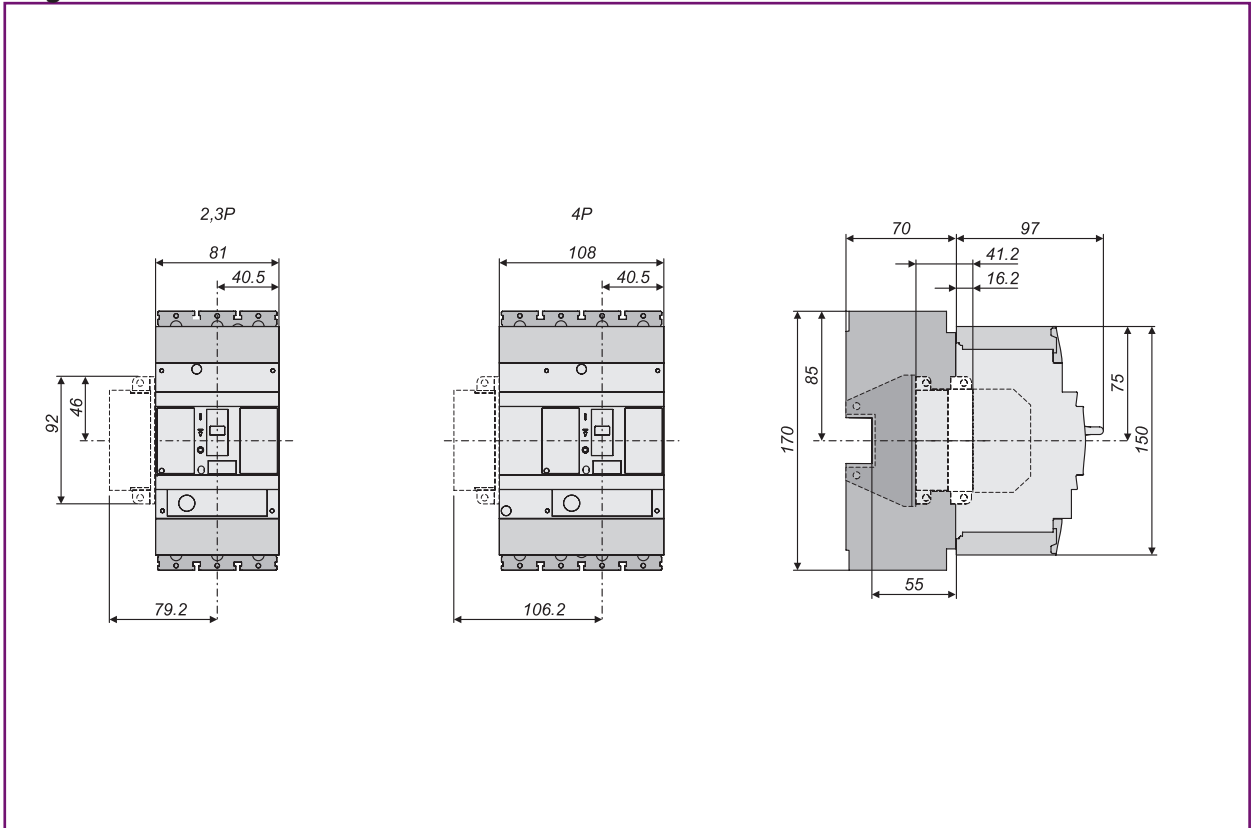
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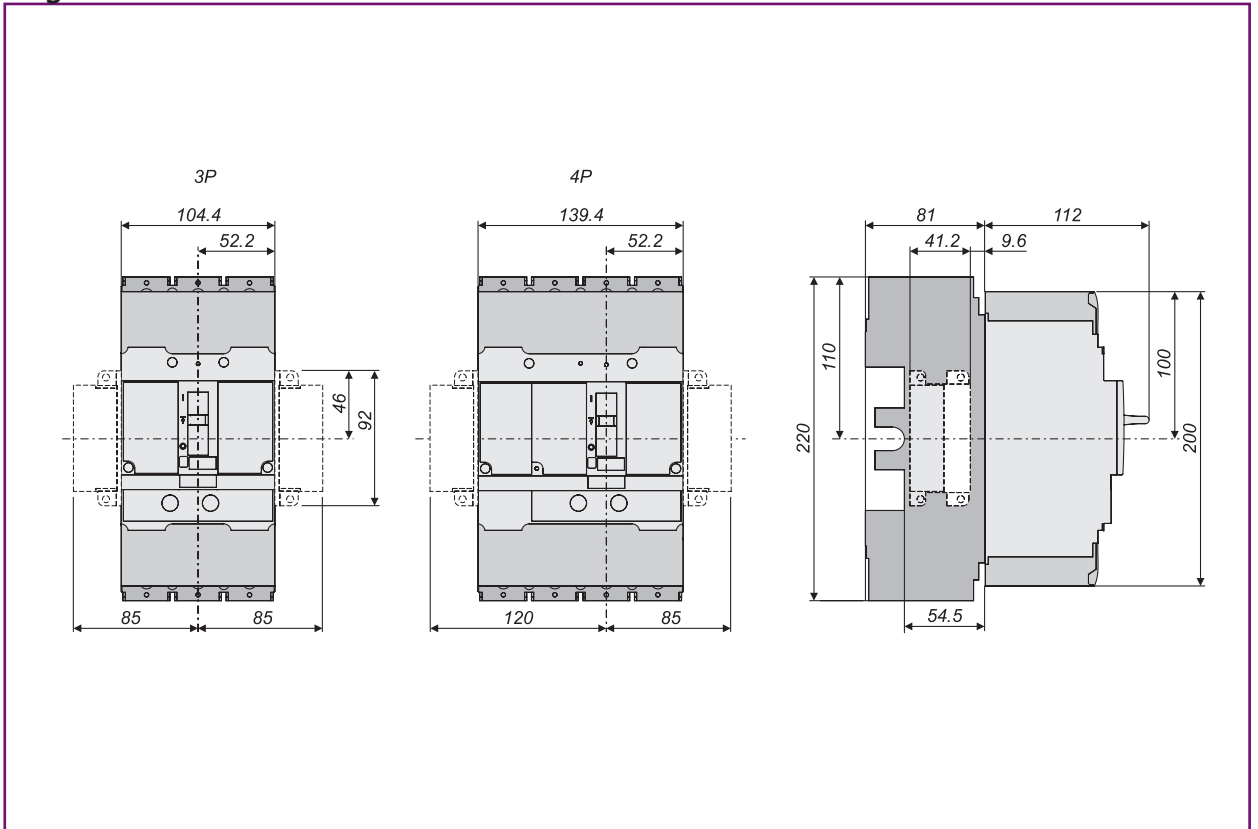


Dimensional Drawings

Plug-in version - FD160



Plug-in version - FE160 and FE250



Dimensions

Intro

A

B

C

D

E

F

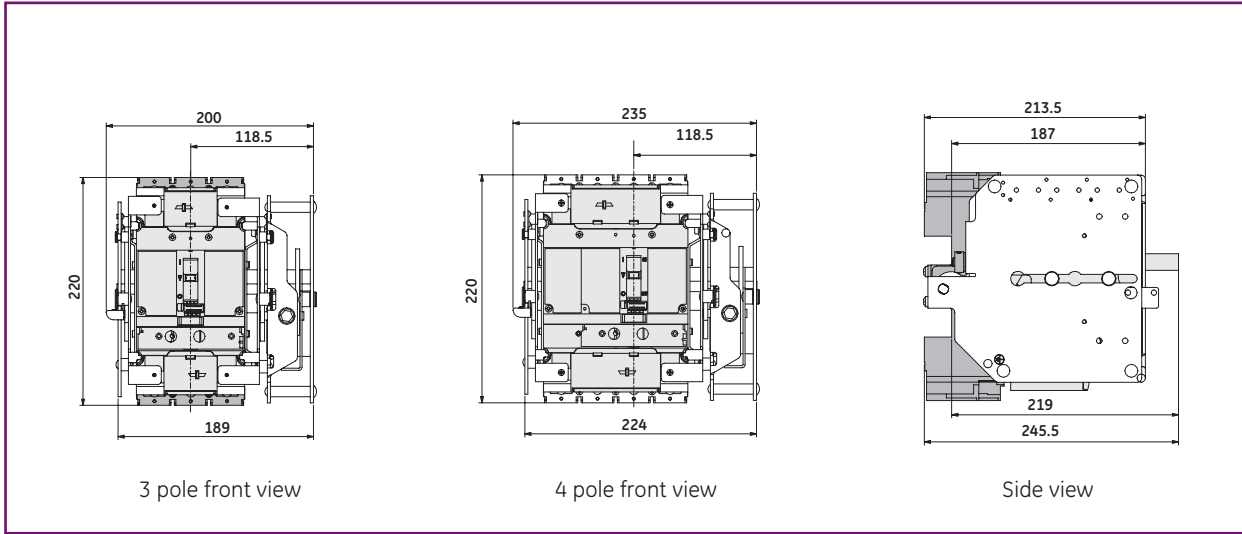
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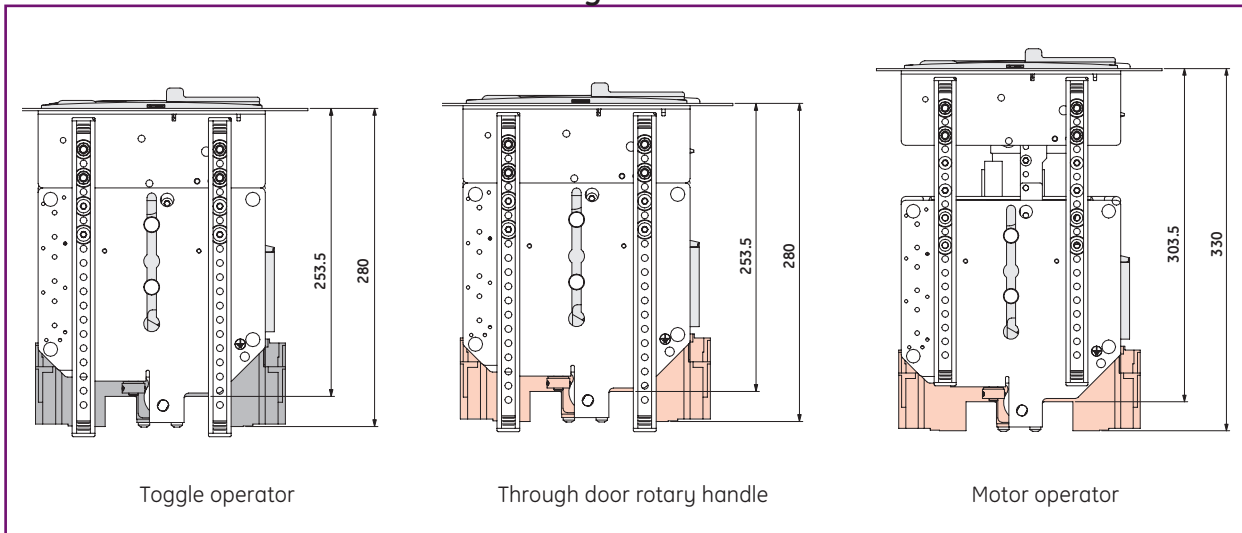


Dimensional Drawings

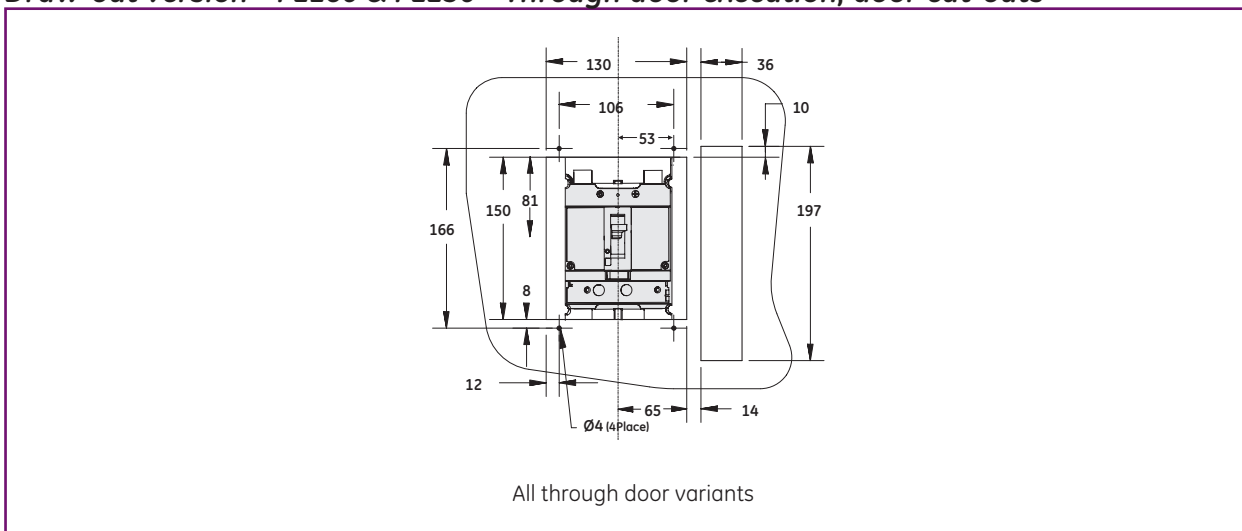
Draw-out version - FE160 & FE250



Draw-out version - FE160 & FE250 - Through door execution side views

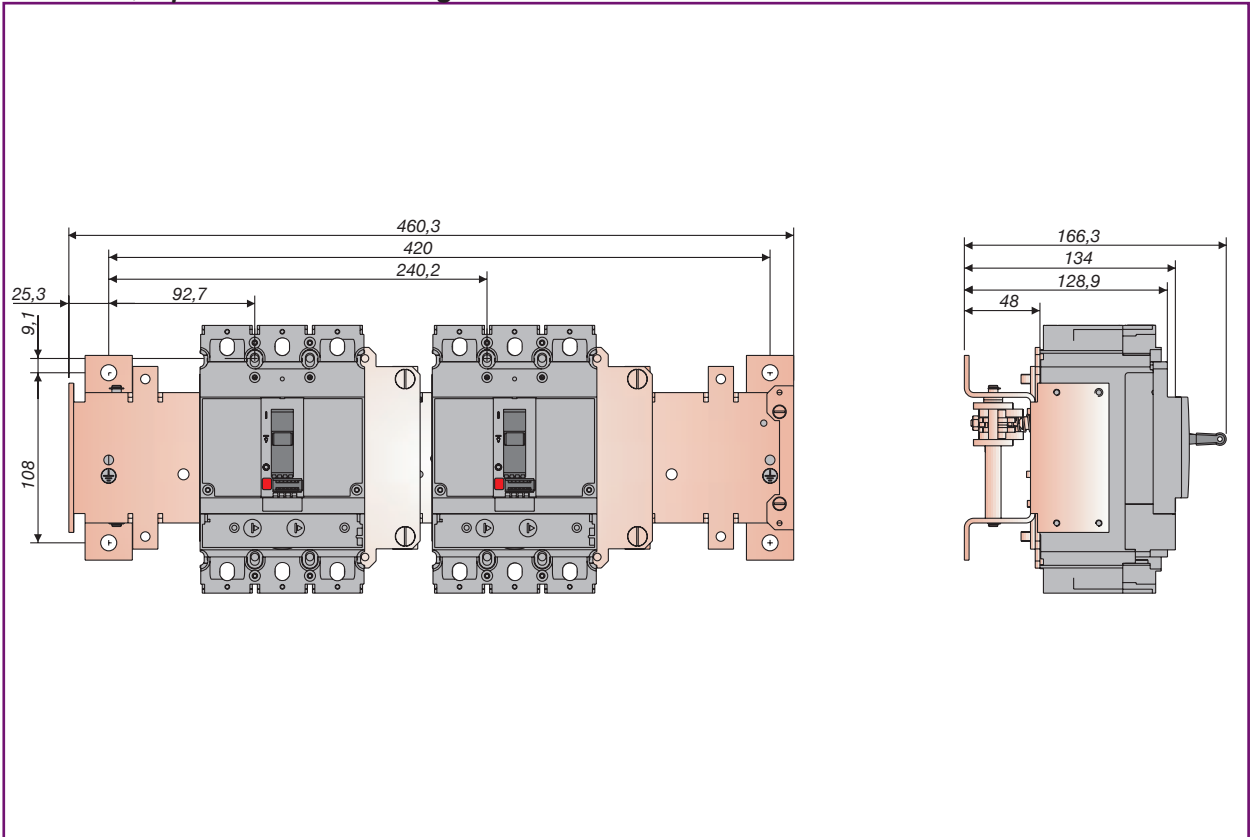


Draw-out version - FE160 & FE250 - Through door execution, door cut-outs

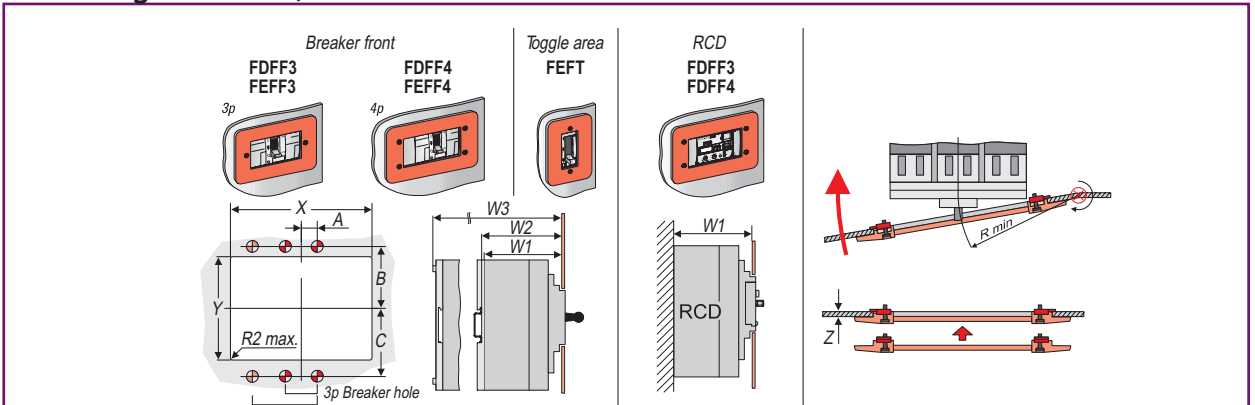


Dimensional Drawings

FE Frame, 2 pieces mechanically interlocked



Door flanges - FD160, FE160 and FE250



		Dimensions										
			A	B	C	Rmin	W1(max)	W2(max)	W3(max)	X	Y	Z
FDFF3	FD 63/160	3p	13.5	55	55	80	83.2	85.8	93.2	114	78	1...4
FDFF4	FD 63/160	4p	13.5	55	55	93.5	83.2	85.8	93.2	146	78	1...4
FEFF3	FE160/250	3p	17.5	55.5	70.5	91.75	89.2	-	-	138	97	1...4
FEFF4	FE160/250	4p	17.5	55.5	70.5	102.5	89.2	-	-	173	97	1...4
FEFT	FE 160/250	3p/4p	17.5	55.5	70.5	93.5	93.2	-	-	60	97	1...4
FDFF3 (RCD*)	FD 63/160	3p	13.5	155	42	80	83.2	85.8	93.2	114	78	1...4
FDFF4 (RCD*)	FD 63/160	4p	13.5	155	42	93.5	83.2	85.8	93.2	146	78	1...4
FDFF3 (RCD*)	FE160/250	3p/4p	18	182.1	42	80	89.2	-	-	114	78	1...4

Dimensions

Intro

A

B

C

D

E

F

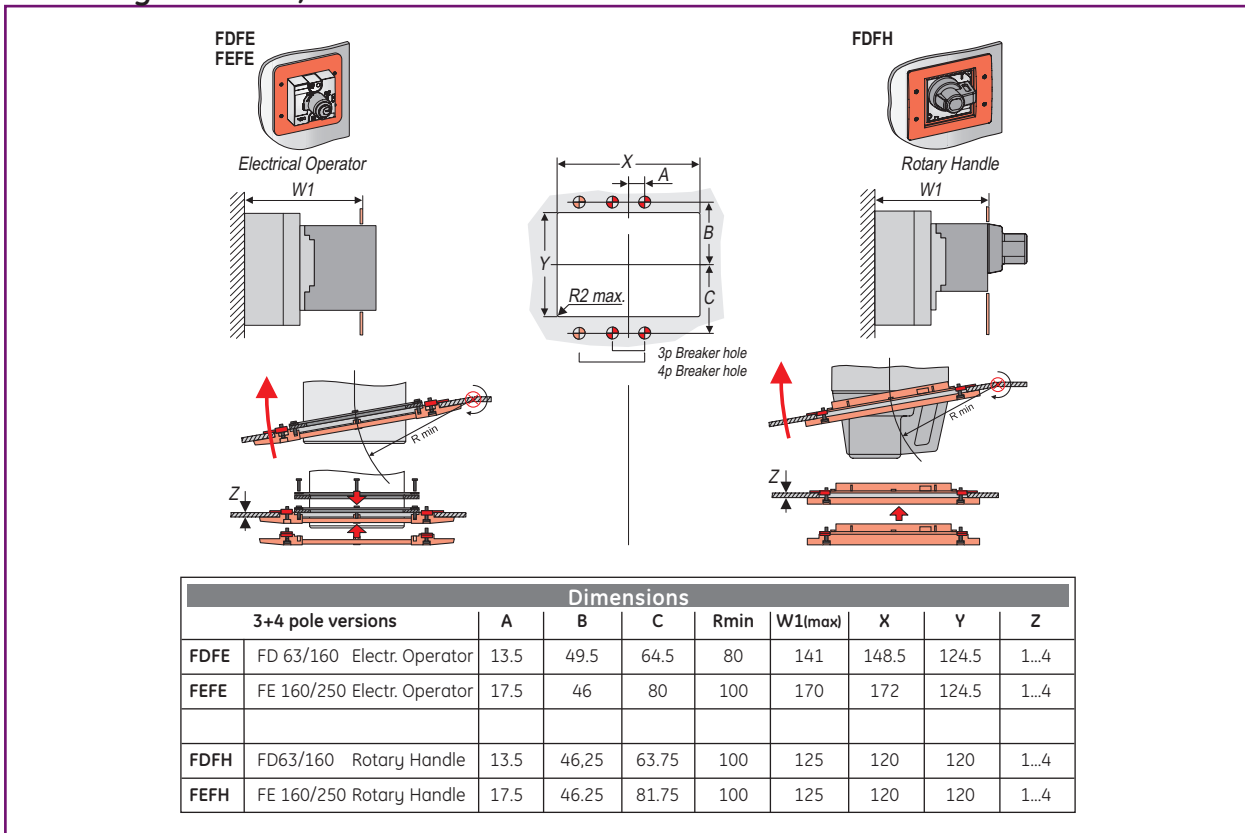
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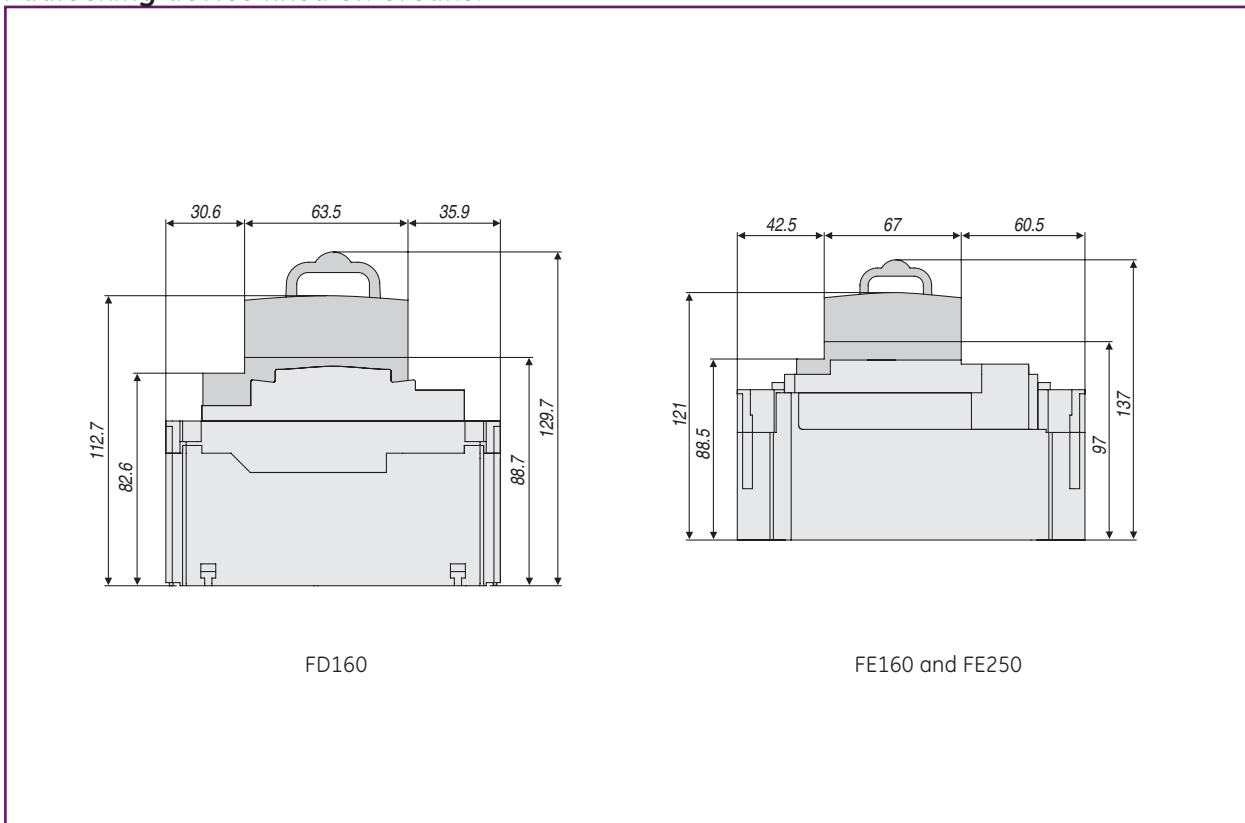


Dimensional Drawings

Door flanges - FD160, FE160 and FE250



Padlocking device fixed on breaker



FD & FE frame

Intro

A

B

C

D

E

F

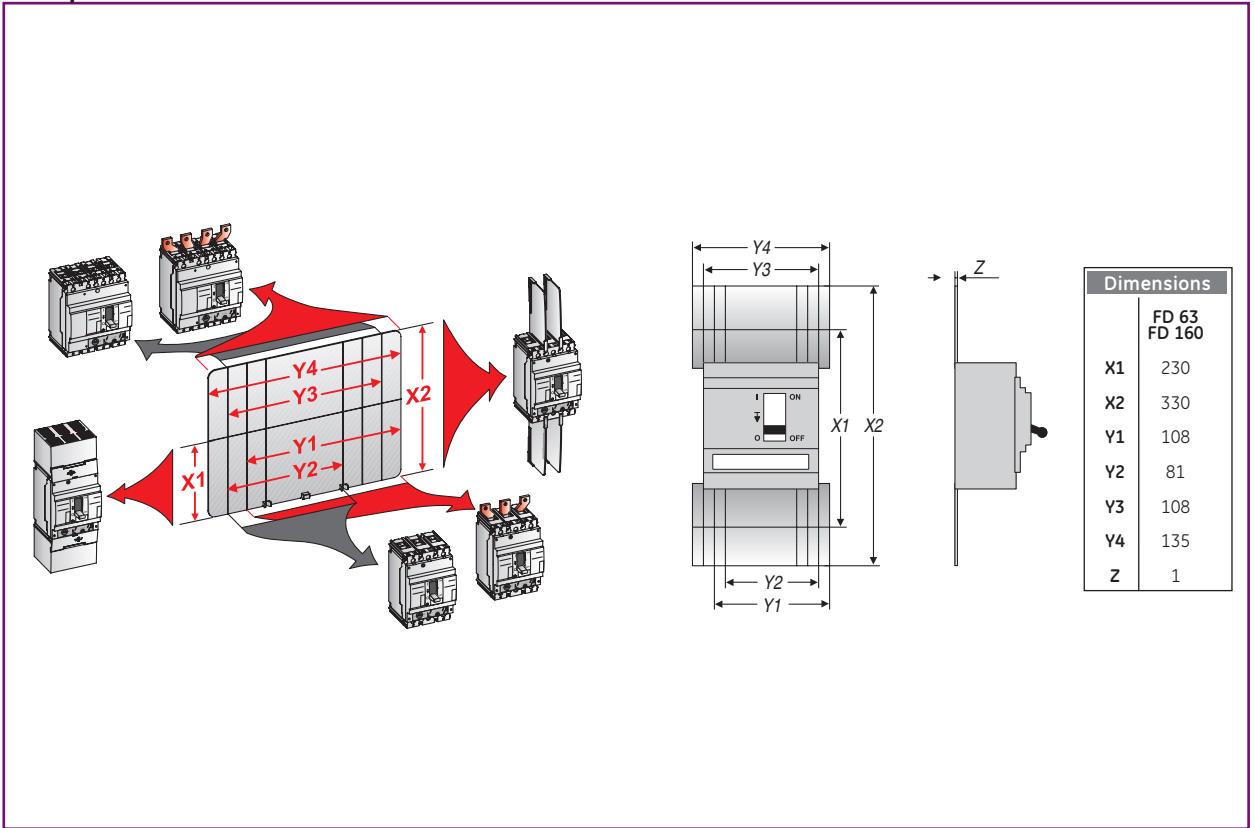
G

X

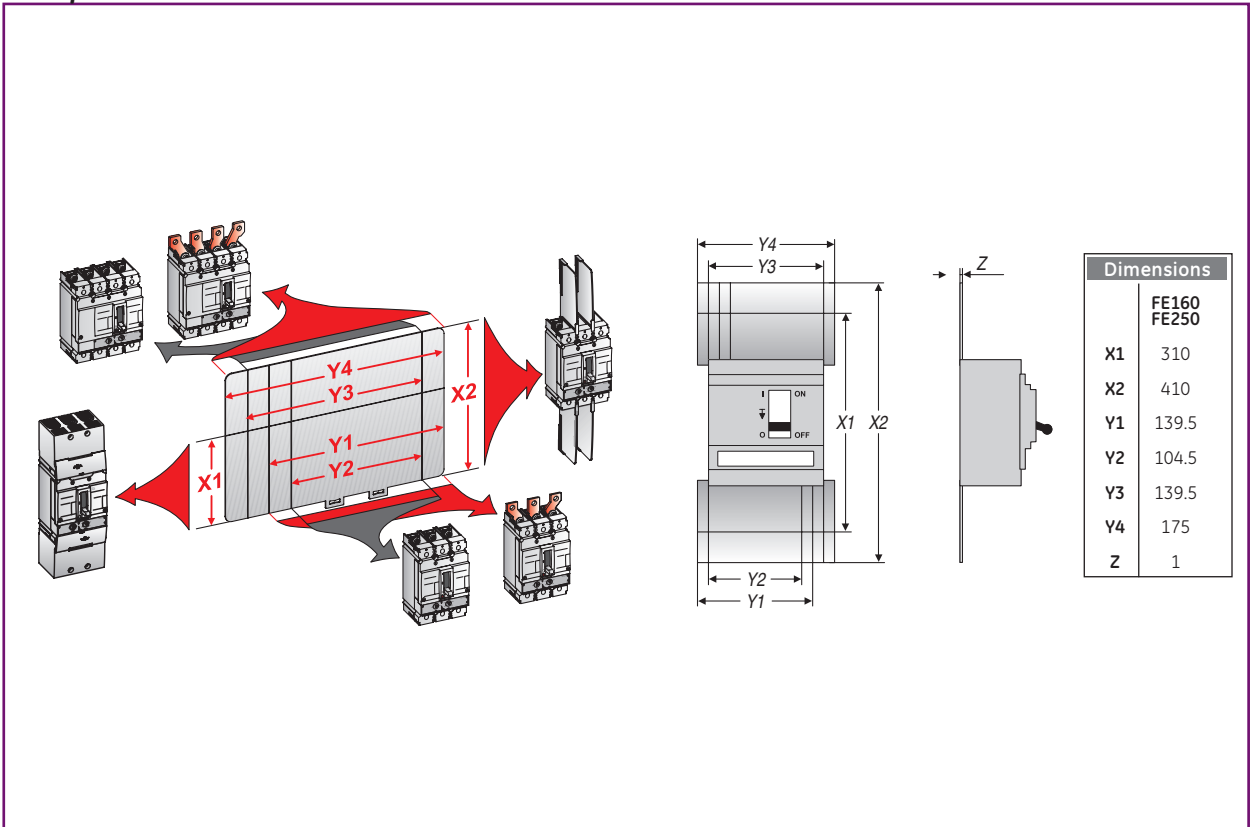


Dimensional Drawings

Backplate - FD160

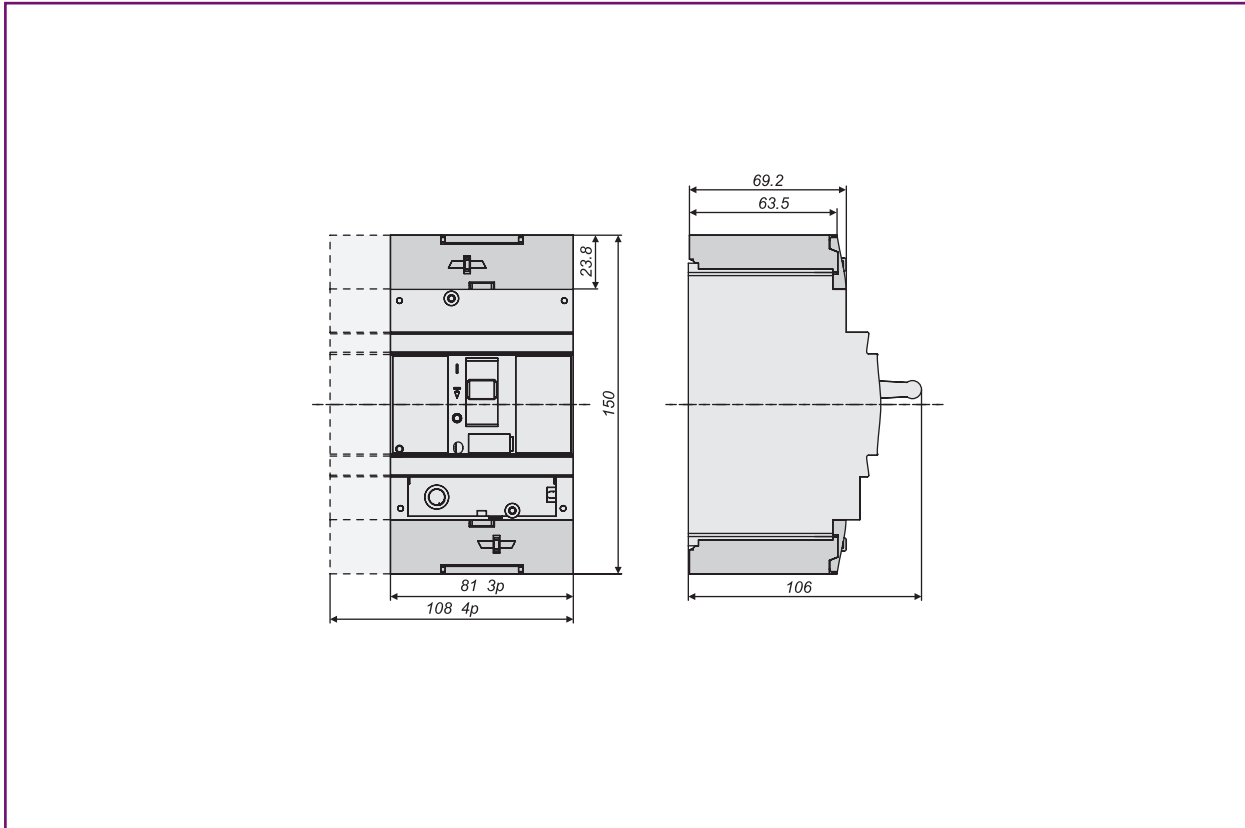


Backplate - FE160 and FE250

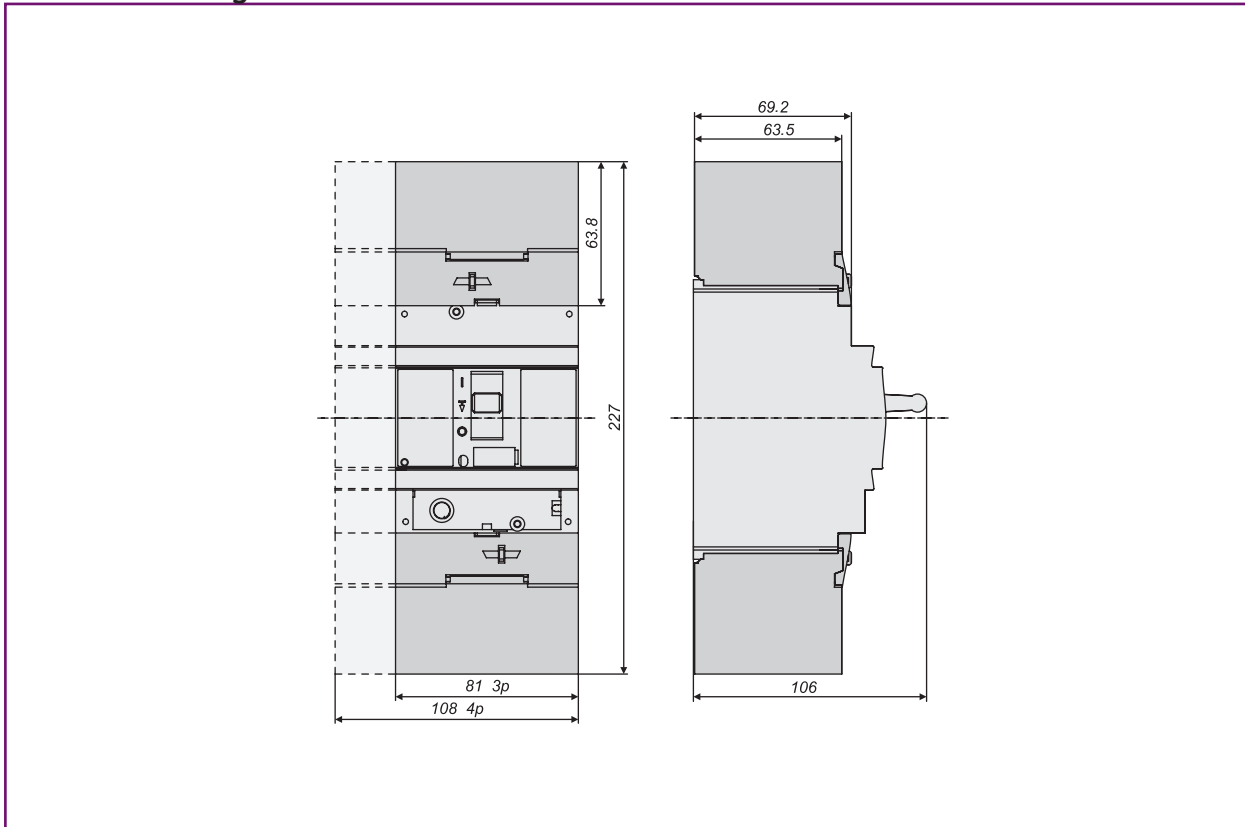


Dimensional Drawings

Breaker with short terminal shields - FD160



Breaker with long terminal shields - FD160



FD & FE frame

Intro

A

B

C

D

E

F

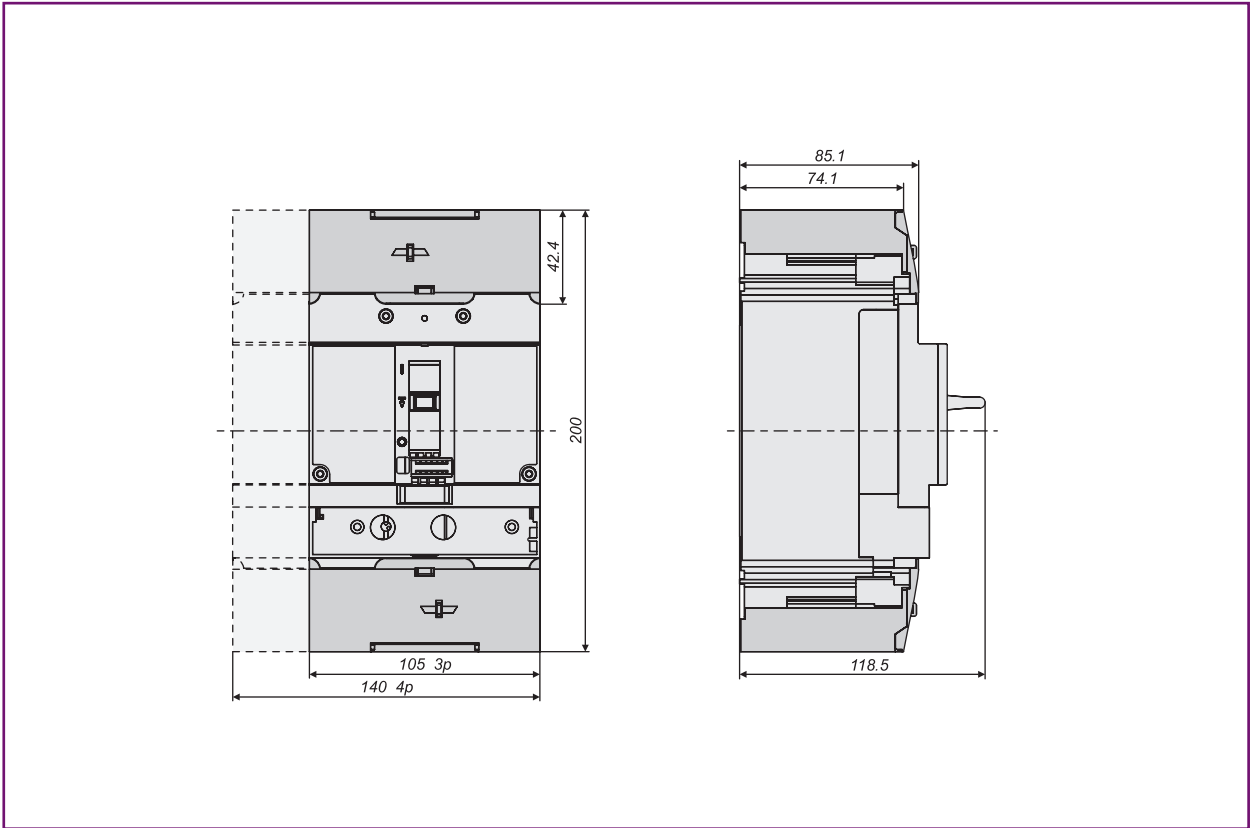
G

X

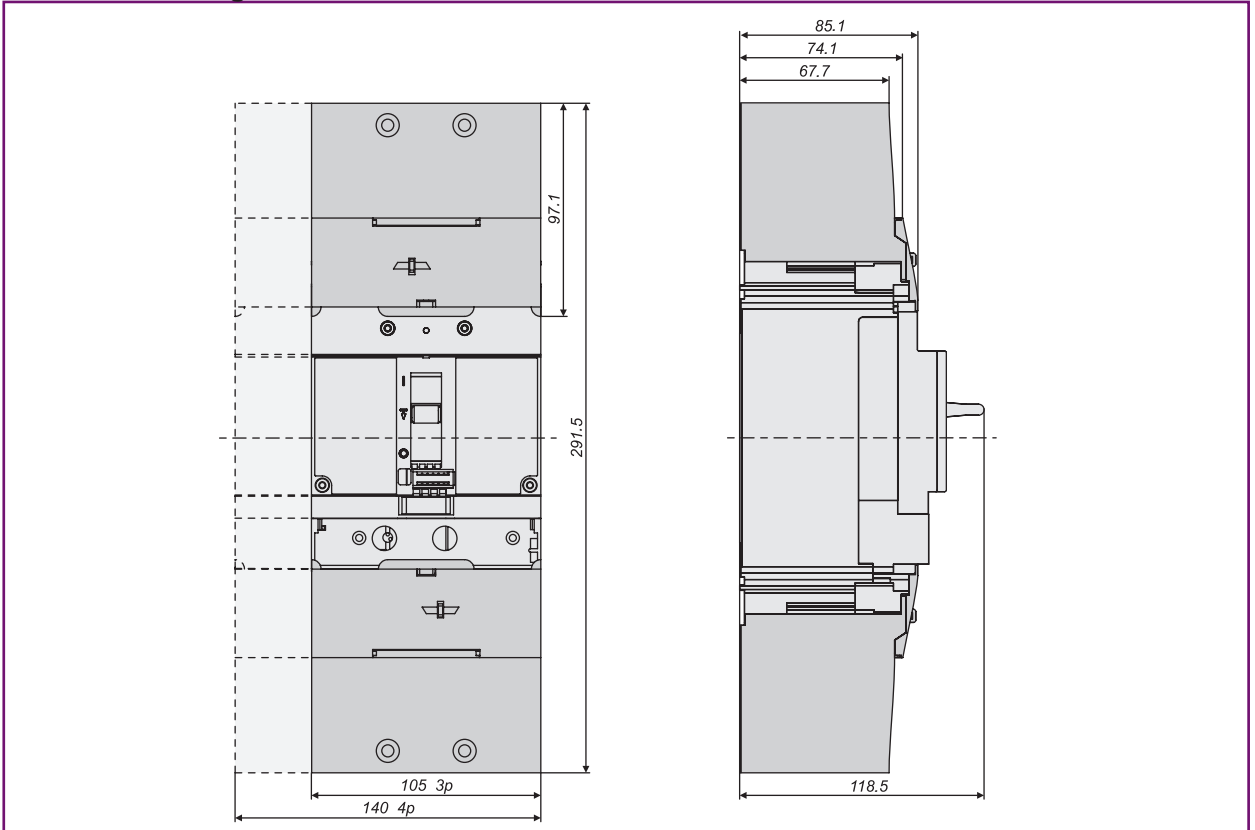


Dimensional Drawings

Breaker with short terminal shields - FE160 and FE250



Breaker with long terminal shields - FE160 and FE250



Dimensions

Intro

A

B

C

D

E

F

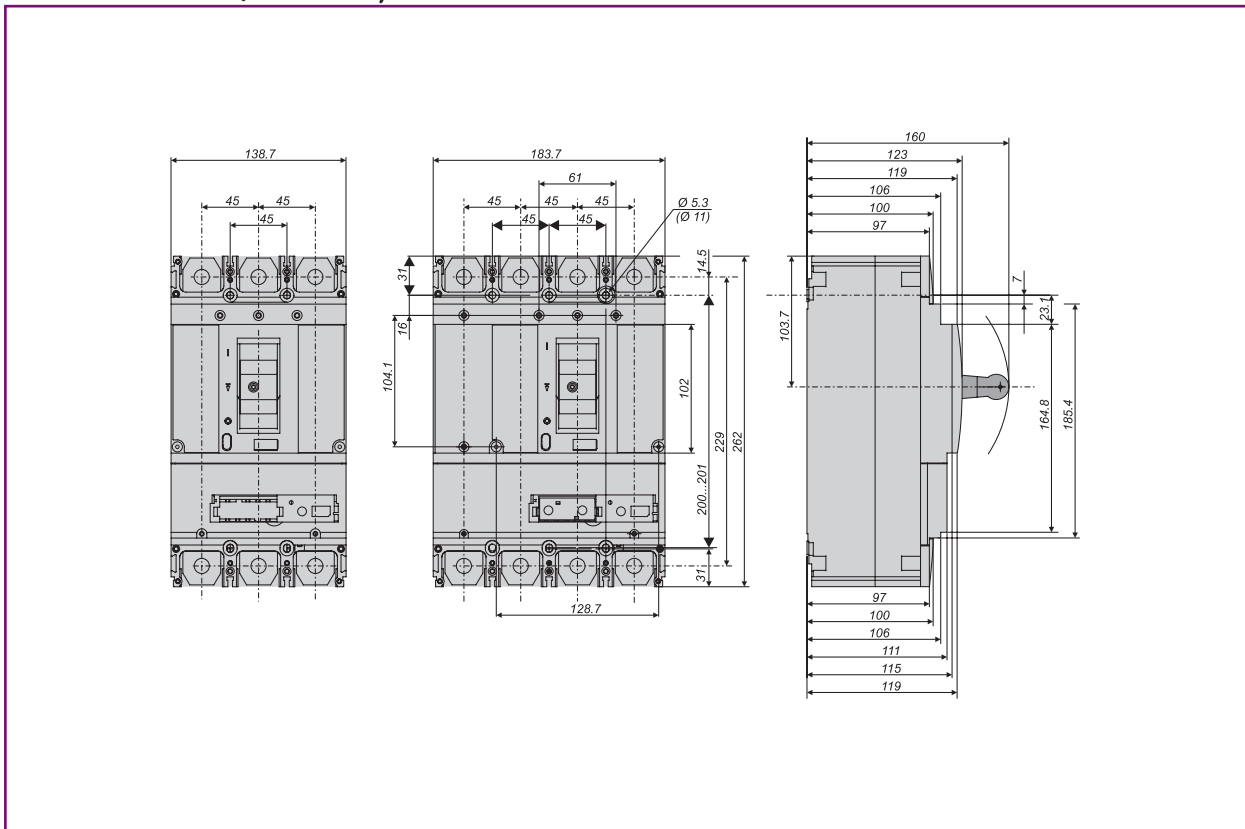
G

X

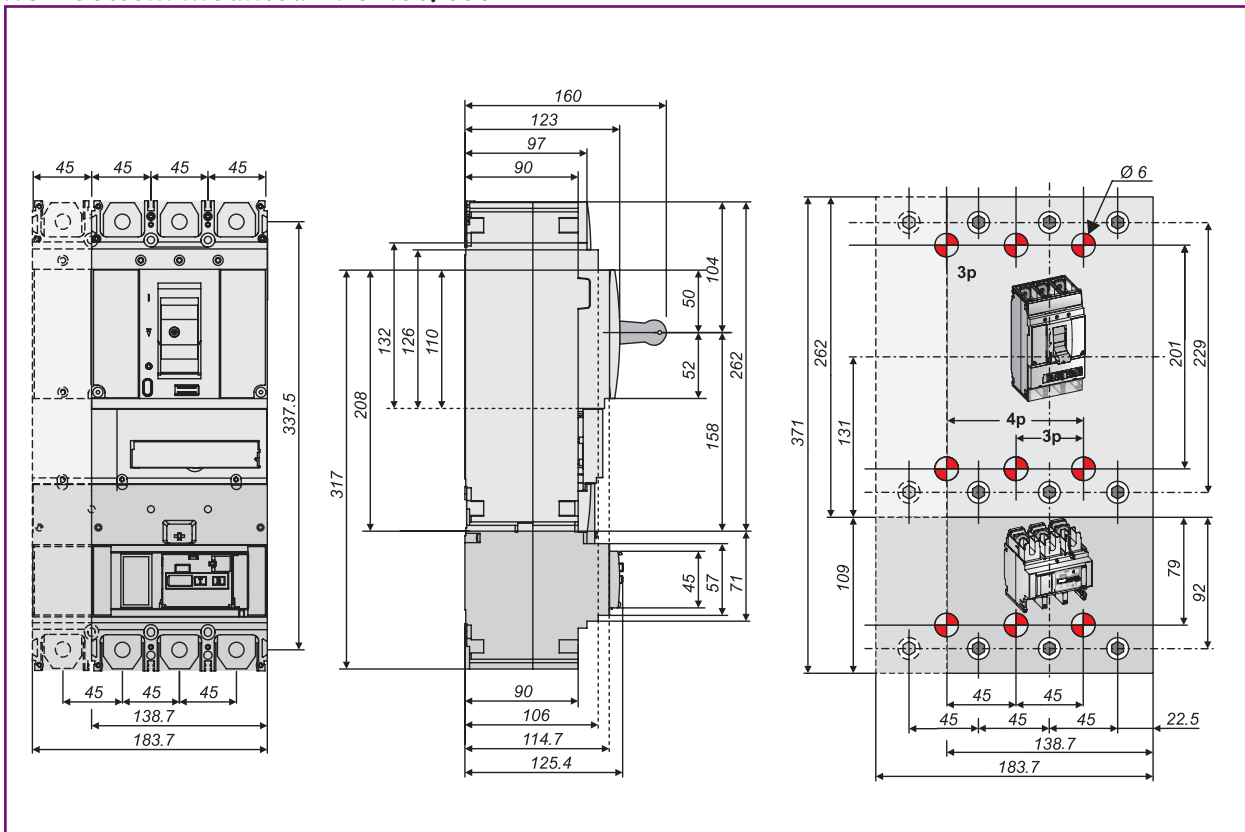


Dimensional Drawings

Breakers - FG400/630 fixed, front connected



RCD bottom mounted - FG 400/630



FG frame

Intro

A

B

C

D

E

F

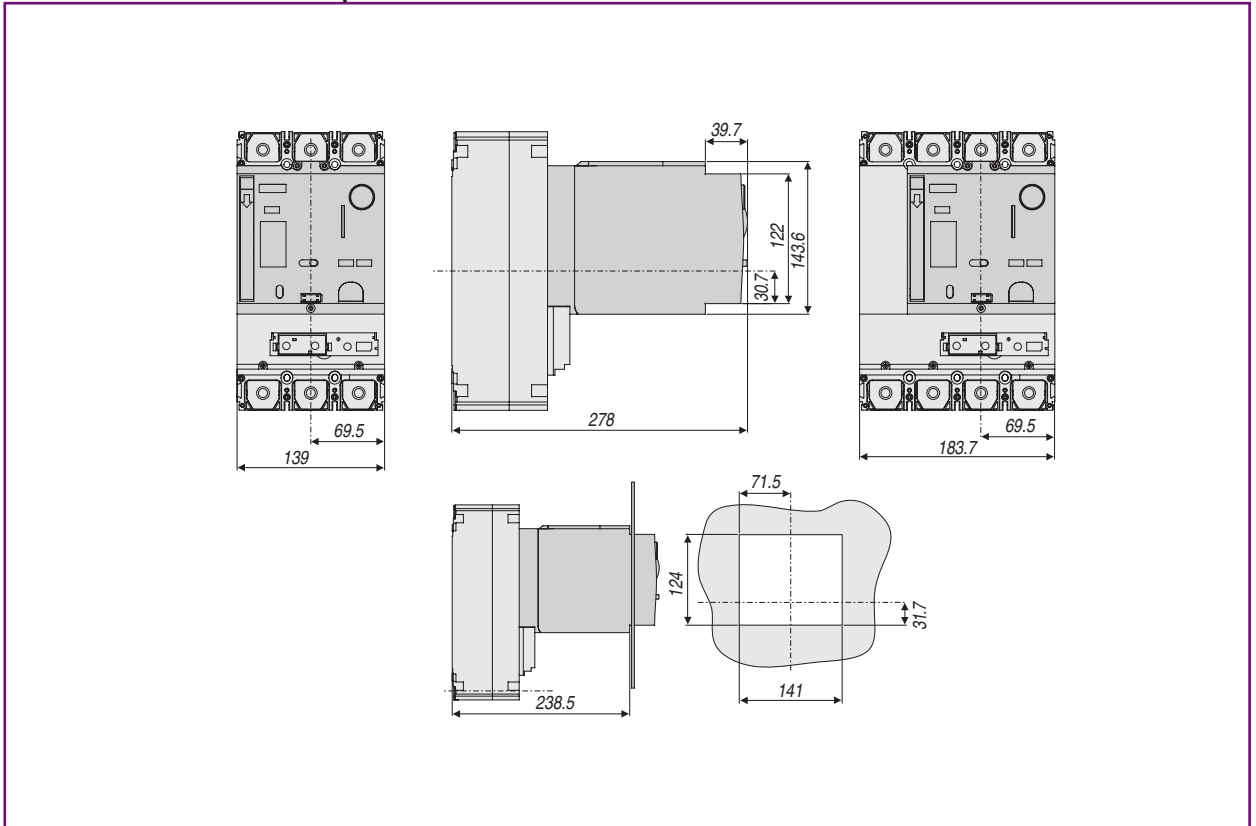
G

X

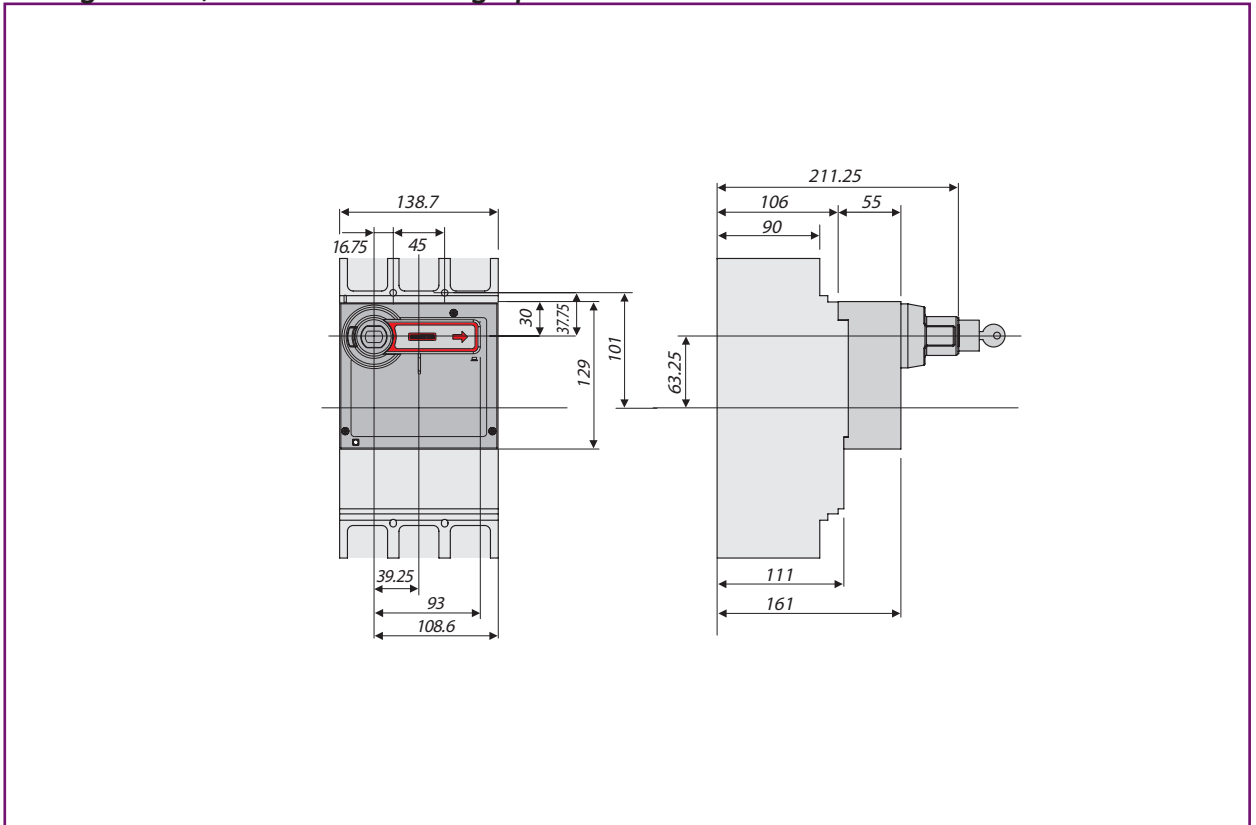


Dimensional Drawings

Breaker with electrical operator - FG400/630



Rotary handle, breaker and through panel mounted - FG400/630



Dimensions

Intro

A

B

C

D

E

F

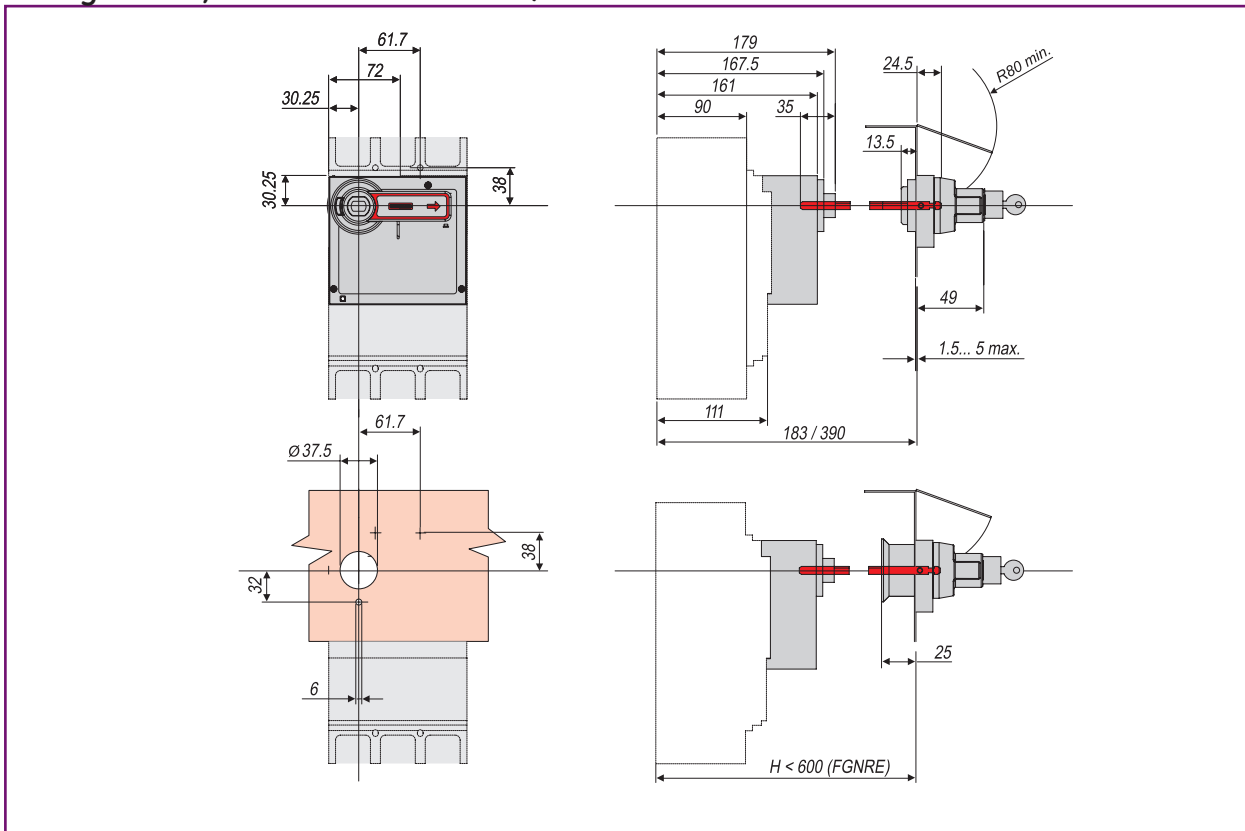
G

X

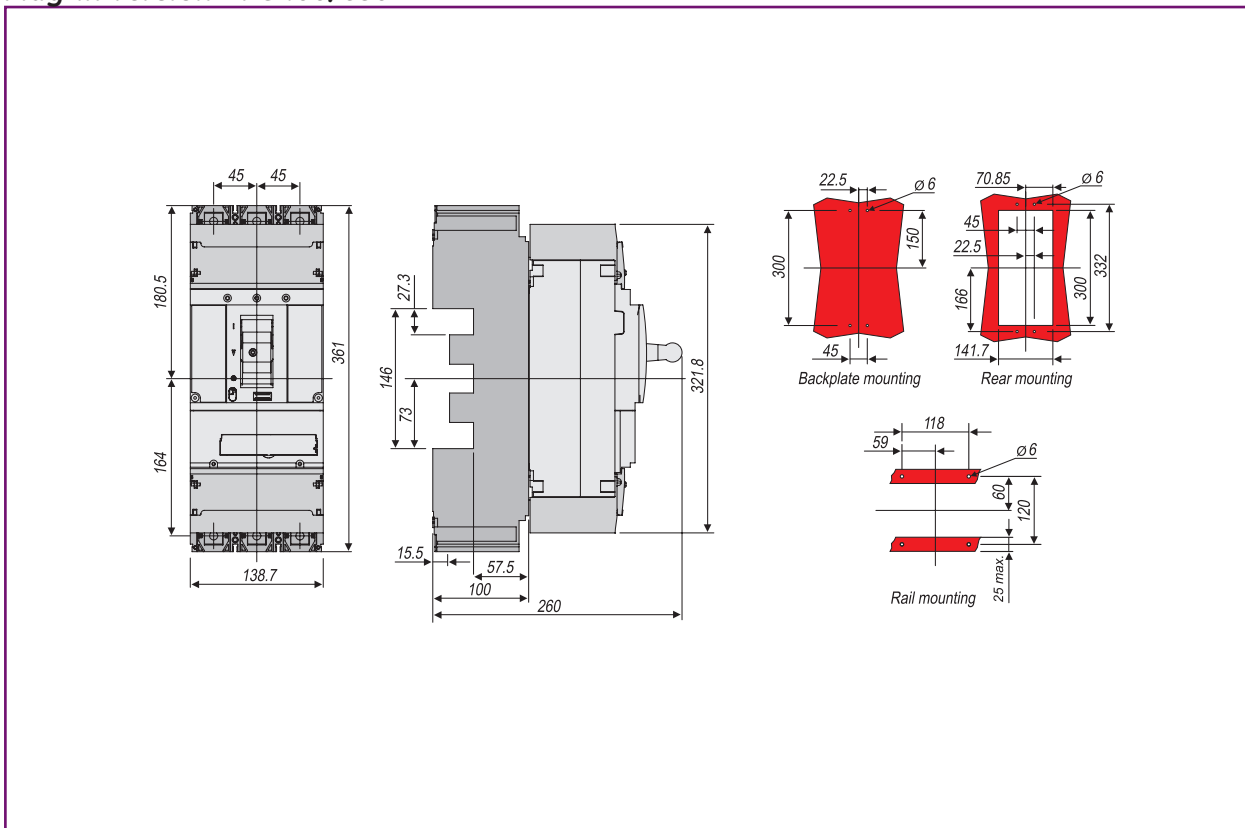


Dimensional Drawings

Rotary handle, door mounted - FG400/630



Plug-in version - FG400/630



FG frame

Intro

A

B

C

D

E

F

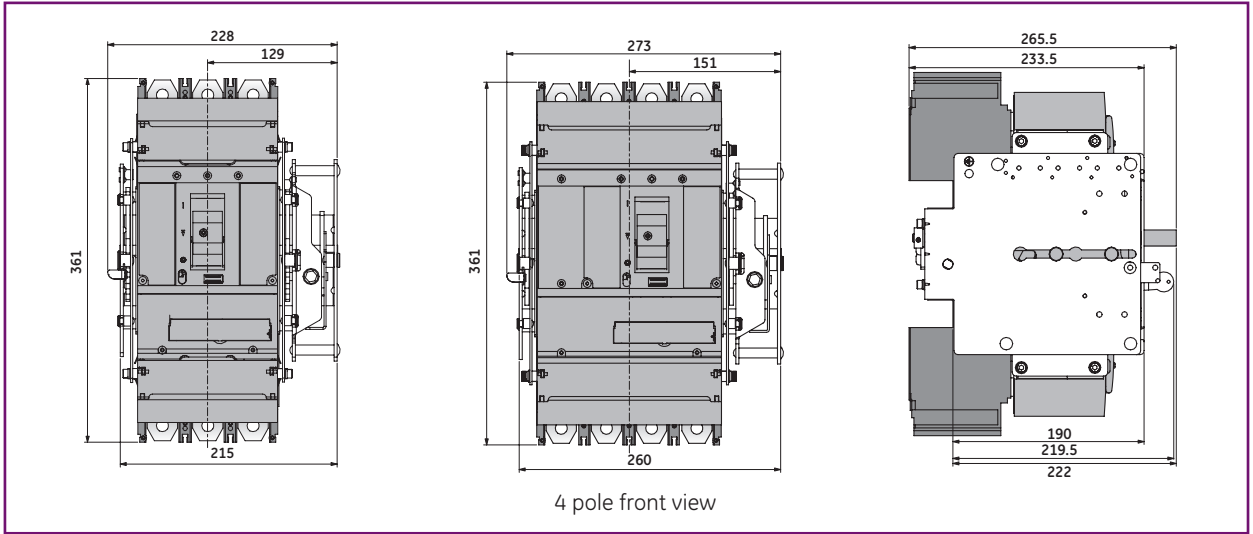
G

X

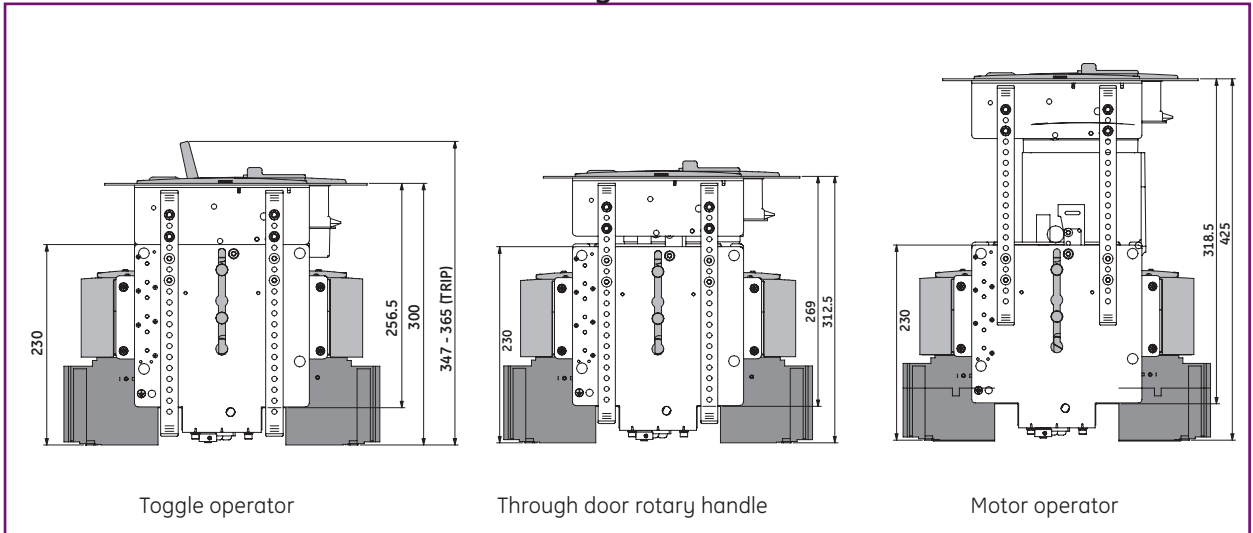


Dimensional Drawings

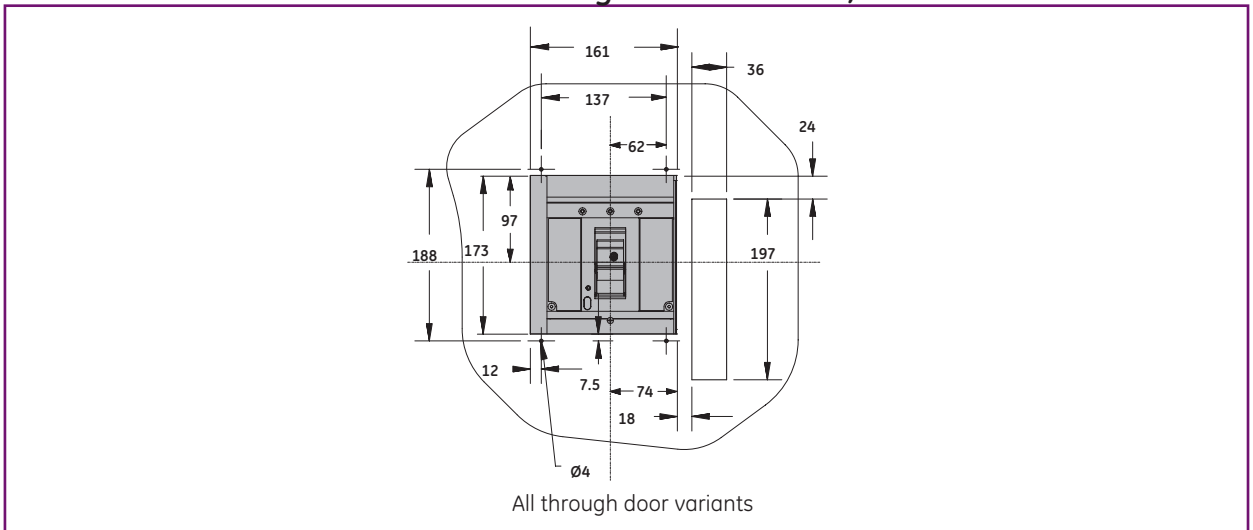
Draw-out version - FG400 & FG630



Draw-out version - FG400 & FG630 - Through door execution side views

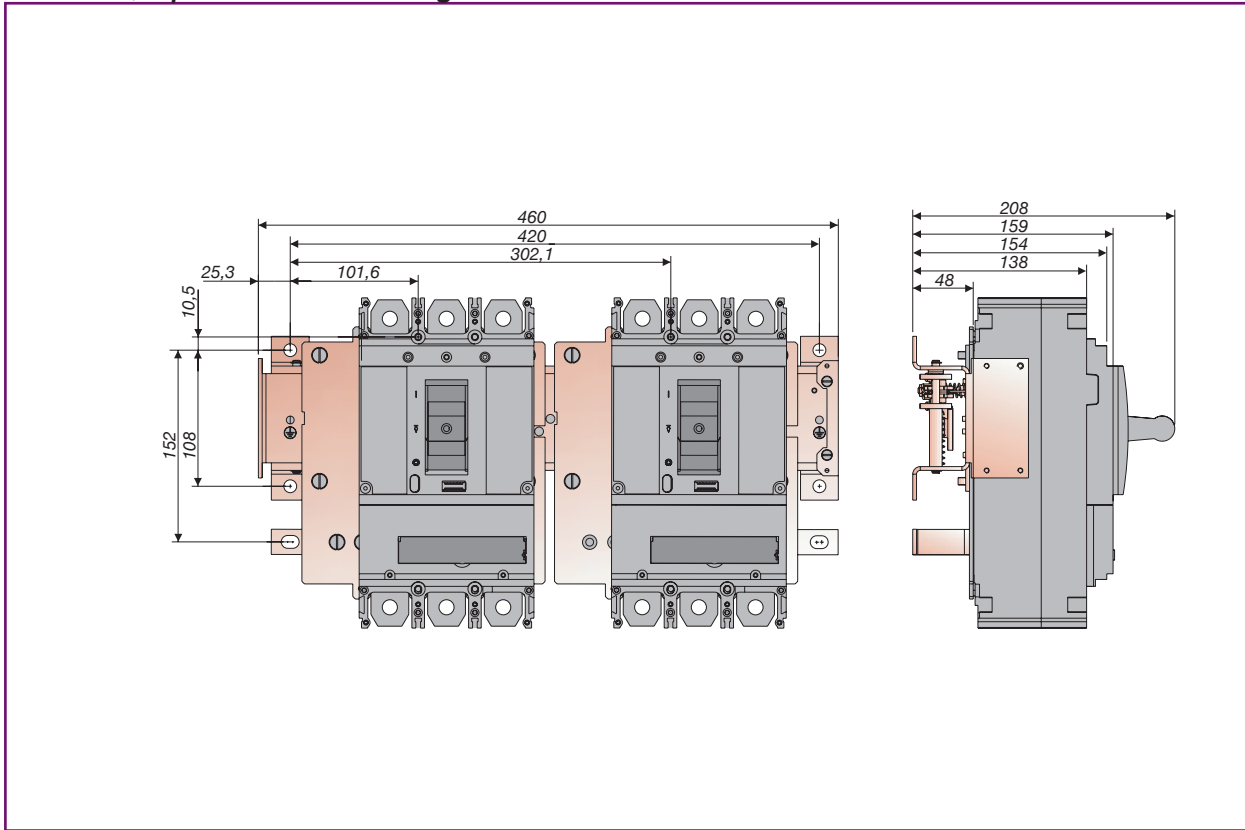


Draw-out version - FG400 & FG630 - Through door execution, door cut-outs

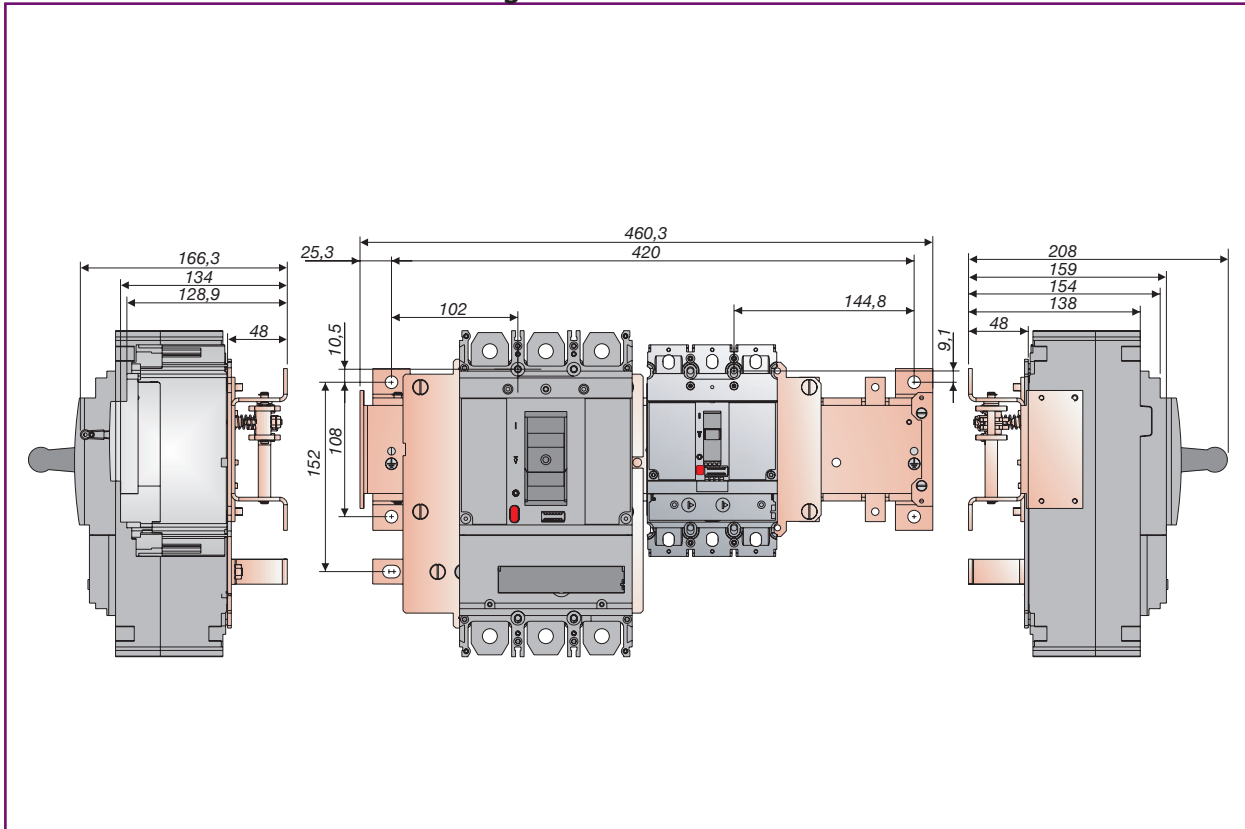


Dimensional Drawings

FG frame, 2 pieces mechanically interlocked



FG frame and FE frame mechanically interlocked



FG frame

Intro

A

B

C

D

E

F

G

X



Dimensional Drawings

Door flanges - FG400/630

Dimensions

Intro

A

B

C

D

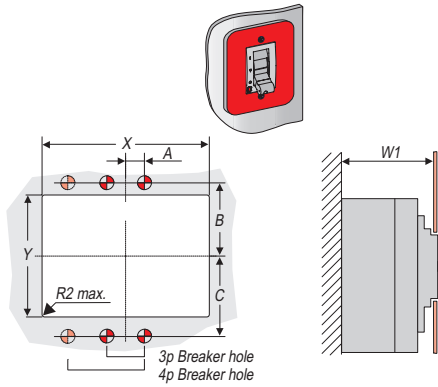
E

F

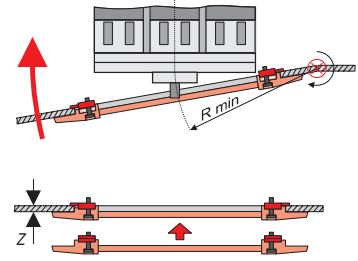
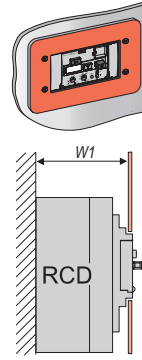
G

X

FG frame Breaker Toggle area
FGFT

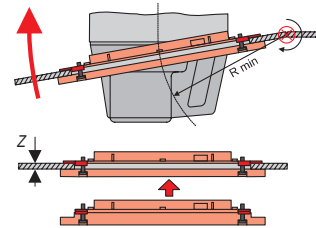
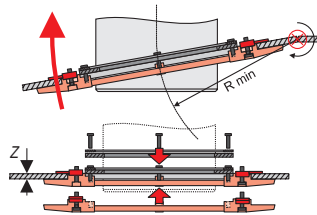
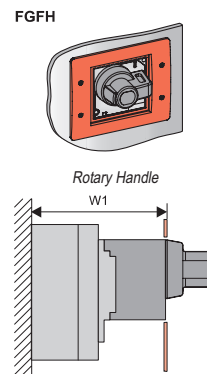
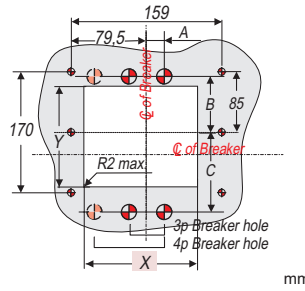
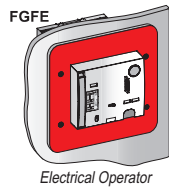


RCD
FDF4



			Dimensions							
			A	B	C	Rmin	W1(max)	X	Y	Z
FGFT	FG 400/630 Toggle	3p/4p	22.5	73	127	100	115	95	135	1...4
FDF4	FG 400/630 RCD	3p/4p	22.5	297.5	68.5	93.5	115	146	78	1...4

Door flanges - FG400/630

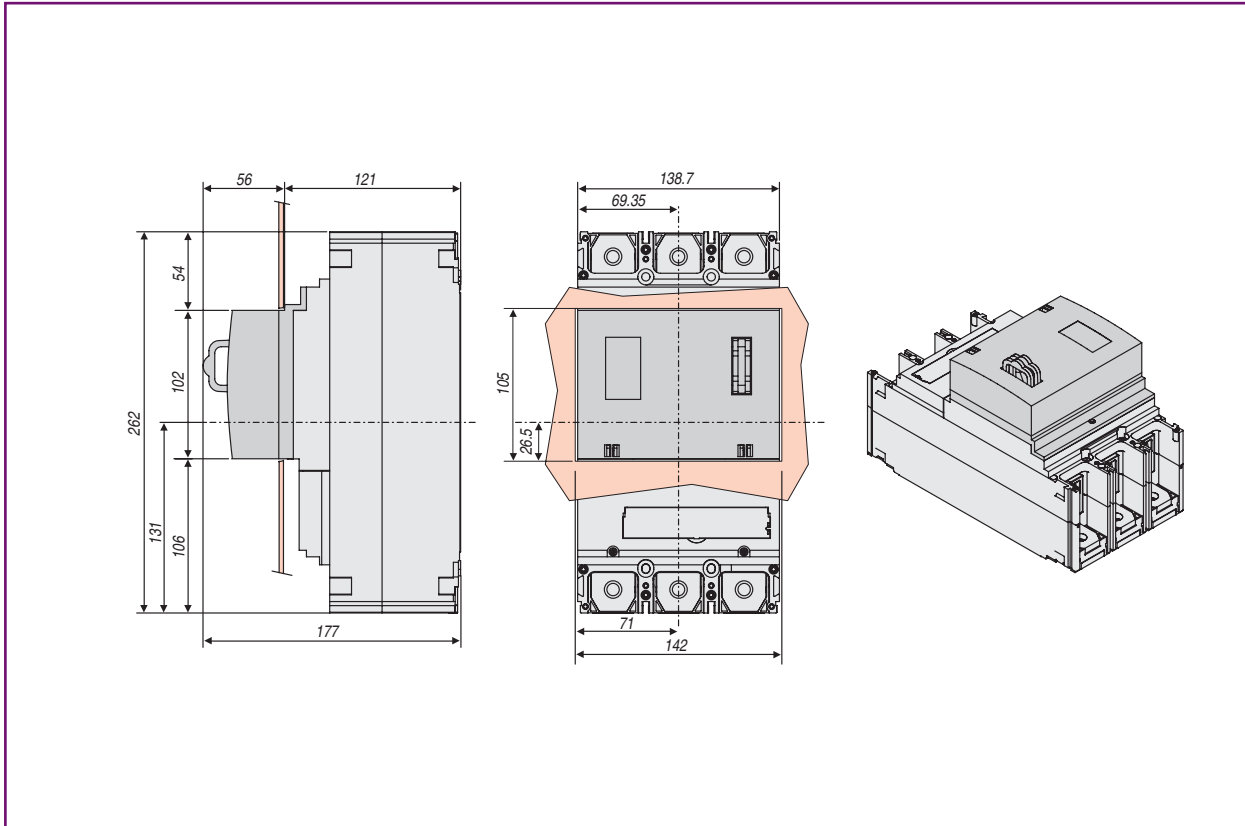


			Dimensions							
3+4 pole versions			A	B	C	Rmin	W1(max)	X	Y	Z
FGFE	FG 400/630 Motor Operator		22.5	70	130.8	100	238.5	143	125	1...4
FGFH	FG 400/630 Rotary Handle		22.5	71.5	129	115	161	143	133	1...4

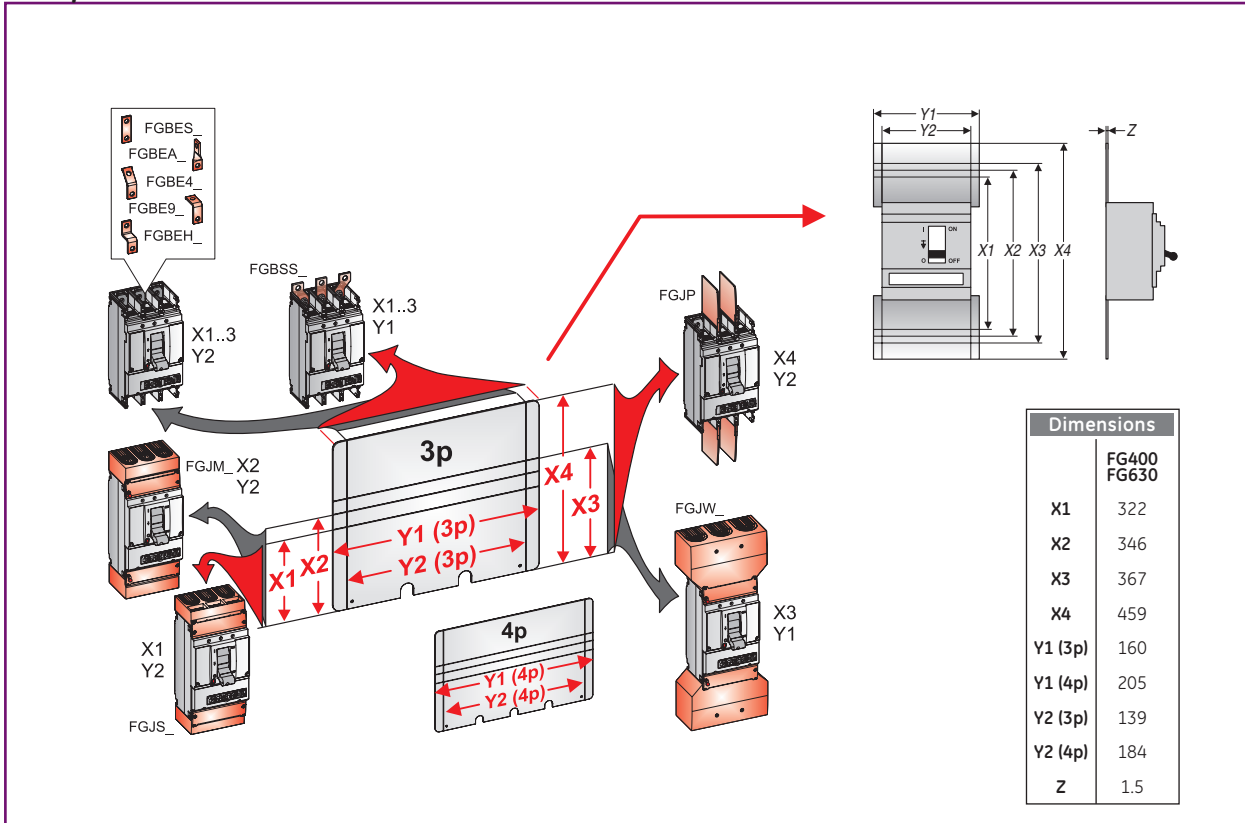


Dimensional Drawings

Padlock fixed - FG400/630



Backplate - FG400/630



FG frame

Intro

A

B

C

D

E

F

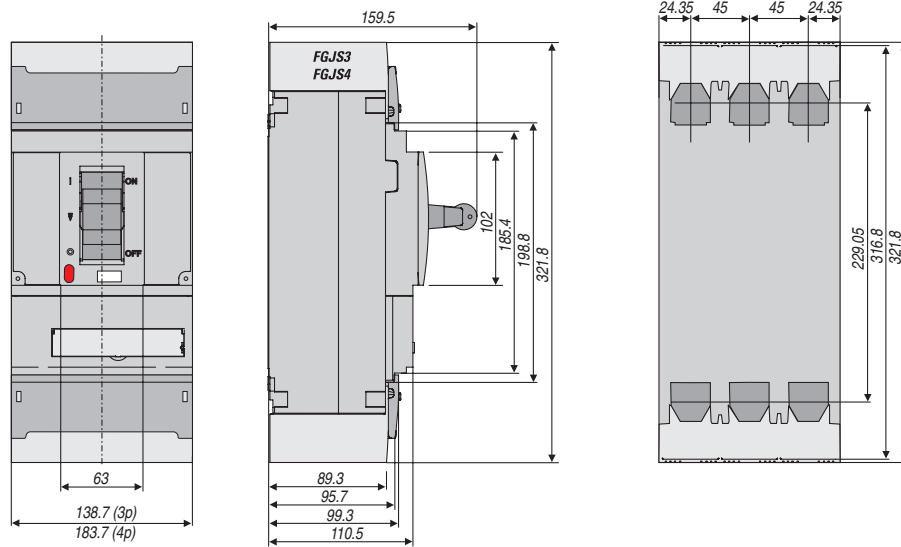
G

X

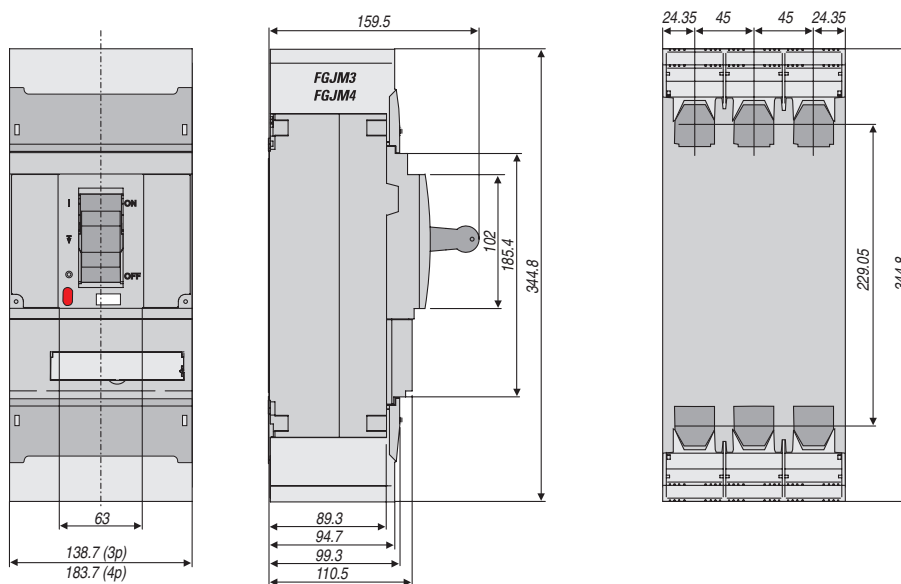


Dimensional Drawings

Breaker with short terminal shields - FG400/630



Breaker with medium terminal shields - FG400/630



Dimensions

Intro

A

B

C

D

E

F

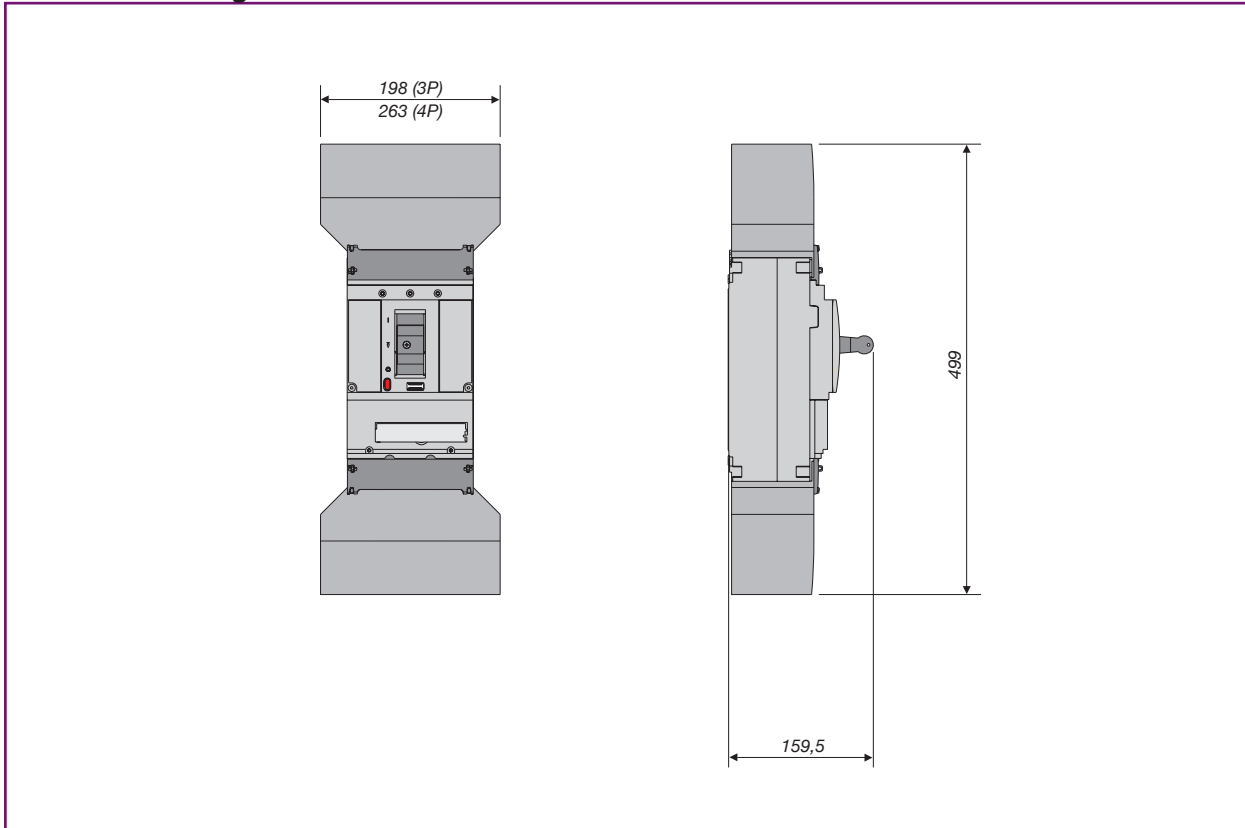
G

X



Dimensional Drawings

Breaker with long and wide terminal shields - FG400/630



FG frame

Intro

A

B

C

D

E

F

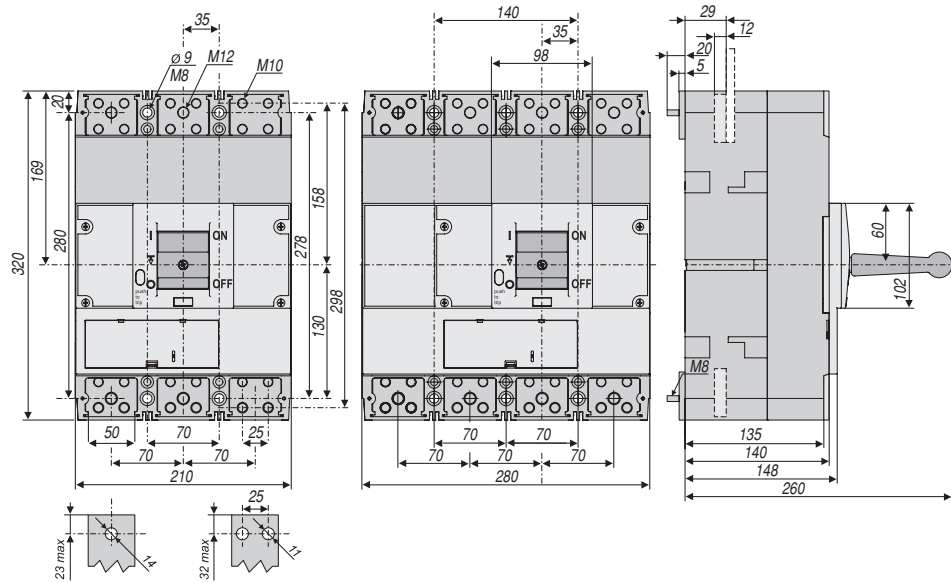
G

X



Dimensional Drawings

Breakers - FK800/1250/1600 fixed, front connected



Dimensions

Intro

A

B

C

D

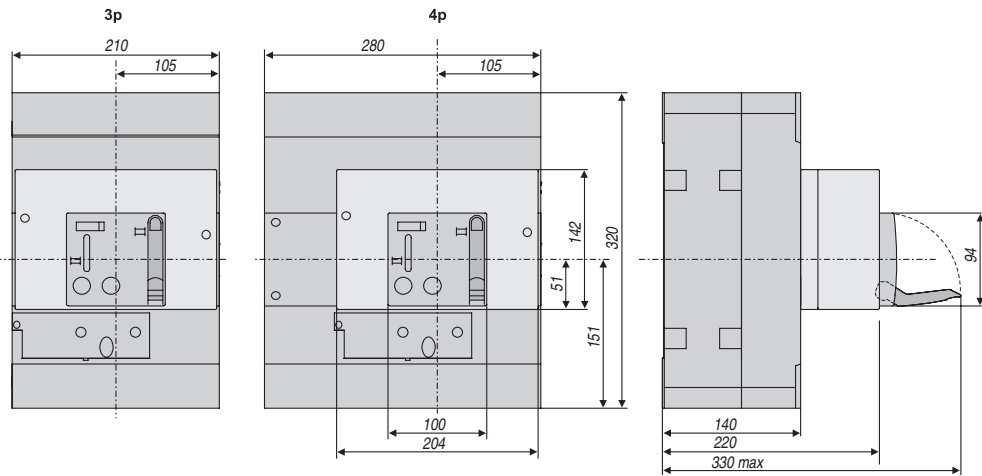
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F

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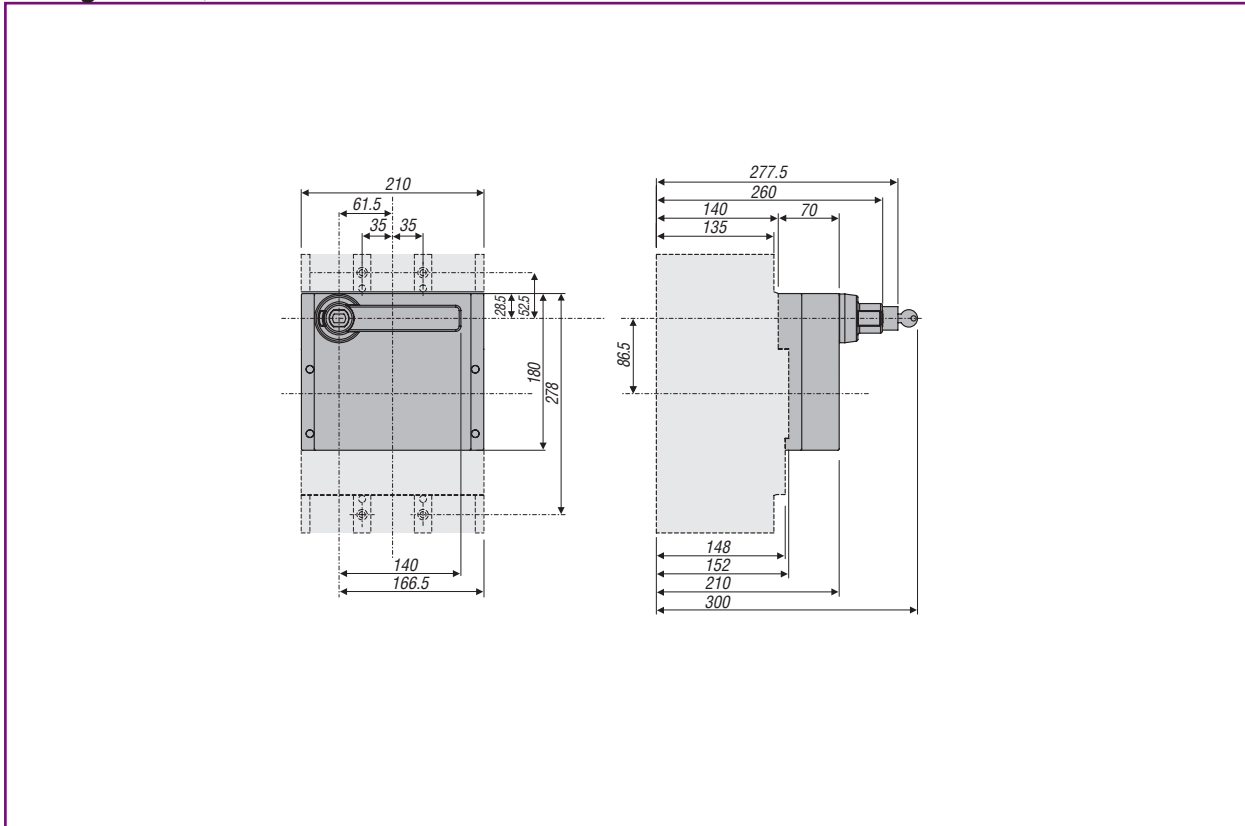
X

Breaker with electrical operator - FK800/1250/1600

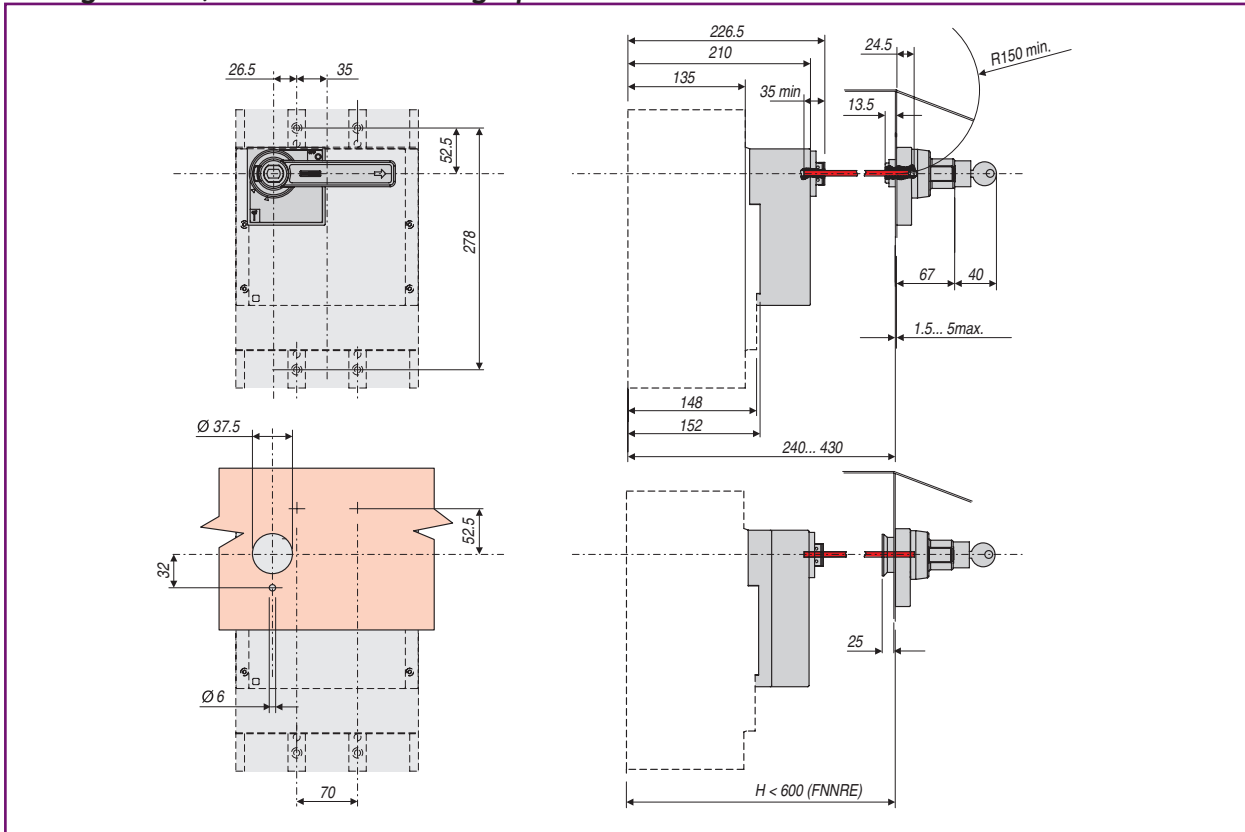


Dimensional Drawings

Rotary handle, door mounted - FK800/1250/1600



Rotary handle, breaker and through panel mounted - FK800/1250/1600



FK frame

Intro

A

B

C

D

E

F

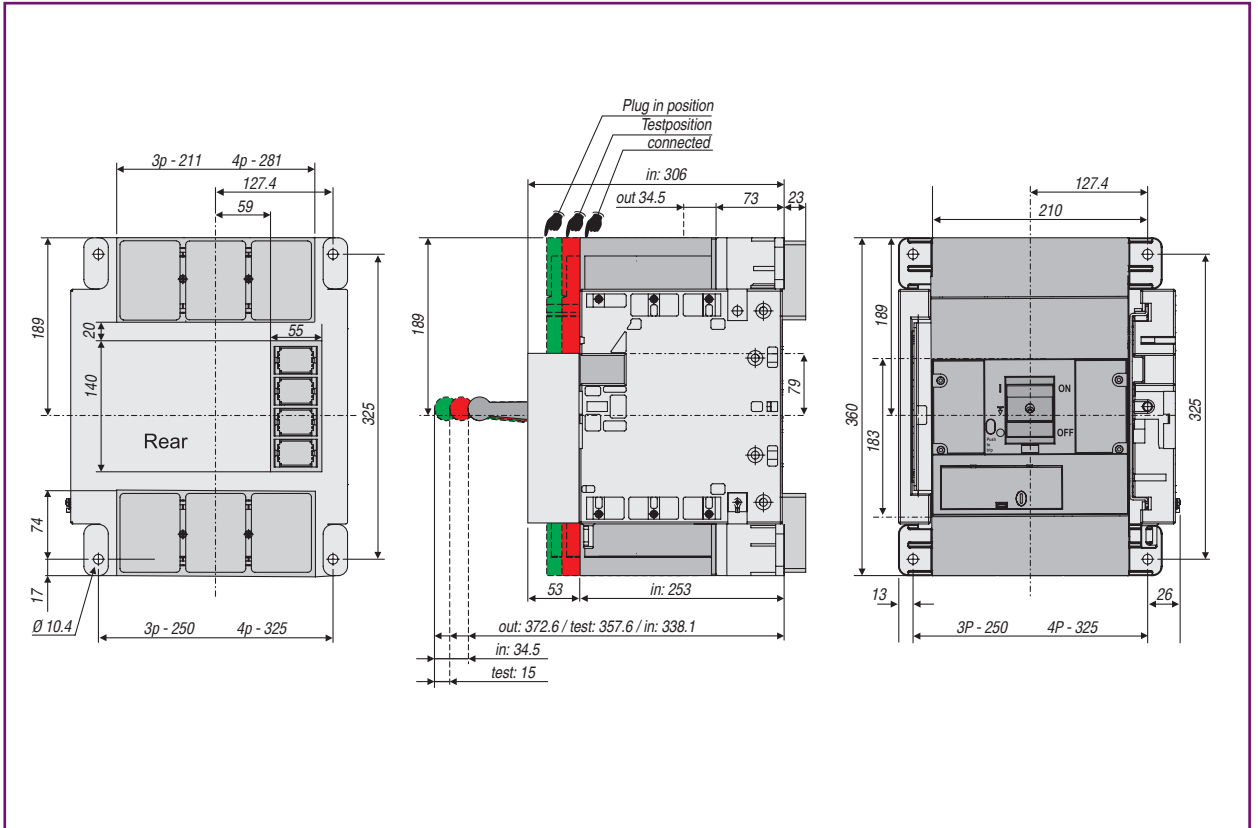
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X

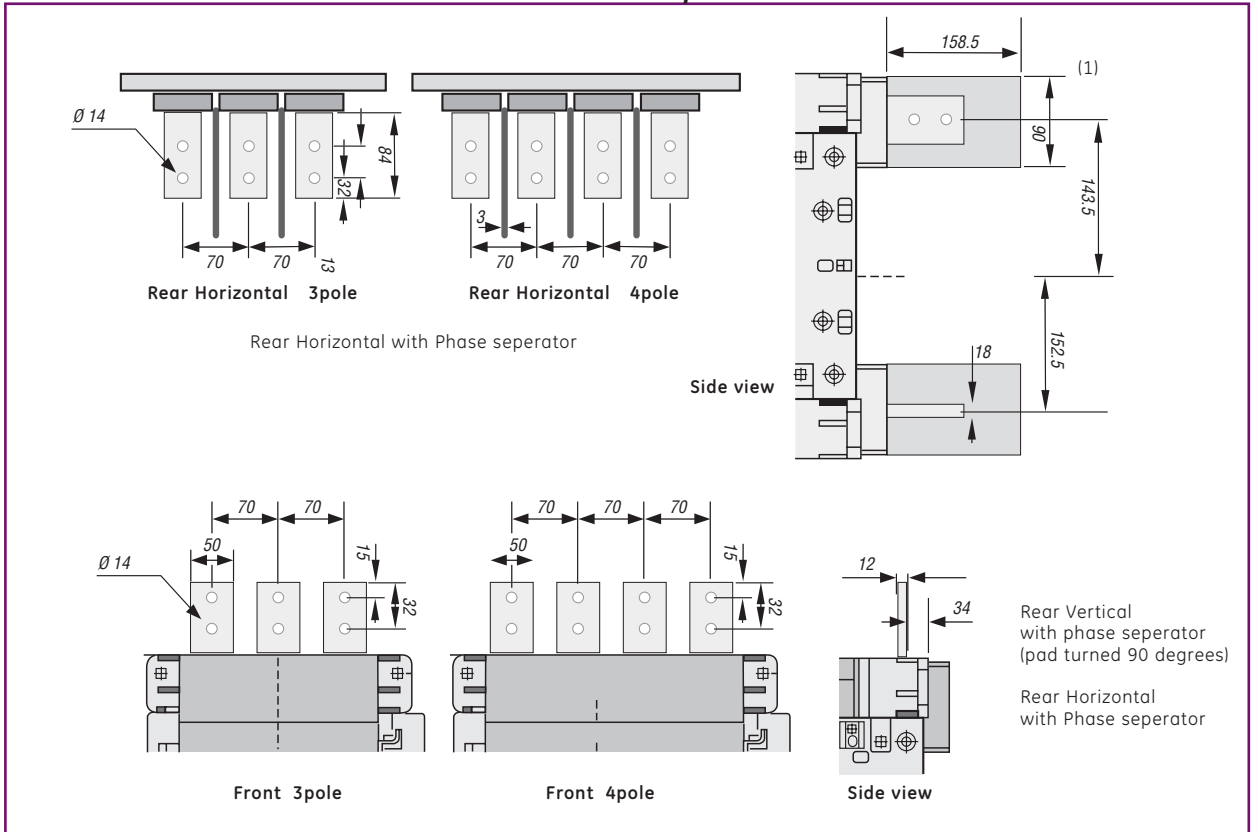


Dimensional Drawings

Draw-out version - FK800/1250/1600



Draw-out version FK800/1250/1600 connection options



(1) Pad can be turned 90 degrees to indicated Rear Vertical connection mode.

Dimensions

Intro

A

B

C

D

E

F

G

X



Dimensional Drawings

Door flanges - FK800/1250/1600

FK frame Breaker Toggle area
FNFT

		Dimensions								
FNFT	FK 800/1250/1600	3p/4p	A	B	C	Rmin	W1(max)	X	Y	Z
			35	130	150	120	153	101	104	1..4

Door flanges - FK800/1250/1600

		Dimensions								
3 + 4 pole versions			A	B	C	Rmin	W1(max)	X	Y	Z
FNFE	FK 800/1250/1600	Electr. operator	35	129	151	120	220	142	125	1..4
FNFH	FK 800/1250/1600	Rotary handle	35	114	163	190	210	232.5	232.5	1..4

FK frame

Intro

A

B

C

D

E

F

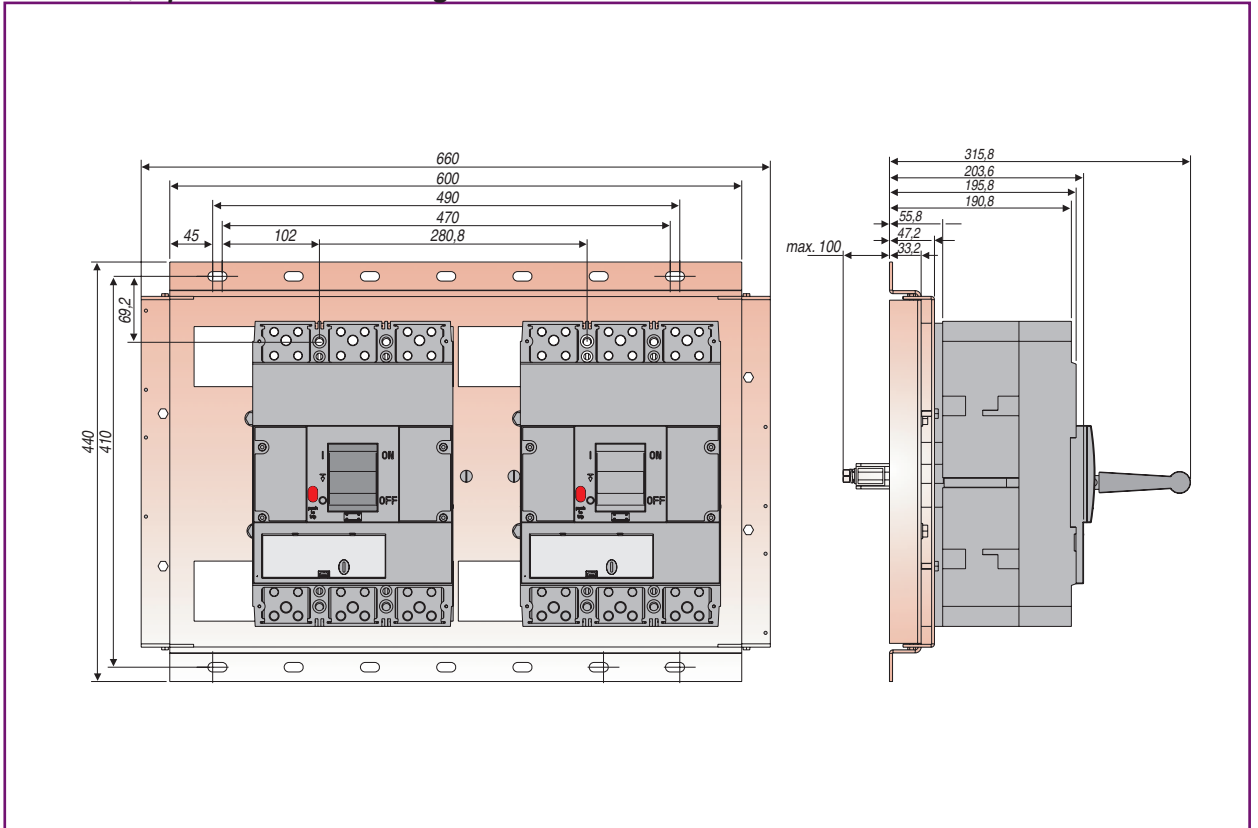
G

X

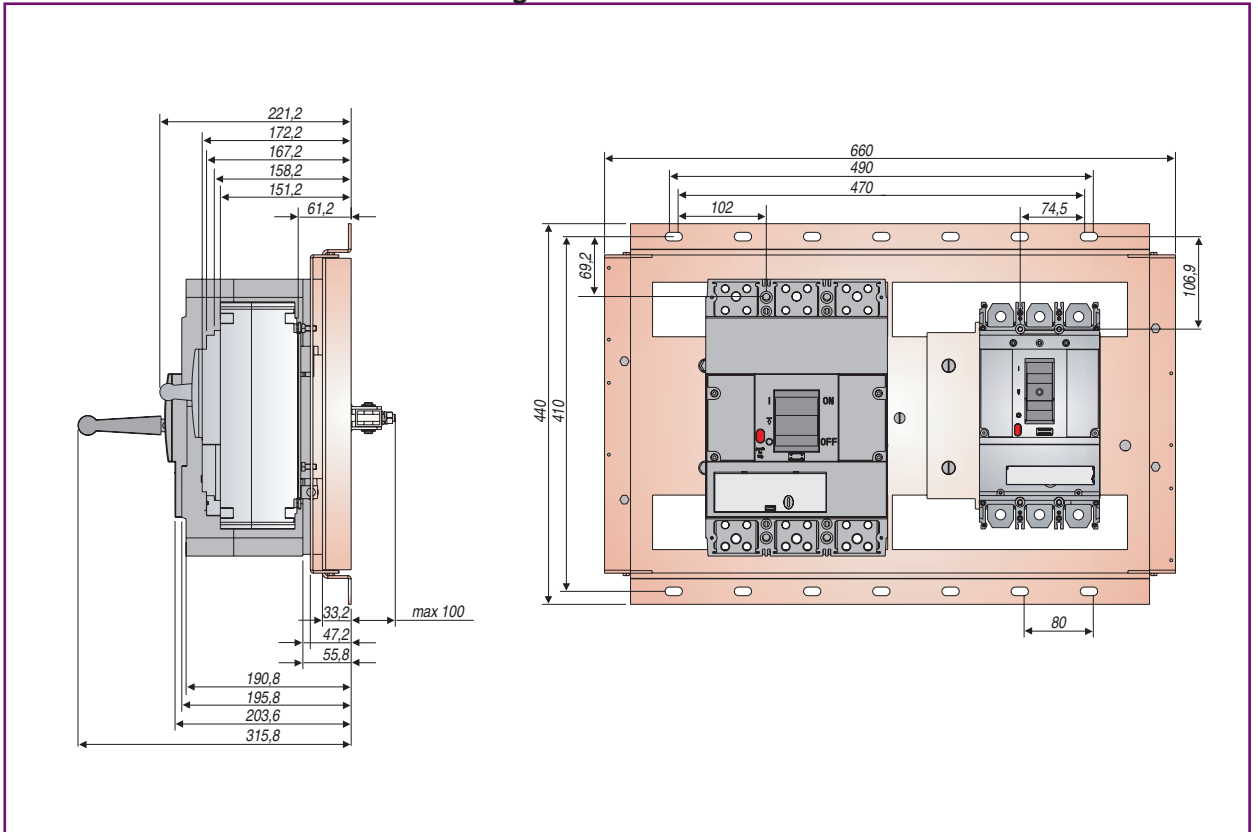


Dimensional Drawings

FK frame, 2 pieces mechanically interlocked



FK frame and FG frame. mechanically interlocked



Dimensions

Intro

A

B

C

D

E

F

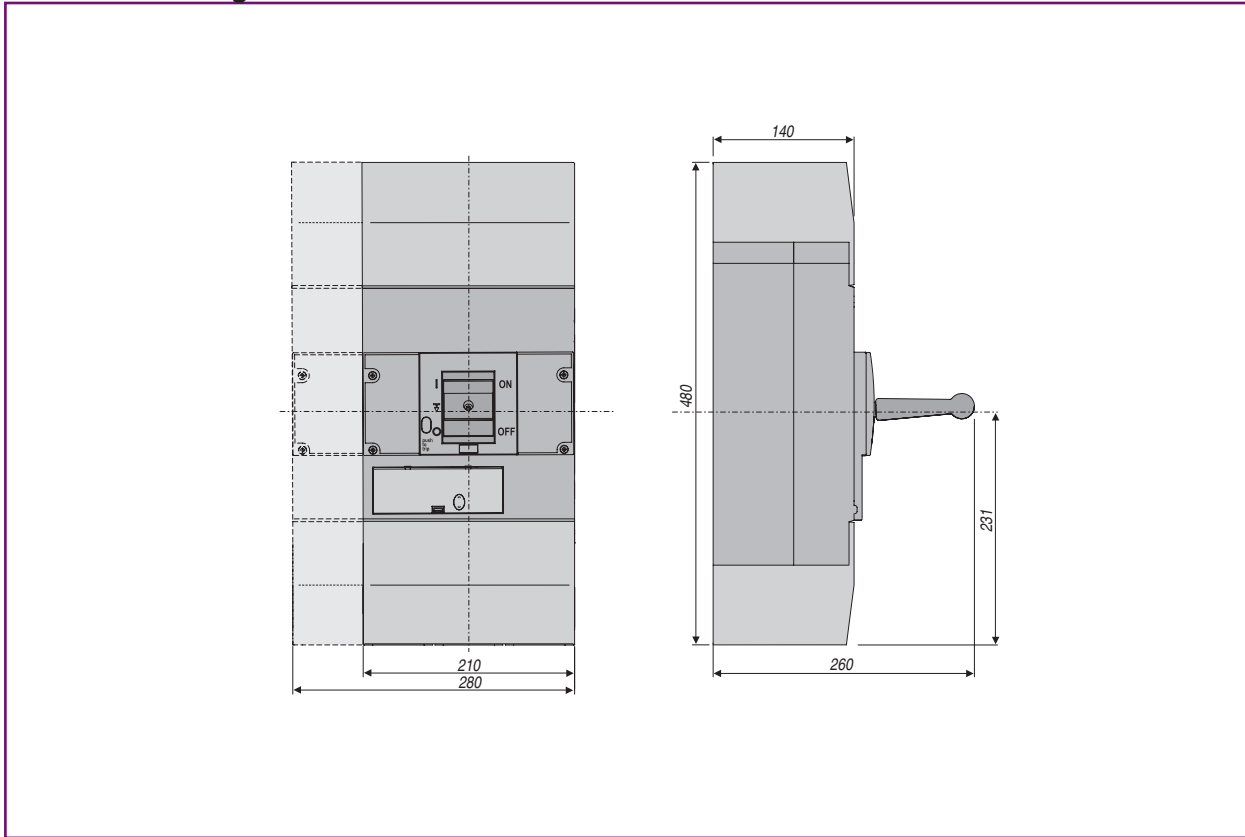
G

X



Dimensional Drawings

Breaker with long terminal shields - FK800/1250/1600



FK frame

Intro

A

B

C

D

E

F

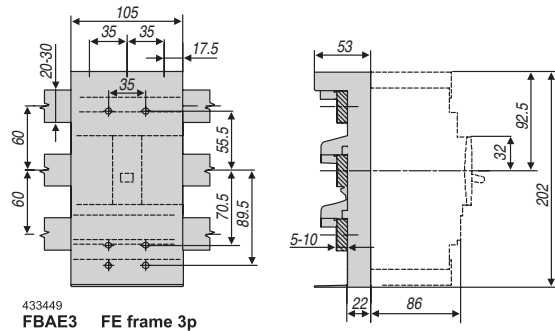
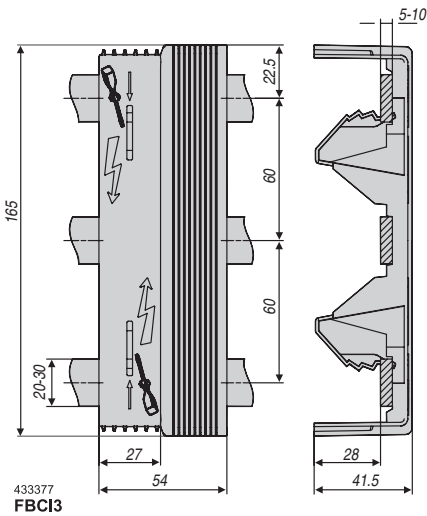
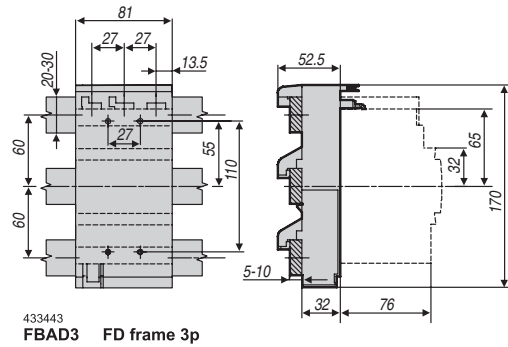
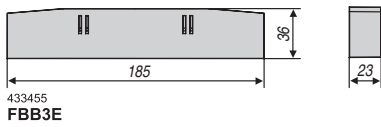
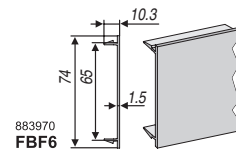
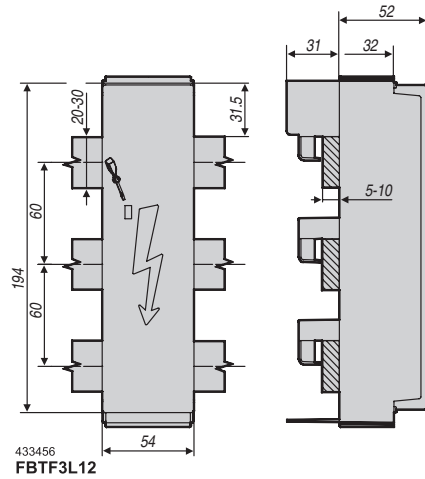
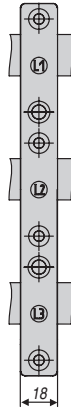
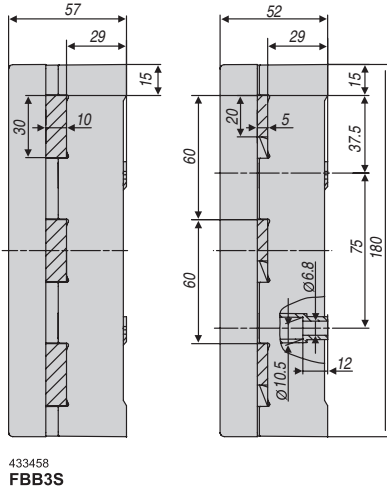
G

X



Dimensional Drawings

Connectivity 60 mm system - FD and FE frame 3 pole



Dimensions

Intro

A

B

C

D

E

F

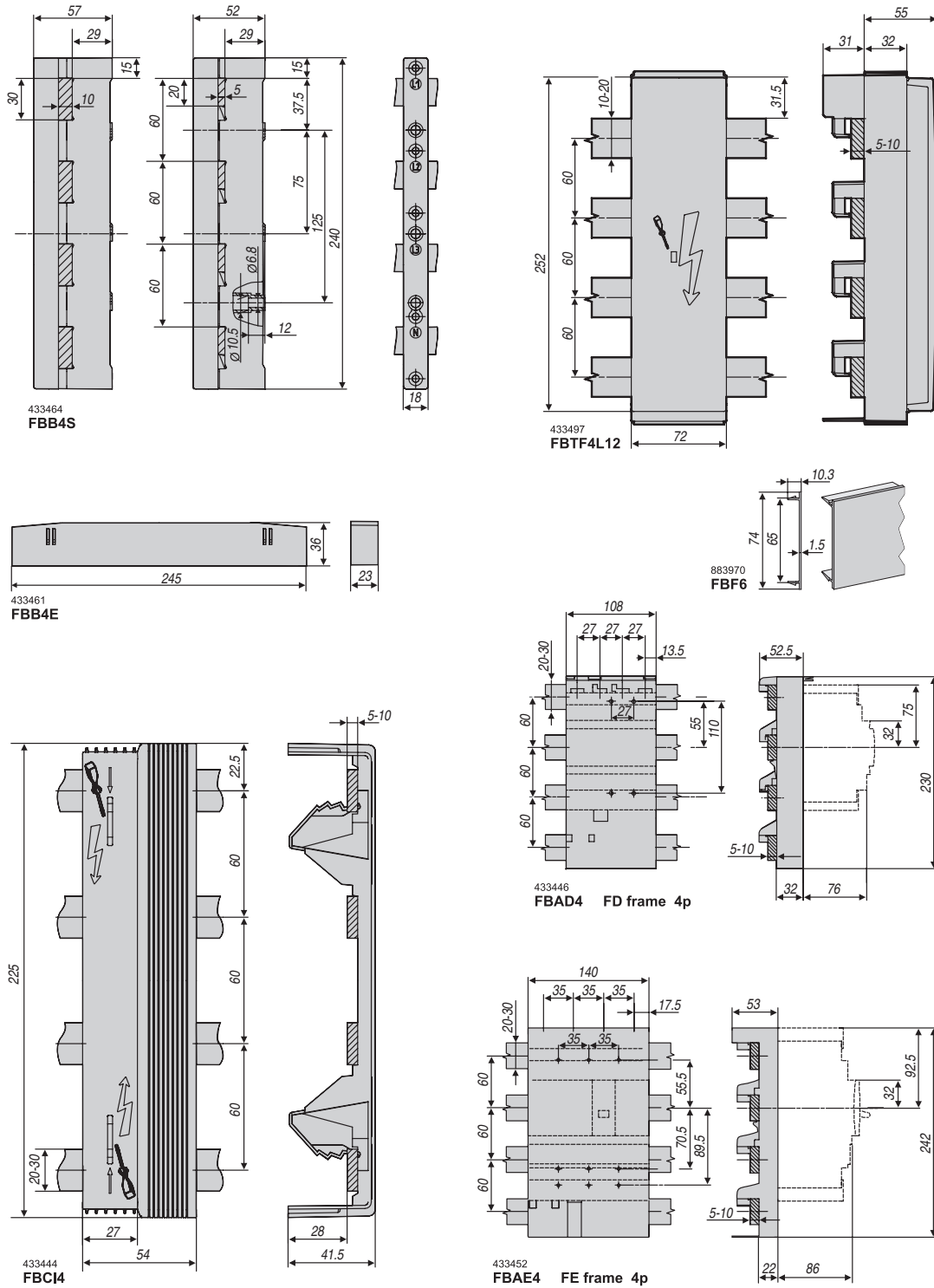
G

X



Dimensional Drawings

Connectivity 60 mm system - FD and FE frame 4 pole



Connectivity

Intro

A

B

C

D

E

F

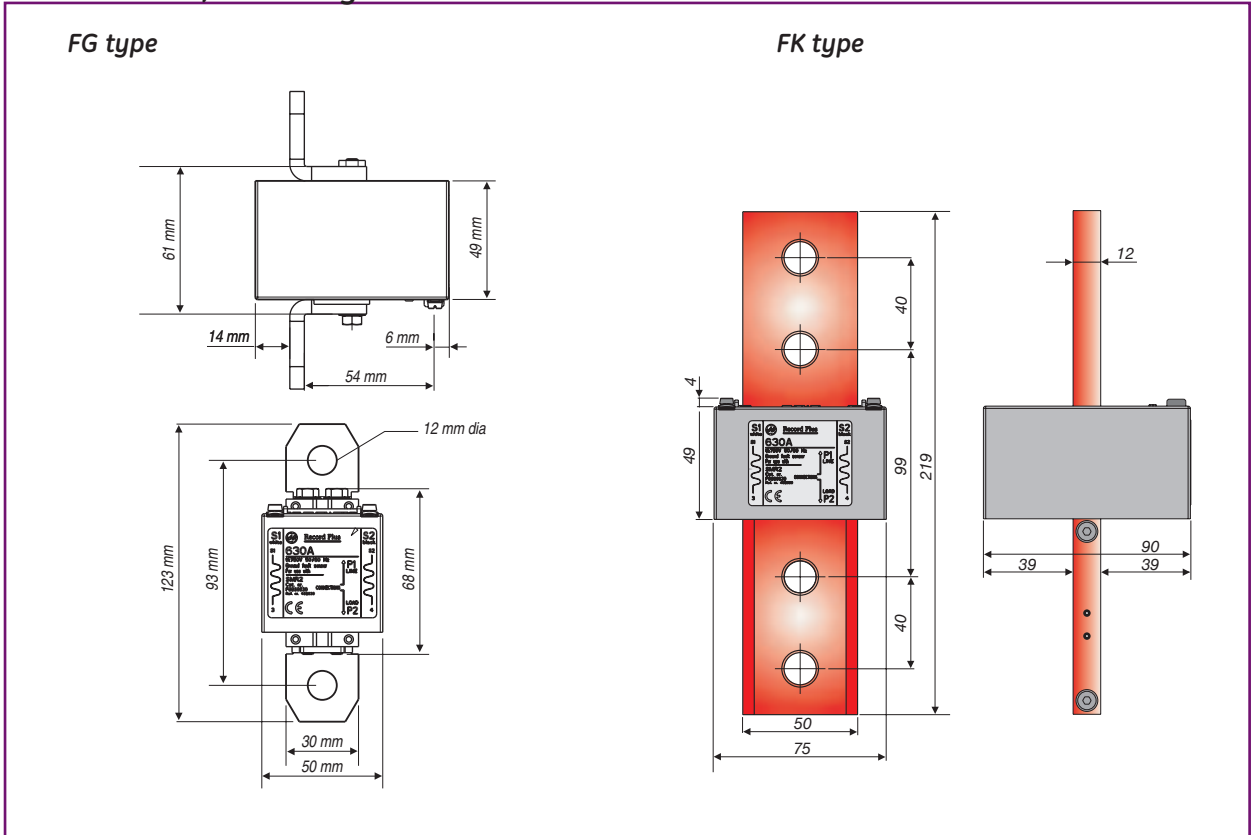
G

X

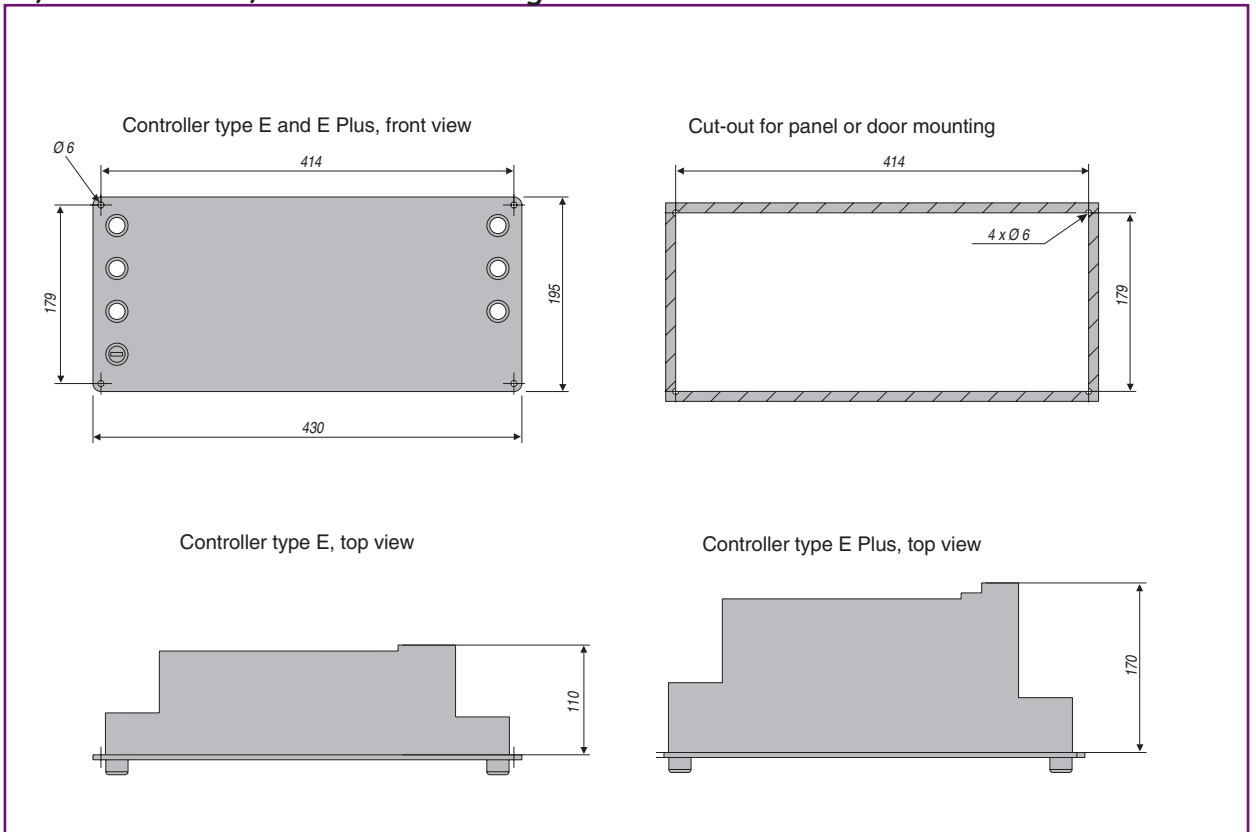


Dimensional Drawings

FG & FK frame, external groundfault sensors



FE, FG & FK frame, controller for changeover device



Dimensions

Intro

A

B

C

D

E

F

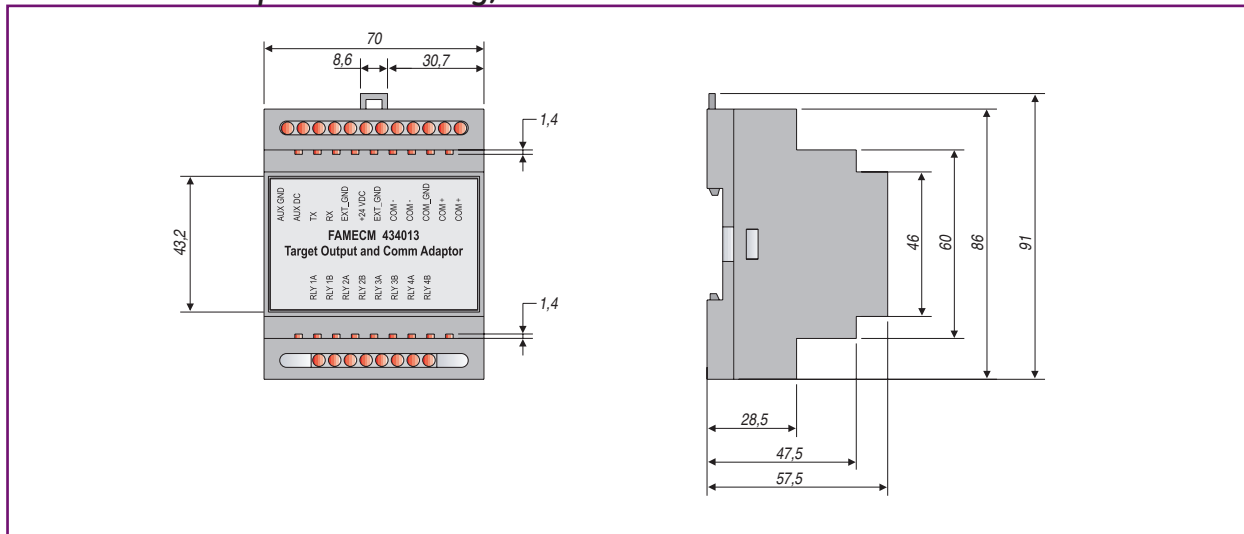
G

X

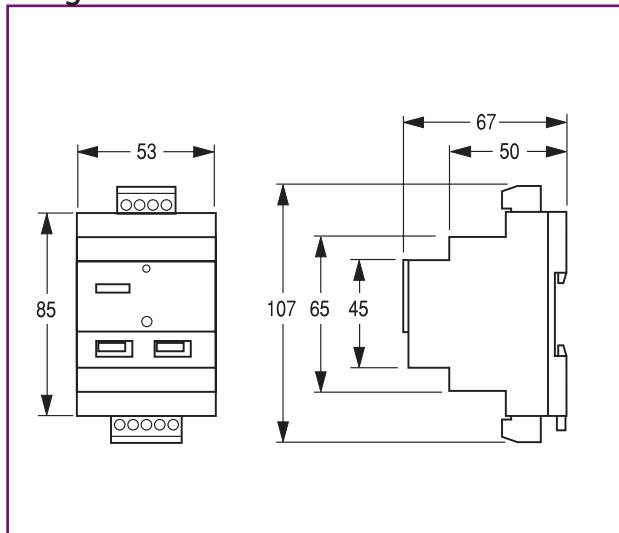


Dimensional Drawings

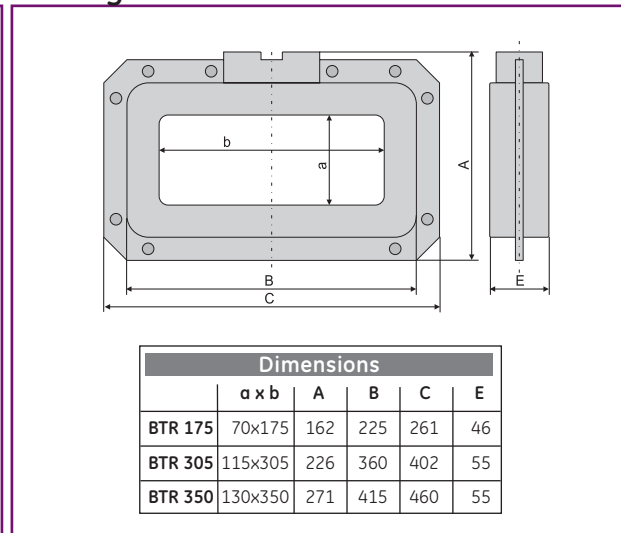
FG frame SMR2 trip unit accessory; FACM module



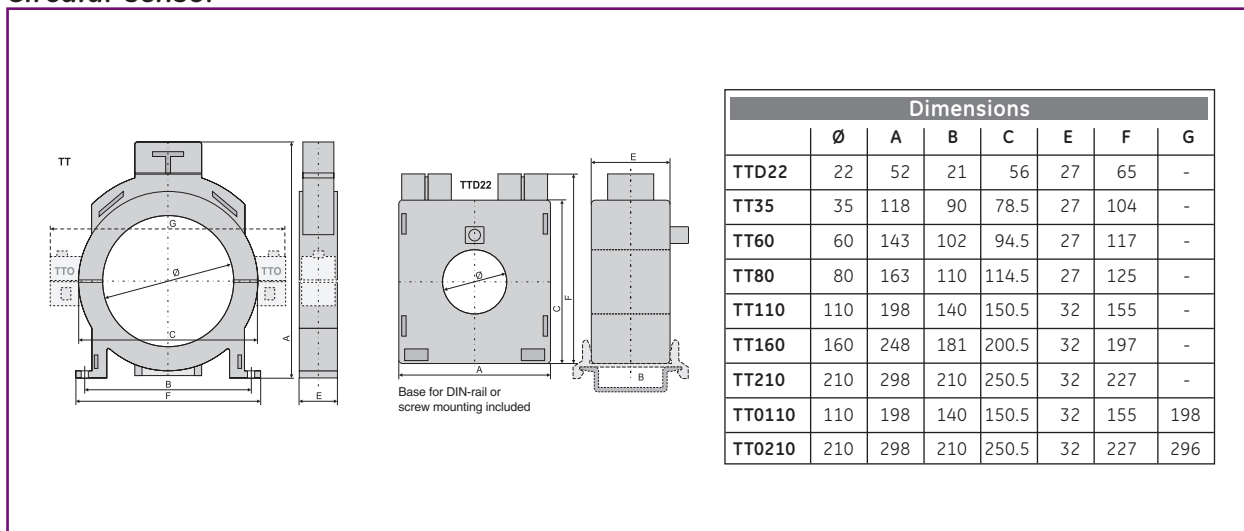
Relay RD5 and RD6



Rectangular sensor



Circular sensor



Just rel

The breaker

Intro

Order codes

A

Trip units

B

Components & Accessories

C

Technical data

D

Application guide

E

Wiring diagrams

F

Dimensions

G

Numerical Index

X

X.2 By reference number

X.9 By catalogue number



Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page
430000			430101	FDN36TD020ED	A.6	430482	FDH46TG100GD	A.7	430846	FASHTF	A.9	431112	FEH36AA125JGF	A.14
430001	FDE36TC016EF	A.5	430102	FDN36TD025ED	A.6	430485	FDH46TG125GD	A.7	430847	FDN36TD125SGD	A.8	431116	FEH36AA125KGF	A.17
430002	FDE36TC020EF	A.5	430103	FDN36TD032ED	A.6	430498	FDL36MC080GD	A.7	430848	FDN36TD160GD	A.8	431117	FEH36AA160JUF	A.14
430003	FDE36TC025EF	A.5	430104	FDN36TD040ED	A.6	430501	FDL36MC100GD	A.7	430849	FASHTJ	A.9	431118	FEQDB3H/	A.19
430004	FDE36TC032EF	A.5	430105	FDN36TD050ED	A.6	430504	FA1BR3	A.9	430850	FDH36TD016ED	A.8	431120	FEH36AA160KJF	A.17
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430014	FDE46TC063EF	A.5	430115	FDN436MC030ED	A.7	430545	FGFH	A.33	430864	FAUVRF	A.9	431144	FEH36SA160KJF	A.17
430015	FDH36MC007ED	A.7	430116	FDN436MC050ED	A.7	430546	FDS36TD016ED	A.8	430866	FDH36TD063ED	A.8	431145	FEQDB4H/6	A.19
430016	FDH36MC012ED	A.7	430117	FDN436TD016ED	A.6	430557	FDL436TD080GD	A.6	430867	FAUVRJ	A.9	431147	FEH36SA250KFF	A.17
430017	FDH36MC020ED	A.7	430118	FDN436TD020ED	A.6	430560	FDL436TD100GD	A.6	430870	FAUVRN	A.9	431150	FGH406F400LF	A.52
430018	FDH36MC030ED	A.7	430119	FDN436TD025ED	A.6	430563	FDL436TD125GD	A.6	430871	FDH36TD080GD	A.8	431151	FEQDB4H/6	A.19
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430020	FDH36TD016ED	A.6	430121	FDN436TD040ED	A.6	430571	FDL456TD100GD	A.6	430874	FDH36TD100GD	A.8	431156	FGH406F630NF	A.53
430021	FDH36TD020ED	A.6	430122	FDN436TD050ED	A.6	430574	FDL456TD125GD	A.6	430875	FDH36TD125GD	A.8	431159	FEQDB4M/6	A.19
430022	FDH36TD025ED	A.6	430123	FDN436TD063ED	A.6	430577	FDS36TD020ED	A.8	430876	FD1BPE	A.9	431161	FEQDB4M/6	A.19
430023	FDH36TD032ED	A.6	430124	FDN436TG025ED	A.7	430578	FDS36TD025ED	A.8	430877	FD1BRE	A.9	431163	FGQDB3H/6	A.30
430024	FDH36TD040ED	A.6	430125	FDN436TG032ED	A.7	430579	FDS36TD032ED	A.8	430878	FD1PF	A.11	431165	FGH406F080JF	A.13
430025	FDH36TD050ED	A.6	430126	FDN436TG040ED	A.7	430580	FDS36TD040ED	A.8	430879	FD1PR	A.11	431168	FGH436SA400NLF	A.27
430026	FDH36TD063ED	A.6	430127	FDN436TG050ED	A.7	430591	FDL46TD080GD	A.6	430880	FDBAM11	A.9	431171	FEH36TA100JUF	A.13
430027	FDH36TG025ED	A.7	430128	FDN436TG063ED	A.7	430594	FDL46TD100GD	A.6	430881	FDH36TD160GD	A.8	431172	FGQDB3M/6	A.30
430028	FDH36TG032ED	A.7	430129	FDN456TD063ED	A.6	430597	FDL46TD125GD	A.6	430883	FDBEA3	A.10	431175	FGQDB4H/6	A.30
430029	FDH36TG040ED	A.7	430130	FDN456TG063ED	A.6	430610	FDN36MC080GD	A.7	430884	FDBEA4	A.10	431177	FEH36TA125JF	A.13
430030	FDH36TG050ED	A.7	430131	FDN46TD016ED	A.6	430613	FDN36MC100GD	A.7	430885	FDBEH3	A.10	431181	FGQDB4M/6	A.30
430031	FDH36TG063ED	A.7	430132	FDN46TD020ED	A.6	430630	FDN36TD080GD	A.6	430886	FDBEH4	A.10	431183	FEH36TA160JF	A.13
430032	FDH436MC007ED	A.7	430133	FDN46TD025ED	A.6	430633	FDN36TD100GD	A.6	430887	FDBES3	A.10	431198	FGH456SA400NLF	A.27
430033	FDH436MC012ED	A.7	430134	FDN46TD032ED	A.6	430636	FDN36TD125GD	A.6	430888	FDBES4	A.10	431201	FEH46AA125JGF	A.14
430034	FDH436MC020ED	A.7	430135	FDN46TD040ED	A.6	430649	FDN36TG080GD	A.7	430889	FDBRC3	A.10	431204	FEH46AA160JUF	A.14
430035	FDH436MC030ED	A.7	430136	FDN46TD050ED	A.6	430652	FDN36TG100GD	A.7	430890	FDBRC4	A.10	431207	FEH46AA160KJF	A.17
430036	FDH436MC050ED	A.7	430137	FDN46TD063ED	A.6	430655	FDN36TG125GD	A.7	430891	FDBSS3	A.10	431210	FEH46AA250KFF	A.17
430037	FDH436TD016ED	A.6	430138	FDN46TG025ED	A.7	430668	FDN436TD080GD	A.7	430892	FDBSS4	A.10	431213	FGH406F160JF	A.50
430038	FDH436TD020ED	A.6	430139	FDN46TG032ED	A.7	430671	FDN436MC100GD	A.7	430893	FDDFF3	A.10	431216	FEH406F250KFF	A.51
430039	FDH436TD025ED	A.6	430140	FDN46TG040ED	A.7	430688	FDN436TD080GD	A.6	430896	FDDFF4	A.10	431219	FEV36T5A125KF	A.18
430040	FDH436TD032ED	A.6	430141	FDN46TG050ED	A.7	430691	FDN436TD100GD	A.6	430899	FDDFF5	A.10	431220	FEV36T5A160KF	A.18
430041	FDH436TD040ED	A.6	430142	FDN46TG063ED	A.7	430694	FDN436TD125GD	A.6	430902	FDDFF4	A.10	431221	FEV36T5A200KF	A.18
430042	FDH436TD050ED	A.6	430143	FDN66TD016ED	A.6	430707	FDN436TG080GD	A.7	430905	FDDMP3	A.10	431222	FEH36T5A225KF	A.18
430043	FDH436TD063ED	A.6	430144	FDN66TD020ED	A.6	430710	FDN436TG100GD	A.7	430908	FDDMP4	A.10	431223	FEH36T5D100KF	A.18
430044	FDH436TG025ED	A.7	430145	FDN66TD025ED	A.6	430713	FDN436TG125GD	A.7	430920	FDEMFB	A.9	431224	FEH36T5D125KF	A.18
430045	FDH436TG032ED	A.7	430146	FDN66TD032ED	A.6	430718	FDN456TD080GD	A.6	430926	FDEMFD	A.9	431225	FEH436SA125JGF	A.15
430046	FDH436TG040ED	A.7	430147	FDN66TD040ED	A.6	430721	FDN456TD100GD	A.6	430929	FDEMFF	A.9	431226	FEH36T5D160KF	A.18
430047	FDH436TG050ED	A.7	430148	FDN66TD050ED	A.6	430724	FDN456TD125GD	A.6	430932	FDEMFG	A.9	431228	FEH436SA160JUF	A.15
430048	FDH436TG063ED	A.7	430149	FDN66TD063ED	A.6	430729	FDN456TG080GD	A.7	430935	FDEMFG	A.9	431229	FEH36T5D200KF	A.18
430049	FDH456TD063ED	A.6	430150	FDY306D063ED	A.7	430732	FDN456TG100GD	A.7	430938	FDEMFN	A.9	431231	FEH436SA160KJF	A.17
430050	FDH456TG063ED	A.7	430151	FDY406D063ED	A.7	430735	FDN456TG125GD	A.7	430941	FDFP3	A.11	431232	FEH36T5D225KF	A.18
430051	FDH46TD016ED	A.6	430161	FDS36TD016ED	A.6	430752	FDN46TD080GD	A.6	430942	FDFP4	A.11	431234	FEH436SA250KFF	A.17
430052	FDH46TD020ED	A.6	430163	FDS36TD020ED	A.6	430755	FDN46TD100GD	A.6	430943	FEFE	A.22	431235	FEH36T5D125KF	A.18
430053	FDH46TD025ED	A.6	430165	FDS36TD025ED	A.6	430758	FDN46TD125GD	A.6	430944	FGDDF3	A.31	431240	FGH46SA400NLF	A.27
430054	FDH46TD032ED	A.6	430167	FDS36TD032ED	A.6	430771	FDN46TG080GD	A.7	430945	FJDB	A.10	431244	FEH36T5D160KF	A.18
430055	FDH46TD040ED	A.6	430169	FDS36TD040ED	A.6	430774	FDN46TG100GD	A.7	430951	FJDL3	A.10	431245	FEH36T5D200KF	A.18
430056	FDH46TD050ED	A.6	430178	FDS36TD050ED	A.6	430777	FDN46TG125GD	A.7	430954	FJDL4	A.10	431246	FGL36AA400LLF	A.25
430057	FDH46TD063ED	A.6	430224	FDS46TD016ED	A.6	430794	FDN66TD080GD	A.6	430957	FJDP	A.10	431247	FEH36T5D250KF	A.18
430058	FDH46TG025ED	A.7	430226	FDS46TD020ED	A.6	430797	FDN66TD100GD	A.6	430960	FJDS3	A.10	431249	FGL36AA630NNF	A.27
430059	FDH46TG032ED	A.7	430228	FDS46TD025ED	A.6	430800	FDN66TD125GD	A.6	430963	FJDS4	A.10	431252	FEH436TA080JF	A.13
430060	FDH46TG040ED	A.7	430230	FDS46TD032ED	A.6	430805	FDY306D160GD	A.7	430966	FKD3	A.11	431258	FEH436TA100JF	A.13
430061	FDH46TG050ED	A.7	430232	FDS46TD040ED	A.6	430810	FY406D160GD	A.7	430967	FKD4	A.11	431261	FGH306F400LF	A.52
430062	FDH46TG063ED	A.7	430241	FDS46TD050ED	A.6	430813	FA1BPH	A.9	430969	FEBAT01	A.19	431264	FEH436TA125JF	A.13
430065	FDL36MC020ED	A.7	430276	FDE36TC080GF	A.5	430814	FDS36T5D050ED	A.8	430970	FEBAT10	A.19	431267	FGH306F400NF	A.53
430066	FDL36MC030ED	A.7	430279	FDE36TC100GF	A.5	430815	FABAT01	A.9	430971	FNDR4	A.9	431270	FEH436TA160JUF	A.13
430067	FDL36MC050ED	A.7	430282	FDE36TC125GF	A.5	430816	FDS36T5D063ED	A.8	430986	FNDR	A.9	431282	FGH306F630NF	A.53
430068	FA1BRH	A.9	430299	FDE46TC080GF	A.5	430817	FDS36T5D080GD	A.8	430987	FEDFO3	A.20	431285	FEH456SA125JGF	A.15
430069	FDJK	A.10	430302	FDE46TC100GF	A.5	430818	FABAT10	A.9	431000			431288	FEH456SA160JUF	A.15
430070	FDL36TD025ED	A.6	430305	FDE46TC125GF	A.5	430819	FDS36T5D100GD	A.8	431007	FEH36TD100JF	A.13	431291	FEH456SA160KJF	A.17
430071	FDL36TD032ED	A.6	430318	FDH36MC080GD	A.7	430820	FDS36T5D125GD	A.8	431021	FEH36TD125JF	A.13	431294	FEH456SA250KFF	A.17
430072	FDL36TD040ED	A.6	430321	FDH36MC100GD	A.7	430821	FAC	A.11	431025	FUA3	A.11	431300	FEH456TA080JF	A.13
430073	FDL36TD050ED	A.6	430338	FDH36TD080GD	A.6	430822	FDS36T5D160GD	A.8	431026	FUA4	A.11	431301	FGH36JA5500NLF	A.29
430074	FDL36TD063ED	A.6	430341	FDH36TD100GD	A.6	430823								

Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page
431404	FG1BRE	A.30	431814	FEN436SA160JF	A.15	432177	FERJ3B0025	A.14	432416	FEV36TA125KF	A.16	432780	FEL456TD125KF	A.16
431405	FEL36AA125JGF	A.14	431817	FEN436SA160KJF	A.17	432180	FERJ3E0040	A.14	432417	FETAA3J0063	A.50	432786	FETT64K0160	A.51
431406	FAZ	A.22	431820	FEN436SA250KKF	A.17	432183	FERJ3E0063	A.14	432420	FETAA3J0125	A.50	432789	FETT64K0200	A.51
431408	FG1PFF	A.33	431824	FEH46AA125KGF	A.13	432186	FERJ3G0080	A.14	432423	FETAA3J0160	A.50	432792	FETT64K0250	A.51
431409	FG1PFR	A.33	431836	FEL36AA125KGF	A.17	432189	FERJ3J0100	A.14	432426	FETAA3K0160	A.51	432796	FGDMP3	A.31
431410	FEL36AA160JF	A.14	431838	FEN436TA080JF	A.13	432190	FEBRCS3	A.21	432429	FETAA3K0250	A.51	432799	FGDMP4	A.31
431413	FEL36AA160KJF	A.17	431842	FEDF04	A.20	432191	FEBRC54	A.21	432432	FETAA4J0025	A.50	432811	FGEMF8	A.30
431416	FEL36AA250KKF	A.17	431844	FEN436TA100JF	A.13	432192	FERJ3G0125	A.14	432435	FETAA4J0063	A.50	432817	FGEMFD	A.30
431419	FEL306F160JF	A.50	431850	FEN436TA125JF	A.13	432195	FERJ3J0160	A.14	432438	FETAA4J0125	A.50	432820	FGEMFF	A.30
431422	FEL306F250KF	A.51	431856	FEN436TA160JF	A.13	432198	FEH436TD100JF	A.13	432441	FETAA4J0160	A.50	432823	FGEMFH	A.30
431425	FGL456SA400NLF	A.27	431870	FGGS0250	A.33	432204	FERJ3K0160	A.17	432444	FETAA4K0160	A.51	432826	FGEMFJ	A.30
431431	FEL36SA125JGF	A.15	431871	FEN456SA125JGF	A.15	432205	FEH436TD125JF	A.13	432447	FETAA4K0250	A.51	432829	FGEMFN	A.30
431434	FEL36SA160JF	A.15	431874	FEN456SA160JF	A.15	432207	FERJ3K0250	A.17	432480	FETD30J0160	A.50	432834	FEL456TD160JF	A.13
431437	FEL36SA160KJF	A.17	431877	FEN456SA160KJF	A.17	432209	FEH436TD125KF	A.16	432483	FETD30K0250	A.51	432836	FGFT	A.33
431440	FEL36SA250KKF	A.17	431880	FEN456SA250KKF	A.17	432210	FERJ43B0016	A.14	432486	FETD40J0160	A.50	432838	FGGS0400	A.33
431449	FGL46SA400NLF	A.27	431886	FEN456TA080JF	A.13	432213	FERJ43B0025	A.14	432489	FETD40K0250	A.51	432839	FGGS0630	A.33
431455	FGN36AA400LLF	A.25	431890	FEL46AA125KGF	A.17	432214	FEH436TD160JF	A.13	432495	FETMC3J0012	A.50	432840	FGJB	A.33
431458	FEL36TA080JF	A.13	431892	FEN456TA100JF	A.13	432216	FERJ43E0040	A.14	432498	FETMC3J0020	A.50	432843	FEL456TD160KF	A.16
431461	FGN36AA630NNF	A.27	431898	FEN456TA125JF	A.13	432218	FEH436TD160KF	A.16	432501	FETMC3J0050	A.50	432846	FGJM3	A.33
431464	FEL36TA100JF	A.13	431904	FEN456TA160JF	A.13	432219	FERJ43E0063	A.14	432504	FETMC3J0100	A.50	432849	FGJM4	A.33
431470	FEL36TA125JF	A.13	431920	FGN36AA125KGF	A.17	432222	FERJ43G0080	A.14	432510	FETMC3J0160	A.50	432852	FGJP	A.33
431473	FGN306F400LF	A.52	431922	FEN46SA125JGF	A.15	432223	FEH436TD200KF	A.16	432513	FETMC3K0160	A.51	432855	FGJS3	A.33
431476	FEL36TA160JF	A.13	431925	FEN46SA160JF	A.15	432225	FERJ43J0100	A.14	432516	FETMC3K0250	A.51	432858	FGJS4	A.33
431488	FGN306F400NF	A.53	431928	FEN46SA160KJF	A.17	432227	FEH436TD250KF	A.16	432528	FETMC4J0050	A.50	432861	FGJW3	A.33
431491	FGN306F630NF	A.53	431931	FEN46SA250KKF	A.17	432228	FERJ43G0125	A.14	432531	FETMC4J0100	A.50	432864	FGJW4	A.33
431494	FEL46AA125JGF	A.14	431938	FEN46AA125KGF	A.17	432231	FERJ43J0160	A.14	432537	FETMC4J0160	A.50	432867	FGNFT	A.30
431497	FEL46AA160JF	A.14	431949	FEN46TA080JF	A.13	432240	FERJ43K0160	A.17	432538	FEWB3	A.20	432868	FEL456TD200KF	A.16
431500	FEL46AA160KJF	A.17	431955	FEN46TA100JF	A.13	432242	FEH456TD100JF	A.13	432540	FETMC4K0160	A.51	432871	FEL456TD250KF	A.16
431503	FEL46AA250KKF	A.17	431960	FAUVRB	A.9	432243	FERJ43K0250	A.17	432543	FETMC4K0250	A.51	432907	FEL46TD100JF	A.13
431506	FEL406F160JF	A.50	431961	FEN46TA125JF	A.13	432249	FERJ45E0063	A.14	432544	FEWB4	A.20	432908	FGA3	A.33
431509	FEL406F250KF	A.51	431965	FEH36TD160JF	A.13	432250	FEH456TD125JF	A.13	432546	FETTA3J0025	A.50	432909	FGUA4	A.33
431518	FEL436SA125JGF	A.15	431967	FEN46TA160JF	A.13	432252	FERJ45G0080	A.14	432549	FETTA3J0032	A.50	432921	FEL46TD125JF	A.13
431521	FEL436SA160JF	A.15	431980	FEH36TD160KF	A.16	432254	FEH456TD125KF	A.16	432550	FGWB3	A.31	432924	FEL46TD125KF	A.16
431524	FEL436SA160KJF	A.17	431983	FGDFP3	A.31	432255	FERJ45J0100	A.14	432552	FETTA3J0040	A.50	432927	FEL46TD160JF	A.13
431527	FEL436SA250KKF	A.17	431986	FGDFP4	A.31	432258	FERJ45G0125	A.14	432555	FETTA3J0050	A.50	432930	FEL46TD160KF	A.16
431530	FGN36SA400NLF	A.27	431988	FEY306D160JF	A.15	432259	FEH456TD160JF	A.13	432556	FGWB4	A.31	432933	FEL46TD200KF	A.16
431536	FGN46AA400LLF	A.25	431991	FEY306D250KF	A.17	432261	FERJ45J0160	A.14	432558	FETTA3J0063	A.50	432936	FEL46TD250KF	A.16
431539	FGN46AA630NNF	A.27	431994	FEY406D160JF	A.15	432263	FEH456TD160KF	A.16	432561	FETTA3J0080	A.50	432945	FEN36TD100JF	A.13
431545	FEL436TA080JF	A.13	431997	FEY406D250KF	A.17	432266	FEH456TD200KF	A.16	432564	FETTA3J0100	A.50	432952	FDS36TD063ED	A.6
431548	FGN406F400LF	A.52	432000			432269	FEH456TD250KF	A.16	432567	FETTA3J0125	A.50	432953	FEN36TD125JF	A.13
431551	FEL436TA100JF	A.13	432000	FABAM01	A.19	432270	FERJ45K0160	A.17	432570	FETTA3J0160	A.50	432955	FDS36TD080GD	A.6
431554	FGN406F400NF	A.53	432003	FABAM10	A.19	432273	FERJ45K0250	A.17	432573	FEL436TD125JF	A.13	432958	FDS36TD100GD	A.6
431557	FEL436TA125JF	A.13	432004	FETAA3K0125	A.51	432276	FERJ4B0016	A.14	432576	FEL436TD125KF	A.16	432961	FDS36TD125GD	A.6
431560	FGN406F630NF	A.53	432007	FETAA4K0125	A.51	432279	FERJ4B0025	A.14	432580	FEWT	A.20	432962	FEN36TD125KF	A.16
431563	FEL436TA160JF	A.13	432010	FOFE	A.11	432282	FERJ4E0040	A.14	432582	FETTA4J0160	A.50	432964	FDS46TD063ED	A.6
431578	FEL456SA125JGF	A.15	432011	FE18PE	A.19	432285	FERJ4E0063	A.14	432583	FEWM	A.20	432967	FDS46TD080GD	A.6
431581	FEL456SA160JF	A.15	432012	FE18RE	A.19	432287	FEH46TD100JF	A.13	432585	FEL436TD160JF	A.13	432970	FDS46TD100GD	A.6
431584	FEL456SA160KJF	A.17	432017	FE1PF	A.22	432288	FERJ4G0080	A.14	432586	FEWN	A.20	432971	FEN36TD160JF	A.13
431587	FEL456SA250KKF	A.17	432018	FEBE43	A.21	432291	FERJ4J0100	A.14	432588	FEL436TD160KF	A.16	432973	FDS46TD125GD	A.6
431593	FEL456TA080JF	A.13	432019	FEBE44	A.21	432294	FERJ4G0125	A.14	432589	FEWA2	A.20	432976	FEN36TD160KF	A.16
431596	FGN436SA400NLF	A.27	432020	FEBE93	A.21	432296	FEH46TD125JF	A.13	432592	FGWT	A.31	432979	FEN36TD200KF	A.16
431599	FEL456TA100JF	A.13	432021	FEBE94	A.21	432297	FERJ4J0160	A.14	432595	FGWM	A.31	432982	FEN36TD250KF	A.16
431605	FEL456TA125JF	A.13	432022	FEBEA3	A.21	432300	FEH46TD125KF	A.16	432598	FGWN	A.31	432984	FEN436TD100JF	A.13
431611	FEL456TA160JF	A.13	432023	FEBEA4	A.21	432303	FEH46TD160JF	A.13	432601	FGWA2	A.31	433000		
431626	FGN456SA400NLF	A.27	432024	FEBEH3	A.21	432306	FERJ4K0160	A.17	432603	FETTA45J0063	A.50	433001	FEN436TD125JF	A.13
431629	FEL46SA125JGF	A.15	432025	FEBEH4	A.21	432307	FEH46TD160KF	A.16	432604	FGWA3	A.31	433004	FEN436TD125KF	A.16
431632	FEL46SA160JF	A.15	432026	FEBE33	A.21	432309	FERJ4K0250	A.17	432606	FETTA45J0080	A.50	433007	FEN436TD160JF	A.13
431635	FEL46SA160KJF	A.17	432027	FEBE54	A.21	432311	FEH46TD200KF	A.16	432607	FAS30W	A.20	433010	FEN436TD160KF	A.16
431638	FEL46SA250KKF	A.17	432028	FEBRC3	A.21	432312	FERS3B0025	A.15	432609	FETTA45J0100	A.50	433013	FEN436TD200KF	A.16
431650	FGN46SA400NLF	A.27	432029	FEBRC4	A.21	432315	FERS3E0063	A.15	432610	FAS33W	A.20	433016	FEN436TD250KF	A.16
431656	FEL46TA080JF	A.13	432032	FEBS53	A.21	432316	FEH46TD250KF	A.16	432612	FETTA45J0125	A.50	433028	FEN456TD100JF	A.13
431659	FGY306D400LF	A.26	432033	FEBS54	A.21	432318	FERS3G0125	A.15	432613	FA1BRWD	A.20	433034	FEN456TD125JF	A.13
431662	FEL46TA100JF	A.13	432034	FEDDF3	A.20	432321	FERS3J0160	A.15	432615	FETTA45J0160	A.50	433037	FEN456TD125KF	A.16
431665	FGY306D630NF	A.28	432037	FEDDF4	A.20	432327	FERS3K0250	A.17	432616	FA1BPWD	A.20	433040	FEN456TD160JF	A.13
431668	FEL46TA125JF	A.13	432040	FEDFF3	A.20	432330	FERS43B0025	A.15	432618	FEL436TD200KF	A.16	433043	FEN456TD160KF	A.16
431671	FGY406D400LF	A.26	432043	FEDFF4	A.20	432332	FEL36TD100JF	A.13	432619	FAWE	A.20	433046	FEN456TD200KF	A.16
431674	FEL46TA160JF	A.13	432046	FEDMP3	A.20	432333	FERS43E0063	A.15	432621	FEL436TD250KF	A.16	433049	FEN456TD250KF	A.16
431687	FGY406D630NF	A.28	432049	FEDMP4	A.20	432336	FERS43G0125	A.15	432636	FETTA4J0025	A.50	433061	FEN46TD100JF	A.13
431698	FEN36AA125JGF	A.14	432052	FEEMFD	A.19	432339	FERS43J0160	A.15	432639	FETTA4J0032	A.50	433067	FEN46TD125JF	A.13
431703	FEN36AA160JF	A.14	432055	FEEMFF	A.19	432341	FEL36TD125JF	A.13	432642	FETTA4J0040	A.50	433070	FEN46TD125KF	A.16
431706	FEN36AA160KJF	A.17	432058	FEEMFH	A.19	432344	FEL36TD125KF	A.16	432645	FETTA4J0050	A.50	433073	FEN46TD160JF	A.13
431709	FEN36AA250KKF	A.17	432061	FEEMFJ	A.19	432345	FERS43K0250	A.17	432648	FETTA4J0063	A.50	433076	FEN46TD160KF	A.16

Record Plus

Numerical index

Intro

A

B

C

D

E

F

G

X

Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page
433191	FETTD3K0200	A.51	433539	FDUT	A.11	434234	FGH406F250LF	A.52	434615	FGRL43LK0250 / 7	A.26	434955	FEL36MC100JF	A.14
433193	FGRJ4NN0630	A.27	433540	FEUT	A.22	434235	FGH436SA250LKF	A.25	434617	FGRL43LL0400 / 7	A.26	434958	FGH36VA630NNF	A.28
433195	FETTD3K0250	A.51	433541	FGUT	A.33	434236	FGH456SA250LKF	A.25	434621	FGH436SA500NNF	A.27	434960	FGH436VA400LLF	A.26
433201	FETTD43J0100	A.50	433553	FDC35TF020EF	A.5	434237	FGH46AA250LKF	A.25	434622	FGRL43NN0630 / 7	A.28	434961	FEL36MC160JF	A.14
433204	FETTD43J0125	A.50	433566	FDE36TC160GF	A.5	434238	FGH46SA250LKF	A.25	434624	FGRL45NN0630 / 7	A.28	434964	FEL36MC160KF	A.16
433207	FETTD43J0160	A.50	433569	FDE46TC160GF	A.5	434239	FGL306F250LF	A.52	434627	FGH456SA500NNF	A.27	434965	FGH436VA630NNF	A.28
433216	FETTD43K0125	A.51	433572	FDN36TD160GD	A.6	434240	FGH36AA250LKF	A.25	434630	FGH46AA500NNF	A.27	434967	FEL36MC250KF	A.16
433219	FETTD43K0160	A.51	433575	FDN36TG160GD	A.7	434241	FGL36SA250LKF	A.25	434633	FGH46KA500NNF	A.28	434970	FEL36TA025JF	A.13
433222	FETTD43K0200	A.51	433578	FDN436TD160GD	A.6	434242	FGL406F250LF	A.52	434636	FGN46AA400NLF	A.27	434971	FGH456VA400LLF	A.26
433225	FETTD43K0250	A.51	433581	FDN436TG160GD	A.7	434243	FGL436SA250LKF	A.25	434642	FGH46SA500NNF	A.27	434973	FEL36TA032JF	A.13
433231	FETTD45J0100	A.50	433584	FDN456TD160GD	A.6	434244	FGL456SA250LKF	A.25	434645	FGL36AA500NNF	A.27	434976	FEL36TA040JF	A.13
433234	FETTD45J0125	A.50	433587	FDN456TG160GD	A.7	434245	FGL46AA250LKF	A.25	434651	FGL36KA500NNF	A.28	434977	FGH456VA630NNF	A.28
433235	FGRS4NL0400	A.27	433590	FDN46TD160GD	A.6	434246	FGL46SA250LKF	A.25	434657	FGL36SA500NF	A.27	434979	FEL36TA050JF	A.13
433239	FETTD45J0160	A.50	433593	FDN46TG160GD	A.7	434247	FGN306F250LF	A.52	434663	FGH36B400LLF	A.25	434982	FEL36TA063JF	A.13
433241	FGRS43NL0400	A.27	433599	FDN66TD160GD	A.6	434248	FGN36AA250LKF	A.25	434666	FGH36BM500NNF	A.27	434983	FGH46VA400LLF	A.26
433246	FDH13TF016EF	A.6	433602	FDS36TD160GD	A.6	434249	FGN36SA250LKF	A.25	434669	FGH436BM400LLF	A.25	434994	FEL436MC050JF	A.14
433247	FGRS45NL0400	A.27	433604	FDS46TD160GD	A.6	434250	FGN406F250LF	A.52	434672	FGH436BM500NNF	A.27	434997	FEL436MC100JF	A.14
433252	FETTD45K0125	A.51	433649	FDE36TE016ED	A.5	434251	FGN436SA250LKF	A.25	434675	FGL36BM400LLF	A.25	435000		
433253	FGRS4NL0400	A.27	433651	FDE36TE020ED	A.5	434252	FGN456SA250LKF	A.25	434678	FGL36BM500NNF	A.27	435003	FGH46VA630NNF	A.28
433255	FDH13TF020EF	A.6	433653	FDE36TE025ED	A.5	434253	FGN46AA250LKF	A.25	434681	FGL436BM400LLF	A.25	435004	FEL436MC160JF	A.14
433257	FETTD45K0160	A.51	433655	FDE36TE032ED	A.5	434254	FGN46SA250LKF	A.25	434684	FGL436BM500NNF	A.27	435005	FKV36NT800PF	A.35
433260	FETTD45K0200	A.51	433657	FDE36TE040ED	A.5	434261	FGTAA4L0400	A.52	434687	FGH36BM400LLF	A.25	435007	FEL436MC160KF	A.16
433262	FDH13TF025EF	A.6	433659	FDE36TE050ED	A.5	434263	FGTKA4N0400	A.53	434690	FGN36BM500NNF	A.27	435010	FEL436MC250KF	A.16
433263	FETTD45K0250	A.51	433661	FDE36TE063ED	A.5	434265	FGTKA4N0630	A.53	434693	FGN436BM400LLF	A.25	435013	FEL436TA025JF	A.13
433268	FDH13TF032EF	A.6	433663	FDE36TE080GD	A.5	434303	FGRS3LK0250	A.25	434696	FGH436BM500NNF	A.27	435016	FEL436TA032JF	A.13
433269	FETTD4J0100	A.50	433665	FDE36TE100GD	A.5	434307	FGRS4LK0250	A.25	434735	FGNRE	A.30	435019	FEL436TA040JF	A.13
433272	FETTD4J0125	A.50	433667	FDE36TE125GD	A.5	434311	FGRS45LK0250	A.25	434736	FETMC3J0030	A.50	435022	FEL436TA050JF	A.13
433274	FDH13TF040EF	A.6	433669	FDE36TE160GD	A.5	434315	FGRS4LK0250	A.25	434742	FEH36MC007JF	A.14	435025	FEL436TA063JF	A.13
433275	FETTD4J0160	A.50	433697	FDE46TE016ED	A.5	434319	FGTAA3L0250	A.52	434745	FEL36MC012JF	A.14	435028	FKV36NT100SF	A.36
433280	FDH13TF050EF	A.6	433699	FDE46TE020ED	A.5	434323	FGTAA4L0250	A.52	434748	FEH36MC020JF	A.14	435030	FEL436NT125SF	A.36
433284	FETTD4K0125	A.51	433701	FDE46TE025ED	A.5	434337	FGRJ3LK0160	A.25	434751	FEL36MC030JF	A.14	435032	FKV36NE160TTF	A.37
433286	FDH13TF063EF	A.6	433703	FDE46TE032ED	A.5	434341	FGRJ4LK0250	A.25	434754	FEH36MC050JF	A.14	435035	FKV36NE125SSF	A.36
433287	FETTD4K0160	A.51	433705	FDE46TE040ED	A.5	434345	FGRJ43LK0160	A.25	434757	FEH36MC100JF	A.14	435037	FEL456TA063JF	A.13
433290	FETTD4K0200	A.51	433707	FDE46TE050ED	A.5	434349	FGRJ43LK0250	A.25	434758	FGL436SA500NNF	A.27	435040	FKV36NE100SQF	A.36
433292	FDH13TF080GF	A.6	433709	FDE46TE063ED	A.5	434353	FGRJ45LK0160	A.25	434763	FEL36MC160JF	A.14	435041	FKV36NE800PPF	A.35
433293	FETTD4K0250	A.51	433711	FDE46TE080GD	A.5	434357	FGRJ45LK0250	A.25	434764	FGL456SA500NNF	A.27	435042	FKV46NE800PPF	A.35
433296	FETTG3J0100	A.50	433713	FDE46TE100GD	A.5	434361	FGRJ4LK0160	A.25	434766	FEL36MC160KF	A.16	435049	FEL46TA025JF	A.13
433298	FDH13TF100GF	A.6	433715	FDE46TE125GD	A.5	434365	FGRJ4LK0250	A.25	434769	FEH36MC250KF	A.16	435052	FEL46TA032JF	A.13
433304	FDH13TF125GF	A.6	433717	FDE46TE160GD	A.5	434393	FGH36KA350LLF	A.26	434770	FGL46AA500NNF	A.27	435055	FEL46TA040JF	A.13
433310	FDH13TF160GF	A.6	433864	FDC35TF025EF	A.5	434399	FGH36KA400LLF	A.25	434772	FEL36TA025JF	A.13	435058	FEL46TA050JF	A.13
433311	FETTG43J0100	A.50	433867	FDC35TF032EF	A.5	434408	FGH436SA400LLF	A.25	434775	FEH36TA032JF	A.13	435061	FEL46TA063JF	A.13
433316	FDN13TF016EF	A.6	433870	FDC35TF040EF	A.5	434414	FGH456SA400LLF	A.25	434778	FEH36TA040JF	A.13	435064	FKV46NT800PF	A.35
433322	FDN13TF020EF	A.6	433873	FDC35TF050EF	A.5	434420	FGH46KA350LLF	A.26	434781	FEL36TA050JF	A.13	435065	FGL436VA400LLF	A.26
433326	FETTG45J0100	A.50	433876	FDC35TF063GF	A.5	434426	FGH46SA400LLF	A.25	434782	FGL46KA500NNF	A.28	435066	FKV46NE100SQF	A.36
433328	FDN13TF025EF	A.6	433879	FDC35TF080GF	A.5	434432	FGH46AA400NLF	A.27	434784	FEL36TA063JF	A.13	435071	FKV46VA630NNF	A.28
433332	FETTG4J0100	A.50	433882	FDC35TF100GF	A.5	434438	FGL36KA350LLF	A.26	434804	FNJF	A.40	435073	FEN36MC007JF	A.14
433334	FDN13TF032EF	A.6	433885	FDC35TF125GF	A.5	434444	FGL36SA400LLF	A.25	434806	FGL46SA500NNF	A.27	435076	FEN36MC012JF	A.14
433340	FDN13TF040EF	A.6	433892	FGNRW	A.30	434448	FAMB2	A.26	434808	FEL36TG100JF	A.13	435077	FGL436VA400LLF	A.26
433346	FDN13TF050EF	A.6	433899	FDC35TF160GF	A.5	434453	FGL436SA400LLF	A.25	434811	FEL36TG125JF	A.13	435079	FEN36MC020JF	A.14
433352	FDN13TF063EF	A.6	433907	FDC35TE016ED	A.5	434459	FGH36AA400NLF	A.27	434812	FGN36AA500NNF	A.27	435082	FEN36MC030JF	A.14
433357	FDBRCL2	A.10	433911	FDC35TE020ED	A.5	434462	FGL456SA400LLF	A.25	434817	FEH36TG160JF	A.13	435083	FKV46NE125SSF	A.36
433358	FDBRCS2	A.10	433914	FDC35TE025ED	A.5	434468	FGL46KA350LLF	A.26	434820	FEL36TG160KF	A.16	435085	FEN36MC050JF	A.14
433376	FAMLT1	A.22	433918	FDC35TE032ED	A.5	434469	FGRL43LK0160 / 7	A.26	434823	FEH36TG200KF	A.16	435086	FKV46NT100SF	A.36
433377	FBC3	A.43	433924	FDC35TE125GD	A.5	434472	FGRL45LK0160 / 7	A.26	434824	FGN36KA500NNF	A.28	435088	FEN36MC100JF	A.14
433400	FDTC1A1316	A.10	433925	FDC35TE160GD	A.5	434474	FGL46SA400LLF	A.25	434826	FEL36TG250KF	A.16	435089	FKV46NT125SF	A.36
433401	FDTC1A1416	A.10	433926	FDC45TF016EF	A.5	434481	FGRL45LK0250 / 7	A.26	434829	FEH436MC050JF	A.14	435091	FGL436VA630NNF	A.28
433415	FN1BR1Y	A.39	433928	FDC45TF020EF	A.5	434482	FGRL45LK0400 / 7	A.26	434832	FEL436MC100JF	A.14	435092	FKV46NE160TTF	A.37
433416	FN1I2F	A.46	433930	FDC45TF025EF	A.5	434483	FGN36KA350LLF	A.26	434835	FGN36SA500NNF	A.27	435094	FEN36MC160JF	A.14
433417	FN1PR	A.40	433932	FDC45TF032EF	A.5	434489	FGN36SA400LLF	A.25	434838	FEH436MC160JF	A.14	435095	FGL456VA400LLF	A.26
433419	FN6S0800	A.40	433934	FDC45TF040EF	A.5	434492	FGRL4NL0250 / 7	A.28	434841	FEH436MC160KF	A.16	435097	FEN36MC160KF	A.16
433420	FN6S3R	A.39	433936	FDC45TF050EF	A.5	434493	FGRL4NL0400 / 7	A.28	434844	FEL436MC250KF	A.16	435100	FEN36MC250KF	A.16
433421	FN6S1000	A.40	433938	FDC45TF063EF	A.5	434496	FGRL4NN0400 / 7	A.28	434847	FEL436TA025JF	A.13	435103	FEL36TA025JF	A.13
433422	FN6S4R	A.39	433940	FDC45TF080GF	A.5	434502	FGRL4NN0500 / 7	A.28	434848	FGN436SA500NNF	A.27	435106	FEN36TA032JF	A.13
433423	FNBR3C	A.39	433942	FDC45TF100GF	A.5	434504	FGN456SA400LLF	A.25	434850	FEH436TA032JF	A.13	435109	FEN36TA040JF	A.13
433425	FNBR4C	A.39	433944	FDC45TF125GF	A.5	434510	FGN46KA350LLF	A.26	434853	FEL436TA040JF	A.13	435112	FEN36TA050JF	A.13
433426	FNBRCS3	A.39	433946	FDC45TF160GF	A.5	434512	FGRS3NN0500	A.27	434856	FEH436TA050JF	A.13	435115	FEN36TA063JF	A.13
433427	FNBRCS4	A.39	433948	FDC45TE016ED	A.5	434516	FGRS43LK0400	A.25	434859	FEH436TA063JF	A.13	435118	FASHTH	A.9
433434	FNWS3WP	A.39	433949	FDC45TE020ED	A.5	434521	FGRS43NN0500	A.27	434860	FGN456SA500NNF	A.27	435120	FAUVRH	A.9
433436	FNWS3AP	A.39	433950	FDC45TE025ED	A.5	434525	FGRS45LK0400	A.25	434866	FGN46AA500NNF	A.27	435122	FGL436VA630NNF	A.28
433438	FNTCA4327	A.39	433951	FDC45TE032ED	A.5	434530	FGRS45NN0500	A.27	434871	FEH456TA063JF	A.13	435127	FDE36TF016EF	A.5
433439	FNTCA4427	A.39	433952	FDC45TE040ED	A.5	434532	FGRL4NN063							

Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page	Ref. no.	Cat. no.	Page
435172	FEN436MC160KF	A.16	435447	FKN46NE800PPF	A.35	435839	FDH46TD160GD	A.6	436187	FAMGAT2	A.26	436600	FDE36T5C155GF	A.8
435175	FEN436MC250KF	A.16	435450	FKN46NE100SQF	A.36	435842	FDH46TG160GD	A.7	436188	FAMGMF2	A.26	436651	FNTCA3427	A.39
435176	FGN46VA630NNF	A.28	435456	FKN46NG125SSF	A.36	435845	FDL36TD160GD	A.6	436189	FAMGFS2	A.26	436656	FGRL3L0K0250/7	A.26
435178	FEN436TA025JF	A.13	435459	FKN46NG160TTF	A.37	435848	FDL36TD160GD	A.6	436190	FAMGFT2	A.26	436720	FDKM1	A.11
435181	FEN436TA032JF	A.13	435462	FKH436NT630PF	A.35	435851	FDL456TD160GD	A.6	436191	FAMMT2	A.26	436721	FGRL3L0L0400/7	A.26
435182	FGRJ3NLO400	A.27	435465	FKN46NG800PPF	A.35	435854	FDL46TD160GD	A.6	436192	FAMSM2	A.26	436722	FGRL3NN0630/7	A.28
435184	FEN436TA040JF	A.13	435468	FKN46NG100SQF	A.36	435857	FEH36AA025JBF	A.14	436197	FAMST2	A.26	436726	FGRL3NN04000/7	A.28
435187	FEN436TA050JF	A.13	435474	FKN46NS125SSF	A.36	435860	FEH36AA063JEF	A.14	436316	FNTCA3327	A.39	436738	FGRL3NN05000/7	A.28
435188	FGRJ43NLO400	A.27	435477	FKN46NS160TTF	A.37	435863	FEH46AA025JBF	A.14	436321	FNEMFF/M	A.38	436739	FGRL3NLO250/7	A.28
435190	FEN436TA063JF	A.13	435480	FKL36NT630PF	A.35	435866	FEH46AA063JEF	A.14	436322	FNEMFD/M	A.38	436746	FGRL3NLO4000/7	A.28
435193	FDE36TF100GF	A.5	435483	FKN46NS800PPF	A.35	435869	FEL36AA025JBF	A.14	436323	FNEMF3/M	A.38	436747	FGRL3L0250/7	A.26
435194	FGRJ45NLO400	A.27	435486	FKN46NS100SQF	A.36	435872	FEL36AA063JEF	A.14	436324	FNEMF6/M	A.38	436748	FGRL3L0350/7	A.26
435195	FDE36TF125GF	A.5	435489	FKY306DN125SF	A.37	435875	FEL46AA025JBF	A.14	436327	FEH36MC125JF	A.14	436749	FGRL3L0160/7	A.26
435200	FGRJ4NLO400	A.27	435492	FKY306DN160TF	A.37	435878	FEH46AA063JEF	A.14	436329	FEH436MC125JF	A.14	436754	FEH36MC200KF	A.16
435202	FEN456TA063JF	A.13	435495	FKY306DN800PF	A.37	435881	FEN36AA025JBF	A.14	436331	FEL36MC125JF	A.14	436755	FEH436MC200KF	A.16
435205	FDE36TF160GF	A.5	435498	FKY406DN125SF	A.37	435884	FEN36AA063JEF	A.14	436333	FEL436MC125JF	A.14	436756	FEL36MC200KF	A.16
435207	FDE46TF016EF	A.5	435501	FKY406DN160TF	A.37	435887	FEN46AA025JBF	A.14	436335	FEN36MC125JF	A.14	436757	FEL436MC200KF	A.16
435214	FEN46TA025JF	A.13	435504	FKY406DN800PF	A.37	435890	FEN46AA063JEF	A.14	436336	FEN436MC125JF	A.14	436764	FEN36MC200KF	A.16
435217	FEN46TA032JF	A.13	435534	FKL436NT630PF	A.35	435893	FEH36MC080JF	A.14	436338	FETMC3J0125	A.50	436765	FEN436MC200KF	A.16
435220	FEN46TA040JF	A.13	435535	FKL436NT800PF	A.35	435896	FEL36MC080JF	A.14	436339	FETMC43J0125	A.50	436778	FETMC3K0200	A.51
435223	FEN46TA050JF	A.13	435537	FKN36NM800PF	A.35	435899	FEN36MC080JF	A.14	436361	FEH36MC003JF	A.14	436779	FETMC43K0200	A.51
435226	FEN46TA063JF	A.13	435538	FKN36NM800PF	A.35	435902	FEH436TG100JF	A.13	436363	FEL36MC003JF	A.14	436782	FEL36TA160KF	A.16
435229	FDE46TF020EF	A.5	435539	FKL36NM800PF	A.35	435903	FEH436TG125JF	A.13	436365	FEN36MC003JF	A.14	436817	FEV46TA160KF	A.16
435231	FDE46TF025EF	A.5	435541	FKN436NM800PF	A.35	435904	FEH436TG160JF	A.13	436396	FDH36MC003ED	A.7	436880	FKMF1P	A.38
435238	FDE46TF032EF	A.5	435542	FKH436NM800PF	A.35	435905	FDH436TG160KF	A.16	436398	FDH436MC003ED	A.7	436881	FKMF2P	A.38
435240	FDE46TF040EF	A.5	435543	FKL436NM800PF	A.35	435906	FEH436TG200KF	A.16	436401	FNS11R	A.38	436882	FKMF3P	A.38
435242	FDE46TF050EF	A.5	435545	FKL36NE100SQF	A.36	435907	FEH436TG250KF	A.16	436409	FDN36MC003ED	A.7	436883	FKMF6P	A.38
435244	FDE46TF063EF	A.5	435546	FKL36NE125SSF	A.36	435908	FEH456TG160KF	A.16	436411	FDN436MC003ED	A.7	436884	FKF1S	A.38
435246	FDE46TF080GF	A.5	435547	FKL46NE100SQF	A.36	435909	FEH456TG200KF	A.16	436449	FNCE6E	A.47	436885	FKF2S	A.38
435248	FDE46TF100GF	A.5	435549	FKH46NE125SSF	A.36	435910	FEH456TG250KF	A.16	436450	FNCE3	A.47	436886	FKF3S	A.38
435250	FEN46TG100JF	A.13	435550	FKN36NT100SF	A.36	435923	FEL36TG100JF	A.13	436451	FNCEA6E	A.47	436887	FKF6S	A.38
435253	FEN46TG125JF	A.13	435551	FKN36NT125SF	A.36	435926	FEL36TG125JF	A.13	436452	FNCEA3	A.47	437000	FEE01J	A.47
435256	FDE46TF125GF	A.5	435553	FKH36NT100SF	A.36	435932	FEL36TG160JF	A.13	436453	FAECA3	A.47	437001	FEI12	A.46
435258	FDE46TF160GF	A.5	435554	FKH36NT125SF	A.36	435935	FEL36TG160KF	A.16	436458	FNEMFJ/M	A.38	437002	FEE01N	A.47
435259	FEN46TG160JF	A.13	435555	FKL36NT100SF	A.36	435938	FEL36TG200KF	A.16	436459	FNEMFN/M	A.38	437004	FGEO2J	A.47
435262	FEN46TG160KF	A.16	435557	FKL36NT125SF	A.36	435941	FEL36TG250KF	A.16	436467	FEJN3	A.20	437005	FGI12	A.46
435265	FEN46TG200KF	A.16	435558	FKN36NM125SF	A.36	435944	FEL436TG100JF	A.13	436469	FGJN3	A.31	437007	FGEO2N	A.47
435268	FEN46TG250KF	A.16	435559	FKH36NM125SF	A.36	435947	FEL436TG125JF	A.13	436470	FGJN4	A.31	437008	FGEO3N	A.47
435273	FKY406DN100SF	A.37	435561	FKL36NM125SF	A.36	435950	FEL436TG160JF	A.13	436471	FNGS1600	A.40	437009	FGI14	A.46
435276	FKH36NE125SSF	A.36	435562	FKN436NT100SF	A.36	435953	FEL436TG160KF	A.16	436472	FAUVR8	A.9	437010	FGEO3N	A.47
435277	FGN436SA400LLF	A.25	435563	FKN436NT125SF	A.36	435956	FEL436TG200KF	A.16	436474	FDNRC/	A.9	437011	FKE04J	A.47
435279	FKH36NE160TF	A.37	435565	FKH436NT100SF	A.36	435959	FEL436TG250KF	A.16	436475	FDNRCV/	A.9	437012	FKE04N	A.47
435280	FGN46SA400LLF	A.25	435566	FKH436NT125SF	A.36	435962	FEL456TG100JF	A.13	436476	FDNRCV/	A.9	437013	FKE05J	A.47
435282	FKL46NE800PPF	A.35	435567	FKL436NT100SF	A.36	435965	FEL456TG125JF	A.13	436477	FDNRDV/5	A.9	437014	FKF14F	A.46
435285	FKH36NE800PPF	A.35	435569	FKL436NT125SF	A.36	435968	FEH456TG160JF	A.13	436478	FDNRF/5	A.9	437015	FKE05N	A.47
435288	FKH36NE100SQF	A.36	435570	FKN436NM125SF	A.36	435971	FEL456TG160KF	A.16	436479	FDNRFV/	A.9	437016	FNUVRJ	A.45
435294	FKH36NG125SSF	A.36	435571	FKH436NM125SF	A.36	435974	FEL456TG200KF	A.16	436481	FNWSAWP	A.39	560000		
435297	FKH36NG160TTF	A.37	435573	FKL436NM125SF	A.36	435977	FEL456TG200KF	A.16	436482	FNWS3WT	A.39	560090	TTD 22	A.39
435300	FKN436NT800PF	A.35	435574	FN1BR2Y	A.39	435992	FEL46TG100JF	A.13	436487	FDNRV/5	A.9	617000		
435303	FKH36NG800PPF	A.35	435575	FN1BRW1	A.39	435995	FEL46TG125JF	A.13	436488	FDNRV/	A.9	617947	FDKE	A.11
435306	FKH36NG100SQF	A.36	435577	FN1BRW2	A.39	436000	FEL46TG160JF	A.13	436489	FDNRZ/5	A.9	704000		
435312	FKH36NS125SSF	A.36	435578	FN1FW	A.39	436002	FEL46TG160KF	A.16	436490	FDNRZV/5	A.9	704154	BTR 175	A.39
435315	FKH36NS160TTF	A.37	435678	FN1BPE	A.38	436005	FEL46TG160KF	A.16	436491	FENRC/5	A.19	704155	BTR 305	A.39
435318	FKH36NT800PF	A.35	435679	FN1BRE	A.38	436008	FEL46TG200KF	A.16	436492	FENRCV/5	A.19	704156	BTR 350	A.39
435321	FKH36NS800PPF	A.35	435692	FNSHT8	A.38	436011	FEL46TG250KF	A.16	436493	FENRD/5	A.19	704169	RDS 220	A.39
435324	FKH36NS100SQF	A.36	435693	FNSHTD	A.38	436014	FEN436TG100JF	A.13	436494	FENRDV/5	A.19	704175	RDS 110	A.39
435330	FKH46NE125SSF	A.36	435694	FNSHTF	A.38	436015	FEN436TG125JF	A.13	436495	FENRF/5	A.19	704176	RDS 380	A.39
435333	FKH46NE160TTF	A.37	435695	FNSHTJ	A.38	436016	FEN436TG160JF	A.13	436496	FENRFV/	A.19	704177	RD6 220	A.39
435336	FKN36NT800PF	A.35	435696	FNSHTN	A.38	436017	FEN436TG160KF	A.16	436499	FENRX/5	A.45	704178	RD6 110	A.39
435339	FKH46NE800PPF	A.35	435697	FNVDV6	A.38	436018	FEN436TG200KF	A.16	436500	FENRV/5	A.19	704179	RD6 380	A.39
435342	FKH46NE100SQF	A.36	435698	FNUVR1	A.38	436019	FEN436TG250KF	A.16	436501	FENRVV/5	A.19	855000		
435343	FGRJ3LLO250	A.25	435699	FNUVR6	A.38	436020	FEN456TG100JF	A.13	436502	FNRENZ/5	A.19	855085	-	D.11
435348	FKH46NG125SSF	A.36	435700	FNUVR8	A.38	436021	FEN456TG125JF	A.13	436503	FNRENZV/5	A.19	855087	-	D.11
435351	FKH46NG160TTF	A.37	435701	FNUVRD	A.38	436022	FEN456TG160JF	A.13	436504	FGNRC/5	A.30	855088	-	D.11
435354	FKH436NT800PF	A.35	435702	FNUVRF	A.38	436023	FEN456TG160KF	A.16	436505	FGNRCV/5	A.30	872000		
435356	FGRJ43LLO250	A.25	435706	FNBS3P	A.39	436024	FEN456TG200KF	A.16	436506	FGNRD/5	A.30	872140	FAECE6	A.47
435357	FKH46NG800PPF	A.35	435707	FNBS4P	A.39	436025	FEN456TG250KF	A.16	436507	FGNRDV/5	A.30	872224	RD10 220	A.39
435360	FKH46NG100SQF	A.36	435708	FNBS53P	A.39	436026	FEH456TG100JF	A.13	436509	FGNRF/5	A.30	872225	RD10 110	A.39
435366	FKH46NS125SSF	A.36	435709	FNBS1250	A.40	436027	FEH456TG125JF	A.13	436510	FGNRFV/5	A.30	872226	RD10 380	A.39
435367	FGRJ45LLO250	A.25	435710	FNBS33P	A.39	436028	FEH456TG160JF	A.13	436512	FGNRX/5	A.45	872227	RDFR	A.39
435369	FKH46NS160TTF	A.37	435711	FNBS44P	A.39	436029	FETMC3J0080	A.50	436513	FGNRY/5	A.30	872240	FAECA6	A.47
435372	FKL36NT800PF	A.35	435712	FNBS44R	A.39	436117	FDC35TE040ED	A.5	436514	FGNRYV/5	A.30	872754	TT 35	A.39
435375	FKH46NS800PPF	A.35	435713	FNFE	A.40	436118	FDC35TE050ED	A.5	436515	FGNRZ/5	A.30	872755	TT 60	A.39
435378	FKH46NS													

Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page
BT...			FDBEH4	430886	A.10	FDE36TE160GD	433669	A.5	FDH36TD100GD	430341	A.6	FDL36TD125GD	430524	A.6
BTR 175	704154	A.39	FDBES3	430887	A.10	FDE36TF016EF	435127	A.5	FDH36TD125GD	430344	A.6	FDL36TD160GD	435845	A.6
BTR 305	704155	A.39	FDBES4	430888	A.10	FDE36TF020EF	435129	A.5	FDH36TD160GD	435821	A.6	FDL436MC020ED	430077	A.7
BTR 350	704156	A.39	FDBRC3	430889	A.10	FDE36TF025EF	435130	A.5	FDH36TG025ED	430027	A.7	FDL436MC030ED	430078	A.7
FA...			FDBRC4	430890	A.10	FDE36TF032EF	435132	A.5	FDH36TG032ED	430028	A.7	FDL436MC050ED	430079	A.7
FA1BPH	430813	A.9	FDBRCL2	433357	A.10	FDE36TF040EF	435135	A.5	FDH36TG040ED	430029	A.7	FDL436MC080GD	430537	A.7
FA1BPWD	432616	A.20	FDBRCS2	433358	A.10	FDE36TF050EF	435138	A.5	FDH36TG050ED	430030	A.7	FDL436MC100GD	430540	A.7
FA1BR1	430088	A.9	FDBSS3	430891	A.10	FDE36TF063EF	435145	A.5	FDH36TG063ED	430031	A.7	FDL436TD025ED	430082	A.6
FA1BR2	430089	A.9	FDBSS4	430892	A.10	FDE36TF080GF	435147	A.5	FDH36TG080GD	430357	A.7	FDL436TD032ED	430083	A.6
FA1BR3	430504	A.9	FDC35TE016ED	433907	A.5	FDE36TF100GF	435193	A.5	FDH36TG100GD	430360	A.7	FDL436TD040ED	430084	A.6
FA1BR4	430505	A.9	FDC35TE020ED	433911	A.5	FDE36TF125GF	435195	A.5	FDH36TG125GD	430363	A.7	FDL436TD050ED	430085	A.6
FA1BR5	430506	A.9	FDC35TE025ED	433914	A.5	FDE36TF160GF	435205	A.5	FDH36TG160GD	435824	A.7	FDL436TD063ED	430086	A.6
FA1BR6	430507	A.9	FDC35TE032ED	433918	A.5	FDE46TC016EF	430008	A.5	FDH436MC003ED	436398	A.7	FDL436TD080GD	430557	A.6
FA1BRH	430068	A.9	FDC35TE040ED	436117	A.5	FDE46TC020EF	430009	A.5	FDH436MC007ED	430032	A.7	FDL436TD100GD	430560	A.6
FA1BRWD	432613	A.20	FDC35TE050ED	436118	A.5	FDE46TC025EF	430010	A.5	FDH436MC012ED	430033	A.7	FDL436TD125GD	430563	A.6
FABAM01	432000	A.19	FDC35TE063ED	436133	A.5	FDE46TC032EF	430011	A.5	FDH436MC020ED	430034	A.7	FDL436TD160GD	435848	A.6
FABAM10	432003	A.19	FDC35TE080GD	436143	A.5	FDE46TC040EF	430012	A.5	FDH436MC030ED	430035	A.7	FDL456TD063ED	430087	A.6
FABAT 01	430815	A.9	FDC35TE100GD	436144	A.5	FDE46TC050EF	430013	A.5	FDH436MC050ED	430036	A.7	FDL456TD080GD	430568	A.6
FABAT01	430815	A.9	FDC35TE125GD	433924	A.5	FDE46TC063EF	430014	A.5	FDH436MC080GD	430376	A.7	FDL456TD100GD	430571	A.6
FABAT10	430818	A.9	FDC35TE160GD	433925	A.5	FDE46TC080GF	430299	A.5	FDH436MC100GD	430379	A.7	FDL456TD125GD	430574	A.6
FAC	430821	A.11	FDC35TF016EF	433532	A.5	FDE46TC100GF	430302	A.5	FDH436TD016ED	430037	A.6	FDL456TD160GD	435851	A.6
FAECA3	436453	A.47	FDC35TF020EF	433553	A.5	FDE46TC125GF	430305	A.5	FDH436TD020ED	430038	A.6	FDL46TD025ED	430090	A.6
FAECA6	872240	A.47	FDC35TF025EF	433864	A.5	FDE46TC160GF	433569	A.5	FDH436TD025ED	430039	A.6	FDL46TD032ED	430091	A.6
FAECE3	872141	A.47	FDC35TF032EF	433867	A.5	FDE46TE016ED	433697	A.5	FDH436TD032ED	430040	A.6	FDL46TD040ED	430092	A.6
FAECE6	872140	A.47	FDC35TF040EF	433870	A.5	FDE46TE020ED	433699	A.5	FDH436TD040ED	430041	A.6	FDL46TD050ED	430093	A.6
FAMAM2	436183	A.26	FDC35TF050EF	433873	A.5	FDE46TE025ED	433701	A.5	FDH436TD050ED	430042	A.6	FDL46TD063ED	430094	A.6
FAMB2	434448	A.26	FDC35TF063EF	433876	A.5	FDE46TE032ED	433703	A.5	FDH436TD063ED	430043	A.6	FDL46TD080GD	430591	A.6
FAMECM	434013	A.26	FDC35TF080GF	433879	A.5	FDE46TE040ED	433705	A.5	FDH436TD080GD	430396	A.6	FDL46TD100GD	430594	A.6
FAMGAM2	436185	A.26	FDC35TF100GF	433882	A.5	FDE46TE050ED	433707	A.5	FDH436TD100GD	430399	A.6	FDL46TD125GD	430597	A.6
FAMGAS2	436186	A.26	FDC35TF125GF	433885	A.5	FDE46TE063ED	433709	A.5	FDH436TD125GD	430402	A.6	FDL46TD160GD	435854	A.6
FAMGAT2	436187	A.26	FDC35TF160GF	433899	A.5	FDE46TE080GD	433711	A.5	FDH436TD160GD	435827	A.6	FDL31TF016EF	433316	A.6
FAMGMF2	436188	A.26	FDC45TE016ED	433948	A.5	FDE46TE100GD	433713	A.5	FDH436TG025ED	430044	A.7	FDL31TF020EF	433322	A.6
FAMGFS2	436189	A.26	FDC45TE020ED	433949	A.5	FDE46TE125GD	433715	A.5	FDH436TG032ED	430045	A.7	FDL31TF025EF	433328	A.6
FAMGFT2	436190	A.26	FDC45TE025ED	433950	A.5	FDE46TE160GD	433717	A.5	FDH436TG040ED	430046	A.7	FDL31TF032EF	433334	A.6
FAMLT1	433376	A.22	FDC45TE032ED	433951	A.5	FDE46TF016EF	433727	A.5	FDH436TG050ED	430047	A.7	FDL31TF040EF	433340	A.6
FAMMT2	436191	A.26	FDC45TE040ED	433952	A.5	FDE46TF020EF	435229	A.5	FDH436TG063ED	430048	A.7	FDL31TF050EF	433346	A.6
FAMSM2	436192	A.26	FDC45TE050ED	433953	A.5	FDE46TF025EF	435231	A.5	FDH436TG080GD	430415	A.7	FDL31TF063EF	433352	A.6
FAMST2	436197	A.26	FDC45TE063ED	433954	A.5	FDE46TF032EF	435238	A.5	FDH436TG100GD	430418	A.7	FDL31TF080GF	433519	A.6
FAPF8	430823	A.10	FDC45TE080GD	436145	A.5	FDE46TF040EF	435240	A.5	FDH436TG125GD	430421	A.7	FDL31TF100GF	433522	A.6
FAPFM	430824	A.10	FDC45TE100GD	436146	A.5	FDE46TF050EF	435242	A.5	FDH436TG160GD	430430	A.7	FDL31TF125GF	433525	A.6
FAPIP	430825	A.10	FDC45TE125GD	436147	A.5	FDE46TF063EF	435244	A.5	FDH456TD063ED	430049	A.6	FDL31TF160GF	433527	A.6
FAPM8	430826	A.10	FDC45TE160GD	436148	A.5	FDE46TF080GF	435246	A.5	FDH456TD080GD	430426	A.6	FDL36MC003ED	436409	A.7
FAPPS	430827	A.10	FDC45TF016EF	433926	A.5	FDE46TF100GF	435248	A.5	FDH456TD100GD	430429	A.6	FDL36MC007ED	430095	A.7
FAR	433500	A.22	FDC45TF020EF	433928	A.5	FDE46TF125GF	435256	A.5	FDH456TD125GD	430432	A.6	FDL36MC012ED	430096	A.7
FAS01L	430828	A.9	FDC45TF025EF	433930	A.5	FDE46TF160GF	435258	A.5	FDH456TD160GD	430433	A.6	FDL36MC020ED	430097	A.7
FAS01R	430831	A.9	FDC45TF032EF	433932	A.5	FDEMFB	430920	A.9	FDH456TG063ED	430050	A.7	FDL36MC030ED	430098	A.7
FAS10L	430834	A.9	FDC45TF040EF	433934	A.5	FDEMFD	430926	A.9	FDH456TG080GD	430437	A.7	FDL36MC050ED	430099	A.7
FAS10R	430837	A.9	FDC45TF050EF	433936	A.5	FDEMFF	430929	A.9	FDH456TG100GD	430440	A.7	FDL36MC080GD	430610	A.7
FAS30W	432607	A.20	FDC45TF063EF	433938	A.5	FDEMFH	430932	A.9	FDH456TG125GD	430443	A.7	FDL36MC100GD	430613	A.7
FAS33W	432610	A.20	FDC45TF080GF	433940	A.5	FDEMFI	430935	A.9	FDH456TG160GD	435836	A.7	FDL36TD016ED	430833	A.8
FASHTB	430840	A.9	FDC45TF100GF	433942	A.5	FDEMFN	430938	A.9	FDH46TD016ED	430051	A.6	FDL36TD020ED	430835	A.8
FASHTD	430843	A.9	FDC45TF125GF	433944	A.5	FDFF	432010	A.11	FDH46TD020ED	430052	A.6	FDL36TD025ED	430836	A.8
FASHTF	430846	A.9	FDC45TF160GF	433946	A.5	FDFF3	430941	A.11	FDH46TD025ED	430053	A.6	FDL36TD032ED	430838	A.8
FASHTH	435118	A.9	FDDDF3	430893	A.10	FDFF4	430942	A.11	FDH46TD032ED	430054	A.6	FDL36TD040ED	430839	A.8
FASHTJ	430849	A.9	FDDDF4	430896	A.10	FDHF	430829	A.11	FDH46TD040ED	430055	A.6	FDL36TD050ED	430841	A.8
FASHTN	430852	A.9	FDDFF3	430899	A.10	FDL13TF016EF	433246	A.6	FDH46TD050ED	430056	A.6	FDL36TD063ED	430842	A.8
FASHTU	430855	A.9	FDDFF4	430902	A.10	FDL13TF020EF	433255	A.6	FDH46TD063ED	430057	A.6	FDL36TD080GD	430844	A.8
FAUVDN	430858	A.9	FDDFQ3	433489	A.10	FDL13TF025EF	433262	A.6	FDH46TD080GD	430460	A.6	FDL36TD100GD	430845	A.8
FAUVR8	436472	A.9	FDDFQ4	433492	A.10	FDL13TF032EF	433268	A.6	FDH46TD100GD	430463	A.6	FDL36TD125GD	430847	A.8
FAUVRB	431960	A.9	FDDMP3	430905	A.10	FDL13TF040EF	433274	A.6	FDH46TD125GD	430466	A.6	FDL36TD160GD	430848	A.8
FAUVRD	430861	A.9	FDDMP4	430908	A.10	FDL13TF050EF	433280	A.6	FDH46TD160GD	435839	A.6	FDL36TD016ED	430100	A.6
FAUVRF	430864	A.9	FDE36TS016EF	436582	A.8	FDL13TF063EF	433286	A.6	FDH46TG025ED	430058	A.7	FDL36TD020ED	430101	A.6
FAUVRH	435120	A.9	FDE36TS020EF	436583	A.8	FDL13TF080GF	433292	A.6	FDH46TG032ED	430059	A.7	FDL36TD025ED	430102	A.6
FAUVRJ	430867	A.9	FDE36TS025EF	436584	A.8	FDL13TF100GF	433298	A.6	FDH46TG040ED	430060	A.7	FDL36TD032ED	430103	A.6
FAUVRN	430870	A.9	FDE36TS032EF	436588	A.8	FDL13TF125GF	433304	A.6	FDH46TG050ED	430061	A.7	FDL36TD040ED	430104	A.6
FAUVRU	430873	A.9	FDE36TS040EF	436589	A.8	FDL13TF160GF	433310	A.6	FDH46TG063ED	430062	A.7	FDL36TD050ED	430105	A.6
FAWE	432619	A.20	FDE36TS050EF	436591	A.8	FDL36MC003ED	436396	A.7	FDH46TG080GD	430479	A.7	FDL36TD063ED	430106	A.6
FAZ	431406	A.22	FDE36TS063EF	436593	A.8	FDL36MC007ED	430015	A.7	FDH46TG100GD	430482	A.7	FDL36TD080GD	430630	A.6
FB...			FDE36TS080GF	436594	A.8	FDL36MC012ED	430016	A.7	FDH46TG125GD	430485	A.7	FDL36TD100GD	430633	A.6
FBAD3	433443	A.43	FDE36TS100GF	436595	A.8	FDL36MC020ED	430017	A.7	FDH46TG160GD	435842	A.7	FDL36TD125GD	430636	A.6
FBAD4	43													

Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page
FDN436TD050ED	430122	A.6	FDS36TD040ED	430169	A.6	FEH36MC250KF	434769	A.16	FEH46AA160KJF	431207	A.17	FEL436SA125JGF	431518	A.15
FDN436TD063ED	430123	A.6	FDS36TD050ED	430178	A.6	FEH36SA125JGF	431138	A.15	FEH46AA250KFF	431210	A.17	FEL436SA160JGF	431521	A.15
FDN436TD080GD	430688	A.6	FDS36TD063ED	432952	A.6	FEH36SA160JGF	431144	A.17	FEH46SA125JGF	431336	A.15	FEL436SA160KJF	431524	A.17
FDN436TD100GD	430691	A.6	FDS36TD080GD	432955	A.6	FEH36SA160KJF	431144	A.17	FEH46SA160JGF	431339	A.15	FEL436SA250KFF	431527	A.17
FDN436TD125GD	430694	A.6	FDS36TD100GD	432958	A.6	FEH36SA250KFF	431147	A.17	FEH46SA160KJF	431342	A.17	FEL436TA025JF	435013	A.13
FDN436TD160GD	433578	A.6	FDS36TD125GD	432961	A.6	FEH36TSD125KF	431235	A.18	FEH46SA250KFF	431345	A.17	FEL436TA032JF	435016	A.13
FDN436TG025ED	430124	A.7	FDS36TD160GD	433602	A.6	FEH36TSD160KF	431244	A.18	FEH46TA025JF	434883	A.13	FEL436TA040JF	435019	A.13
FDN436TG032ED	430125	A.7	FDS46TD016ED	430224	A.6	FEH36TSD200KF	431245	A.18	FEH46TA032JF	434886	A.13	FEL436TA050JF	435022	A.13
FDN436TG040ED	430126	A.7	FDS46TD020ED	430226	A.6	FEH36TSD250KF	431247	A.18	FEH46TA040JF	434889	A.13	FEL436TA063JF	435025	A.13
FDN436TG050ED	430127	A.7	FDS46TD025ED	430228	A.6	FEH36TA025JF	434772	A.13	FEH46TA050JF	434892	A.13	FEL436TA080JF	431545	A.13
FDN436TG063ED	430128	A.7	FDS46TD032ED	430230	A.6	FEH36TA032JF	434775	A.13	FEH46TA063JF	434895	A.13	FEL436TA100JF	431551	A.13
FDN436TG080GD	430707	A.7	FDS46TD040ED	430232	A.6	FEH36TA040JF	434778	A.13	FEH46TA080JF	431363	A.13	FEL436TA125JF	431557	A.13
FDN436TG100GD	430710	A.7	FDS46TD050ED	430241	A.6	FEH36TA050JF	434781	A.13	FEH46TA100JF	431369	A.13	FEL436TA160JF	431563	A.13
FDN436TG125GD	430713	A.7	FDS46TD063ED	432964	A.6	FEH36TA063JF	434784	A.13	FEH46TA125JF	431375	A.13	FEL436TD100JF	432374	A.13
FDN436TG160GD	433581	A.7	FDS46TD080GD	432967	A.6	FEH36TA080JF	431165	A.13	FEH46TA160JF	431381	A.13	FEL436TD125JF	432573	A.13
FDN456TD063ED	430129	A.6	FDS46TD100GD	432970	A.6	FEH36TA100JF	431171	A.13	FEH46TD100JF	432287	A.13	FEL436TD125KF	432576	A.16
FDN456TD080GD	430718	A.6	FDS46TD125GD	432973	A.6	FEH36TA125JF	431177	A.13	FEH46TD125JF	432296	A.13	FEL436TD160JF	432585	A.13
FDN456TD100GD	430721	A.6	FDS46TD160GD	433604	A.6	FEH36TA160JF	431183	A.13	FEH46TD125KF	432300	A.16	FEL436TD160KF	432588	A.16
FDN456TD125GD	430724	A.6	FDTCA1316	433400	A.10	FEH36TD100JF	431007	A.13	FEH46TD160JF	432303	A.13	FEL436TD200KF	432618	A.16
FDN456TD160GD	433584	A.6	FDTCA1416	433401	A.10	FEH36TD125JF	431021	A.13	FEH46TD160KF	432307	A.16	FEL436TD250KF	432621	A.16
FDN456TG063ED	430130	A.7	FDUA3	431025	A.11	FEH36TD125KF	431393	A.16	FEH46TD200KF	432311	A.16	FEL436TG100JF	435944	A.13
FDN456TG080GD	430729	A.7	FDUAA	431026	A.11	FEH36TD160JF	431965	A.13	FEH46TD250KF	432316	A.16	FEL436TG125JF	435947	A.13
FDN456TG100GD	430732	A.7	FDFU3	430830	A.10	FEH36TD160KF	431980	A.16	FEH46TG100JF	434919	A.13	FEL436TG160JF	435950	A.13
FDN456TG125GD	430735	A.7	FDFU4	430832	A.10	FEH36TD200KF	432076	A.16	FEH46TG125JF	434922	A.13	FEL436TG160KF	435953	A.16
FDN456TG160GD	433587	A.7	FDFUT	433539	A.11	FEH36TD250KF	432096	A.16	FEH46TG160JF	434928	A.13	FEL436TG200KF	435956	A.16
FDN46TD016ED	430131	A.6	FDY306D063ED	430150	A.7	FEH36TG100JF	434808	A.13	FEH46TG160KF	434931	A.16	FEL436TG250KF	435959	A.16
FDN46TD020ED	430132	A.6	FDY306D160GD	430805	A.7	FEH36TG125JF	434811	A.13	FEH46TG200KF	434934	A.16	FEL456SA125JGF	431578	A.15
FDN46TD025ED	430133	A.6	FDY406D063ED	430151	A.7	FEH36TG160JF	434817	A.13	FEH46TG250KF	434937	A.16	FEL456SA160JGF	431581	A.15
FDN46TD032ED	430134	A.6	FDY406D160GD	430810	A.7	FEH36TG160KF	434820	A.16	FEJB	432073	A.22	FEL456SA160KJF	431584	A.17
FDN46TD040ED	430135	A.6	FE			FEH36TG200KF	434823	A.16	FEJL3	432079	A.22	FEL456SA250KFF	431587	A.17
FDN46TD050ED	430136	A.6	FE18PE	432011	A.19	FEH36TG250KF	434826	A.16	FEJL4	432082	A.22	FEL456TA063JF	435037	A.13
FDN46TD063ED	430137	A.6	FE18RE	432012	A.19	FEH406F160JF	431213	A.50	FEJN3	436467	A.20	FEL456TA080JF	431593	A.13
FDN46TD080GD	430752	A.6	FE1I2	437001	A.46	FEH406F250KF	431216	A.51	FEJN4	436467	A.20	FEL456TA100JF	431599	A.13
FDN46TD100GD	430755	A.6	FE1PF	432017	A.22	FEH436MC050JF	434829	A.14	FEJP	432085	A.22	FEL456TA125JF	431605	A.13
FDN46TD125GD	430758	A.6	FEBAT01	430969	A.19	FEH436MC100JF	434832	A.14	FEJS3	432088	A.22	FEL456TA160JF	431611	A.13
FDN46TD160GD	433590	A.6	FEBAT10	430970	A.19	FEH436MC125JF	436329	A.14	FEJS4	432091	A.22	FEL456TD100JF	432699	A.13
FDN46TG025ED	430138	A.7	FEBE43	432018	A.21	FEH436MC160JF	434838	A.14	FEL306F160JF	431419	A.50	FEL456TD125JF	432747	A.13
FDN46TG032ED	430139	A.7	FEBE44	432019	A.21	FEH436MC160KF	434841	A.16	FEL306F250KF	431422	A.51	FEL456TD125KF	432780	A.16
FDN46TG040ED	430140	A.7	FEBE93	432020	A.21	FEH436MC200KF	436755	A.16	FEL36AA025JBF	435869	A.14	FEL456TD160JF	432834	A.13
FDN46TG050ED	430141	A.7	FEBE94	432021	A.21	FEH436MC250KF	434844	A.16	FEL36AA063JGF	435872	A.14	FEL456TD160KF	432843	A.13
FDN46TG063ED	430142	A.7	FEBEA3	432022	A.21	FEH436SA125JGF	431225	A.15	FEL36AA125JGF	431405	A.14	FEL456TD200KF	432868	A.16
FDN46TG080GD	430771	A.7	FEBEA4	432023	A.21	FEH436SA160JGF	431228	A.15	FEL36AA125KGF	431836	A.17	FEL456TD250KF	432871	A.16
FDN46TG100GD	430774	A.7	FEBEH3	432024	A.21	FEH436SA160KJF	431231	A.17	FEL36AA160JGF	431410	A.14	FEL456TG100JF	435962	A.13
FDN46TG125GD	430777	A.7	FEBEH4	432025	A.21	FEH436SA250KFF	431234	A.17	FEL36AA160KJF	431413	A.17	FEL456TG125JF	435965	A.13
FDN46TG160GD	433593	A.7	FEBES3	432026	A.21	FEH436TA025JF	434847	A.13	FEL36AA250KFF	431416	A.17	FEL456TG160JF	435968	A.13
FDN66TD016ED	430143	A.6	FEBES4	432027	A.21	FEH436TA032JF	434850	A.13	FEL36MC003JF	436363	A.14	FEL456TG160KF	435971	A.16
FDN66TD020ED	430144	A.6	FEBRC3	432028	A.21	FEH436TA040JF	434853	A.13	FEL36MC007JF	434940	A.14	FEL456TG200KF	435974	A.16
FDN66TD025ED	430145	A.6	FEBRC4	432029	A.21	FEH436TA050JF	434856	A.13	FEL36MC012JF	434943	A.14	FEL456TG250KF	435977	A.16
FDN66TD032ED	430146	A.6	FEBRC5	432190	A.21	FEH436TA063JF	434859	A.13	FEL36MC020JF	434946	A.14	FEL46AA025JBF	435875	A.14
FDN66TD040ED	430147	A.6	FEBRC3S4	432191	A.21	FEH436TA080JF	431252	A.13	FEL36MC030JF	434949	A.14	FEL46AA063JBF	435878	A.14
FDN66TD050ED	430148	A.6	FEBSS3	432032	A.21	FEH436TA100JF	431258	A.13	FEL36MC050JF	434952	A.14	FEL46AA125JGF	431494	A.14
FDN66TD063ED	430149	A.6	FEBSS4	432033	A.21	FEH436TA125JF	431264	A.13	FEL36MC080JF	435896	A.14	FEL46AA125KGF	431890	A.17
FDN66TD080GD	430794	A.6	FEDDF3	432034	A.20	FEH436TA160JF	431270	A.13	FEL36MC100JF	434955	A.14	FEL46AA160JGF	431497	A.14
FDN66TD100GD	430797	A.6	FEDDF4	432037	A.20	FEH436TD100JF	432198	A.13	FEL36MC125JF	436331	A.14	FEL46AA160KJF	431500	A.17
FDN66TD125GD	430800	A.6	FEDFF3	432040	A.20	FEH436TD125JF	432205	A.13	FEL36MC160JF	434961	A.14	FEL46AA250KFF	431503	A.17
FDN66TD160GD	433599	A.6	FEDFF4	432043	A.20	FEH436TD125KF	432209	A.16	FEL36MC160KF	434964	A.16	FEL46SA125JGF	431629	A.15
FDNR4	430971	A.9	FEDFQ3	430987	A.20	FEH436TD160JF	432214	A.13	FEL36MC200KF	436756	A.16	FEL46SA160JGF	431632	A.15
FDNRC/	436474	A.9	FEDFO4	431842	A.20	FEH436TG160KF	432218	A.16	FEL36MC250KF	434967	A.16	FEL46SA160KJF	431635	A.17
FDNRCV/	436475	A.9	FEDMP3	432046	A.20	FEH436TD200KF	432223	A.16	FEL36SA125JGF	431431	A.15	FEL46SA250KFF	431638	A.17
FDNRD/5	436476	A.9	FEDMP4	432049	A.20	FEH436TD250KF	432227	A.16	FEL36SA160JGF	431434	A.15	FEL46TA025JF	435049	A.13
FDNRDV/5	436477	A.9	FEEMF8	435812	A.19	FEH46TG100JF	435902	A.13	FEL36SA160KJF	431437	A.17	FEL46TA032JF	435052	A.13
FDNRE/	430986	A.9	FEEMFD	432052	A.19	FEH436TG125JF	435903	A.13	FEL36SA250KFF	431440	A.17	FEL46TA040JF	435055	A.13
FDNRF/5	436478	A.9	FEEMFF	432055	A.19	FEH436TG160JF	435904	A.13	FEL36TA025JF	434970	A.13	FEL46TA050JF	435058	A.13
FDNRFV/	436479	A.9	FEEMFH	432058	A.19	FEH436TG160KF	435905	A.16	FEL36TA032JF	434973	A.13	FEL46TA063JF	435061	A.13
FDNRV/5	436487	A.9	FEEMFG	432061	A.19	FEH436TG200KF	435906	A.16	FEL36TA040JF	434976	A.13	FEL46TA080JF	431656	A.13
FDNRVW/	436488	A.9	FEEMFN	432064	A.19	FEH436TG250KF	435907	A.16	FEL36TA050JF	434979	A.13	FEL46TA100JF	431662	A.13
FDNRZ/5	436489	A.9	FEEO1J	437000	A.47	FEH456SA125JGF	431285	A.15	FEL36TA063JF	434982	A.13	FEL46TA125JF	431668	A.13
FDNRZV/5	436490	A.9	FEEO1N	437003	A.47	FEH456SA160JGF	431288	A.15	FEL36TA080JF	431458	A.13	FEL46TA160JF	431674	A.13
FDQDB3H/	431076	A.9	FEFE	430943	A.22	FEH456SA160KJF	431291	A.17	FEL36TA100JF	431464	A.13	FEL46TD100JF	432907	A.13
FDQDB3M/	431078	A.9	FEFF3	432067	A.22	FEH456SA250KFF	431294	A.17	FEL36TA125JF	431470	A.13	FEL46TD125JF	432921	A.13
FDQDB4H/6	431080	A.9	FEFF4	432068	A.22	FEH456TA063JF	434871	A.13	FEL36TA160JF	431476	A.13	FEL46TD125KF	432924	A.16
FDQDB4M/6	431084	A.9	FEFT	432071	A.22	FEH456TA080JF	431300	A.13	FEL36TD100JF	432332	A.13	FEL46TD160JF	432927	A.13
FDQD13M/	431086	A.9	FEH306F160JF	431126	A.50	FEH456TA100JF	431306	A.13	FEL36TD125JF	432341	A.13	FEL46TD160KF	432930	A.16
FDQD14M/6	431088	A.9	FEH306F250KF	431129										

Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page
FEN36MC020JF	435079	A.14	FEN456TG125JF	436021	A.13	FERJ4J0100	432291	A.14	FETTA4J0050	432645	A.50	FGDF4	431986	A.31
FEN36MC030JF	435082	A.14	FEN456TG160JF	436022	A.13	FERJ4J0160	432297	A.14	FETTA4J0063	432648	A.50	FGDMP3	432796	A.31
FEN36MC050JF	435085	A.14	FEN456TG160KF	436023	A.16	FERJ4K0160	432306	A.17	FETTA4J0080	432651	A.50	FGDMP4	432799	A.31
FEN36MC080JF	435089	A.14	FEN456TG200KF	436024	A.16	FERJ4K0250	432309	A.17	FETTA4J0100	432654	A.50	FGFMF8	432811	A.30
FEN36MC100JF	435088	A.14	FEN456TG250KF	436025	A.16	FERS3B0025	432312	A.15	FETTA4J0125	432657	A.50	FGEMFD	432817	A.30
FEN36MC125JF	436335	A.14	FEN46AA025JBF	435887	A.14	FERS3E0063	432315	A.15	FETTA4J0160	432660	A.50	FGEMFF	432820	A.30
FEN36MC160JF	435094	A.14	FEN46AA063JEF	435890	A.14	FERS3G0125	432318	A.15	FETTD3J0100	433159	A.50	FGEMFH	432823	A.30
FEN36MC160KF	435097	A.16	FEN46AA125JGF	431787	A.14	FERS3J0160	432321	A.15	FETTD3J0125	433164	A.50	FGEMFJ	432826	A.30
FEN36MC200KF	436764	A.16	FEN46AA125KGF	431938	A.17	FERS3K0250	432327	A.17	FETTD3J0160	433168	A.50	FGEMFN	432829	A.30
FEN36MC250KF	435100	A.16	FEN46AA160JGF	431790	A.14	FERS43B0025	432330	A.15	FETTD3K0125	433182	A.51	FGEO2J	437004	A.47
FEN36SA125JGF	431724	A.15	FEN46AA160KJF	431793	A.17	FERS43E0063	432333	A.15	FETTD3K0160	433186	A.51	FGEO2N	437007	A.47
FEN36SA160JGF	431727	A.15	FEN46AA250KKF	431796	A.17	FERS43G0125	432336	A.15	FETTD3K0200	433191	A.51	FGEO3J	437008	A.47
FEN36SA160KJF	431730	A.17	FEN46SA125JGF	431922	A.15	FERS43J0160	432339	A.15	FETTD3K0250	433195	A.51	FGEO3N	437010	A.47
FEN36SA250KKF	431733	A.17	FEN46SA160JGF	431925	A.15	FERS43K0250	432345	A.17	FETTD4J0100	433201	A.50	FGFE	430544	A.33
FEN36T5D100KF	431223	A.18	FEN46SA160KJF	431928	A.17	FERS45E0063	432348	A.15	FETTD4J0125	433204	A.50	FGFH	430545	A.33
FEN36T5D125KF	431224	A.18	FEN46SA250KKF	431931	A.17	FERS45G0125	432351	A.15	FETTD4J0160	433207	A.50	FGFT	432836	A.33
FEN36T5D160KF	431226	A.18	FEN46TA025JF	435214	A.13	FERS45J0160	432354	A.15	FETTD4K0125	433216	A.51	FGGS0250	431870	A.33
FEN36T5D200KF	431229	A.18	FEN46TA032JF	435217	A.13	FERS45K0250	432360	A.17	FETTD4K0160	433219	A.51	FGGS0400	432838	A.33
FEN36T5D225KF	431232	A.18	FEN46TA040JF	435220	A.13	FERS480025	432363	A.15	FETTD4K0200	433222	A.51	FGGS0630	432839	A.33
FEN36TA025JF	435103	A.13	FEN46TA050JF	435223	A.13	FERS4E0063	432366	A.15	FETTD4K0250	433225	A.51	FGH306F250LF	434231	A.52
FEN36TA032JF	435106	A.13	FEN46TA063JF	435226	A.13	FERS4G0125	432369	A.15	FETTD4J0100	433231	A.50	FGH306F400LF	431050	A.52
FEN36TA040JF	435109	A.13	FEN46TA080JF	431949	A.13	FERS4J0160	432372	A.15	FETTD4J0125	433234	A.50	FGH306FA00NF	431067	A.53
FEN36TA050JF	435112	A.13	FEN46TA100JF	431955	A.13	FERS4K0250	432378	A.17	FETTD4J0160	433239	A.50	FGH306F630NF	431073	A.53
FEN36TA063JF	435115	A.13	FEN46TA125JF	431961	A.13	FETA3J0025	432414	A.50	FETTD4K0125	433252	A.51	FGH36AA250LKF	434232	A.25
FEN36TA080JF	431751	A.13	FEN46TA160JF	431967	A.13	FETA3J0063	432417	A.50	FETTD4K0160	433257	A.51	FGH36AA400LLF	431032	A.25
FEN36TA100JF	431757	A.13	FEN46TD100JF	433061	A.13	FETA3J0125	432420	A.50	FETTD4K0200	433260	A.51	FGH36AA400NLF	433142	A.27
FEN36TA125JF	431763	A.13	FEN46TD125JF	433067	A.13	FETA3J0160	432423	A.50	FETTD4K0250	433263	A.51	FGH36AA500NLF	434600	A.27
FEN36TA160JF	431769	A.13	FEN46TD125KF	433070	A.16	FETA3K0125	432004	A.51	FETTD4J0100	433269	A.50	FGH36AA630NLF	431038	A.27
FEN36TD100JF	432945	A.13	FEN46TD160JF	433073	A.13	FETA3K0160	432426	A.51	FETTD4J0125	433272	A.50	FGH36BM400LLF	434663	A.25
FEN36TD125JF	432953	A.13	FEN46TD160KF	433076	A.16	FETA3K0250	432429	A.51	FETTD4J0160	433275	A.50	FGH36BM500NLF	434666	A.27
FEN36TD125KF	432962	A.16	FEN46TD200KF	433079	A.16	FETA4A0025	432432	A.50	FETTD4K0125	433284	A.51	FGH36JA5400LLF	431303	A.29
FEN36TD160JF	432971	A.13	FEN46TD250KF	433082	A.16	FETA4A0063	432435	A.50	FETTD4K0160	433287	A.51	FGH36JA5500NLF	431301	A.29
FEN36TD160KF	432976	A.16	FEN46TG100JF	435250	A.13	FETA4A0125	432438	A.50	FETTD4K0200	433290	A.51	FGH36KA250LKF	436150	A.26
FEN36TD200KF	432979	A.16	FEN46TG125JF	435253	A.13	FETA4A0160	432441	A.50	FETTD4K0250	433293	A.51	FGH36KA350LLF	434393	A.26
FEN36TD250KF	432982	A.16	FEN46TG160JF	435259	A.13	FETA4A0125	432407	A.51	FETTG3J0100	433296	A.50	FGH36KA400LLF	436151	A.26
FEN36TG100JF	435139	A.13	FEN46TG160KF	435262	A.16	FETA4A0160	432444	A.51	FETTG3J0125	432693	A.50	FGH36KA400NLF	436152	A.28
FEN36TG125JF	435142	A.13	FEN46TG200KF	435265	A.16	FETA4K0250	432447	A.51	FETTG3J0160	432696	A.50	FGH36KA500NLF	434606	A.28
FEN36TG160JF	435148	A.13	FEN46TG250KF	435268	A.16	FETCA1316	432156	A.21	FETTG3K0160	432705	A.51	FGH36KA630NLF	434028	A.28
FEN36TG160KF	435151	A.16	FENR4	432099	A.19	FETCA1320	432157	A.21	FETTG3K0200	432708	A.51	FGH36SA250LKF	434233	A.25
FEN36TG200KF	435154	A.16	FENRC/5	436491	A.19	FETCA1323	432160	A.21	FETTG3K0250	432711	A.51	FGH36SA400LLF	434399	A.25
FEN36TG250KF	435157	A.16	FENRCV/5	436492	A.19	FETCA1416	432158	A.21	FETTG4J0100	433311	A.50	FGH36SA400NLF	431091	A.27
FEN406F160JF	431799	A.50	FENRD/5	436493	A.19	FETCA1420	432159	A.21	FETTG4J0125	432717	A.50	FGH36SA500NLF	434612	A.27
FEN406F250KF	431802	A.51	FENRDV/5	436494	A.19	FETCA1423	432161	A.21	FETTG4J0160	432720	A.50	FGH36VA400LLF	434953	A.26
FEN436MC050JF	435160	A.14	FENRF/5	436495	A.19	FETCA630A	880954	A.21	FETTG4K0160	432729	A.51	FGH36VA630NLF	434958	A.28
FEN436MC100JF	435163	A.14	FENRFV/5	436496	A.19	FETCA640A	880955	A.21	FETTG4K0200	432732	A.51	FGH406F250LF	434234	A.52
FEN436MC125JF	436356	A.14	FENRW	432120	A.19	FETD30J0160	432480	A.50	FETTG4K0250	432735	A.51	FGH406F400LF	431150	A.52
FEN436MC160JF	435169	A.14	FENRX/5	436499	A.45	FETD30K0250	432483	A.51	FETTG4J0100	433326	A.50	FGH406F400NF	431153	A.53
FEN436MC160KF	435172	A.16	FENRY/5	436500	A.19	FETD40J0160	432486	A.50	FETTG4J0125	432741	A.50	FGH406F630NF	431156	A.53
FEN436MC200KF	436765	A.16	FENRV/5	436500	A.19	FETD40K0250	432489	A.51	FETTG4J0160	432744	A.50	FGH436BM400LLF	434669	A.25
FEN436MC250KF	435175	A.16	FENRVV/5	436501	A.19	FETD400J0125	432495	A.50	FETTG4K0160	432753	A.51	FGH436BM500NLF	434672	A.27
FEN436SA125JGF	431811	A.15	FENRZ/5	436502	A.19	FETMC3J0020	432498	A.50	FETTG4K0200	432756	A.51	FGH436SA250LKF	434235	A.25
FEN436SA160JGF	431814	A.15	FENRZV/5	436503	A.19	FETMC3J0030	434736	A.50	FETTG4K0250	432759	A.51	FGH436SA400LLF	434408	A.25
FEN436SA160KJF	431817	A.17	FEQDB3HJ/	431118	A.19	FETMC3J0050	432501	A.50	FETTG4J0100	433332	A.50	FGH436SA400NLF	431168	A.27
FEN436SA250KKF	431820	A.17	FEQDB3HK/	431124	A.19	FETMC3J0080	436078	A.50	FETTG4J0125	432774	A.50	FGH436SA500NLF	434621	A.27
FEN436TA025JF	435178	A.13	FEQDB3MJ/	431136	A.19	FETMC3J0100	432504	A.50	FETTG4J0160	432777	A.50	FGH436VA400LLF	434960	A.26
FEN436TA032JF	435181	A.13	FEQDB3MK/	431139	A.19	FETMC3J0125	436358	A.50	FETTG4K0160	432786	A.51	FGH436VA630NLF	434965	A.28
FEN436TA040JF	435184	A.13	FEQDB4HJ/6	431145	A.19	FETMC3J0160	432510	A.50	FETTG4K0200	432789	A.51	FGH46SA250LKF	434236	A.25
FEN436TA050JF	435187	A.13	FEQDB4KH/6	431151	A.19	FETMC3K0160	432513	A.51	FETTG4K0250	432792	A.51	FGH46SA400LLF	434414	A.25
FEN436TA063JF	435190	A.13	FEQDB4MJ/6	431159	A.19	FETMC3K0200	436778	A.51	FEU43	432162	A.22	FGH46SA400NLF	431198	A.27
FEN436TA080JF	431838	A.13	FEQDB4MK/6	431161	A.19	FETMC3K0250	432516	A.51	FEU44	432163	A.22	FGH46SA500NLF	434627	A.27
FEN436TA100JF	431844	A.13	FERJ3B0016	432174	A.14	FETMC4J0050	432528	A.50	FEUT	433540	A.22	FGH46VA400LLF	434971	A.26
FEN436TA125JF	431850	A.13	FERJ3B0025	432177	A.14	FETMC4J0100	432531	A.50	FEV36T5A125KF	431219	A.18	FGH46VA630NLF	434977	A.28
FEN436TA160JF	431856	A.13	FERJ3E0040	432180	A.14	FETMC4J0125	432539	A.50	FEV36T5A160KF	431220	A.18	FGH46AA250LKF	434237	A.25
FEN436TD100JF	432994	A.13	FERJ3E0063	432183	A.14	FETMC4J0160	432537	A.50	FEV36T5A200KF	431221	A.18	FGH46AA400LLF	431106	A.25
FEN436TD100KF	433001	A.13	FERJ3G0080	432186	A.14	FETMC4K0160	432540	A.51	FEV36T5A225KF	431222	A.18	FGH46AA400NLF	434432	A.27
FEN436TD125JF	433004	A.16	FERJ3G0125	432192	A.14	FETMC4K0200	436779	A.51	FEV36TA125KF	432416	A.16	FGH46AA500NLF	434630	A.27
FEN436TD125KF	433007	A.13	FERJ3J0100	432189	A.14	FETMC4K0250	432543	A.51	FEV36TA160KF	436798	A.16	FGH46AA630NLF	431132	A.27
FEN436TD160JF	433007	A.13	FERJ3J0160	432195	A.14	FETTA3J0025	432546	A.50	FEV36TA200KF	431058	A.16	FGH46KA250LKF	434041	A.26
FEN436TD160KF	433010	A.16	FERJ3K0160	432204	A.17	FETTA3J0032	432549	A.50	FEV36TA250KF	431061	A.16	FGH46KA350LLF	434020	A.26
FEN436TD200KF	433016	A.16	FERJ3K0250	432207	A.17	FETTA3J0040	432552	A.50	FEV46TA125KF	431082	A.16	FGH46KA400LLF	434042	A.26
FEN436TG100JF	436014	A.13	FERJ43B0016	432210	A.14	FETTA3J0050	432555	A.50	FEV46TA160KF	436817	A.16	FGH4		

Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page	Cat. no.	Ref. no.	Page
FGL36AA250LKF	434240	A.25	FGN456SA400NLF	431626	A.27	FGRL43NL0400 /7	434590	A.28	FKE05J	437015	A.47	FKN46NG125SSF	435456	A.36
FGL36AA400LLF	431246	A.25	FGN456SA500NLF	434860	A.27	FGRL43NL0400/7	434590	A.53	FKE05N	437017	A.47	FKN46NG160TTF	435459	A.37
FGL36AA400NLF	434459	A.27	FGN456VA400LLF	435164	A.26	FGRL43NN0400 /7	434605	A.28	FKF1S	436884	A.38	FKN46NG800PPF	435465	A.35
FGL36AA500NLF	434645	A.27	FGN456VA630NLF	435167	A.26	FGRL43NN0400/7	434605	A.53	FKF2S	436885	A.38	FKN46NS100SQF	435486	A.36
FGL36AA630NLF	431249	A.25	FGN46AA250LKF	434253	A.25	FGRL43NN0500 /7	434607	A.28	FKF3S	436886	A.38	FKN46NS125SSF	435474	A.36
FGL36BM400LLF	434675	A.25	FGN46AA400LLF	431536	A.25	FGRL43NN0500/7	434607	A.53	FKF6S	436887	A.38	FKN46NS160TTF	435477	A.37
FGL36BM500NLF	434678	A.27	FGN46AA400NLF	434636	A.27	FGRL43NN0630 /7	434622	A.28	FKH36NE100SQF	435288	A.36	FKN46NS800PPF	435483	A.35
FGL36KA250LKF	434049	A.26	FGN46AA500NLF	434866	A.27	FGRL43NN0630/7	434622	A.53	FKH36NE125SSF	435276	A.36	FKV36NE100SQF	435040	A.36
FGL36KA350LLF	434438	A.26	FGN46AA630NLF	431539	A.27	FGRL45LK0160 /7	434472	A.26	FKH36NE160TTF	435279	A.37	FKV36NE125SSF	435035	A.36
FGL36KA400LLF	434050	A.26	FGN46KA250LKF	436159	A.26	FGRL45LK0160/7	434472	A.52	FKH36NE800PPF	435285	A.35	FKV36NE160TTF	435032	A.37
FGL36KA400NLF	434051	A.28	FGN46KA350LLF	434510	A.26	FGRL45LK0250 /7	434481	A.26	FKH36NG100SQF	435306	A.36	FKV36NE800PPF	435041	A.35
FGL36KA500NLF	434651	A.28	FGN46KA400LLF	436160	A.26	FGRL45LK0250/7	434481	A.52	FKH36NG125SSF	435294	A.36	FKV36NT100SF	435028	A.36
FGL36KA630NLF	434052	A.28	FGN46KA400NLF	436161	A.28	FGRL45LL0250 /7	434579	A.26	FKH36NG160TTF	435297	A.37	FKV36NT125SF	435030	A.36
FGL36SA250LKF	434241	A.25	FGN46KA500NLF	434872	A.28	FGRL45LL0250/7	434579	A.52	FKH36NG800PPF	435303	A.35	FKV36NT800PF	435005	A.36
FGL36SA400LLF	434444	A.25	FGN46KA630NLF	434092	A.28	FGRL45LL0350 /7	434596	A.26	FKH36NM125SF	435559	A.36	FKV46NE100SQF	435066	A.36
FGL36SA400NLF	431309	A.27	FGN46SA250LKF	434254	A.25	FGRL45LL0350/7	434596	A.52	FKH36NM800PF	435538	A.35	FKV46NE125SSF	435083	A.36
FGL36SA500NLF	434657	A.27	FGN46SA400LLF	435280	A.25	FGRL45LL0400 /7	434482	A.26	FKH36NS100SQF	435324	A.36	FKV46NE160TTF	435092	A.37
FGL36VA400LLF	435065	A.26	FGN46SA400NLF	431650	A.27	FGRL45LL0400/7	434482	A.52	FKH36NS125SSF	435312	A.36	FKV46NE800PPF	435042	A.35
FGL36VA630NLF	435071	A.28	FGN46SA500NLF	434884	A.27	FGRL45NL0250 /7	434592	A.28	FKH36NS160TTF	435315	A.37	FKV46NT100SF	435086	A.36
FGL406F250LF	434242	A.52	FGN46VA400LLF	435170	A.26	FGRL45NL0250/7	434592	A.53	FKH36NS800PPF	435321	A.35	FKV46NT125SF	435089	A.36
FGL406F400LF	431351	A.52	FGN46VA630NLF	435176	A.28	FGRL45NL0400 /7	434594	A.28	FKH36NT100SF	435553	A.36	FKV46NT800PF	435064	A.35
FGL406F400NLF	431354	A.53	FGNFT	432867	A.30	FGRL45NL0400 /7	434594	A.53	FKH36NT125SF	435554	A.36	FKV36ND100SF	435381	A.37
FGL406F630NLF	431357	A.53	FGNRC/5	436504	A.30	FGRL45NN0400 /7	434581	A.28	FKH36NT630PF	435426	A.35	FKV36DN125SF	435489	A.37
FGL436BM400LLF	434681	A.25	FGNRCV/5	436505	A.30	FGRL45NN0400/7	434581	A.53	FKH36NT800PF	435318	A.35	FKV36DN160TF	435492	A.37
FGL436BM500NLF	434684	A.27	FGNRD/5	436506	A.30	FGRL45NN0500 /7	434597	A.28	FKH436NM125SF	435571	A.36	FKV36DN800PF	435495	A.37
FGL436SA250LKF	434243	A.25	FGNRDV/5	436507	A.30	FGRL45NN0500/7	434597	A.53	FKH436NM800PF	435542	A.35	FKV406DN100SF	435273	A.37
FGL436SA400LLF	434453	A.25	FGNRE	434735	A.30	FGRL45NN0630 /7	434624	A.28	FKH436NT100SF	435565	A.36	FKV406DN125SF	435498	A.37
FGL436SA400NLF	431372	A.27	FGNRF/5	436509	A.30	FGRL45NN0630/7	434624	A.53	FKH436NT125SF	435566	A.36	FKV406DN160TF	435501	A.37
FGL436SA500NLF	434758	A.27	FGNRFV/5	436510	A.30	FGRL4LK0160/7	434559	A.26	FKH436NT630PF	435462	A.35	FKV406DN800PF	435504	A.37
FGL436VA400LLF	435077	A.26	FGNRW	433892	A.30	FGRL4LK0250/7	434562	A.26	FKH436NT800PF	435354	A.35	FN.....		
FGL436VA630NLF	435091	A.28	FGNRX/5	436512	A.45	FGRL4LL0250/7	434568	A.26	FKH46NE100SQF	435342	A.36	FN18PE	435678	A.38
FGL456SA250LKF	434244	A.25	FGNRY/5	436513	A.30	FGRL4LL0350/7	434582	A.26	FKH46NE125SSF	435330	A.36	FN18RE	435679	A.38
FGL456SA400LLF	434462	A.25	FGNRYV/5	436514	A.30	FGRL4LL0400/7	434584	A.26	FKH46NE160TTF	435333	A.37	FN18RW1	435575	A.39
FGL456SA400NLF	431425	A.27	FGNRZ/5	436515	A.30	FGRL4NL0250/7	434492	A.28	FKH46NE800PPF	435339	A.35	FN18RW2	435577	A.39
FGL456SA500NLF	434764	A.27	FGNRZV/5	436516	A.30	FGRL4NL0400 /7	434493	A.28	FKH46NG100SQF	435360	A.36	FN18RY1	433415	A.39
FGL456VA400LLF	435095	A.26	FGQDB3H/6	431163	A.30	FGRL4NN0400/7	434496	A.28	FKH46NG125SSF	435348	A.36	FN18RY2	435574	A.39
FGL456VA630NLF	435122	A.28	FGQDB3M/6	431172	A.30	FGRL4NN0500/7	434502	A.28	FKH46NG160TTF	435351	A.37	FN1I2F	433416	A.46
FGL46AA250LKF	434245	A.25	FGQDB4H/6	431175	A.30	FGRL4NN0630/7	434532	A.28	FKH46NG800PPF	435357	A.35	FN1I4F	437016	A.46
FGL46AA400LLF	431330	A.25	FGQDB4M/6	431181	A.30	FGRS3LK0250	434303	A.25	FKH46NS100SQF	435378	A.36	FN1PR	433417	A.40
FGL46AA400NLF	434534	A.27	FGRJ3LK0160	434337	A.25	FGRS3LK0400	435435	A.25	FKH46NS125SSF	435366	A.36	FNBA11R	435761	A.38
FGL46AA500NLF	434770	A.27	FGRJ3LK0250	434341	A.25	FGRS3NL0400	433235	A.27	FKH46NS160TTF	435369	A.37	FNBS3P	435706	A.39
FGL46AA630NLF	431333	A.27	FGRJ3LL0250	435343	A.25	FGRS3NN0500	434512	A.27	FKH46NS800PPF	435375	A.35	FNBS3R	433420	A.39
FGL46KA250LKF	436153	A.26	FGRJ3LL0400	433151	A.25	FGRS43LK0250	434307	A.25	FKL36NE100SQF	435545	A.36	FNBS4P	435707	A.39
FGL46KA350LLF	434468	A.26	FGRJ3NL0250	433148	A.27	FGRS43LL0400	434516	A.25	FKL36NE125SSF	435546	A.36	FNBS4R	433422	A.39
FGL46KA400LLF	436154	A.26	FGRJ3NL0400	435182	A.27	FGRS43NL0400	433241	A.27	FKL36NE800PPF	435390	A.35	FNBR3C	433423	A.39
FGL46KA400NLF	436155	A.28	FGRJ3NN0400	433154	A.27	FGRS43NN0500	434521	A.27	FKL36NM125SF	435561	A.36	FNBR4C	433425	A.39
FGL46KA500NLF	434782	A.28	FGRJ3NN0630	433157	A.27	FGRS45LK0250	434311	A.25	FKL36NM800PF	435539	A.35	FNBRCS3	433426	A.39
FGL46KA630NLF	434068	A.28	FGRJ43LK0160	434345	A.25	FGRS45LL0400	434525	A.25	FKL36NT100SF	435555	A.36	FNBRCS4	433427	A.39
FGL46SA250LKF	434246	A.25	FGRJ43LK0250	434349	A.25	FGRS45NL0400	433247	A.27	FKL36NT125SF	435557	A.36	FNBS3P	435708	A.39
FGL46SA400LLF	434474	A.25	FGRJ43LL0250	435356	A.25	FGRS45NN0500	434530	A.27	FKL36NT630PF	435480	A.35	FNBS3R	435710	A.39
FGL46SA400NLF	431449	A.27	FGRJ43LL0400	433163	A.25	FGRS4LK0250	434315	A.25	FKL36NT800PF	435372	A.35	FNBS4P	435711	A.39
FGL46SA500NLF	434806	A.27	FGRJ43NL0250	433160	A.27	FGRS4LL0400	434537	A.25	FKL436NM125SF	435573	A.36	FNBS4R	435712	A.39
FGL46VA400LLF	435128	A.26	FGRJ43NL0400	435188	A.27	FGRS4NL0400	433253	A.27	FKL436NM800PF	435543	A.35	FNECA3	436452	A.47
FGL46VA630NLF	435134	A.28	FGRJ43NN0400	433166	A.27	FGRS4NN0500	434542	A.27	FKL436NT100SF	435567	A.36	FNECA6	436451	A.47
FGN306F250LF	434247	A.52	FGRJ43NN0630	433169	A.27	FGTAA3L0250	434319	A.52	FKL436NT125SF	435569	A.36	FNECE3	436450	A.47
FGN306F400LF	431473	A.52	FGRJ45LK0160	434353	A.25	FGTAA3L0400	431718	A.52	FKL436NT630PF	435534	A.35	FNECE6	436449	A.47
FGN306F400NLF	431488	A.53	FGRJ45LK0250	434357	A.25	FGTAA3N0400	431721	A.53	FKL436NT800PF	435535	A.35	FNEMF3/M	436323	A.38
FGN306F630NLF	431491	A.53	FGRJ45LL0250	435367	A.25	FGTAA3N0500	434893	A.53	FKL46NE100SQF	435547	A.36	FNEMF6/M	436324	A.38
FGN36AA250LKF	434248	A.25	FGRJ45LL0400	433175	A.25	FGTAA3N0630	431736	A.53	FKL46NE125SSF	435549	A.36	FNEMFD/M	436322	A.38
FGN36AA400LLF	431455	A.25	FGRJ45NL0250	433172	A.27	FGTAA4L0250	434323	A.52	FKL46NE800PPF	435282	A.35	FNEMFM/M	436321	A.38
FGN36AA400NLF	434561	A.27	FGRJ45NL0400	435194	A.27	FGTAA4L0400	431742	A.52	FKMF1P	436880	A.38	FNEMFM/M	436458	A.38
FGN36AA500NLF	434812	A.27	FGRJ45NN0400	433178	A.27	FGTAA4N0400	431745	A.53	FKMF2P	436881	A.38	FNEMFN/M	436459	A.38
FGN36AA630NLF	431461	A.27	FGRJ45NN0630	433181	A.27	FGTAA4N0500	434899	A.53	FKMF3P	436882	A.38	FNFE	435713	A.40
FGN36BM400LLF	434687	A.25	FGRJ4LK0160	434361	A.25	FGTAA4N0630	431748	A.53	FKMF6P	436883	A.38	FNFH	435714	A.40
FGN36BM500NLF	434690	A.27	FGRJ4LK0250	434365	A.25	FGTKA3L0250	434201	A.52	FKN36NE100SQF	435396	A.36	FNFT	435715	A.40
FGN36JA5400LLF	431305	A.29	FGRJ4LL0250	435397	A.25	FGTKA3L0350	434902	A.52	FKN36NE125SSF	435384	A.36	FNFW	435578	A.39
FGN36JA5500NLF	431304	A.29	FGRJ4LL0400	433187	A.25	FGTKA3L0400	434202	A.52	FKN36NE160TTF	435387	A.37	FNGS0800	433419	A.40
FGN36KA250LKF	434073	A.26	FGRJ4NL0250	433184	A.27	FGTKA3N0400	434203	A.53	FKN36NE800PPF	435393	A.35	FNGS1000	433421	A.40
FGN36KA350LLF	434483	A.26	FGRJ4NL0400	435200	A.27	FGTKA3N0500	434905	A.53	FKN36NG100SQF	435414	A.36	FNGS1250	435709	A.40
FGN36KA400LLF	436156	A.26	FGRJ4NN0400	433190	A.27	FGTKA3N0630	434204	A.53	FKN36NG125SSF	435402	A.36	FNGS1600	436471	A.40
FGN36KA400NLF	436157	A.28	FGRJ4NN0630	433193	A.27	FGTKA4L0250	434205	A.52	FKN36NG160TTF	435405	A.37	FNJF	434804	A.40
FGN36KA500NLF	434824	A.28	FGRL3LK0160/7	436749	A.26	FGTKA4L0350	434908	A.52	FKN36NG800PPF	435411	A.35	FNJL3	435716	A.40
FGN36KA630NLF	436158	A.28	FGRL3LK0250/7	436656	A.26	FGTKA4L0400	434261	A.52	FKN36NM125SF</					

Cat. no.	Ref. no.	Page
FNSHTJ	435695	A.38
FNSHTN	435696	A.38
FNTCA3327	436316	A.39
FNTCA3427	436651	A.39
FNTCA4327	433438	A.39
FNTCA4427	433439	A.39
FNUA3	435762	A.40
FNUA4	435763	A.40
FNUT	435764	A.40
FNUVD6	435697	A.38
FNUVR1	435698	A.38
FNUVR6	435699	A.38
FNUVR8	435700	A.38
FNUVRD	435701	A.38
FNUVRF	435702	A.38
FNUVRJ	437018	A.45
FNWS3AP	433436	A.39
FNWS3AT	435757	A.39
FNWS3WP	433434	A.39
FNWS3WT	436482	A.39
FNWS4AP	433440	A.39
FNWS4AT	435759	A.39
FNWS4WP	436481	A.39
FNWS4WT	433442	A.39
RD..		
RD1D 110	872225	A.39
RD1D 220	872224	A.39
RD1D 380	872226	A.39
RD5 110	704175	A.39
RD5 220	704169	A.39
RD5 380	704176	A.39
RD6 110	704178	A.39
RD6 220	704177	A.39
RD6 380	704179	A.39
RDFR	872227	A.39
TT..		
TT 110	872757	A.39
TT 160	872758	A.39
TT 210	872759	A.39
TT 35	872754	A.39
TT 60	872755	A.39
TT 80	872756	A.39
TTD 22	560090	A.39
TTO 110	872761	A.39
TTO 210	872762	A.39
TTO 60	872760	A.39

Intro

A

B

C

D

E

F

G

H

I

X

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February 2010
GE Industrial Solutions



Industrial Solutions (formerly Power Protection), a division of GE Energy, is a first class European supplier of low-voltage products including wiring devices, residential and industrial electrical distribution components, automation products, enclosures and switchboards. Demand for the company's products comes from wholesalers, installers, panel-board builders, contractors, OEMs and utilities worldwide.


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GE INDUSTRIAL BELGIUM
International Sales
Nieuwevaart 51
B-9000 Gent - Belgium
Tel. +32/9 265 21 11
Fax +32/9 265 28 90
E-mail: gepcb@gepc.ge.com



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