

Moulded Case Circuit Breakers Selective and Current Limiting

Record Plus Ed. 06



Moulded case circuit breakers - Selective and current limiting

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EN 60947-2 Standard

Circuit Breaker type		FD160				FD160				FE160			
Denomination		N	H	C	E	S	N	H	L	N	H	L	
Poles	Number of	1			3, 4		2 ^[1]	3, 4			3, 4		
Rated insulation voltage	Ui (Volts)	750		500	750	750		750			750		
Rated impulse withstand voltage	Uimp (Kilovolt)	3		6	8	8		8			8		
Rated operational voltage Ue	Volts AC	240		500	690	690		690			690		
	Volts DC	250		-	-	500		500			500		
Line Protection device													
Category of use		A		A		A		A					
Suitable for use as a isolator	Positive ON and OFF	yes		yes		yes		yes					
Rated current Ith = Ie	A at 40°C	160		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 ^[2]	42	65	130	
	500V AC	-	-	10	12	18	22	36	50 ^[2]	30	50	100	
	690V AC	-	-	-	4.5	6	8	10	12	10	22	75	
	250V DC Two pole	-	50	-	-	25	40	65	100	50	85	100	
	500V DC Three Pole	-	-	-	-	25	40	65	100	50	85	100	
	≤ 500V	100%	100%	75%	75%	100%	100%	100%	100%	100%	100%	100%	
Service breaking capacity Ics (%Icu)	690V AC	-	-	-	-	50%	50%	50%	50%	100%	75%	25%	
	400/415V AC	-	-	36	52.5	75	110	176	330	110	176	330	
Making capacity Icm (kA peak)	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		40000					
	Electrical at In and 415V AC	5000		5000		10000		20000					
	Electrical at In/2 and 415V AC	10000		10000		20000		30000					
Endurance (On-Tripped operations)	Mechanical	4000		4000		10000		16000					
Trip Units	Interchangeable	no		no		no		yes					
	Thermal Magnetic line	LTM				LTM							
	Thermal Magnetic generator					GTM							
	Thermal Magnetic discriminating					LTMD							
	Magnetic Only					Mag Break*							
	Electronic discriminating					Mag Break* or PremEon S							
	Electronic enhanced					PremEon S							

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		160
Rated making capacity	Icm (kA peak)			1.7					2.8		4.2
Short-term withstand current Icw (A)	Icw eff. 1 second			1.2					2		3
	Icw eff. 3 seconds			1.2					2		3

EN 60947-4 Standard

Use in motor circuits											
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* or PremEon S	
	Overload class 10 and Short circuit									PremEon S	
	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		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		140x170		
		x85		x85		x85	x95		x95		
Weights (kg)	Fixed front connection	0.4		0.9		1.3	1.5		2		

(1) N type only

(2) The 160A current rating of the L type is limited to 65kA at 440V and 36kA at 500V





FE250				FG400				FG630				FK800				FK1250				FK1600		
V	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			-				-				750 ⁽⁵⁾				750 ⁽⁵⁾				-	
A				B				B ⁽³⁾				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 ⁽⁴⁾		10	22	40 ⁽⁴⁾		20	25	30		20	25	30		20	25	
25	50	85	100									50	60	-		50	60	-		-	-	
-	50	85	100									36	50	-		36	50	-		-	-	
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	(6)	(6)		10	(6)	(6)		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				no				no				no		
LTM												LTM				LTM						
GTM																						
LTMD																						
Mag Break* or PremEon S				Mag Break* or PremEon S				Mag Break*				Mag Break*										
PremEon S				PremEon S				SMR1e				SMR1e				SMR1s and g						
-				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* or PremEon S				PremEon S				PremEon S				Mag Break*				Mag Break*					
	PremEon S				PremEon S or SMR2				PremEon S or SMR2				SMR1s or SMR1g				SMR1s or SMR1g					
	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	
	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	
	105x170		140x170		140x265		185x265		140x265		185x265		210x320		280x320		210x320		280x320		210x320	
	x95		x95		x115		x115		x115		x115		x160		x160		x160		x160		x160	
	1.5		2.0		4.5		6.0		4.5		6.0		12.2		15.1		18.0		23.4		18.0	

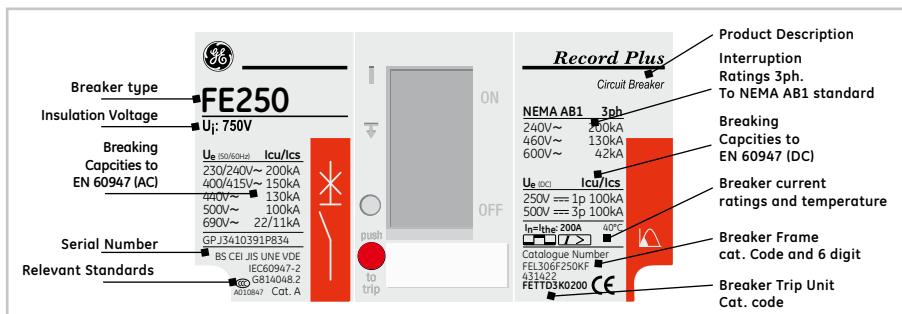
(3) Limited to 500Amp

(4) At a voltage of 690V AC the uses of a long widened terminal shield is mandatory (see page D.9)

(5) 4 poles in series are needed for 750V DC, Icu N type 20kA, Icu H type 36kA

(6) Please contact GE





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

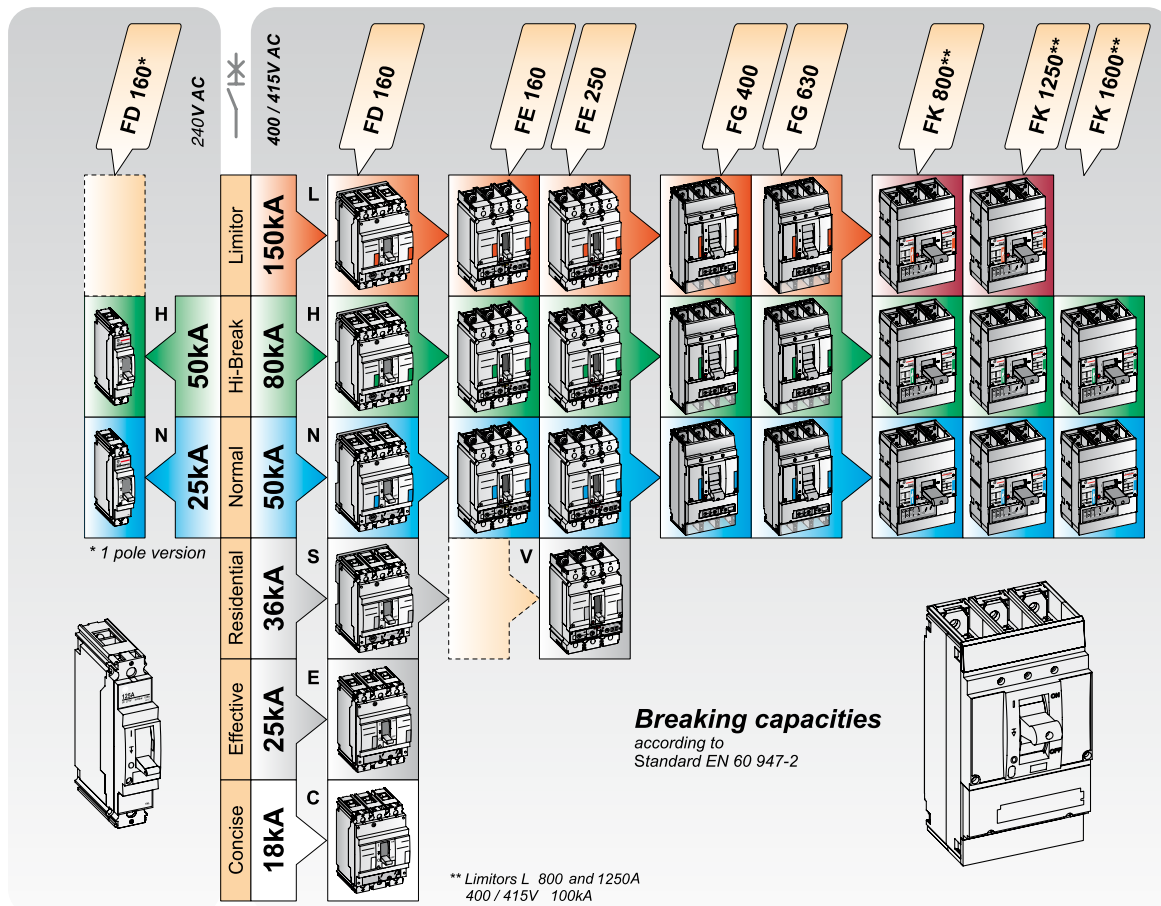
This compliance has been verified by three authorities; the Kema, the CCC organization and Lovag.
(Appropriate certificates can be made available on request)

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

The Record Plus product certificates are available from the following regulatory bodies:
Germanischer Lloyd
CCC (China)

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.



Moulded Case Circuit Breakers designed for global applications



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Common accessories - safe and easy to mount

Wide range of electrical and mechanical operators

Versatile installation options

A full solution for low voltage distribution

Record Plus

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 and current limiting breakers

FG400 and FG630

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.



FK800, 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

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

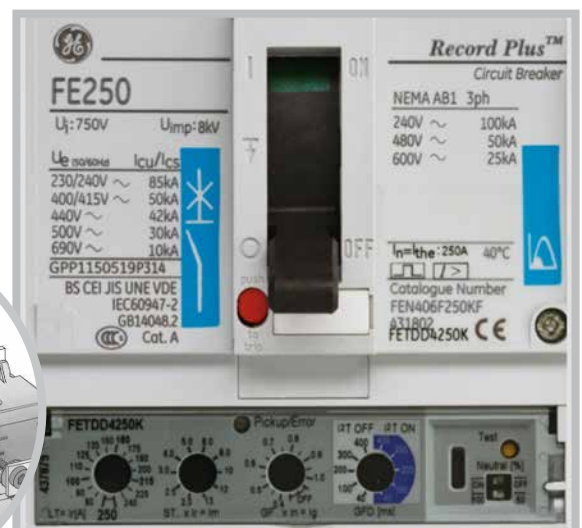
The **Record Plus*** FE, FG and FK frame sizes are available with rigorously designed and tested electronic trip units in three and four pole versions with a current range of 25 to 1600A.

PremEon

Is an interchangeable electronic trip unit designed to offer uncompromising reliability in all network environments in a current range of 25-630A.

The first of the line, the PremEon S combines sophisticated 32-bit technology with a built-in temperature sensor and a complete set of protection functions.

- An overload protection (LT) with a range of 0.3 to 1 times the chosen trip unit rating.
- A delayed short circuit protection (ST) with a wide setting range and I^2t band.
- A selective instantaneous device (II) that uses waveform recognition to assure selectivity.
- An optional ground fault protection device (residual principle) that can be used with multiple delay and or I^2t settings.



(1) Only applicable for the FE frame type.





SMR2

Designed to provide a flexible solution for all protection scenarios in a current range of 250-630A. The device provides an extensive set of protection features as:

- An overload protection (LT) with a range of 0.4 to 1 times the chosen trip unit rating.
- A delayed short circuit protection (ST) with a wide current and time setting range and optional I^2t bands.
- A selective instantaneous device (I) with a wide setting range.

Each SMR2 has a battery supplying the thermal memory function, a ZSI option and a built in temperature sensor.

SMR1e, 1s and 1g

The FK Frame can be supplied with a fixed electronic trip unit available in three different versions.

- SMR1e for selective simplicity.
- SMR1s for a broad range of settable devices.
- SMR1g which is basically an S type with an additional ground fault device.

Protection with flexible and interchangeable trip units

Personnel protection

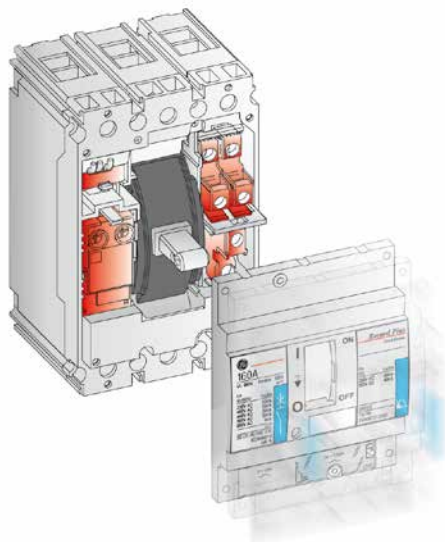
A line of three and four pole add-on residual current devices are available as side or bottom mounted units with ratings up to 630A and sensitivities of 30mA to 10A. The devices slide on to the breaker easily and are fixed by simply tightening the main electrical connections. Designed to meet the latest 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.



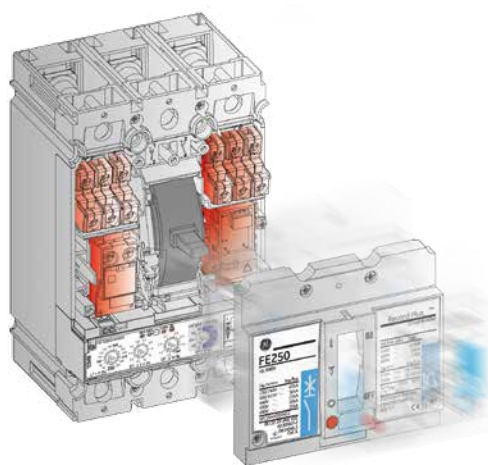
Common accessories safe and easy to mount



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.

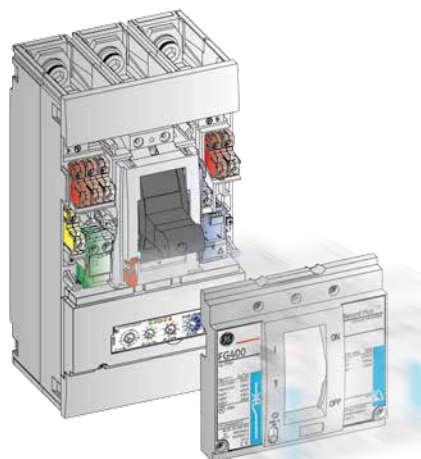
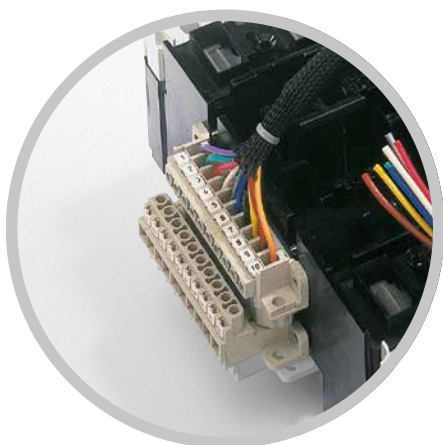
The advanced design includes routing channels for external wiring that allows access to internal terminals, making it easier to connect accessories. Particular attention has been paid to the design of these terminals that allow the connection of wiring from 0.5 to 2.5 mm².

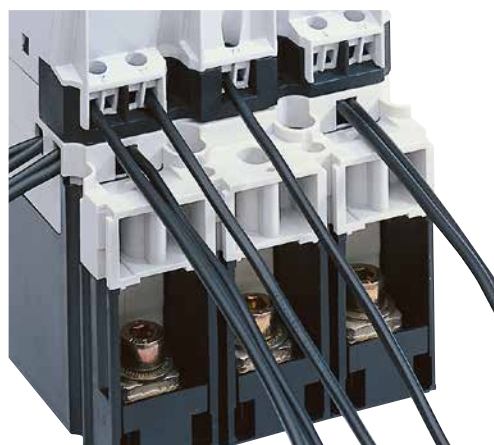
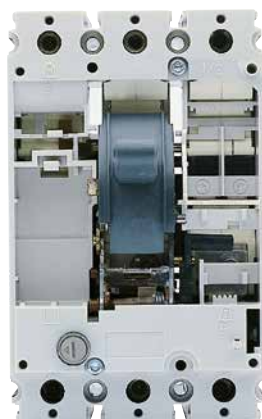


Common and adaptable

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 and 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. Three of these devices (for FD, FE and FK) can be mounted in the field. Additional factory operators are available for the FG and the FK frame sizes.

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.

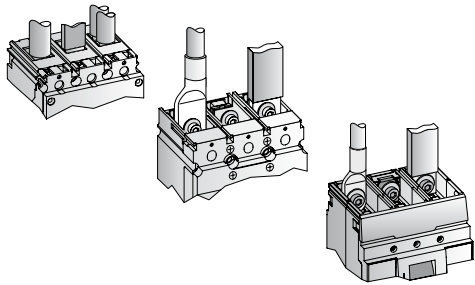
All Electrical Operators have a user interface that includes a CLEAR and ACCURATE ON, OFF and TRIPPED indication and offer the option to operate locally (Manual) or remotely (Auto).

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

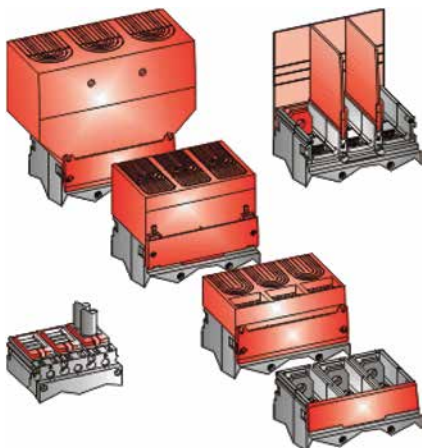
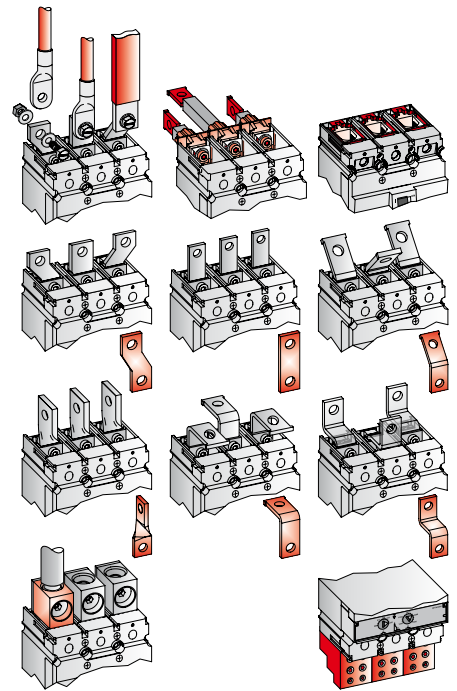


Standard connection options

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 it 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:

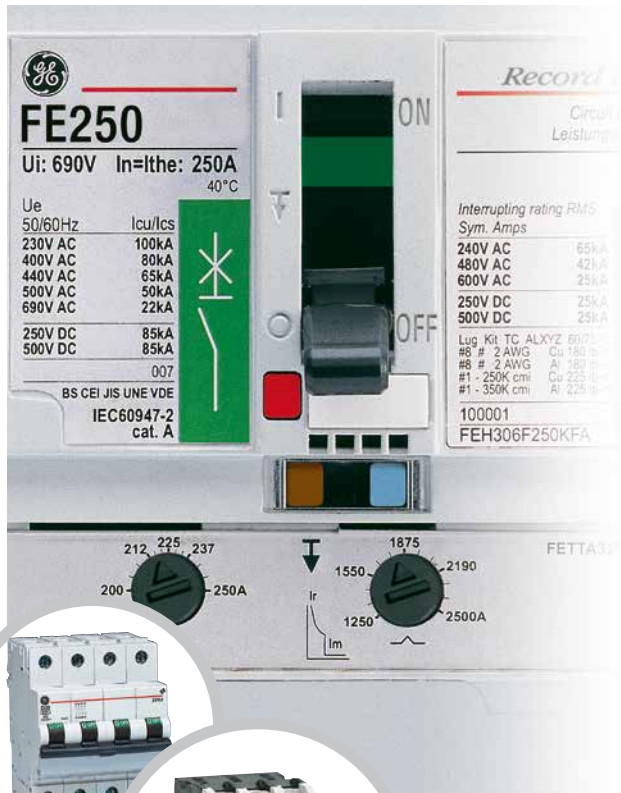
- Use behind door.
- Trip functionality on insertion and withdrawal.
- With MCCB style test position.
- Easily accessible earthing point.
- Through door version allowing accessibility of all draw-out and/or breaker functions from the door front.
- A locking option for multiple padlocks and/or multiple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

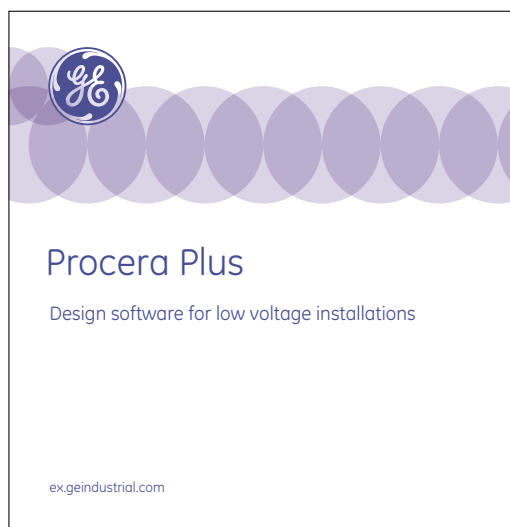
GE's name is synonymous with a broad range of products designed to meet our customer's changing and competitive environment. Our drive to exceed our customer's expectations is the foundation for continual renewal of our commitment to provide innovative low voltage solutions.

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 co-ordinated 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.

Intro

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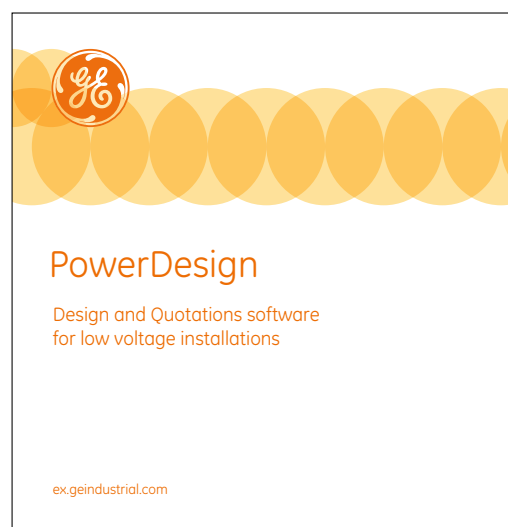
D

E

F

G

X

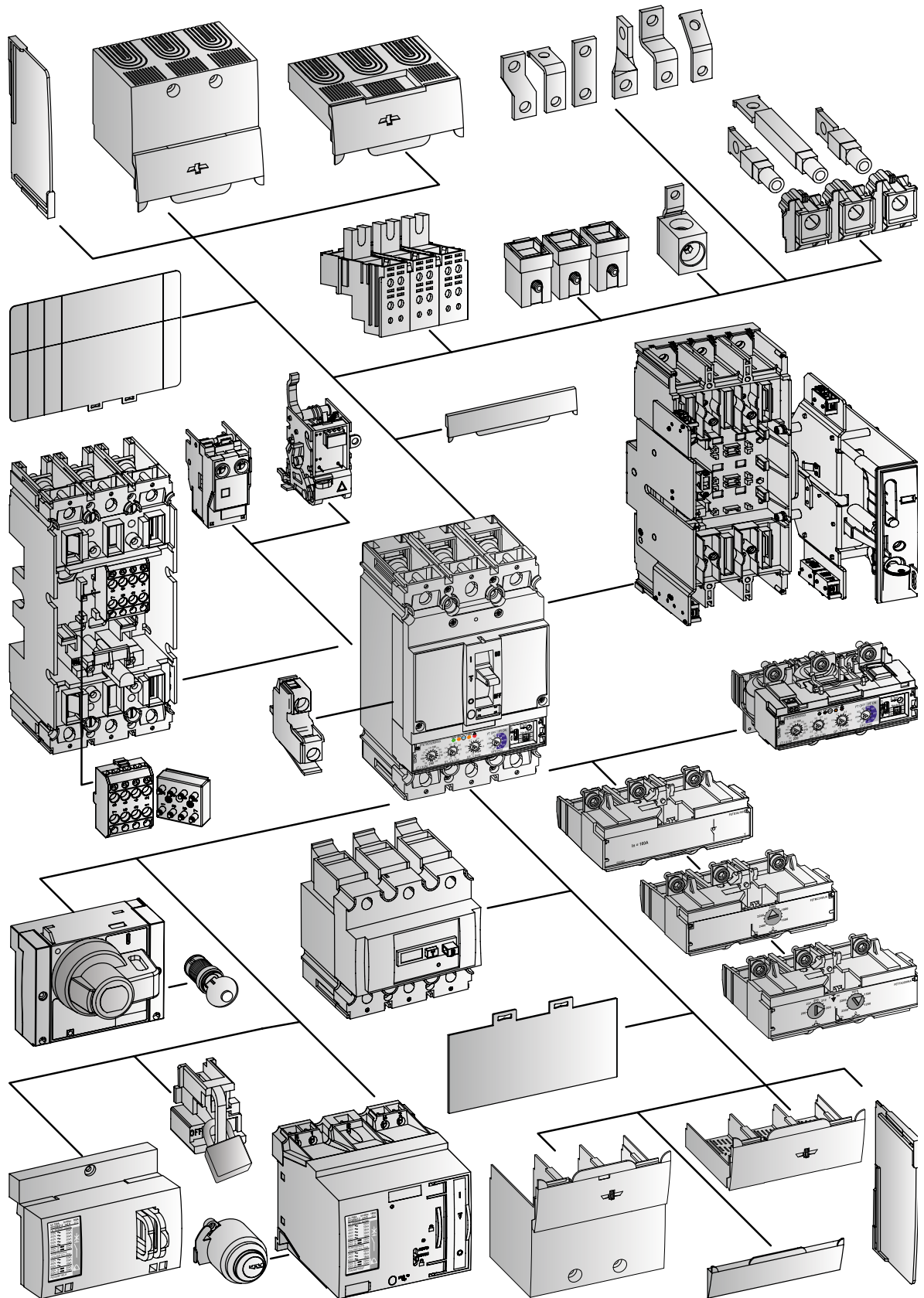


Implementation Software

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 and FE250

A.19 Accessories

The breaker

Order codes

A.24 **FG frame**

A.25 Complete circuit breakers FG400 and FG630

A.30 Accessories

A.34 **FK frame**

A.35 Complete circuit breakers FK800, FK1250 and FK1600

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

A.44 Interlocking Breakers

A.46 Residual Current Devices with separate sensor

A.48 Circuit Breaker in Components FE160 and FE250

A.50 Circuit Breaker in Components FG400 and FG630

Trip units

Components and accessories

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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 additionally.

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

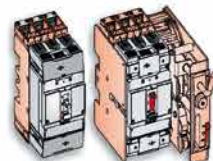
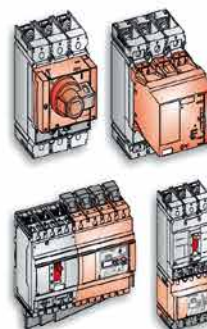
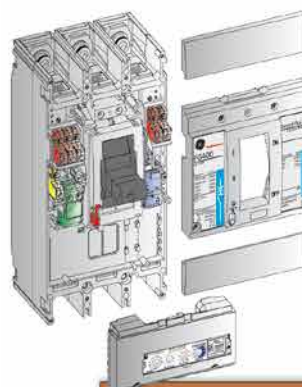
If the standard connection options do not meet the requirements a wide variety of others is available. The connection options are supplied in kit form for mounting on one side (load or line) of a breaker and can be used for the fixed, plug-in or draw-out version of the breaker.

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.



Record Plus*
moulded case circuit breaker
for.. Fixed mounting
with.. Front access connection



order 1 **code**
for complete breaker

2 codes
for complete breaker

3 codes
for complete breaker

order 1 **code**
per accessory

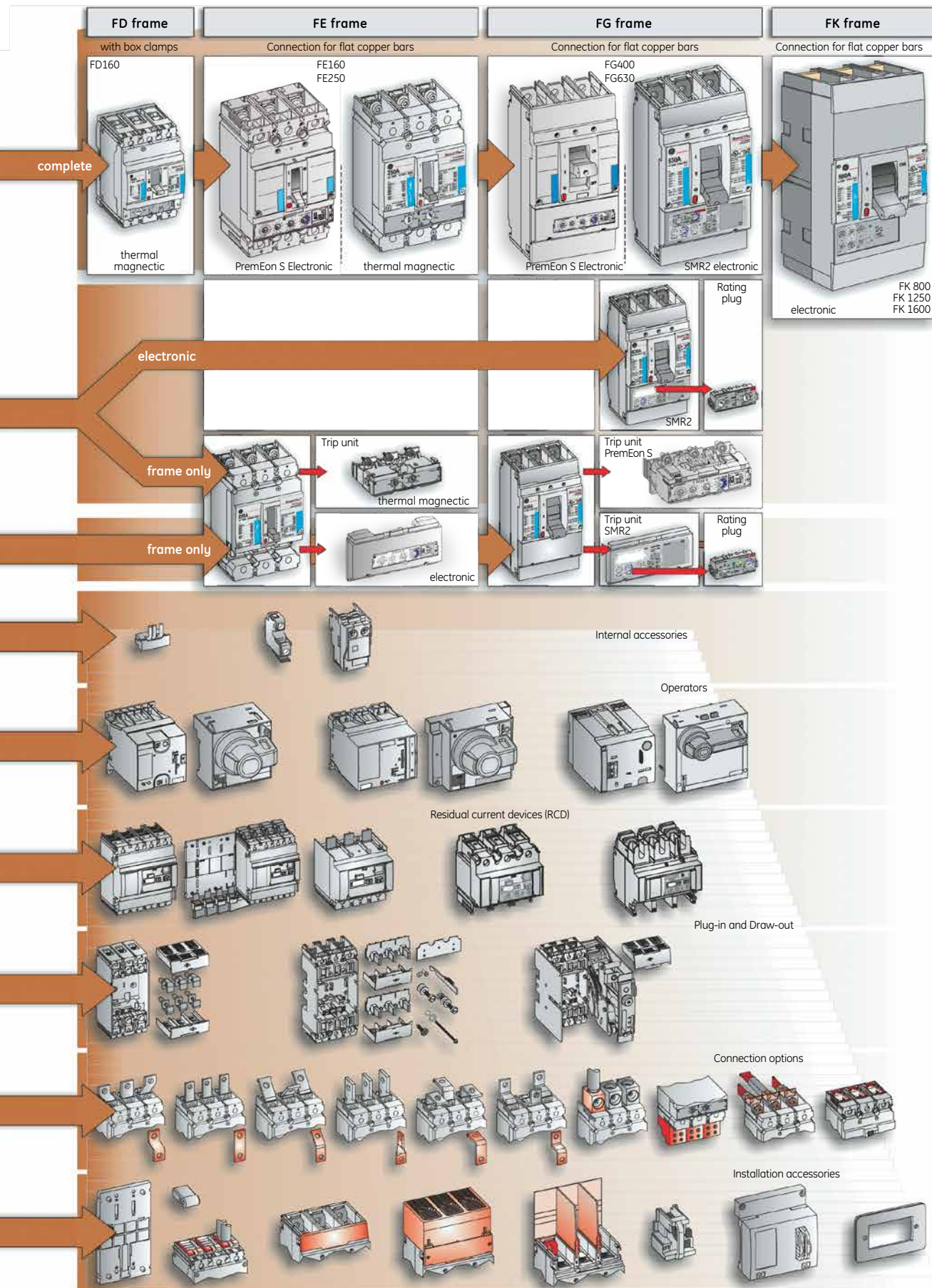
1 code
per operator

1 code
per complete set

order 1 **code**
per complete set

order 1 **code**
per load side or per line side

order 1 **code**
per accessory



FD frame

Breaking capacities

2, 3 and 4 pole types

Single pole types

Icu 400/415V AC
in kA effIcu 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

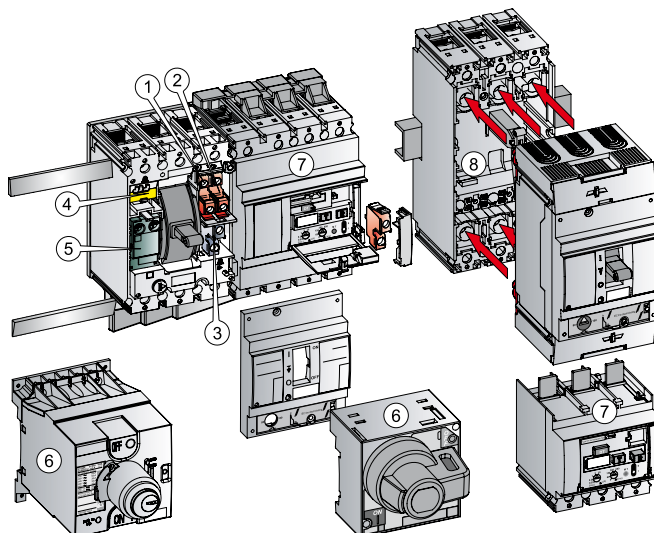
Trip Unit	Rated Current (A)	LTM	LTMD	GTM	Mag Break*	Trip Unit	Rated Current (A)	LTM
FD160 (2, 3 and 4 pole)	3	-	-	-	N,H	FD160 (1 pole)	-	-
	7	-	-	-	N,H		-	-
	12.5	-	-	-	N,H		-	-
	16	C,E	S,N,H	-	-		16	N,H
	20	C,E	S,N,H	-	N,H,L		20	N,H
	25	C,E	S,N,H,L	N,H	-		25	N,H
	30	-	-	-	N,H,L		-	-
	32	C,E	S,N,H,L	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)					Number of poles/ protected poles (trips)	
2 pole 2 trips	-	S,N,H,L	N,H	N,H,L	1 pole 1 trip	N,H
3 pole 3 trips	C, E	N,H,L	N,H	N,H,L		
4 pole 3 trips	-	S,N,H,L	N,H	-		
4 pole 4 trips	C, E	-	-	-		
4 pole 3.5 trips (N = 50%) ⁽²⁾	-	N,H,L	N,H	-		

Accessories

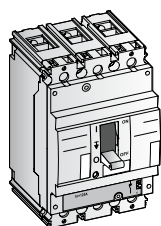
- ① Auxiliary contact left mounted (NO or NC)
- ② Auxiliary contact right mounted (NO or NC)
- ③ Bell Alarm trip unit (NO or NC)
- ④ Bell Alarm mechanism (CO)⁽¹⁾
- ⑤ Shunt or Undervoltage release
- ⑥ Operators
Rotary Handle
Electrical Operator
- ⑦ RCD, side or bottom mounted⁽¹⁾
(Insert indicates Bell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

(1) Not applicable for some FDC and FDE types.
(2) Rated current ≥ 63A

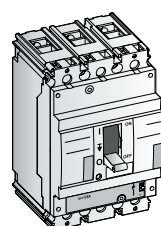


FD160 - Complete circuit breaker

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

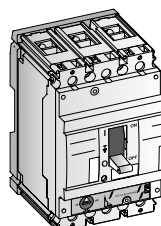


In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
16	FDC35TF016EF	433532	FDC45TF016EF	433926
20	FDC35TF020EF	433553	FDC45TF020EF	433928
25	FDC35TF025EF	433864	FDC45TF025EF	433930
32	FDC35TF032EF	433867	FDC45TF032EF	433932
40	FDC35TF040EF	433870	FDC45TF040EF	433934
50	FDC35TF050EF	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.				

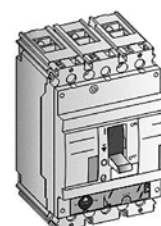


16	FDE36TF016EF	435127	FDE46TF016EF	435207
20	FDE36TF020EF	435129	FDE46TF020EF	435229
25	FDE36TF025EF	435130	FDE46TF025EF	435231
32	FDE36TF032EF	435132	FDE46TF032EF	435238
40	FDE36TF040EF	435135	FDE46TF040EF	435240
50	FDE36TF050EF	435138	FDE46TF050EF	435242
63	FDE36TF063EF	435145	FDE46TF063EF	435244
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.				

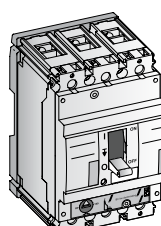
Line Thermal Magnetic LTM (adjustable thermals calibrated at 40°C)



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.				



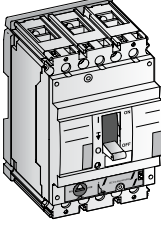
16	FDE36TE016ED	433649	FDE46TE016ED	433697
20	FDE36TE020ED	433651	FDE46TE020ED	433699
25	FDE36TE025ED	433653	FDE46TE025ED	433701
32	FDE36TE032ED	433655	FDE46TE032ED	433703
40	FDE36TE040ED	433657	FDE46TE040ED	433705
50	FDE36TE050ED	433659	FDE46TE050ED	433707
63	FDE36TE063ED	433661	FDE46TE063ED	433709
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.				

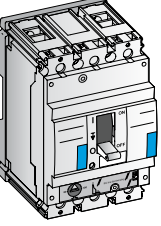
(1) Neutral on the left. If neutral on the right is needed, please contact us.



FD160 - Complete circuit breaker

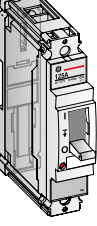
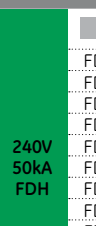
Selective Thermal Magnetic LTMD (Settable thermals calibrated at 40°C)

	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.				
 36 kA FDS	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				

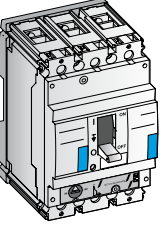
	In (A)	2 pole 2 trips		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.						
 50kA FDN	16	FDN66TD016ED	430143						
	20	FDN66TD020ED	430144						
	25	FDN66TD025ED	430145						
	32	FDN66TD032ED	430146						
	40	FDN66TD040ED	430147						
	50	FDN66TD050ED	430148						
	63	FDN66TD063ED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

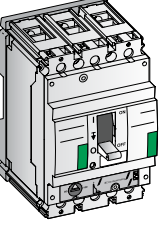
One code covers: a standard fixed front connection breaker + DIN-rail mounting kit + toggle elongator + breaker finishing covers + fixation hardware

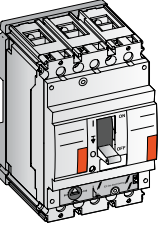
Line Thermal Magnetic LTM (fixed settings calibrated at 40°C)

	In (A)	1 pole 1 trip ⁽²⁾			In (A)	1 pole 1 trip ⁽²⁾	
		Cat. no.	Ref. no.			Cat. no.	Ref. no.
 240V 25kA FDN	16	FDN13TF016EF	433316	 240V 50kA FDH	16	FDH13TF016EF	433246
	20	FDN13TF020EF	433322		20	FDH13TF020EF	433255
	25	FDN13TF025EF	433328		25	FDH13TF025EF	433262
	32	FDN13TF032EF	433334		32	FDH13TF032EF	433268
	40	FDN13TF040EF	433340		40	FDH13TF040EF	433274
	50	FDN13TF050EF	433346		50	FDH13TF050EF	433280
	63	FDN13TF063EF	433352		63	FDH13TF063EF	433286
	80	FDN13TF080GF	433519		80	FDH13TF080GF	433292
	100	FDN13TF100GF	433522		100	FDH13TF100GF	433298
	125	FDN13TF125GF	433525		125	FDH13TF125GF	433304
	160	FDN13TF160GF	433527		160	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.
 50kA FDN	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

	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.
 80kA FDH	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

	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.
 150kA FDL	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

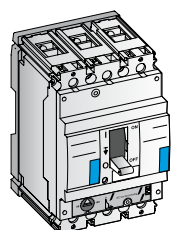
One code covers: a standard fixed front connection breaker + DIN-rail mounting kit + toggle elongator + breaker finishing covers + fixation hardware

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

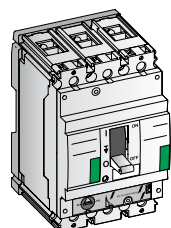
(2) Fixation hardware not suitable for mounting of one individual single pole breaker (see page A.10)

FD160 - Complete circuit breaker

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



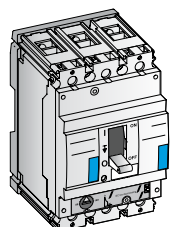
In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
50 kA FDN	25	FDN36TG025ED	430107	FDN436TG025ED	430124	FDN46TG025ED	430138	-
	32	FDN36TG032ED	430108	FDN436TG032ED	430125	FDN46TG032ED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



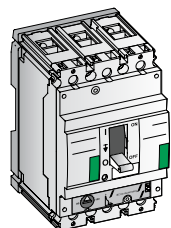
80kA FDH	25	FDH36TG025ED	430027	FDH436TG025ED	430044	FDH46TG025ED	430058	-
	32	FDH36TG032ED	430028	FDH436TG032ED	430045	FDH46TG032ED	430059	-
	40	FDH36TG040ED	430029	FDH436TG040ED	430046	FDH46TG040ED	430060	-
	50	FDH36TG050ED	430030	FDH436TG050ED	430047	FDH46TG050ED	430061	-
	63	FDH36TG063ED	430031	FDH436TG063ED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

One code covers: a standard fixed front connection breaker + DIN-rail mounting kit + toggle elongator + breaker finishing covers + fixation hardware

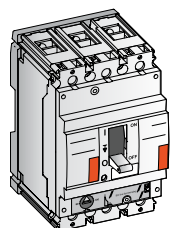
Motor Protection (Mag Break* Magnetic Only Breakers (Rated at 40°C)



In (A)	3 pole		4 pole ⁽¹⁾	
50kA FDN	3	FDN36MC003ED	436409	FDN436MC003ED
	7	FDN36MC007ED	430095	FDN436MC007ED
	12.5	FDN36MC012ED	430096	FDN436MC012ED
	20	FDN36MC020ED	430097	FDN436MC020ED
	30	FDN36MC030ED	430098	FDN436MC030ED
	50	FDN36MC050ED	430099	FDN436MC050ED
	80	FDN36MC080GD	430610	FDN436MC080GD
	100	FDN36MC100GD	430613	FDN436MC100GD



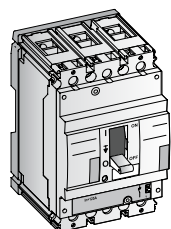
80kA FDH	3	FDH36MC003ED	436396	FDH436MC003ED
	7	FDH36MC007ED	430015	FDH436MC007ED
	12.5	FDH36MC012ED	430016	FDH436MC012ED
	20	FDH36MC020ED	430017	FDH436MC020ED
	30	FDH36MC030ED	430018	FDH436MC030ED
	50	FDH36MC050ED	430019	FDH436MC050ED
	80	FDH36MC080GD	430318	FDH436MC080GD
	100	FDH36MC100GD	430321	FDH436MC100GD



150kA FDL	20	FDL36MC020ED	430065	FDL436MC020ED
	30	FDL36MC030ED	430066	FDL436MC030ED
	50	FDL36MC050ED	430067	FDL436MC050ED
	80	FDL36MC080GD	430498	FDL436MC080GD
	100	FDL36MC100GD	430501	FDL436MC100GD

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⁾	
FDY	63	FDY306D063ED	430150	FDY406D063ED
	160	FDY306D160GD	430805	FDY406D160GD

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

E

F

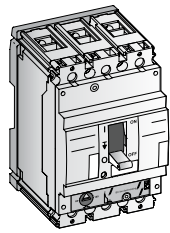
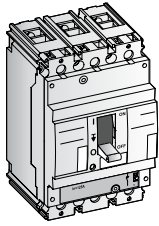
G

X



FD160 - Complete Circuit Breaker

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



	In (A)	3 pole 3 trips				3 pole 3 trips			
		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	FDE36T5C160GF	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

C

D

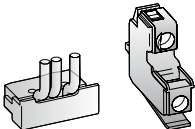
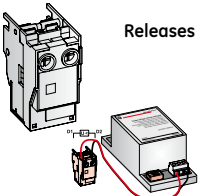
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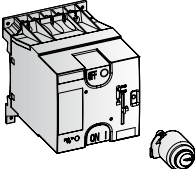
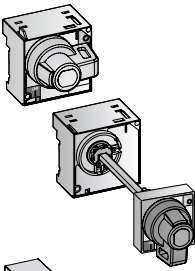
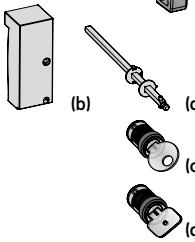
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X

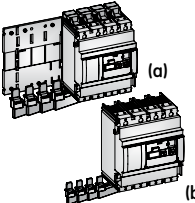
FD - Internal accessories

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	430880
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
	400/415V AC	FASHTU	430855	FAUVR8	436472	-

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.
	48V AC/DC	FDEMFF	430929			
	60V AC/DC	FDEMFB	430932			
	110V AC/DC	FDEMFB	430935			
	220/250V AC/DC	FDEMFB	430938			
	400/440V AC	FDEMFB	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⁾	-	-	FDNRV/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. 600mm) (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 and multidirectional supply kit					
	Side connected only					
	Voltage 220/440V AC	(b)	FDQDI3M/6	431086	FDQDI4M/6	431088
RCD bottom mounted ⁽⁵⁾ (below trip unit area)	One code covers an RCD with: DIN-rail mounting kit and interconnection kit.					
	Normally open		Normally closed			
	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

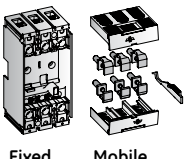
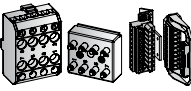
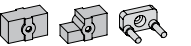
(2) Key included

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

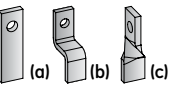
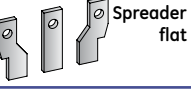
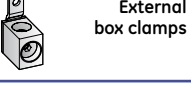
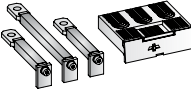
(4) On request 1xNO/1xNC is available.

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

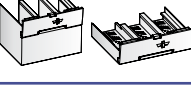
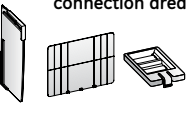
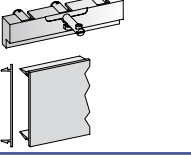
FD - Plug-in system⁽¹⁾

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Main system complete Fixed Mobile	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 and RCD	FDDFQ3	433489	FDDFQ4	433492
	Mobile part for breaker and 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				
 Auxiliary disconnects secondary wiring ⁽²⁾	Complete set 8 pole	FAPFM	430824		
	Fixed part 8 pole	FAPF8	430823		
	Mobile part 8 pole	FAPM8	430826		
	10 pole wired Plug and Socket for Plug-in Device	FAPPS	430827		
 Insertion prevention kit (of ...wrong A rating)	Insertion prevention kit (of ...wrong A rating)	FAPIP	430825		

FD - Connections: Optional⁽⁴⁾

			3 pole		4 pole	
 Extenders (a) (b) (c)	Standard flat type	(a)	FDBES3	430887	FDBES4	430888
	Heightened type	(b)	FDBEH3	430885	FDBEH4	430886
	Twisted 90°	(c)	FDBEA3	430883	FDBEA4	430884
 Spreader flat	Pole spacing 35mm		FDBSS3	430891	FDBSS4	430892
 External box clamps	Cable Cu/Al 95mm ² (3)		FDCA1316	433400	FDCA1416	433401
 Rear connections	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

			3 pole		4 pole	
 Terminal shields (with finishing covers)	Long, set of 2 pcs.		FDJL3	430951	FDJL4	430954
	Short, set of 2 pcs.		FDJS3	430960	FDJS4	430963
 Specific to connection area	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		
 Covers	Cut-out adaptor, Breaker + Trip unit		FDUF3	430830	FDUF4	430832
	Cut-out filler for cover plate (64mm), length of 1.2m		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)

Padlocking devices for toggle operator ⁽¹⁾		Cat. no.		Ref. no.	
	Padlocking removable	FD1PR	430879		
	Padlocking fixed	FD1PF	430878		
Circuit indication/coding	Set of 20 blank labels	FAC	430821		
Heightning set for Redline/ElfaPlus MCBs	Length = (18 mod. of 18mm) 354mm	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	FDFF3	430941	FDFF4	430942
	Rotary handle (through cover plate model)	FD FH	430829	-	-
	Electrical operator	FDFE	432010	-	-
Spare parts	DIN-rail adaptor kit ⁽²⁾	FDKD3	430966	FDKD4	430967
	Finishing covers, set of 2 pcs. ⁽²⁾	FDUA3	431025	FDUA4	431026
	Spare toggle (set of 5 pieces)	FDUT	433539	-	-

(1) Padlocks not included

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

FE frame



LTM

Line thermal magnetic protection

LTMD

Selective thermal magnetic protection

GTM

Generator thermal magnetic protection

Mag Break*

Magnetic Only protection

PremEon S

Selective electronic trip unit

Y

Non Automatic or switch (not mentioned in tables)

- ① Auxiliary contact left mounted (NO or NC) 1 or 2 pcs.
- ② Auxiliary contact right mounted (NO or NC) 1 or 2 pcs.
- 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)
- ⑧ (Insert indicates Bell alarm contact mounting) Plug-in or draw-out system

Breaking capacities

Icu 400/415V AC in kA eff

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

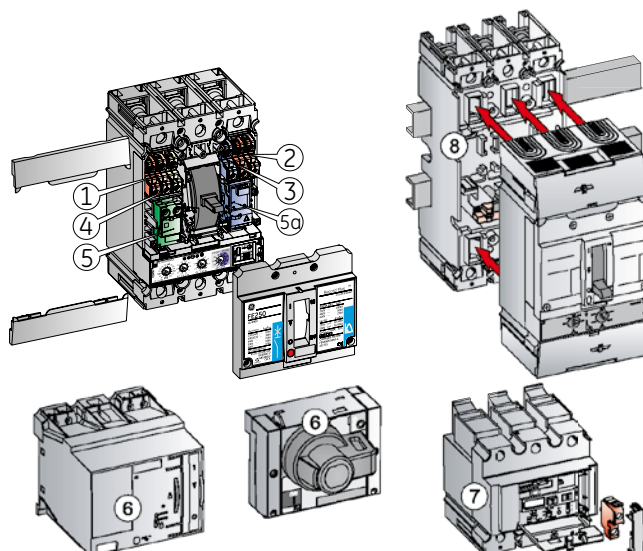
Protection

Trip Unit	Rated Current (A)	LTM	LTMD	GTM	Mag Break*	PremEon S
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
FE250	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
	125	V	N, H, L	-	-	V, N, H, L
	160	V	N, H, L	N, H, L	N, H, L	V, 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	V, N, H, L

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

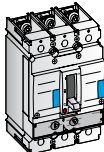
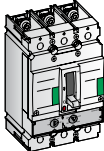
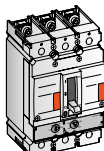
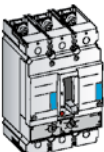
(1) Rated current ≥ 63A

Accessories (main types)

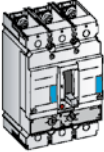
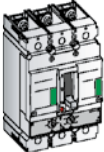
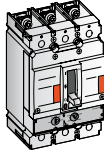
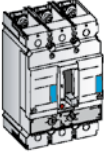


FE160 - Complete circuit breaker

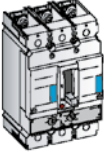
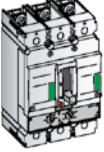
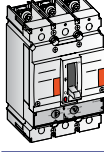
Line Thermal Magnetic LTM (adjustable settings; calibrated at 40°C)

	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.
	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
	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
	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.
	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
	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
	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.
	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
	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
	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.

FE frame

Intro

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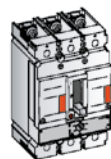
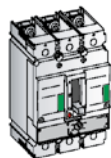
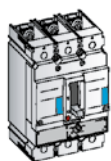
G

X



FE160 - Complete circuit breaker

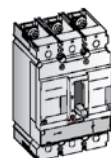
Motor protection (Mag Break*) Magnetic Only Breaker (Rated at 40°C)



In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FEN	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	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	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

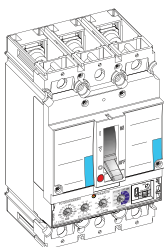
Complete Non-Automatic Circuit Breaker (Switch rated at 40°C)



In (A)	3 pole		4 pole ⁽¹⁾	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
FEY 160	FEY306D160JF 431988		FEY406D160JF 431994	

One code covers: a standard fixed front connection breaker + toggle elongator + breaker finishing covers + fixation hardware

Selective Electronic Trip Unit PremEon S (LT, ST and I)



In (A)	3 pole		4 pole	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	25	FEV37DA025JF 437405	FEV47DA025JF 437420	
	63	FEV37DA063JF 437444	FEV47DA063JF 437452	
	125	FEV37DA125JF 437476	FEV47DA125JF 437484	
	160	FEV37DA160JF 437508	FEV47DA160JF 437516	

One code covers: a standard fixed front connection breaker + fixation hardware

50kA FEN	25	FEN37DA025JF 437400	FEN47DA025JF 437416	
	63	FEN37DA063JF 437441	FEN47DA063JF 437449	
	125	FEN37DA125JF 437473	FEN47DA125JF 437481	
	160	FEN37DA160JF 437505	FEN47DA160JF 437513	

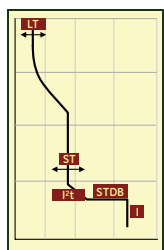
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

80kA FEH	25	FEH37DA025JF 437401	FEH47DA025JF 437418	
	63	FEH37DA063JF 437442	FEH47DA063JF 437450	
	125	FEH37DA125JF 437474	FEH47DA125JF 437482	
	160	FEH37DA160JF 437506	FEH47DA160JF 437514	

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

150kA FEL	25	FEL37DA025JF 437402	FEL47DA025JF 437419	
	63	FEL37DA063JF 437443	FEL47DA063JF 437451	
	125	FEL37DA125JF 437475	FEL47DA125JF 437483	
	160	FEL37DA160JF 437507	FEL47DA160JF 437515	

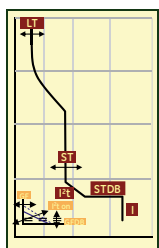
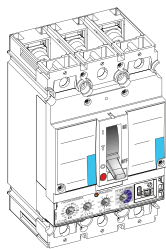
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware



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

FE160 - Complete circuit breaker

Selective Electronic Trip Unit PremEon S (LT, ST, I and GF)



	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	25	FEV37DD025JF	437428	FEV47DD025JF	437432
	63	FEV37DD063JF	437460	FEV47DD063JF	437464
	125	FEV37DD125JF	437492	FEV47DD125JF	437496
	160	FEV37DD160JF	437524	FEV47DD160JF	437528

One code covers: a standard fixed front connection breaker + fixation hardware

50kA FEN	25	FEN37DD025JF	437425	FEN47DD025JF	437429
	63	FEN37DD063JF	437457	FEN47DD063JF	437461
	125	FEN37DD125JF	437489	FEN47DD125JF	437493
	160	FEN37DD160JF	437521	FEN47DD160JF	437525

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

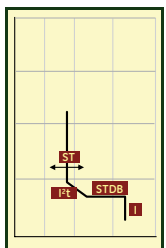
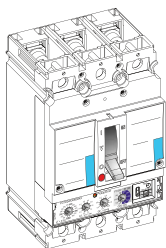
80kA FEH	25	FEH37DD025JF	437426	FEH47DD025JF	437430
	63	FEH37DD063JF	437458	FEH47DD063JF	437462
	125	FEH37DD125JF	437490	FEH47DD125JF	437494
	160	FEH37DD160JF	437522	FEH47DD160JF	437526

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

150kA FEL	25	FEL37DD025JF	437427	FEL47DD025JF	437431
	63	FEL37DD063JF	437459	FEL47DD063JF	437463
	125	FEL37DD125JF	437491	FEL47DD125JF	437495
	160	FEL37DD160JF	437523	FEL47DD160JF	437527

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

Selective Electronic Trip Unit PremEon S (ST and I)



	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	25	FEV37DN025JF	437413	FEV47DN025JF	437424
	63	FEV37DN063JF	437448	FEV47DN063JF	437456
	125	FEV37DN125JF	437480	FEV47DN125JF	437488
	160	FEV37DN160JF	437512	FEV47DN160JF	437520

One code covers: a standard fixed front connection breaker + fixation hardware

50kA FEN	25	FEN37DN025JF	437406	FEN47DN025JF	437421
	63	FEN37DN063JF	437445	FEN47DN063JF	437453
	125	FEN37DN125JF	437477	FEN47DN125JF	437485
	160	FEN37DN160JF	437509	FEN47DN160JF	437517

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

80kA FEH	25	FEH37DN025JF	437409	FEH47DN025JF	437422
	63	FEH37DN063JF	437446	FEH47DN063JF	437454
	125	FEH37DN125JF	437478	FEH47DN125JF	437486
	160	FEH37DN160JF	437510	FEH47DN160JF	437518

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

150kA FEL	25	FEL37DN025JF	437412	FEL47DN025JF	437423
	63	FEL37DN063JF	437447	FEL47DN063JF	437455
	125	FEL37DN125JF	437479	FEL47DN125JF	437487
	160	FEL37DN160JF	437511	FEL47DN160JF	437519

One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware

FE frame

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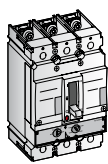
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New



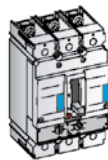
FE250 - Complete circuit breaker

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

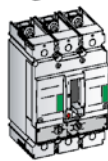


	In (A)	3 pole 3 trips		4 pole 4 trips ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36 kA FEV	125	FEV36TA125KF	432416	FEV46TA125KF	431082
	160	FEV36TA160KF	436798	FEV46TA160KF	436817
	200	FEV36TA200KF	431058	FEV46TA200KF	431094
	250	FEV36TA250KF	431061	FEV46TA250KF	431097
One code covers: a standard fixed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

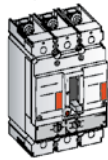
Selective Thermal Magnetic LTMD (adjustable settings; calibrated at 40°C)



	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	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

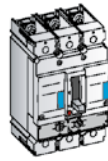


80 kA FEH	125	FEH36TD125KF	431393	FEH436TD125KF	432209	FEH46TD125KF	432300	FEH456TD125KF	432254
	160	FEH36TD160KF	431980	FEH436TD160KF	432218	FEH46TD160KF	432307	FEH456TD160KF	432263
	200	FEH36TD200KF	432076	FEH436TD200KF	432223	FEH46TD200KF	432311	FEH456TD200KF	432266
	250	FEH36TD250KF	432096	FEH436TD250KF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

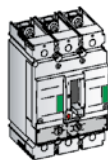


150 kA FEL	125	FEL36TD125KF	432344	FEL436TD125KF	432576	FEL46TD125KF	432924	FEL456TD125KF	432780
	160	FEL36TD160KF	432353	FEL436TD160KF	432588	FEL46TD160KF	432930	FEL456TD160KF	432843
	200	FEL36TD200KF	432357	FEL436TD200KF	432618	FEL46TD200KF	432933	FEL456TD200KF	432868
	250	FEL36TD250KF	432361	FEL436TD250KF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

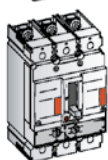
Generator Thermal Magnetic GTM (adjustable settings; calibrated at 40°C)



	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	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

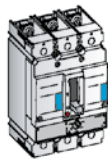


80 kA FEH	160	FEH36TG160KF	434820	FEH436TG160KF	435905	FEH46TG160KF	434931	FEH456TG160KF	435908
	200	FEH36TG200KF	434823	FEH436TG200KF	435906	FEH46TG200KF	434934	FEH456TG200KF	435909
	250	FEH36TG250KF	434826	FEH436TG250KF	435907	FEH46TG250KF	434937	FEH456TG250KF	435910

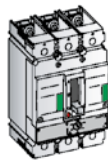


150 kA FEL	160	FEL36TG160KF	435935	FEL436TG160KF	435953	FEL46TG160KF	436005	FEL456TG160KF	435971
	200	FEL36TG200KF	435938	FEL436TG200KF	435956	FEL46TG200KF	436008	FEL456TG200KF	435974
	250	FEL36TG250KF	435941	FEL436TG250KF	435959	FEL46TG250KF	436011	FEL456TG250KF	435977
One code covers: a standard fixed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

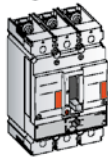
Motor protection (Mag Break*) Magnetic Only Breaker (Rated at 40°C)



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



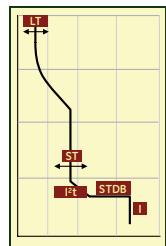
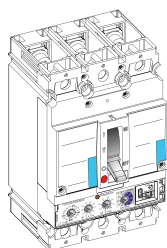
80 kA FEH	160	FEH36MC160KF	434766	FEH436MC160KF	434841
	200	FEH36MC200KF	436754	FEH436MC200KF	436755
	250	FEH36MC250KF	434769	FEH436MC250KF	434844



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 PremEon S (LT, ST and I)

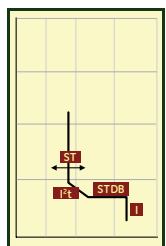
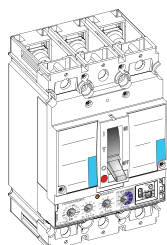
	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	125	FEV37DA125KF	437540	FEV47DA125KF	437548
	160	FEV37DA160KF	437572	FEV47DA160KF	437580
	250	FEV37DA250KF	437604	FEV47DA250KF	437612
50kA FEN	125	FEN37DA125KF	437537	FEN47DA125KF	437545
	160	FEN37DA160KF	437569	FEN47DA160KF	437577
	250	FEN37DA250KF	437601	FEN47DA250KF	437609
80kA FEH	125	FEH37DA125KF	437538	FEH47DA125KF	437546
	160	FEH37DA160KF	437570	FEH47DA160KF	437578
	250	FEH37DA250KF	437602	FEH47DA250KF	437610
150kA FEL	125	FEL37DA125KF	437539	FEL47DA125KF	437547
	160	FEL37DA160KF	437571	FEL47DA160KF	437579
	250	FEL37DA250KF	437603	FEL47DA250KF	437611
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

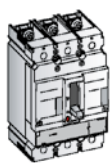
Selective Electronic Trip Unit PremEon S (LT, ST, I and GF)

	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	125	FEV37DD125KF	437556	FEV47DD125KF	437560
	160	FEV37DD160KF	437588	FEV47DD160KF	437592
	250	FEV37DD250KF	437620	FEV47DD250KF	437624
50kA FEN	125	FEN37DD125KF	437553	FEN47DD125KF	437557
	160	FEN37DD160KF	437585	FEN47DD160KF	437589
	250	FEN37DD250KF	437617	FEN47DD250KF	437621
80kA FEH	125	FEH37DD125KF	437554	FEH47DD125KF	437558
	160	FEH37DD160KF	437586	FEH47DD160KF	437590
	250	FEH37DD250KF	437618	FEH47DD250KF	437622
150kA FEL	125	FEL37DD125KF	437555	FEL47DD125KF	437559
	160	FEL37DD160KF	437587	FEL47DD160KF	437591
	250	FEL37DD250KF	437619	FEL47DD250KF	437623
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

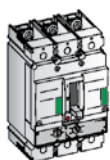
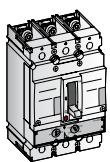
Selective Electronic Trip Unit PremEon S (ST and I)

	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
36kA FEV	125	FEV37DN125KF	437544	FEV47DN125KF	437552
	160	FEV37DN160KF	437576	FEV47DN160KF	437584
	250	FEV37DN250KF	437608	FEV47DN250KF	437616
One code covers: a standard fixed front connection breaker + fixation hardware					
50kA FEN	125	FEN37DN125KF	437541	FEN47DN125KF	437549
	160	FEN37DN160KF	437573	FEN47DN160KF	437581
	250	FEN37DN250KF	437605	FEN47DN250KF	437613
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FEH	125	FEH37DN125KF	437542	FEH47DN125KF	437550
	160	FEH37DN160KF	437574	FEH47DN160KF	437582
	250	FEH37DN250KF	437606	FEH47DN250KF	437614
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FEL	125	FEL37DN125KF	437543	FEL47DN125KF	437551
	160	FEL37DN160KF	437575	FEL47DN160KF	437583
	250	FEL37DN250KF	437607	FEL47DN250KF	437615
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					



FE250 - Complete Circuit Breaker*Complete Non-Automatic Circuit Breaker (Switch rated at 40°C)*

	In (A)	3 pole		4 pole ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
FEY	250	FEY306D250KF	431991	FEY406D250KF	431997

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

	In (A)	3 pole 3 trips			
36 kA FEV	125	FEV36T5A125KF	431219		
	160	FEV36T5A160KF	431220		
	200	FEV36T5A200KF	431221		
	225	FEV36T5A225KF	431222		

50 kA FEN	100	FEN36T5D100KF	431223		
	125	FEN36T5D125KF	431224		
	160	FEN36T5D160KF	431226		
	200	FEN36T5D200KF	431229		
	225	FEN36T5D225KF	431232		

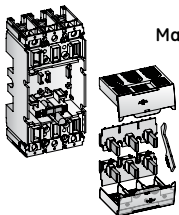
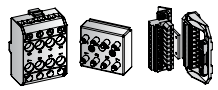
80 kA FEH	100	FEH36T5D100KF	431235		
	125	FEH36T5D125KF	431243		
	160	FEH36T5D160KF	431244		
	200	FEH36T5D200KF	431245		
	225	FEH36T5D225KF	431247		

One code covers: a standard, fixed front connection breaker + fixation hardware

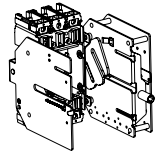
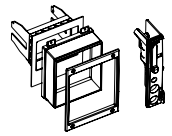
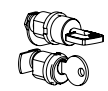
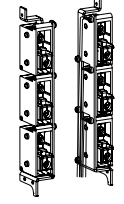
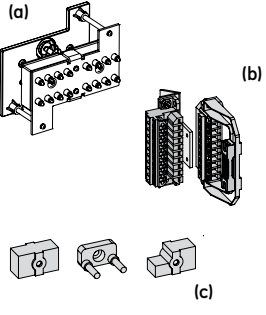
(1) Neutral on the left. If neutral on the right is needed, please contact us



FE - Plug-in system

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Main system	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 and RCD	FEDFQ3	430987	FEDFQ4	431842
	Mobile part for breaker and 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 and socket for plug-in device	FAPPS	430827		
Spares	Set of nutplates and connection bolts (For connection of bases used as spare)	FEJN3	436467	FEJN4	436468

FE- Draw-out system

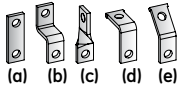
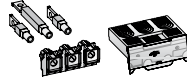
		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Draw-out system	Complete set for breaker				
	Draw-out system for behind door applications	FEWB3	432538	FEWB4	432544
 Through Door mounting kits	Through door adaption kit with padlocking and keylocking option⁽²⁾				
	Toggle Operated	FEWT	432580	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

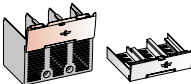
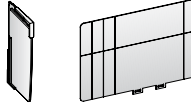
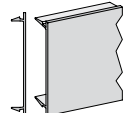
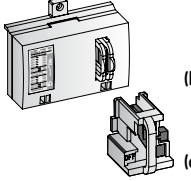
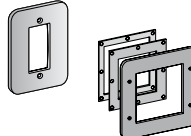
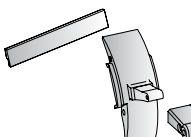
FE - Connections: Optional

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Extenders⁽¹⁾	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
 Rear connections⁽¹⁾	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	432157
	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 35mm ²			
	Set 3 pole	FETCA630A	880954		
	Set 4 pole	FETCA640A	880955		

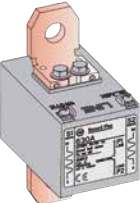
(1) Set for equipping the line OR load side of the breaker

(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	Cut-out filler for cover plate (64mm), length of 1.2m	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	FDFF3	430941	FDFF3	430941
	Front face toggle area	FEFT	432071	FEFT	432071
	Rotary handle (through cover plate model)	FDFFH	430829	FDFFH	430829
	Motor operator	FEFE	430943	FEFE	430943
 Spare parts	Finishing covers, set of 2 pcs. ⁽²⁾	FEUA3	432162	FEUA4	432163
	Spare toggle (set of 5 pcs.)	FEUT	433540	FEUT	433540

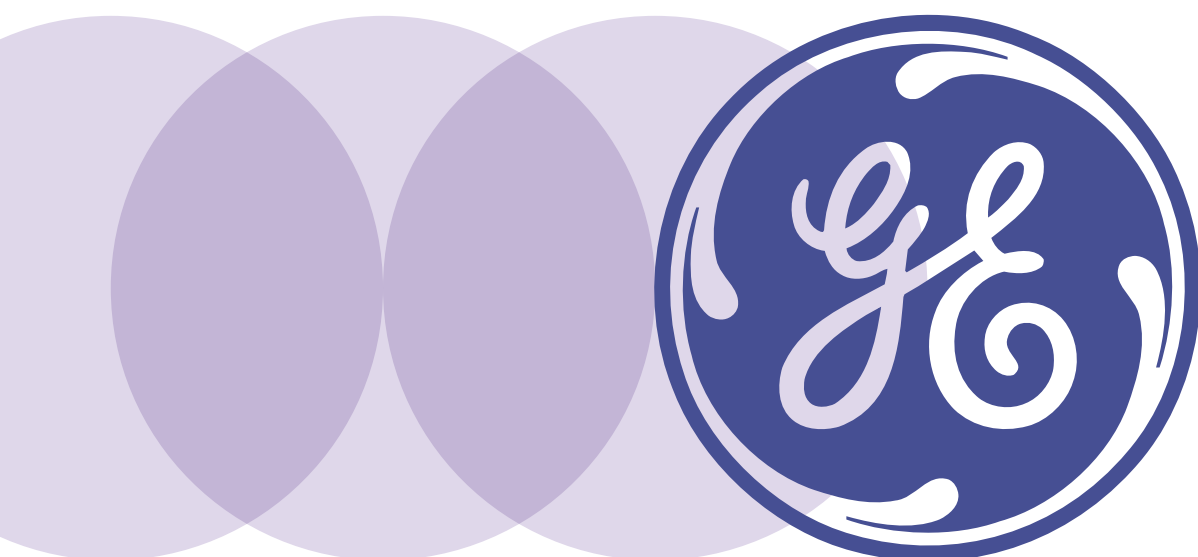
PremEon electronic trip units: sensors for use with ground fault protection

	Neutral sensors ⁽³⁾	FE160 and FE250 models	
		Cat. no.	Ref. no.
	In = 25A	FEGS0025	437881
	In = 63A	FEGS0063	437882
	In = 125A	FEGS0125	437883
	In = 160A	FEGS0160	437884
	In = 250A	FEGS0250	437885

(1) Padlocks not included

(2) Supplied with breakers, not with FEV type

(3) Image is of the FG model



FG frame



PremEon S

Selective electronic protection.

SMR2

Modular electronic protection with enhanced functionality

Y

Non Automatic or switch
(not mentioned in tables)

Breaking capacities

Icu 400/415V AC in kA eff

Type	N	H	L
FG400	50	80	150
FE630	50	80	150

Protection

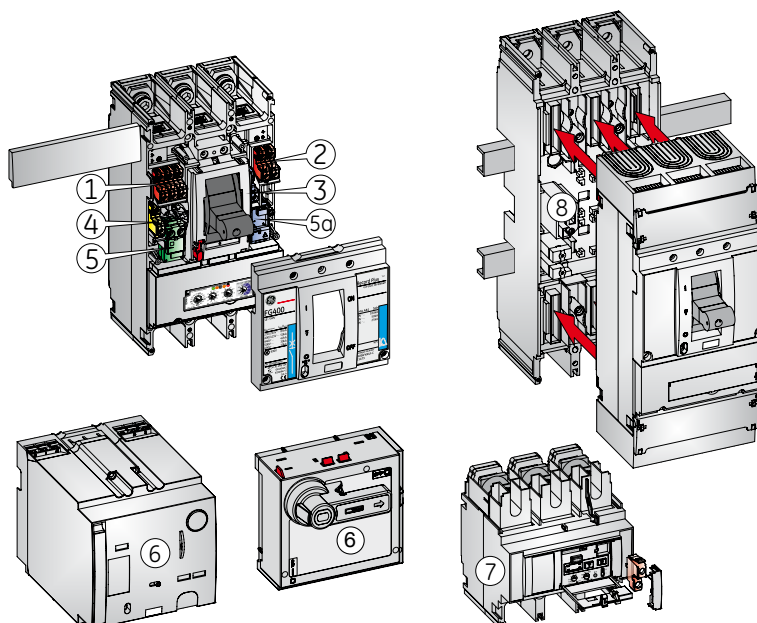
Trip Unit	Rated Current (A)	PremEon S	SMR2
FG400	250	N, H, L	N, H, L
	350	-	N, H, L
	400	N, H, L	N, H, L
FG630	400	N, H, L	N, H, L
	500	N, H, L	N, H, L
	630	N, H, L	N, H, L

Number of poles/ protected poles (trips)

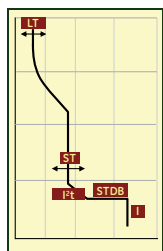
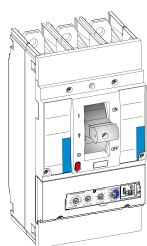
Number of poles/ protected poles (trips)	PremEon S	SMR2
3 pole 3 trips	N, H, L	N, H, L
4 pole 3 trips	N, H, L	N, H, L
4 pole 4 trips	N, H, L	N, H, L
4 pole 3.5 trips (N = 50%)	N, H, L	N, H, L

Accessories (main types)

- ① Auxiliary contact left mounted (NO or NC) 1, 2 or 3 pcs.
- ② Auxiliary contact right mounted (NO or NC) 1 or 2 pcs.
- 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 PremEon S (LT, ST and I)

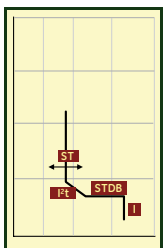
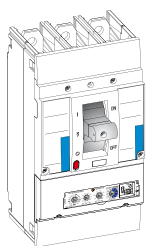
	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	250	FGN37DA250LF	438400	FGN47DA250LF	438408
	400	FGN37DA400LF	438432	FGN47DA400LF	438440
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	250	FGH37DA250LF	438401	FGH47DA250LF	438409
	400	FGH37DA400LF	438433	FGH47DA400LF	438441
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FGL	250	FGL37DA250LF	438402	FGL47DA250LF	438410
	400	FGL37DA400LF	438434	FGL47DA400LF	438442
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

Selective Electronic Trip Unit PremEon S (LT, ST, I and GF)

	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	250	FGN37DD250LF	438416	FGN47DD250LF	438420
	400	FGN37DD400LF	438448	FGN47DD400LF	438452
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	250	FGH37DD250LF	438417	FGH47DD250LF	438421
	400	FGH37DD400LF	438449	FGH47DD400LF	438453
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FEL	250	FGL37DD250LF	438418	FGL47DD250LF	438422
	400	FGL37DD400LF	438450	FGL47DD400LF	438454
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

Selective Electronic Trip Unit PremEon S (ST and I)

	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	250	FGN37DN250LF	438404	FGN47DN250LF	438412
	400	FGN37DN400LF	438436	FGN47DN400LF	438444
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	250	FGH37DN250LF	438405	FGH47DN250LF	438413
	400	FGH37DN400LF	438437	FGH47DN400LF	438445
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FGL	250	FGL37DN250LF	438406	FGL47DN250LF	438414
	400	FGL37DN400LF	438438	FGL47DN400LF	438446
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					



FG frame

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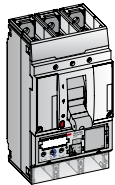
G

New



FG400 - Complete circuit breaker

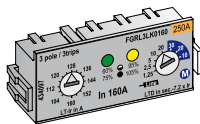
Modular Electronic Trip Unit (SMR2) without Rating Plug



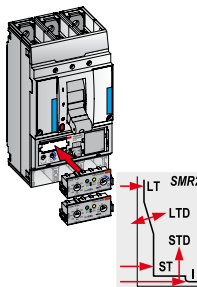
	In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FGN	250	FGN36KA250LKF	434073	FGN46KA250LKF	436159				
	350 ⁽²⁾	FGN36KA350LLF	434483	FGN46KA350LLF	434510				
	400	FGN36KA400LLF	436156	FGN46KA400LLF	436160				
80kA FGH	250	FGH36KA250LKF	436150	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: $I_r = 0.625 \times I_n$
LTD: Line and Motor; 8 options

Adjustable LT and LTD settable Rating Plugs for Trip Units SMR2

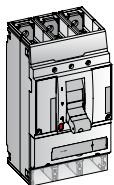


	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
250A	160	FGRL3LK0160/7	436749	FGRL4LK0160/7	434469	FGRL4LK0160/7	434559	FGRL45LK0160/7	434472
	250	FGRL3LK0250/7	436656	FGRL4LK0250/7	434615	FGRL4LK0250/7	434562	FGRL45LK0250/7	434481
400A	250	FGRL3LL0250/7	436747	FGRL4LL0250/7	434599	FGRL4LL0250/7	434568	FGRL45LL0250/7	434579
	400	FGRL3LL0400/7	436721	FGRL4LL0400/7	434617	FGRL4LL0400/7	434584	FGRL45LL0400/7	434482
350 ⁽²⁾	350 ⁽²⁾	FGRL3LL0350/7	436748	FGRL4LL0350/7	434601	FGRL4LL0350/7	434582	FGRL45LL0350/7	434596

Modular Electronic Trip Unit (SMR2) with two adjustable Rating Plugs, setting $0.4 - 1 \times I_n$ 

	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	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									

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

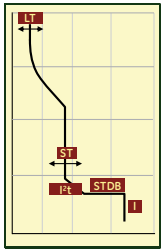
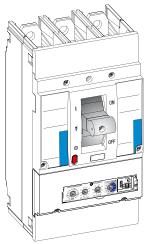


	In (A)	3 pole		4 pole	
FGY	400	FGY306D400LF	431659	FGY406D400LF	431671
One code covers: a standard fixed front connection breaker + assembled trip unit + toggle elongator + breaker finishing covers + fixation hardware					

- (1) Neutral on the left. If neutral on the right is needed, please contact us.
(2) Specifically configured for Motor Protection

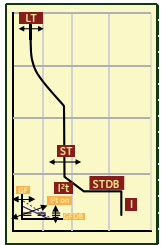
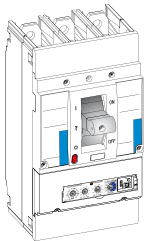
FG630 - Complete circuit breaker

Selective Electronic Trip Unit PremEon S (LT, ST and I)



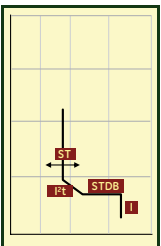
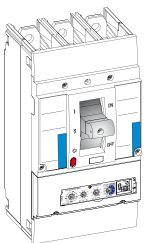
	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	400	FGN37DA400NF	438464	FGN47DA400NF	438472
	630	FGN37DA630NF	438496	FGN47DA630NF	438504
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	400	FGH37DA400NF	438465	FGH47DA400NF	438473
	630	FGH37DA630NF	438497	FGH47DA630NF	438505
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FGL	400	FGL37DA400NF	438466	FGL47DA400NF	438474
	630	FGL37DA630NF	438498	FGL47DA630NF	438506
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

Selective Electronic Trip Unit PremEon S (LT, ST, I and GF)



	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	400	FGN37DD400NF	438480	FGN47DD400NF	438484
	630	FGN37DD630NF	438512	FGN47DD630NF	438516
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	400	FGH37DD400NF	438481	FGH47DD400NF	438485
	630	FGH37DD630NF	438513	FGH47DD630NF	438517
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FEL	400	FGL37DD400NF	438482	FGL47DD400NF	438486
	630	FGL37DD630NF	438514	FGL47DD630NF	438518
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

Selective Electronic Trip Unit PremEon S (ST and I)



	In (A)	3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FGN	400	FGN37DN400NF	438468	FGN47DN400NF	438476
	500	FGN37DN500NF	438500	FGN47DN500NF	438508
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
80kA FGH	400	FGH37DN400NF	438469	FGH47DN400NF	438477
	500	FGH37DN500NF	438501	FGH47DN500NF	438509
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					
150kA FGL	400	FGL37DN400NF	438470	FGL47DN400NF	438478
	500	FGL37DN500NF	438502	FGL47DN500NF	438510
One code covers: a standard fixed front connection breaker + toggle elongator + finishing covers + fixation hardware					

FG frame

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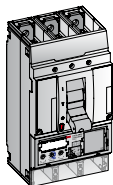
G

New



FG630 - Complete circuit breaker

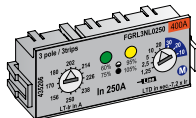
Modular Electronic Trip Unit (SMR2) without Rating Plug



	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	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									

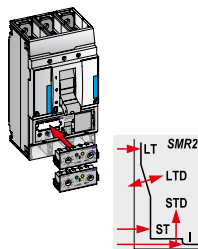
LT: $I_r = 0.625 \times I_n$
LTD: Line and Motor; 8 options

Adjustable LT and LTD settable Rating Plugs for Trip Units SMR2



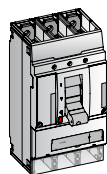
	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
400A	250	FGRL3NL0250/7	436739	FGRL43NL0250/7	434588	FGRL4NL0250/7	434492	FGRL45NL0250/7	434592
	400	FGRL3NL0400/7	436746	FGRL43NL0400/7	434590	FGRL4NL0400/7	434493	FGRL45NL0400/7	434594
630A	400	FGRL3NN0400/7	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

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	FGN436VA630NNF	435158	FGN46VA630NNF	435176	FGN456VA630NNF	435167
80kA FGH	630	FGH36VA630NNF	434958	FGH436VA630NNF	434965	FGH46VA630NNF	435003	FGH456VA630NNF	434977
150kA FGL	630	FGL36VA630NNF	435071	FGL436VA630NNF	435091	FGL46VA630NNF	435134	FGL456VA630NNF	435122
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									

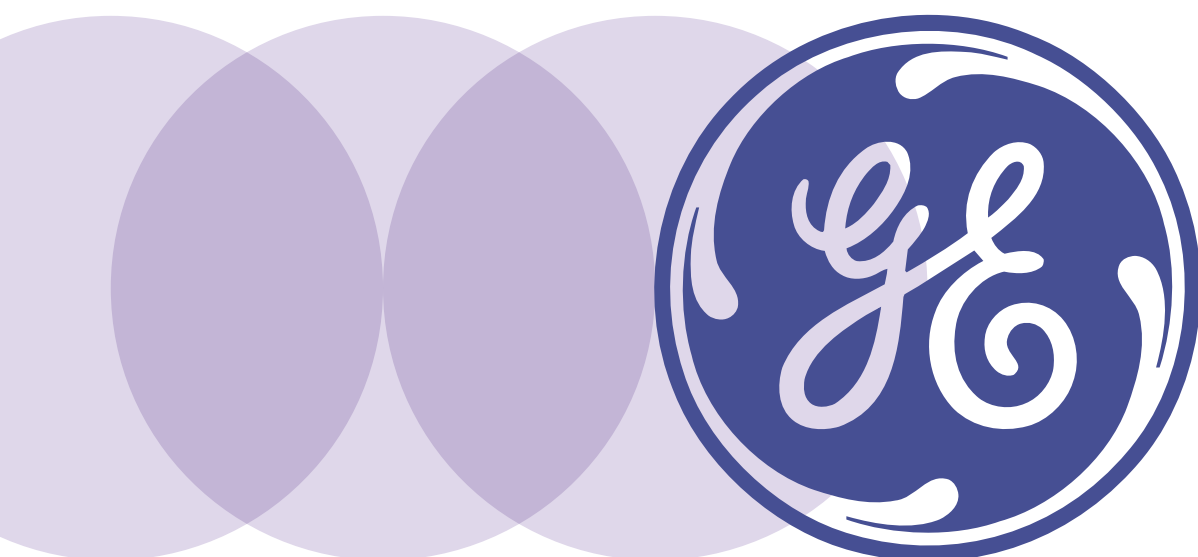
Non-Automatic Circuit Breaker (Switch rated at 40°C)



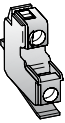
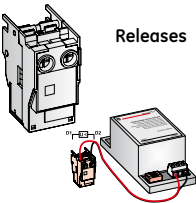
	In (A)	3 pole	4 pole ⁽¹⁾	
630	FGY306D630NF	431665	FGY406D630NF	431687
FGY	One code covers: a standard fixed front connection breaker + assembled trip unit + toggle elongator + breaker finishing covers + fixation hardware			

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

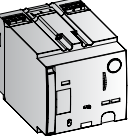
(2) Specifically configured for Motor Protection.

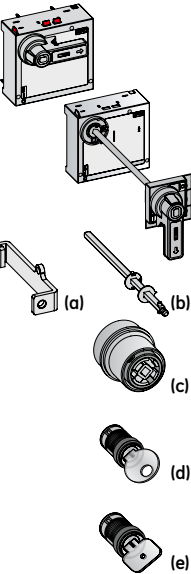


FG - Internal accessories

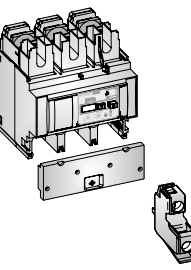
		Normally open		Normally closed		Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.		
	Contacts	Aux. switch right mounted	FAS10R	430837	FAS01R	430831	
		Aux. switch left mounted	FAS10L	430834	FAS01L	430828	
		Bell alarm electronic trip unit	FABAT10	430818	FABAT01	430815	
		Bell alarm mechanism	FABAM10	432003	FABAM01	432000	
		Bell alarm RCD device	FABAT10	430818	FABAT01	430815	
	Releases	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	-
							430858

FG - Operators - Factory fitted

	Electrical operators	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			

		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.
	Rotary handles	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
		Red	-	-	-	-	FGNRDV/5
		Grey + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	-	FGNRZ/5
		Red + Early closing Aux. Switches 2xNO ⁽³⁾	-	-	-	-	FGNRZV/5
							436506
							436507
							436515
							436516

FG - Residual current devices

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
	RCD bottom mounted ⁽⁴⁾	400/630A Voltage 200/440V AC	FGQDB3M/6	431172	FGQDB4M/6
				431181	

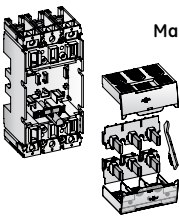
(1) Key included

(2) Add door flange FGfH for door lock options

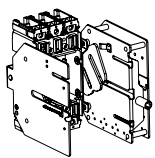
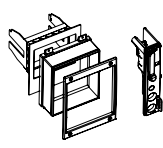
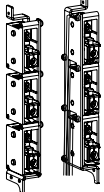
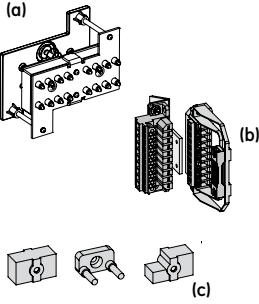
(3) On request 1xNO/1xNC is available.

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

FG - Plug-in system

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Main system	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 and 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 - Draw-out system

		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
 Draw-out system	Complete set for breaker Draw-out 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		
	With Rotary Handle Type FGNRC and FGNRY	FGWN	432598		
	Adaption kit ONLY with padlocking and keylocking option on door Breaker operation behind door	FAWE	432619		
 Keylocks	Keylock for draw-out position RONIS 1104b ⁽³⁾	FA1BRWD	432613		
	Keylock for draw-out 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 draw-out Breaker (a) (Secondary wiring)	FGWA2	432601		
	24 pole complete set for draw-out Breaker (Secondary wiring)	FGWA3	432604		
	10 pole wired plug and socket for Plug-in or Draw-out device (b)	FAPPS	430827		
	Rating adjustable interlock kit between fixed and 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

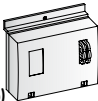
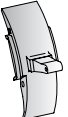
(3) A maximum of two locks can be placed (with through door kits only)

FG - Connections: optional

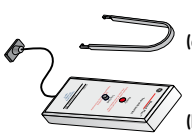
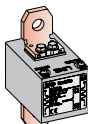
		3 pole		4 pole		
		Cat. no.	Ref. nr.	Cat. no.	Ref. nr.	
 (a) (b) (c)	Extenders	Standard flat type	(a) FGBES3	431696	FGBES4	431697
		Heightened type	(b) FGBEH3	431691	FGBEH4	431695
		Twisted 90° c	(c) FGBEA3	431686	FGBEA4	431690
	Spreader flat ⁽¹⁾	Pole spacing 52.5mm	FGBSS3	431981	FGBSS4	431982
	Rear 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
	Semi-internal box clamps ⁽¹⁾		One cable 240mm ² or two cables 95mm ²		Two cables 1x300mm ² and 1x240mm ²	
		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.

FG - Installation accessories

Terminal shields (with finishing covers)	3 pole		4 pole	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
 	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⁾  (a)  (b)	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   		3 pole	4 pole	
	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 PremEon S and SMR2

	(a)	Rating plug tool (SMR2) (a)	FAR	433500	
	(b)	Battery test device (SMR2)	FAZ	431406	
	(d)	Ground Fault Sensor 250A	FGGS0250	431870	
	(d)	Ground Fault Sensor 400A	FGGS0400	432838	
	(d)	Ground Fault Sensor 630A	FGGS0630	432839	

(1) Padlocks not included

FK frame



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)

- 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

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

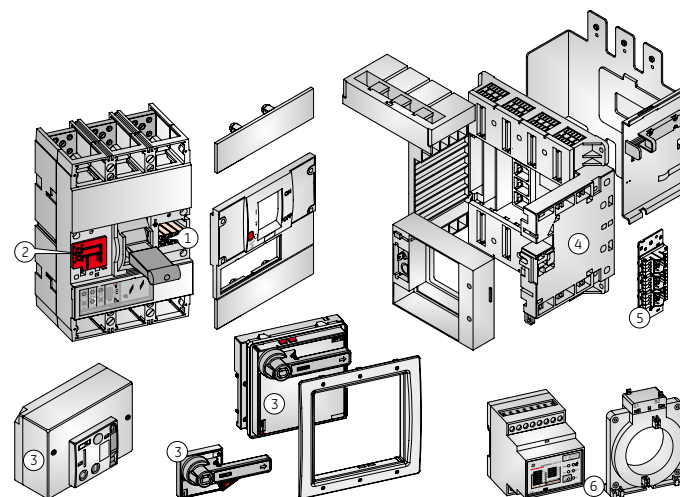
Trip Unit	Rated Current (A)	LTM	Mag Break*	SMR1e ⁽¹⁾	SMR1s ⁽¹⁾	SMR1g ⁽¹⁾
FK800	630	N, H, L	-	-	-	-
	800	N, H, L	N, H, L	N, H, L	N, H	N, H
FK1250	1000	N, H, L	-	N, H, L	N, H	N, H
	1250	N, H, L	N, H, L	N, H, L	N, H	N, H
FK1600	1600	-	-	N, H	N, H	N, H

Number of poles/
protected poles
(trips)

	N	H	L	N	H	L
3 pole 3 trips	N, H, L	N, H, L	N, H, L	N, H	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	N, H

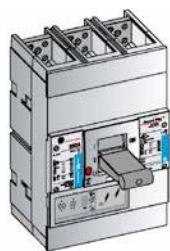
(1) Switchable, 0%, 50% or 100% neutral protection

Accessories (main types)



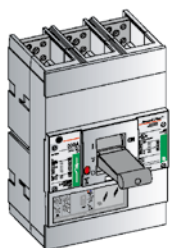
FK800 - Complete circuit breaker

Selective Electronic Trip Unit with fixed time settings type SMR1e



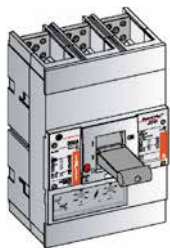
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKV	800	FKV36NE800PPF	435041	FKV46NE800PPF	435042
One code covers: a standard fixed front connection breaker + assembled trip unit + fixation hardware (electrical operator not possible)					
50kA FKN	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



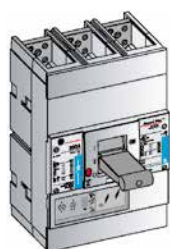
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	800	FKN36NS800PPF	435429	FKN46NS800PPF	435483
80kA FKH	800	FKH36NS800PPF	435321	FKH46NS800PPF	435375
One code covers: a standard fixed front connection breaker + assembled trip unit + toggle elongator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

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



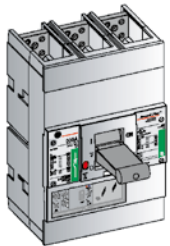
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	800	FKN36NG800PPF	435411	FKN46NG800PPF	435465
80kA FKH	800	FKH36NG800PPF	435303	FKH46NG800PPF	435357
One code covers: a standard fixed front connection breaker + assembled trip unit + toggle elongator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

Line Thermal magnetic trip unit LTM (adjustable settings)



	In (A)				
50kA FKV	800	FKV36NT800PF	435005	FKV46NT800PF	435064
One code covers: a standard fixed front connection breaker + assembled trip unit + fixation hardware (electrical operator not possible)					
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

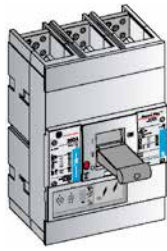


	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	800	FKN36NM800PF	435537	FKN436NM800PF	435541
80kA FKH	800	FKH36NM800PF	435538	FKH436NM800PF	435542
100kA FKL	800	FKL36NM800PF	435539	FKL436NM800PF	435543
One code covers: a standard fixed front connection breaker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

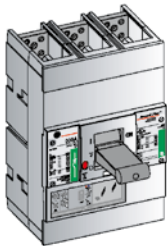
FK1250 - Complete circuit breaker

Selective Electronic Trip Unit with fixed time settings type SMR1e



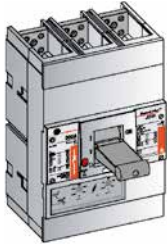
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKV	1000	FKV36NE100SQF	435040	FKV46NE100SQF	435066
	1250	FKV36NE125SSF	435035	FKV46NE125SSF	435083
One code covers: a standard fixed front connection breaker - assembled trip unit - fixation hardware (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



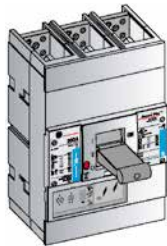
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1000	FKN36NS100SQF	435432	FKN46NS100SQF	435486
	1250	FKN36NS125SSF	435420	FKN46NS125SSF	435474
80kA FKH	1000	FKH36NS100SQF	435324	FKH46NS100SQF	435378
	1250	FKH36NS125SSF	435312	FKH46NS125SSF	435366
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



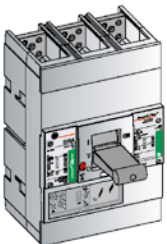
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1000	FKN36NG100SQF	435414	FKN46NG100SQF	435468
	1250	FKN36NG125SSF	435402	FKN46NG125SSF	435456
80kA FKH	1000	FKH36NG100SQF	435306	FKH46NG100SQF	435360
	1250	FKH36NG125SSF	435294	FKH46NG125SSF	435348
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

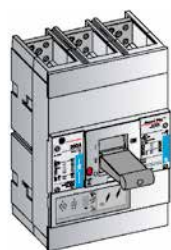


	In (A)	3 pole 3 trips		4 pole 3 trips ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1250	FKN36NM125SF	435558	FKN436NM125SF	435570
80kA FKH	1250	FKH36NM125SF	435559	FKH436NM125SF	435571
100kA FKL	1250	FKL36NM125SF	435561	FKL436NM125SF	435573
One code covers: a standard fixed front connection breaker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

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

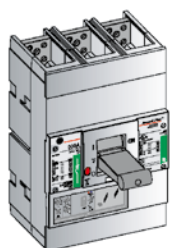
(2) Neutral on left

FK1600 - Complete circuit breaker



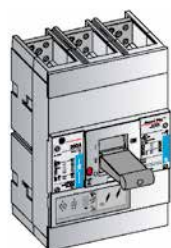
Selective Electronic Trip Unit with fixed time settings type SMR1e

	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

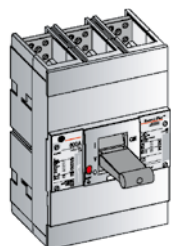
	In (A)	3 pole 3 trips		4 pole ⁽¹⁾ N selectable 0-50-100%	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
50kA FKN	1600	FKN36NS160TTF	435423	FKN46NS160TTF	435477
80kA FKH	1600	FKH36NS160TTF	435315	FKH46NS160TTF	435369
	One code covers: a standard fixed front connection breaker + assembled trip unit + toggle elongator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

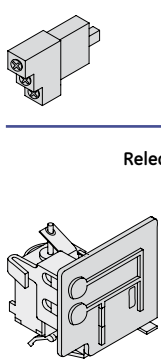
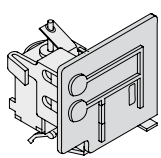
FKY- Non-Automatic circuit breaker (Switch)



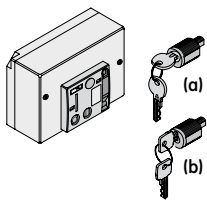
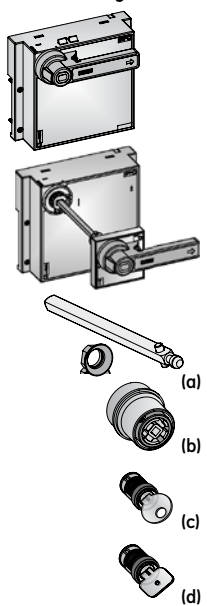
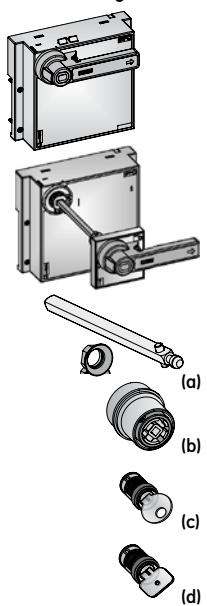
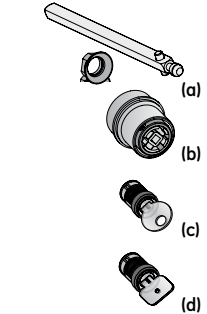
	In (A)	3 pole		4 pole ⁽²⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
FKY	800	FKY306DN800PF	435495	FKY406DN800PF	435504
	1000	FKY306DN100SF	435381	FKY406DN100SF	435273
	1250	FKY306DN125SF	435489	FKY406DN125SF	435498
	1600	FKY306DN160TF	435492	FKY406DN160TF	435501
	One code covers: a standard fixed front connection 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 - 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.	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 and 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						FNEMFF/M	436321
	48V AC/DC		FKMF2P	436881	FKF2S	436885		
	48V AC		FKMF3P	436882	FKF3S	436886	FNEMF3/M	436323
	110V AC						FNEMFJ/M	436458
	110V DC						FNEMF6/M	436324
	230V AC		FKMF6P	436883	FKF6S	436887	FNEMFN/M	436459
	230V DC		-	-	-	-		
	Field Mounting kit for operators ⁽⁴⁾							
	For three pole breakers		FKUE3	434801	FKUE3	434801	-	-
	For four pole breakers		FKUE4	434802	FKUE4	434802	-	-
	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					
			Cat. no.	Ref. no.				
	Extension shaft kit (max. 600mm)	(a)	FNNRE	435738	Only for use with panel or door mounted type			
	Adaptor for draw-out	(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

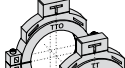
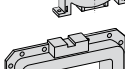
(3) On request 1xNO/1xNC is available.

(4) Kit must be ordered for each field mounted motor operator.

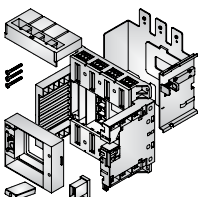
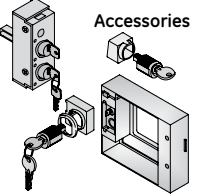
FK - Residual current devices

	Relay				No. of modules	Cat. no.	Ref. no.	Pack.
		IΔn	Operating voltage	Settable delay				
	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

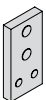
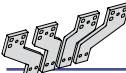
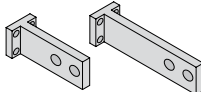
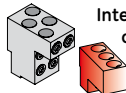
Sensor

Sensor		Ø internal (mm) (internal opening)		Cat. no.	Ref. no.	Pack.
	Round	28	closed	TTR28	456090	1
		35	closed	TTR35	456091	1
		60	closed	TTR60	456092	1
		80	closed	TTR80	456093	1
		110	closed	TTR110	456094	1
		140	closed	TTR140	456095	1
		210	closed	TTR210	456096	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		FNWS3WP	433434
	Complete set for FK1250 and FK1600		FNWS3WT	436482
	Model with rear connection			
	Complete set for FK800		FNWS3AP	433436
	Complete set for FK1250 and FK1600		FNWS3AT	435757
	One code covers the fixed and withdrawable portion of the draw-out system, a doorframe with extended toggle operator, mounting accessories and fixation hardware.			
	Complete set 6 pole		FNPFM	435758
	Kit for mounting two keylocks on Chassis with one type Ronis 1104A lock ⁽¹⁾		FN1BRW1	435575
	Provision for 1 extra keylock on Chassis type Ronis 1104A ⁽¹⁾		FN1BRW2	435577
	Position Indication Contact 1 X CO, for withdrawn and/or plugged in position.		FNS11L	435760
	Spare doorframe for draw-out type		FNFW	435578
	Provision for first keylock in doorframe type Ronis 1104A ⁽¹⁾		FN1BRV1	433415
	Provision for second keylock in doorframe type Ronis 1104A ⁽¹⁾		FN1BRV2	435574

FK - Connections: optional

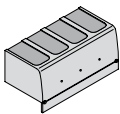
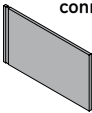
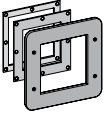
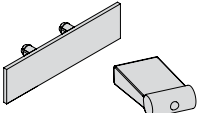
		3 pole		4 pole		
	Terminal extenders ⁽²⁾	Flat FK800 - FK1250	FNBES3P	435706	FNBES4P	435707
		Flat FK1250 -FK 1600	FNBES3R	433420	FNBES4R	433422
	Terminal spreader flat ⁽²⁾	Flat FK800 - FK1250	FNBSS3P	435708	FNBSS4P	435711
		Flat FK1250 -FK 1600	FNBSS3R	435710	FNBSS4R	435712
	Rear connections ⁽²⁾	Set 3 pole (2 short, 1 long)	FNBRCS3	433423	-	-
		Set 4 pole (2 short, 2 long)	-	-	FNBRCS4	433425
		Set 3 pole (3 short)	FNBRCS3	433426	-	-
		Set 4 pole (4 short)	-	-	FNBRCS4	433427
	Internal box clamps ⁽²⁾	Box Clamp Cu/Al, for 3 x 70-240mm ²	FNTCA3327	436316	FNTCA3427	436651
		Box Clamp Cu/Al, for 4 x 70-240mm ²	FNTCA4327	433438	FNTCA4427	433439

(1) Key included

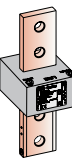
(2) Set for equipping the line OR load side of breaker.



FK - Installation Accessories

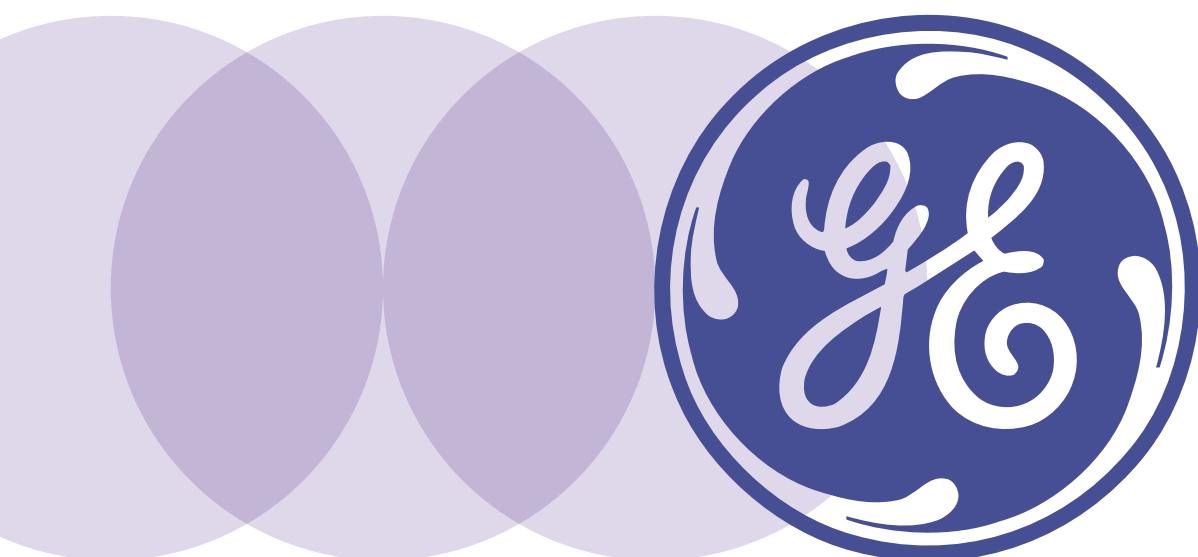
		3 pole		4 pole	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.
Terminal shields (with finishing covers) 	Long, set of 2 pcs.	FNJL3	435716	FNJL4	435719
Specific to connection area 	Phase separators				
	Set of 12 pcs. for rear connected breaker	FNJP	435722		
	Set of 12 pcs. for front connected breaker	FNJF	434804		
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				
	Pc driven digital testkit for trip units type SMR1e, s and g (2)	FKZD	434803		

(1) Padlocks not included

(2) For use with USB jack on Windows PC's.





Record Plus* Breaker types

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

Icu 400/415V AC in kA eff

Type	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*** MCCBs

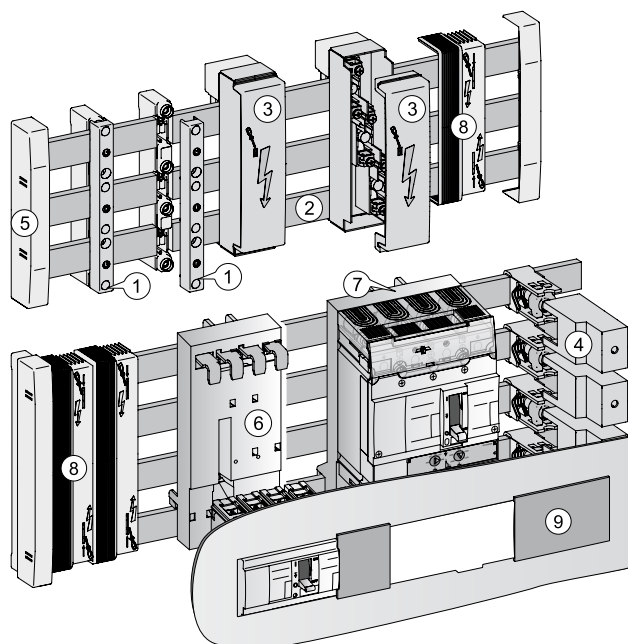
(1) Depending on support spacing (see page C.16)

Standards

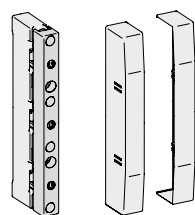
EN 60439-1

VDE 0660 Teil 500

- 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

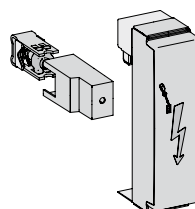


Connectivity system with 60mm spacing; three and four pole



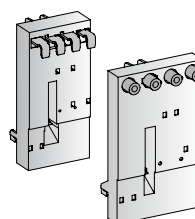
Busbar supports

	3 pole		4 pole	
	Cat. no.	Ref. no.	Cat. no.	Ref. no.
Set of left and right	FBB3S	433458	FBB4S	433464
Endplate covers, pair of	FBB3E	433455	FBB4E	433461



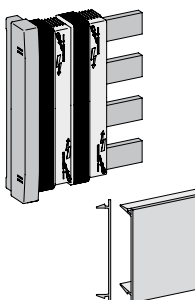
Connections

	Incoming from side		Incoming from front	
1 pole for lateral bar, flexible bar or cable connection Cu/Al 35-240mm ² for busbar section 5mm	FBTS1L12	433468	-	-
1 pole for lateral bar, flexible bar or cable connection Cu/Al 35-300mm ² for busbar section 10mm	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



Adaptors

	3 pole		4 pole	
FD frame 160A	FBAD3	433443	FBAD4	433446
FE frame 250A	FBAE3	433449	FBAE4	433452

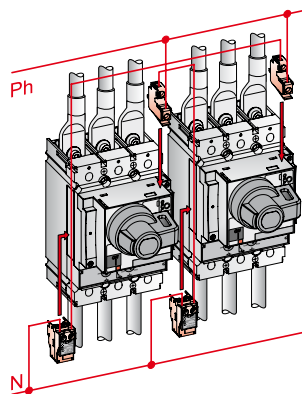


Installation

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

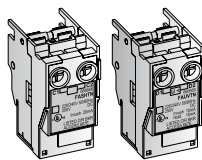
Interlocking Breakers

Electrical

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

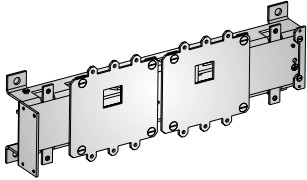
Main Device N (left)			Secondary Device R (right)			Required main components Listed protection devices are breakers or switches order codes can be found on: FE160: page A.13 FE250: page A.16 FG400: page A.25 FG630: page A.27 FK800: page A.35 FK1250: page A.36 FK1600: page A.37	Can be combined with Option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

(1) Also applicable for combinations of three breakers.



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

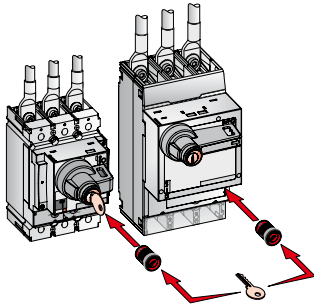
Mechanical



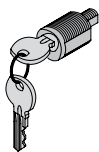
System with walking beam

Main Device N (left)			Secondary Device R (right)			Required components 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	Option 1		
FE160/250	FG400/630	FK800/1600	FE160/250	FG400/630	FK800/1600		Cat. no.	Ref. no.	Qty
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 and 1 FE frame breakers	FG1I4	437009	1
			x		x	Mechanical interlock 2 FK frame breakers	FN1I2F	433416	1
			x		x	Mechanical interlock 1 FK and 1 FG frame breaker	FN1I4F	437016	1

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



Main Device N (left)			Secondary Device R (right)			Required components 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	Option 2		
FE160/250	FG400/630	FK800/1600	FE160/250	FG400/630	FK800/1600		Cat. no.	Ref. no.	Qty
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			One type only
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	

Residual current devices with separate sensors



Applications



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.

Characteristics

RCD Relay

- Complies with EN 50082 and 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 18mm
- For installation in modular enclosures, DIN-rail mounted

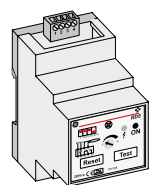
Sensor

- 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)

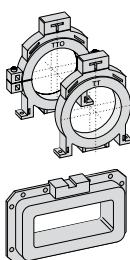
Dimensions ● pg G.33

	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	2.5mm ² ; plug-in terminal box	2.5mm ² ; plug-in terminal box	2.5mm 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	No. 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

Sensor	Ø internal (mm) (internal opening)		Cat. no.	Ref. no.	Pack.
Round	28	closed	TTR28	456090	1
	35	closed	TTR35	456091	1
	60	closed	TTR60	456092	1
	80	closed	TTR80	456093	1
	110	closed	TTR110	456094	1
	140	closed	TTR140	456095	1
	210	closed	TTR210	456096	1
Rectangular	70x175	closed	BTR 175	704154	1
	115x305	closed	BTR 305	704155	1
	130x350	closed	BTR 350	704156	1

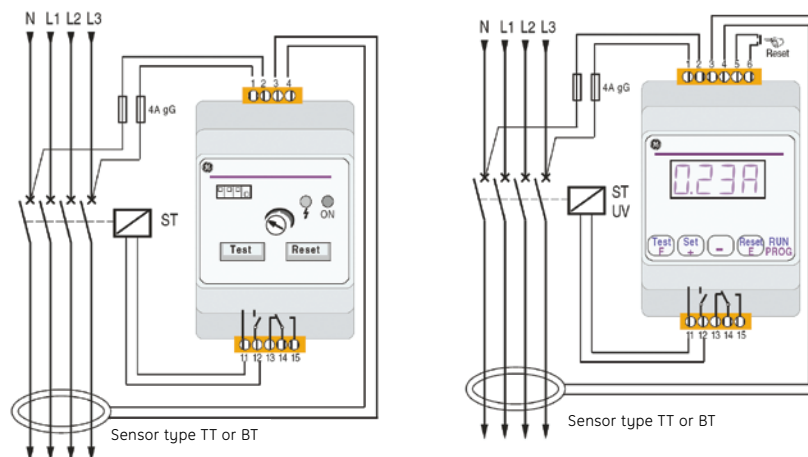
Accessories

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

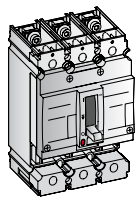
Wiring Diagram

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)

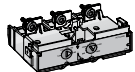
Alternately points 13, 14 and 15 can be used allowing the use of a Shunt or Undervoltage release of a different voltage rating.



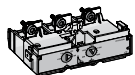
FE160 - Circuit breaker in components



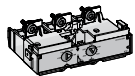
Breaker frames: Without trip unit									
	In (A)	3 pole		4 pole		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FEN	160	FEN306F160JF	431712	FEN406F160JF	431799				
80kA FEH	160	FEH306F160JF	431126	FEH406F160JF	431213				
150kA FEL	160	FEL306F160JF	431419	FEL406F160JF	431506				
One code covers: a standard fixed front connection breaker + toggle elongator + breaker finishing covers + fixation hardware									



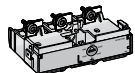
Trip units: Line Thermal Magnetic (adjustable settings)									
	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
LTM	25	FETTA3J0025	432546	FETTA43J0025	432391	FETTA4J0025	432636	-	-
	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)									
	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.
LTMD	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



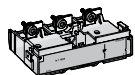
Trip units: Generator Thermal Magnetic									
	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
GTM	100	FETTG3J0100	433296	FETTG43J0100	433311	FETTG4J0100	433332	FETTG45J0100	433326
	125	FETTG3J0125	433293	FETTG43J0125	433271	FETTG4J0125	433274	FETTG45J0125	433271
	160	FETTG3J0160	433296	FETTG43J0160	433270	FETTG4J0160	433277	FETTG45J0160	433274



Trip units: Mag Break*, Magnetic only type for motor protection									
	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾					
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
MC	50	FETMC3J0050	432501	FETMC43J0050	432528				
	80	FETMC3J0080	436078	-	-				
	100	FETMC3J0100	432504	FETMC43J0100	432531				
	125	FETMC3J0125	436358	FETMC43J0125	436359				
	160	FETMC3J0160	432510	FETMC43J0160	432537				



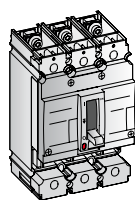
Trip units: Selective Electronic type									
	In (A)	3 pole		4 pole ⁽¹⁾					
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
PremEonS LT, ST and I	25	FFETDA3025J	437825	FETDA4025J	437829				
	63	FETDA3063J	437833	FETDA4063J	437837				
	125	FETDA3125J	437841	FETDA4125J	437845				
	160	FETDA3160J	437849	FETDA4160J	437853				
PremEonS LT, ST I and GF	25	FETDD3025J	437827	FETDD4025J	437831				
	63	FETDD3063J	437835	FETDD4063J	437839				
	125	FETDD3125J	437843	FETDD4125J	437847				
	160	FETDD3160J	437851	FETDD4160J	437855				
PremEonS ST and I	25	FETDN3025J	437826	FETDN4025J	437830				
	63	FETDN3063J	437834	FETDN4063J	437838				
	125	FETDN3125J	437842	FETDN4125J	437846				
	160	FETDN3160J	437850	FETDN4160J	437854				



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	FETD30J0160	432480	FETD40J0160	432486				

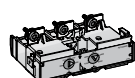
(1) Neutral on the left. If neutral on the right is needed, please contact us

FE250 - Circuit breaker in components



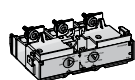
Breaker frames: Without trip unit

	In (A)	3 pole		4 pole		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FEN	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									



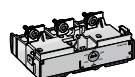
Trip units: Selective Thermal Magnetic (adjustable settings)

	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.
LTMD	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

	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.
GTM	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



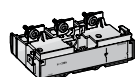
Trip units: Mag Break*, Magnetic only type for motor protection

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



Trip units: Selective Electronic type

	In (A)	3 pole		4 pole ⁽¹⁾					
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
PremEonS LT, ST and I	125	FETDA3125K	437857	FETDA4125K	437861				
	160	FETDA3160K	437865	FETDA4160K	437869				
	250	FETDA3250K	437873	FETDA4250K	437877				
PremEonS LT, ST I and GF	125	FETDD3125K	437859	FETDD4125K	437863				
	160	FETDD3160K	437867	FETDD4160K	437871				
	250	FETDD3250K	437875	FETDD4250K	437879				
PremEonS ST and I	125	FETDN3125K	437858	FETDN4125K	437862				
	160	FETDN3160K	437866	FETDN4160K	437870				
	250	FETDN3250K	437874	FETDN4250K	437878				

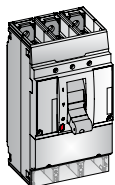


Trip units: Dummy for non Automatic Circuit Breaker (Switch)

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

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

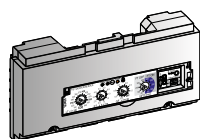
FG400 - Circuit breaker in components



Breaker frame without Trip Unit

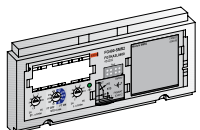
	In (A)	3 pole		4 pole ⁽¹⁾		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
50kA FGN	250	FGN306F250LF	434247	FGN406F250LF	434250				
	400	FGN306F400LF	431473	FGN406F400LF	431548				
80kA FGH	250	FGH306F250LF	434231	FGH406F250LF	434234				
	400	FGH306F400LF	431050	FGH406F400LF	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									

Trip units: Selective Electronic type



	In (A)	3 pole		4 pole					
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
PremEonS LT, ST and I	250	FGTDA3250L	438656	FGTDA4250L	438660				
	400	FGTDA3400L	438664	FGTDA4400L	438668				
PremEonS LT and GF	250	FGTDD3250L	438658	FGTDD4250L	438662				
	400	FGTDD3400L	438666	FGTDD4400L	438670				
PremEonS ST and I	250	FGTDN3250L	438657	FGTDN4250L	438661				
	400	FGTDN3400L	438665	FGTDN4400L	438669				

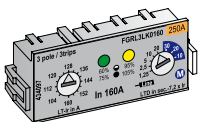
Modular Electronic Trip Unit (SMR2) without Rating Plug



	In (A)	3 pole		4 pole ⁽¹⁾		4 for line, no phase loss protection Six long time delay bands	Adj. $I_r = 0.4 - 1 \times I_n$ 4 for line, no phase loss protection 2 for motor, with phase loss protection ⁽²⁾ Adj. $1.5 - 12 \times I_r^{(2)}$
		Cat. no.	Ref. no.	Cat. no.	Ref. no.		
SMR2	250	FGTKA3L0250	434201	FGTKA4L0250	434205		
	350 ⁽³⁾	FGTKA3L0350	434902	FGTKA4L0350	434908		
	400 ⁽²⁾	FGTKA3L0400	434202	FGTKA4L0400	434261		
						Short time protection Switchable to $I^2 t$ curve Five short time delay bands Instantaneous protection	From 40 to 410 milliseconds Adj. $2 - 13 \times I_s^{(2)}$

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

Adjustable LT and LTD settable Rating Plugs for Trip Units SMR2



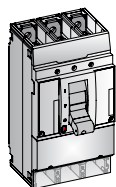
	In (A)	3 pole 3 trips		4 pole 3 trips ⁽¹⁾		4 pole 4 trips ⁽¹⁾		4 pole 3.5 trips (N = 50%) ⁽¹⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
250A	160	FGRL3LK0160/7	436749	FGRL4LK0160/7	434469	FGRL4LK0160/7	434559	FGRL45LK0160/7	434472
	250	FGRL3LK0250/7	436656	FGRL4LK0250/7	434615	FGRL4LK0250/7	434562	FGRL45LK0250/7	434481
400A	250	FGRL3LL0250/7	436747	FGRL4LL0250/7	434599	FGRL4LL0250/7	434568	FGRL45LL0250/7	434579
	400	FGRL3LL0400/7	436721	FGRL4LL0400/7	434617	FGRL4LL0400/7	434584	FGRL45LL0400/7	434482
350A ⁽²⁾	350 ⁽³⁾	FGRL3LL0350/7	436748	FGRL4LL0350/7	434601	FGRL4LL0350/7	434582	FGRL45LL0350/7	434596

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

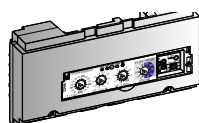
(2) 400A trip unit limited to 5 LTD band settings (SMR2), a maximum ST setting of $10 \times I_r$ and a maximum instantaneous setting of $11 \times I_s$.

(3) Specifically configured for Motor Protection

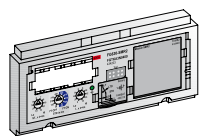
FG630 - Circuit breaker in components



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									

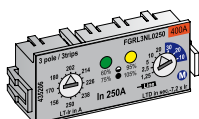


Trip units: Selective Electronic type									
PremEonS LT, ST and I	In (A)	3 pole		4 pole		Cat. no.	Ref. no.	Cat. no.	Ref. no.
		Cat. no.	Ref. no.	Cat. no.	Ref. no.				
400	400	FGTDA3400N	438672	FGTDA4400N	438676				
	630	FGTDA3630N	438680	FGTDA4630N	438684				
PremEonS LT, ST I and GF	400	FGTDD3400N	438674	FGTDD4400N	438678				
	630	FGTDD3630N	438682	FGTDD4630N	438686				
PremEonS ST and	400	FGTDN3400N	438673	FGTDN4400N	438677				
	500	FGTDN3500N	438681	FGTDN4500N	438685				



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	Adj. $I_r = 0.4 - 1 \times I_n$ 4 for line, no phase loss protection 2 for motor, with phase loss protection ⁽²⁾ Adj. $1.5 - 12 \times I_r^{(2)}$	Short time protection Switchable to $I^2 t$ curve Five short time delay bands Instantaneous protection	From 40 to 410 milliseconds Adj. $2 - 13 \times I_s^{(2)}$
		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: $I_r = 0.625 - 1 \times I_n$
LTD: Line and Motor; 8 options



Adjustable LT and 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⁾	
		Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.	Cat. no.	Ref. no.
400A	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

- (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 $10 \times I_r$ and a maximum instantaneous setting of $11 \times I_s$.
(3) Specifically configured for Motor Protection

Thermal magnetic and 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 PremEon S range
- B.12 FE and FG selective electronic trip unit PremEon S
- B.14 SMR2 range
- B.15 FG400 and FG630 advanced electronic trip unit SMR2
- B.20 FK800 - FK1600 electronic trip unit SMR1e, s and g
- B.25 Accessories for SMR1 and SMR2 types
- B.26 Trip units - overview of available types

The breaker

Order codes

Trip units

Components and accessories

Technical data

Application guide

Wiring diagrams

Dimensions

Numerical Index

Intro

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X

yon 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 and 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 and 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 MCBs 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)

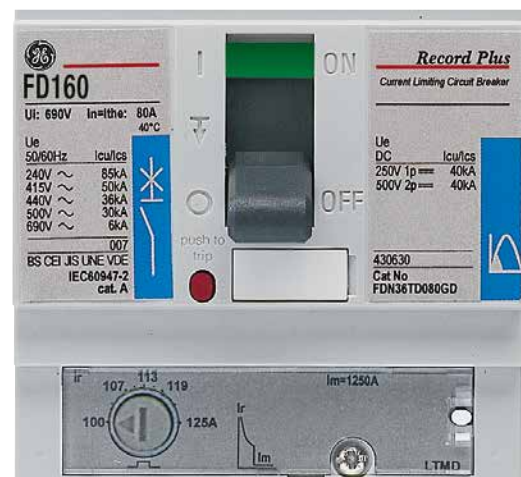
(FD..MO sub type)

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 and 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

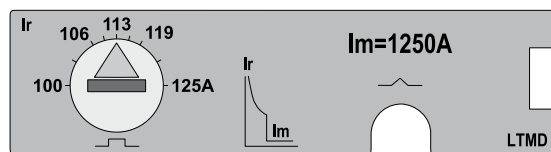


FD160 Trip Unit options

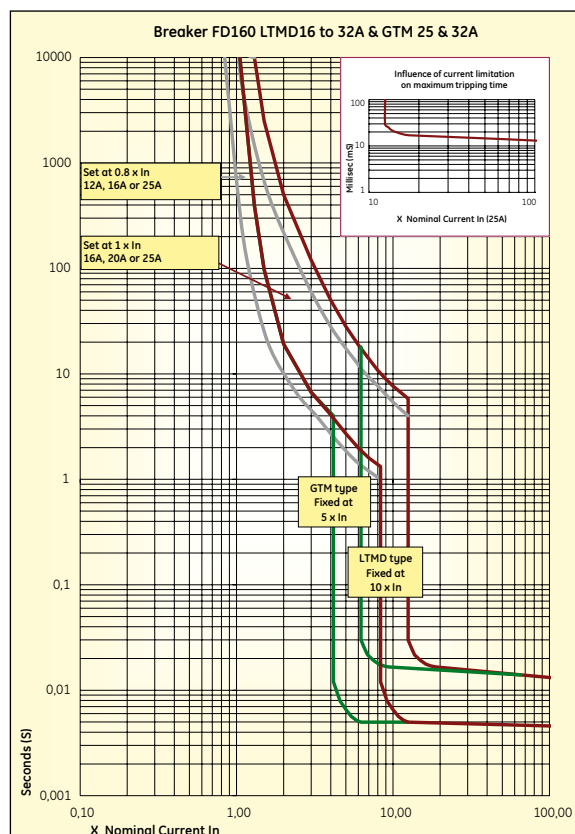
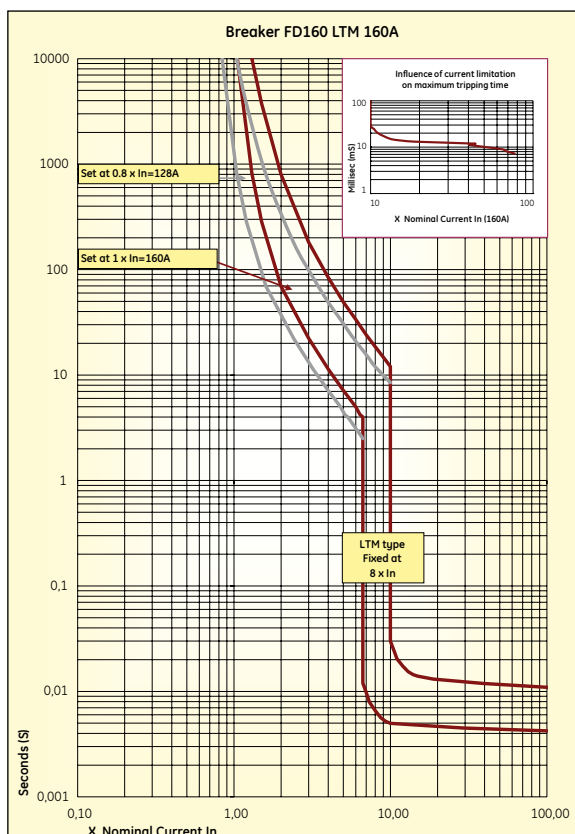
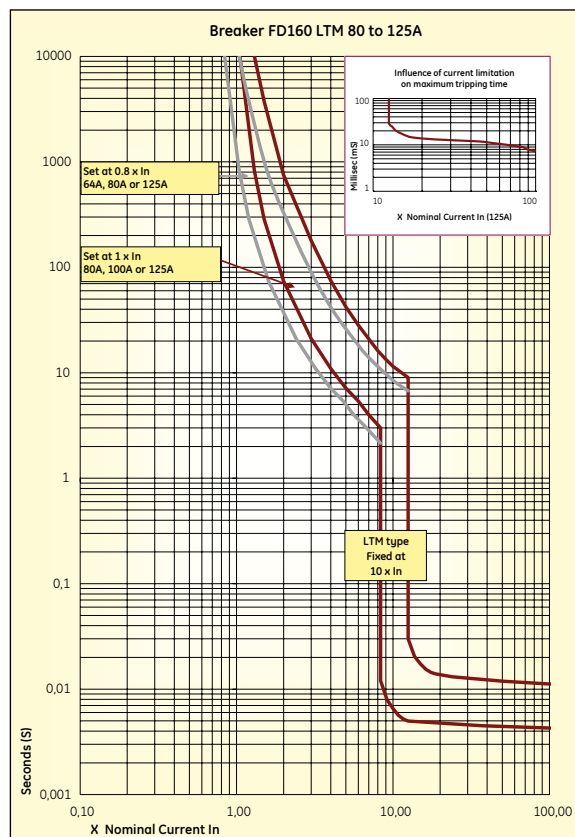
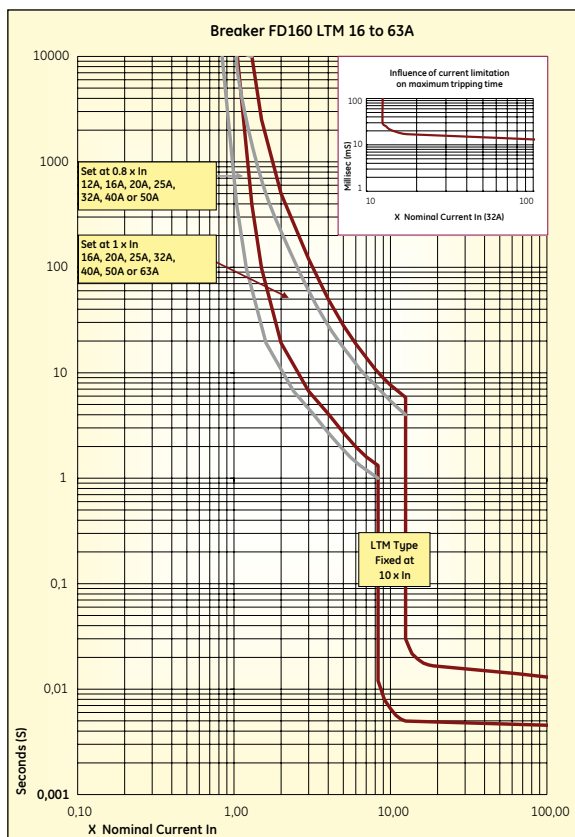
FD Frame						Trip unit overview																
Type	Subtype	Applicable for breaker types				In (A)	Thermal setting Ir		Magnetic setting Im		Neutral Protection											
							pick-up band 1.05 - 1.3 Ir		pick-up band ± 20% Im			4P4T	4P 3.5T	4P3T								
						min (A)	max (A)		fix (A)													
LTM	TF	C	E	N ⁽²⁾	H ⁽²⁾	Ir = In		16	10 x In	160	=Ir											
								20		200	=Ir											
								25		250	=Ir											
								32		320	=Ir											
								40		400	=Ir											
								50		500	=Ir											
								63		630	=Ir											
								80		800	=Ir											
								100		1000	=Ir											
								125		1250	=Ir											
								160		1280	=Ir											
							LTM	TC TE		C	E					Ir = 0.8-1In	12.8	16	10 x In	160	=Ir	
	20	200	=Ir																			
	25	250	=Ir																			
	25.6	32	320	=Ir																		
	32	40	400	=Ir																		
	40	50	500	=Ir																		
	50.4	63	630	=Ir																		
	64	80	800	=Ir																		
	80	100	1000	=Ir																		
	100	1250	=Ir																			
	128	160	1280	=Ir																		
LTMD	TD	S	N	H	L	Ir = 0.8-1In			12.8			16	10 x In				160	=Ir			Not protected ⁽¹⁾	
								20	200	=Ir												
								25	250	=Ir												
								32	320	=Ir												
								40	400	=Ir												
								50	500	=Ir												
								63	630	=Ir												
								80	800	=Ir												
								100	1000	=Ir												
								125	1250	=Ir												
								160	1280	=Ir												
							GTM	TG		N	N			Ir = 0.8-1In	20	25	5 x In	125	=Ir			
	25.6	32	160	=Ir																		
	32	40	160	=Ir																		
	40	50	200	=Ir																		
	50.4	63	252	=Ir																		
	64	80	320	=Ir																		
	80	100	400	=Ir																		
	100	125	500	=Ir																		
	128	160	640	=Ir																		
Mag. Break*	MO		N	H	L	No protection							adjustable 10-15 In		30	45			Not protected			
															70	105						
															125	187.5						
								200	300													
								300	450													
								500	750													
								800	1200													
1000	1500																					
Y			Y			No protection																

(1) Not available in S type

(2) Single pole N and H breaker types are only available with LTM TF trip unit

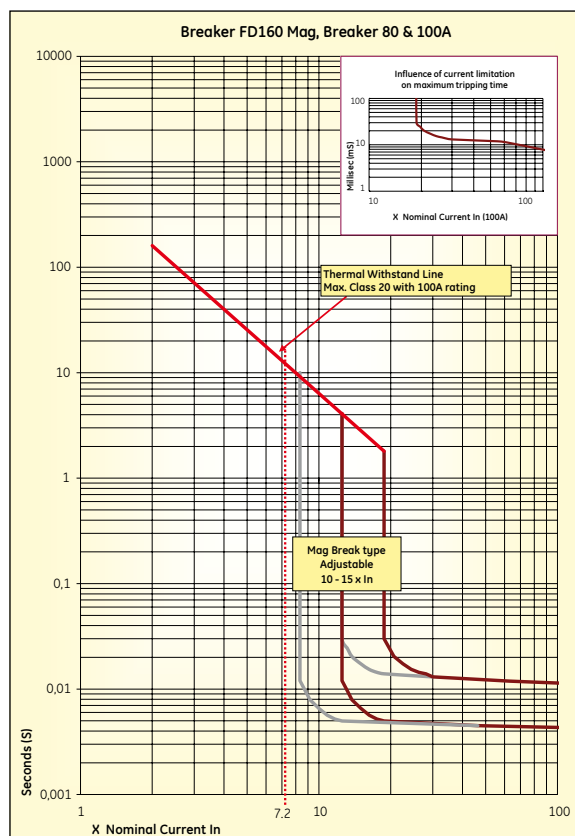
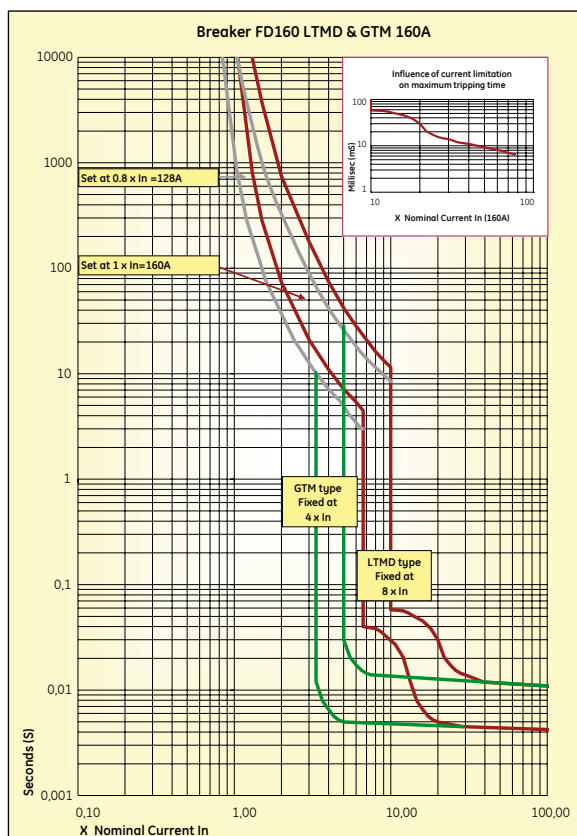
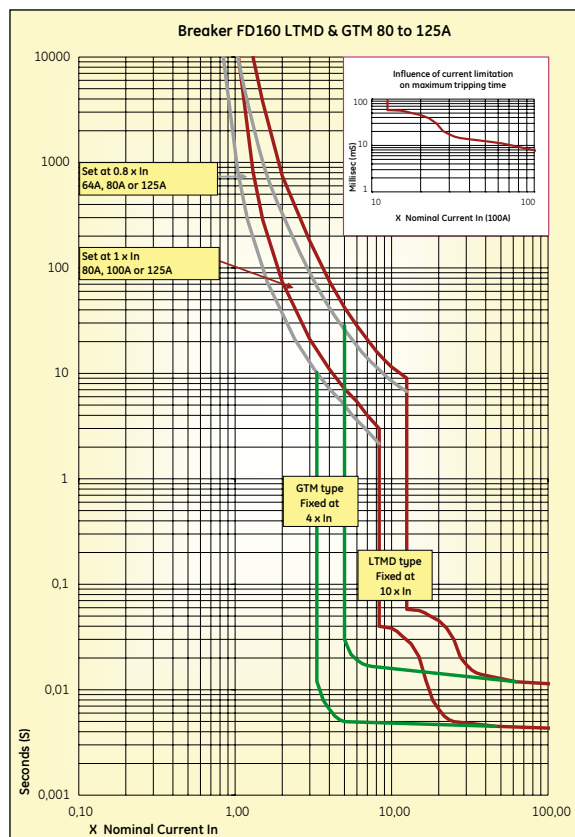
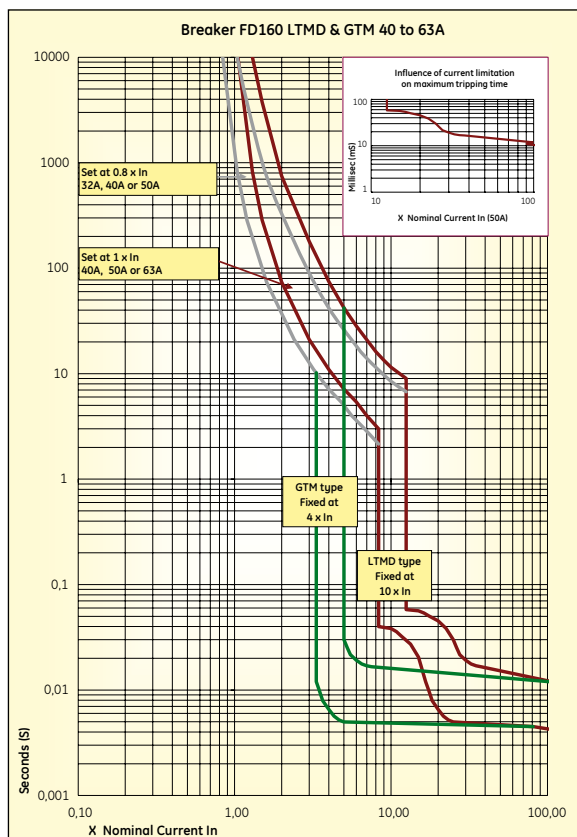


Depicted is the LTMD type



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



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 B11. 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 FE250 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 and 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 MCBs 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 and FE250N) and Hi-Break (FE160H and 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.

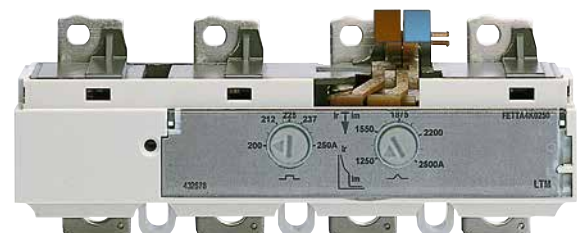
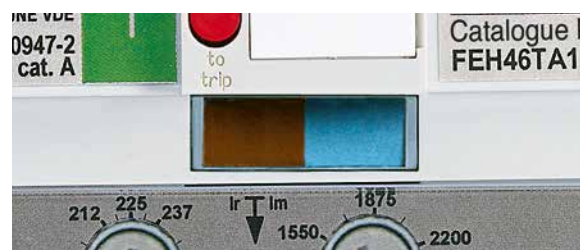
Mag Break* (magnetic only)

(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 and FE250 N, H and L breaker types. This sub type has NO thermal protection and an magnetic relay that is adjustable from 10 to 15 x In.

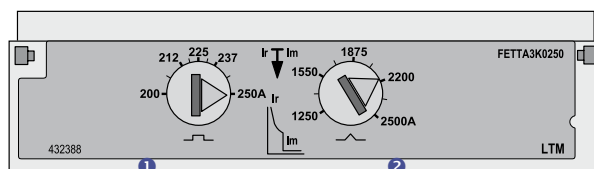
Y (non automatic - switch disconnecter)

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

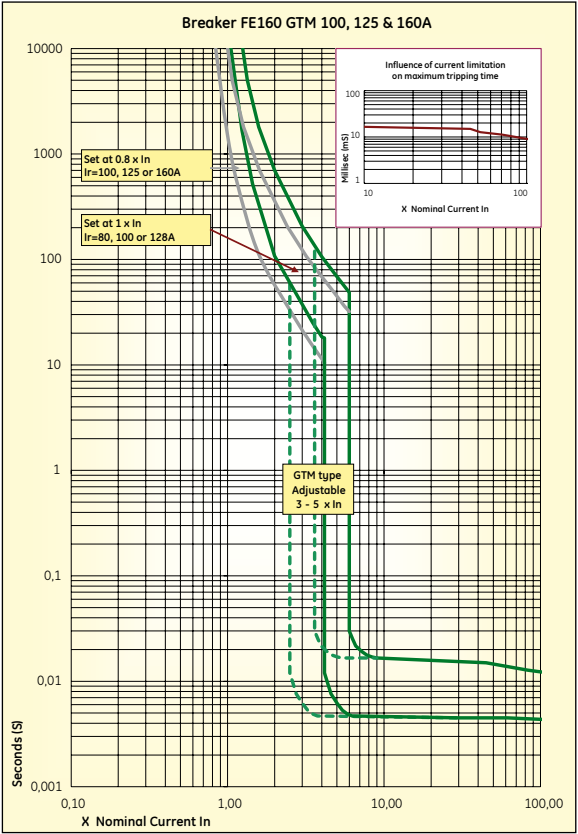
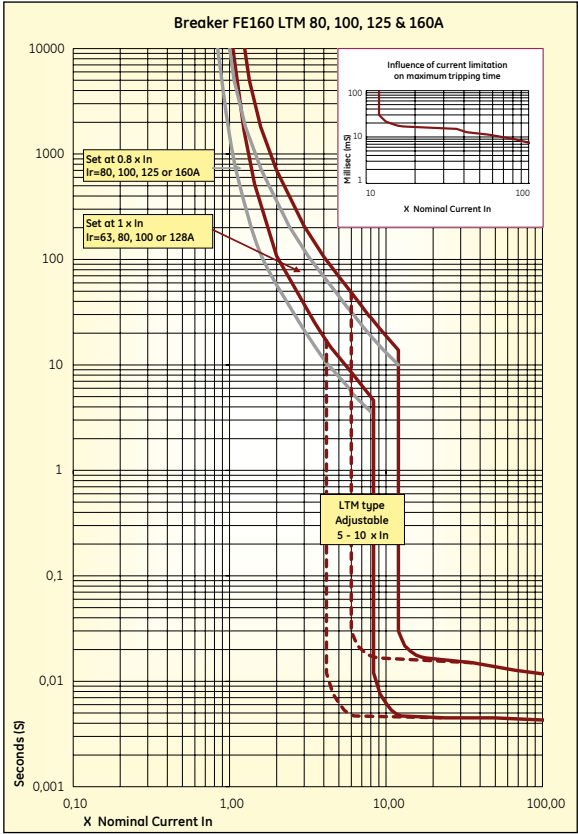
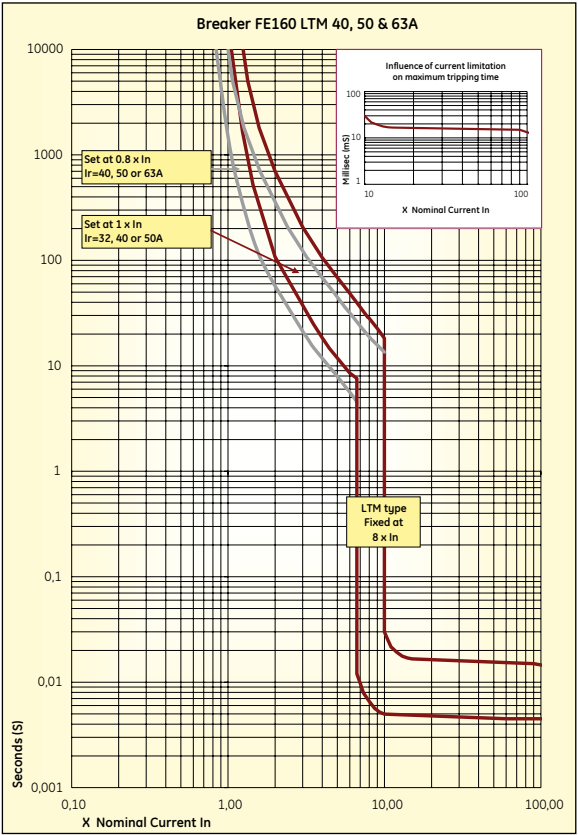
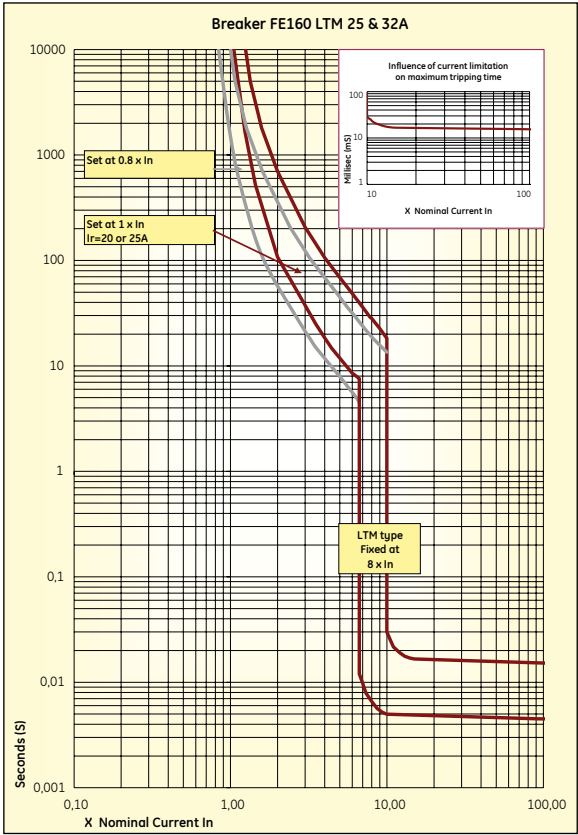


FE160 and FE250 breakers - trip unit overview (electromechanical)

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 - 1.3 Ir		pick-up band ± 20% Im		4P4T	4P 3.5T	4P3T		
						min (A)	max (A)	min (A)	max (A)					
LTM	TA	N	H	L	FE160	25			200	=Ir		Not protected		
						32			256	=Ir				
						40			320	=Ir				
						50			400	=Ir				
						63	adjustable	50	63	504	=Ir		=Ir/2	
						80	0.8-1xIn	64	80	400	800		=Ir	=Ir/2
		V			FE250	100		80	100	500	1000		=Ir	=Ir/2
						125		100	125	625	1250		=Ir	=Ir/2
						160		128	160	800	1600		=Ir	=Ir/2
						200	adjustable	128	160	800	1600			
						250	0.8-1xIn	160	200	1000	2000			
						250		200	250	1250	2500			
LTMD	TD	N	H	L	FE160	100		80	100	500	1000	=Ir	=Ir/2	
						125	adjustable	100	125	adjustable	625	1250	=Ir	=Ir/2
						160	0.8-1xIn	128	160	5-10 In	800	1600	=Ir	=Ir/2
		V			FE250	125		100	125	625	1250	=Ir	=Ir/2	
						160	adjustable	128	160	adjustable	800	1600	=Ir	=Ir/2
						200	0.8-1xIn	160	200	5-10 In	1000	2000	=Ir	=Ir/2
GTM	TG	N	H	L	FE160	100		60	100	300	400	=Ir	=Ir/2	
						125	adjustable	100	125	adjustable	480	625	=Ir	=Ir/2
						160	0.8-1xIn	128	160	3-5 In	375	800	=Ir	=Ir/2
		V			FE250	125		100	125	375	625	=Ir	=Ir/2	
						160	adjustable	128	160	480	800	=Ir	=Ir/2	
						200	0.8-1xIn	160	200	600	1000	=Ir	=Ir/2	
Mag. Break*	MO	N	H	L	FE160	250		200	250	750	1250	=Ir	=Ir/2	
						50				500	750			
						80				800	1200			
		V			FE250	100				1000	1500			
						125	No protection			adjustable	1250	1875		
						160				1600	2400			
Y		Y		FE160	160				1600	2400				
					FE250	250				2000	3000			
					No protection									



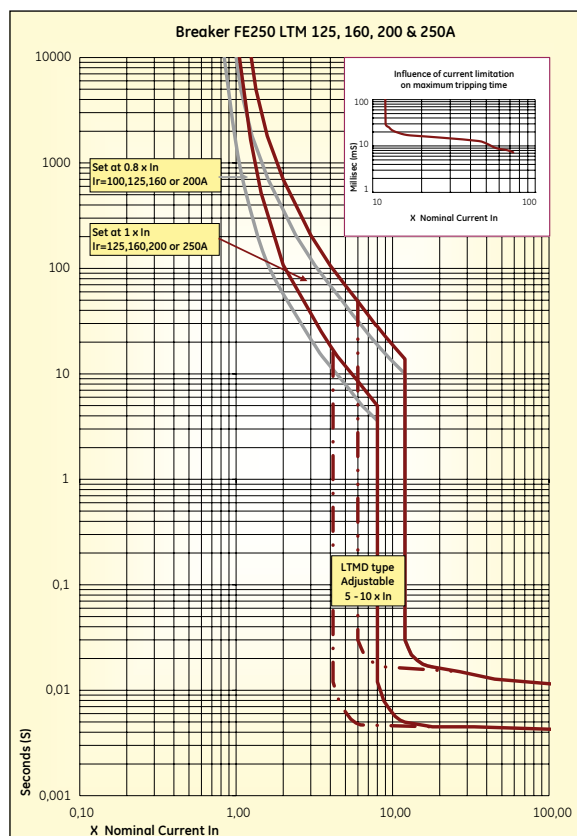
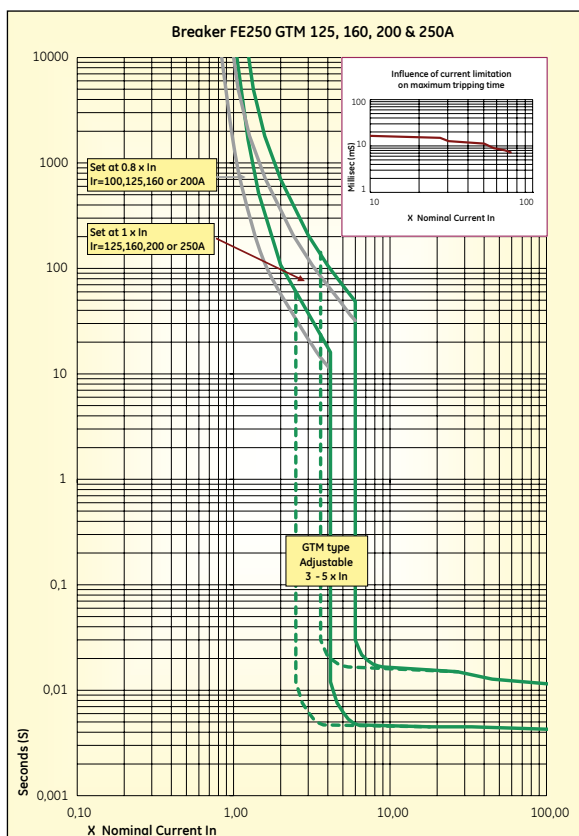
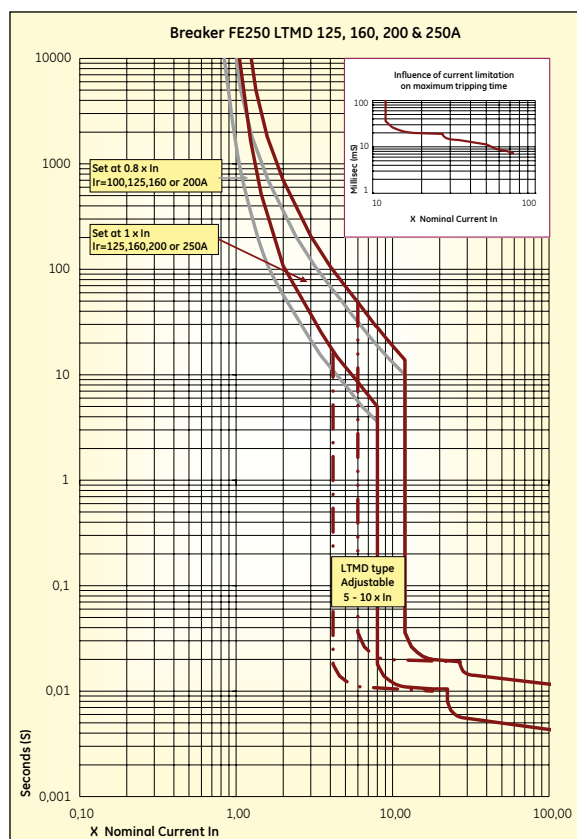
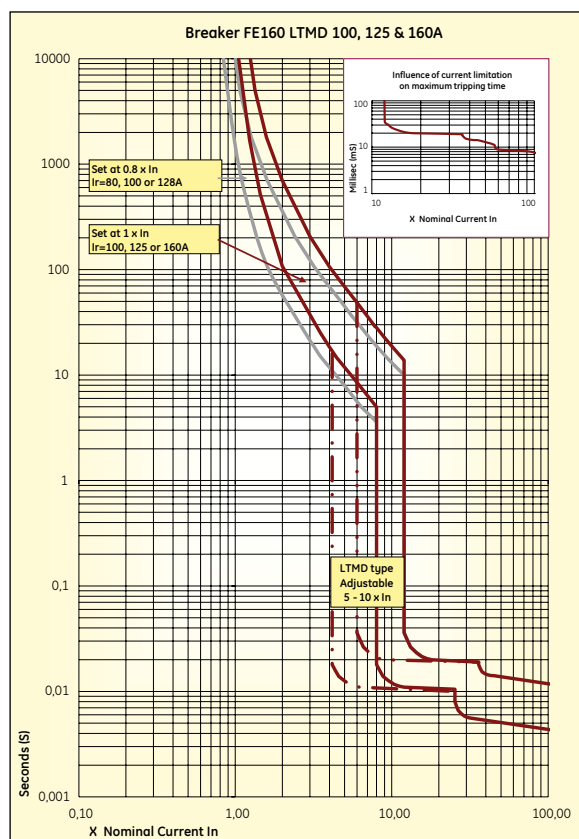
Depicted is the LTMD type



Time current curves are depicted in cold state.

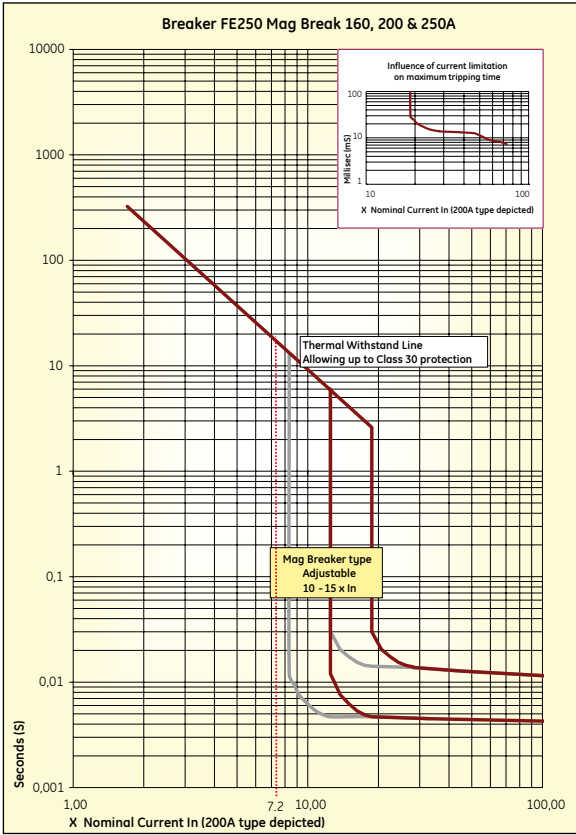
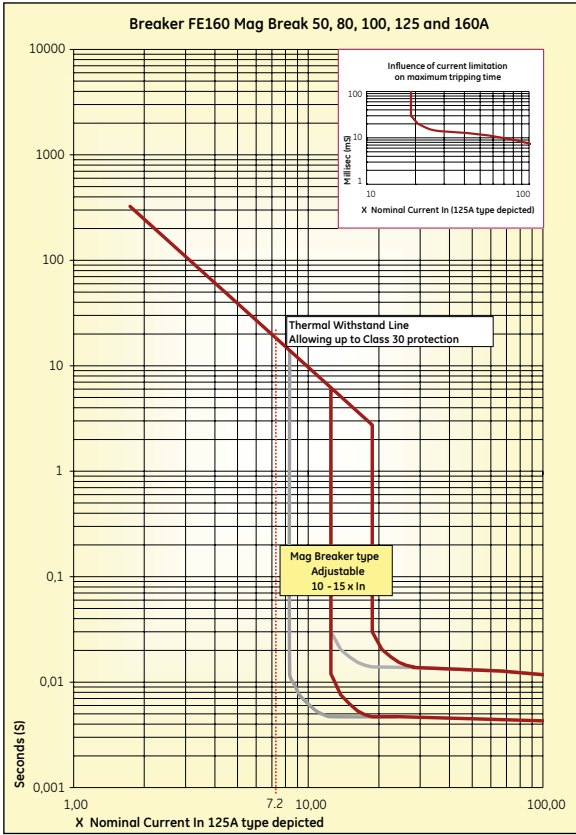


Time Current Curves



Time current curves are depicted in cold state.





Time current curves are depicted in cold state.



Electronic Trip Units

PremEon S 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, electro magnetic 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 PremEon S 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.

PremEon S

PremEon S is an interchangeable electronic trip unit designed to offer uncompromising reliability in all network environments.

It combines sophisticated 32 bit technology with a complete set of protection functions.

Simple dials provide access to a wide setting range of 0.3 to 1 times I_n .

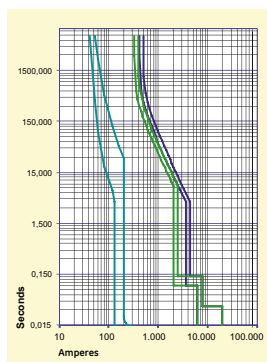
Designed to fit the Record Plus line of moulded case circuit breakers, the devices are available as 3 or 4 pole units in a current range of 7 to 630A.

Each standard unit has between two and four overcurrent protection devices:

- An overload protection (**LT**) with a range of 0.3 to 1 times the chosen trip unit rating⁽¹⁾. Each of the possible 15 positions has a rating mentioned in Amps.
- A delayed short-circuit protection (**ST**) with a wide setting band of 2 to 13⁽²⁾ times the **LT** device setting or I_r value. A fixed time setting per breaker size is applied.
- A selective instantaneous device (**I**) set at a fixed value of 14⁽²⁾ times the chosen trip unit rating, using waveform recognition to assure selectivity.
- An optional ground fault protection device (**GF**) (residual principle) can be set from 0.4 to 1 times the chosen trip unit rating and be used with multiple delay and/or I^2T settings.

Each device is equipped with a LED indicator that flashes when the current reaches 0.95 times I_r and illuminates constantly when an overload trip is imminent (at 1.05 times I_r). The electronics also continuously perform self diagnostics and warn the user of any defect by the LED indicator.

An integrated temperature sensor prevents the electronic components from reaching temperatures that could damage the breaker or it's surroundings.



PremEon together with the unique selective and current limiting line of Record Plus line circuit breakers offer strongly improved selectivity between upstream and downstream devices.

The use of highly accurate sensing technology and of state-of-the-art electronics, reduces the tolerances on expected tripping currents and the associated time spans to a minimum.

The result as depicted in the time current curve: selectivity up to 10,000A between a upstream breaker set at 180A and a downstream breaker set at 145A.

PremEon makes selectivity possible between downstream and upstream devices with a ratio between settings of 1.25.

Selectivity on higher currents is assured by the unique selective and current limiting properties of the implemented Record Plus FG630 (set at 180A) and FE160 (set at 145A) circuit breakers.

Integrated test kit

Simply connect a standard mobile phone charger⁽³⁾ to the micro USB port and the "TEST" button goes live. Depress it and it checks the full electronic circuit and then trips the connected breaker.



Integrated "TEST" function that only needs a USB phone charger.

The USB port also functions as a data access port, allowing the user to verify the breaker settings. The data are covering last 10 fault occurrences and waveform data of the last event⁽⁴⁾. In this configuration, the PC powers the trip unit (charger no longer needed).

Prepared for the future

PremEon S is the first of a new generation of Record Plus trip units. They are interchangeable, designed to allow for future upgrades and have a user definable neutral protection (4 pole devices only).

(1) Version without LT protection is available.
(2) For FG630 630A: 2-10 x I_r and 11 x I_n

(3) To IEC 62684 - Standard for mobile phone chargers
(4) Software available on request.



PremEon range

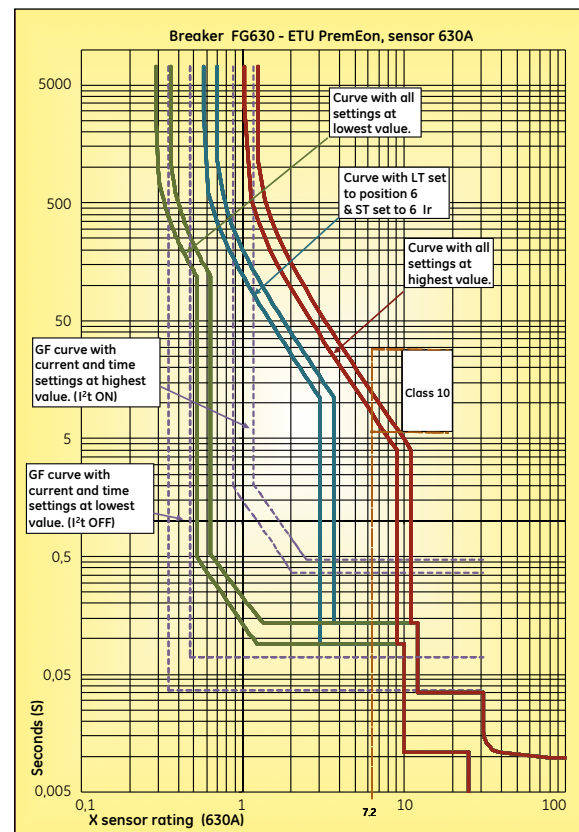
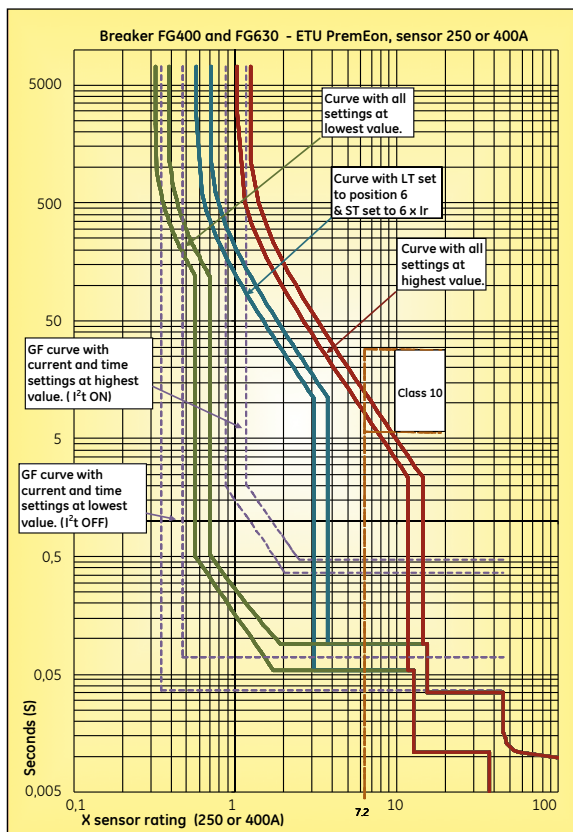
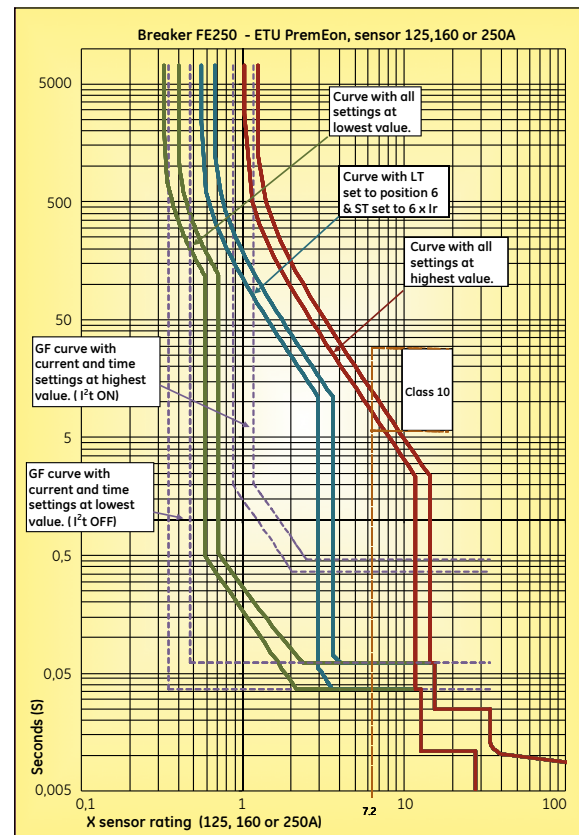
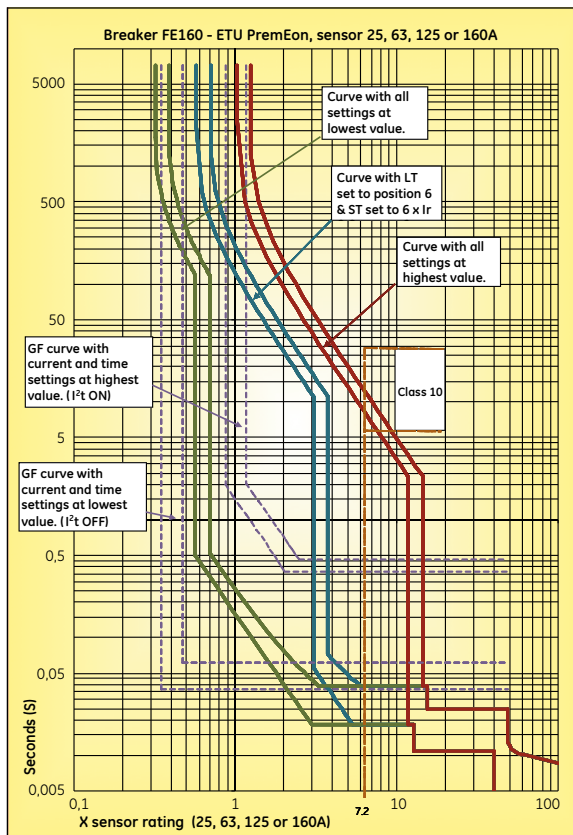
FE and FG Selective Electronic Trip Unit PremEon S

FE Frame					Electronic trip unit overview															
					In (A)	LT			ST			I		Neutral Protection						
						pick-up band 1.05-1.2 I _r			pick-up band ±10% I _m			pick-up band ±10% I _i								
						I _r setting	min (A)	max (A)	I _r setting	min (A)	max (A)	I _i setting	I _i (A)	ON & 100%	ON & 50%	OFF				
PremEon S LT, ST and I	V	N	H	L	FE160	25	8	25		16	325		350	= I _r	= I _r /2 ⁽¹⁾	Not protected				
						63	18	63		36	819		882	= I _r	= I _r /2 ⁽¹⁾					
						125	40	125		80	1625		1750	= I _r	= I _r /2 ⁽¹⁾					
						160	50	160	2-13 x I _r	100	2080	Fixed 14 x I _n	2240	= I _r	= I _r /2 ⁽¹⁾					
						125	40	125	10 steps	80	1625		1750	= I _r	= I _r /2 ⁽¹⁾					
						160	50	160		100	2080		2240	= I _r	= I _r /2 ⁽¹⁾					
						250	80	250		160	3250		3500	= I _r	= I _r /2 ⁽¹⁾					
PremEon S ST and I	V	N	H	L	FE160	25				50	325		350	= I _r	= I _r /2 ⁽¹⁾					
						63				126	819		882	= I _r	= I _r /2 ⁽¹⁾					
						125			2-13 x I _n	250	1625	Fixed 14 x I _n	1750	= I _r	= I _r /2 ⁽¹⁾					
						160	No Protection	10 steps	320	2080	2240		= I _r	= I _r /2 ⁽¹⁾						
						125			250	1625	1750		= I _r	= I _r /2 ⁽¹⁾						
						160			320	2080	2240		= I _r	= I _r /2 ⁽¹⁾						
						250			500	3250	3500	= I _r	= I _r /2 ⁽¹⁾							
PremEon S LT, ST, I and GF	V	N	H	L	FE160	25	8	25		16	325		350	= I _r	= I _r /2 ⁽¹⁾					
						63	18	63		36	819		882	= I _r	= I _r /2 ⁽¹⁾					
						125	40	125	2-13 x I _r	80	1625	Fixed 14 x I _n	1750	= I _r	= I _r /2 ⁽¹⁾					
						160	50	160	10 steps	100	2080		2240	= I _r	= I _r /2 ⁽¹⁾					
						125	40	125		80	1625		1750	= I _r	= I _r /2 ⁽¹⁾					
						160	50	160		100	2080		2240	= I _r	= I _r /2 ⁽¹⁾					
						250	80	250		160	3250	3500	= I _r	= I _r /2 ⁽¹⁾						
					GF															
FG Frame					Electronic trip unit overview															
					In (A)	LT			ST			I		Neutral Protection						
						pick-up band 1.05-1.2 I _r			pick-up band ±10% I _m			pick-up band ±10% I _i								
						I _r setting	min (A)	max (A)	I _r setting	min (A)	max (A)	I _i setting	I _i (A)	ON & 100%	ON & 50%	OFF				
PremEon S LT, ST and I		N	H	L	FG400	250				160	3250	Fixed 14 x I _n		= I _r	= I _r /2 ⁽¹⁾	Not protected				
					FG630	400	0.3-1 x I _n	125	400	10 steps	250		5200		= I _r		= I _r /2 ⁽¹⁾			
						400	16 steps	125	400		250		5200		= I _r		= I _r /2 ⁽¹⁾			
					630		180	630	2-10 x I _r	360	6300			= I _r	= I _r /2 ⁽¹⁾					
PremEon S ST and I		N	H	L	FG400	250				500	3250	Fixed 14 x I _n		= I _r	= I _r /2 ⁽¹⁾					
					FG630	400	No Protection	10 steps	800	5200			= I _r	= I _r /2 ⁽¹⁾						
						400			800	5200			= I _r	= I _r /2 ⁽¹⁾						
					500		2-10 x I _r	1000	5000		= I _r		= I _r /2 ⁽¹⁾							
PremEon S LT, ST, I and GF		N	H	L	FG400	250	0.3-1 x I _n	80	250	2-13 x I _r	160	3250	Fixed 14 x I _n		= I _r		= I _r /2 ⁽¹⁾			
						400	125	400	10 steps	250	5200			= I _r	= I _r /2 ⁽¹⁾					
						400	16 steps	125	400		250	5200			= I _r		= I _r /2 ⁽¹⁾			
						630		180	630	2-10 x I _r	360	6300			= I _r		= I _r /2 ⁽¹⁾			
					GF															
FG400	250	0.4-1 x I _n	100	250																
	400	16 steps	160	400																
	400		160	400																
	630		252	630																

(1) When the neutral setting is set at 50% and the LT setting is less than 0.56×I_n, the trip unit will use 0.28×I_n as the minimum GF value.

Time Current Curves

FE and FG frame



Electronic Trip Units

SMR2 range

The SMR2 is an electronic trip unit offering a fixed set of sophisticated protective functions. 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 (**I²t**).

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. This 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 and FG630 Advanced Electronic Trip Unit SMR2

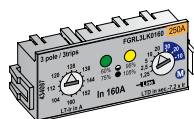
Each SMR 2 device has three plug in elements of which at least two are needed to allow the device to work properly.

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.

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.

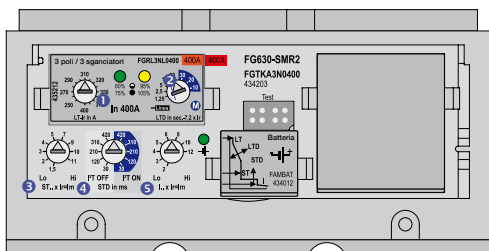
FG Frame				Electronic trip unit overview												
				In (A)	LT			ST			I			Neutral Protection		
					pick-up band 1.05-1.2 Ir			pick-up band ±20% Ist			pick-up band ±10% Ii					
					Ir setting	min (A)	max (A)	Ist setting	min (A)	max (A)	Ii setting	min (A)	max (A)	4P4T	4P 3TN	4P3T
SMR2 + adjustable rating plug	N	H	L	FG400	160	100	160	150	150	1920	2-13 lct	500	3250	= Ir	= Ir/2	Not protected
					250	160	250	1.5-12 Ir	240	3000	2-13 lct	700	4550	= Ir	= Ir/2	
					350	250	350	10 steps	500	3500	10 steps	750	4400	= Ir	= Ir/2	
					400	250	400	10 steps	375	4000	10 steps	1000	6500	= Ir	= Ir/2	
					400	250	400	10 steps	375	4800	10 steps	1260	6930	= Ir	= Ir/2	
	FG630	500	400	500	1.5-12 Ir	600	6000	2-13 lct			= Ir	= Ir/2				
		630	400	630	1.5-10 Ir	600	6300	2-11 lct			= Ir	= Ir/2				
					10 steps			10 steps								
				LTD, Line no phase loss			STD Standard									
				Setting ⁽¹⁾			Setting									
				min (sec.)			min (sec.)									
				max (sec.)			max (sec.)									
				1.25			0.04									
				2.5			0.12									
				5			0.21									
				10			0.31									
				LTD, Motor with phase loss protection ⁽¹⁾			0.42									
				20												
				30 ⁽²⁾												

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

(2) Not applicable for 400 and 630A

SMR2 front view

Indicating the location of the settings, the battery and rating plug. 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.

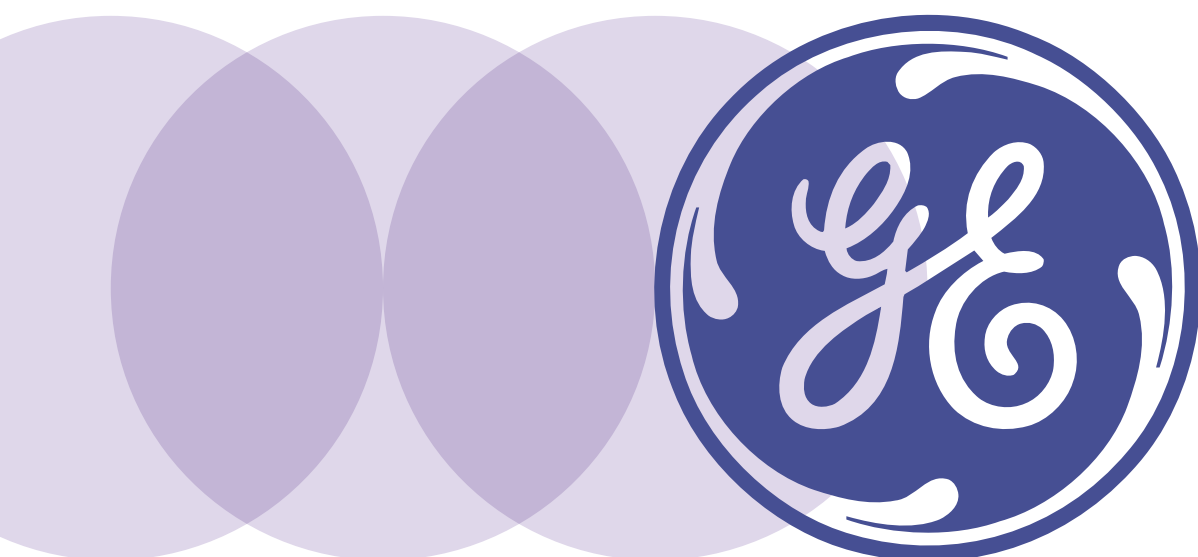


On switching to Motor Protection a phase loss protection is initiated. Do not use for line protection.

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.

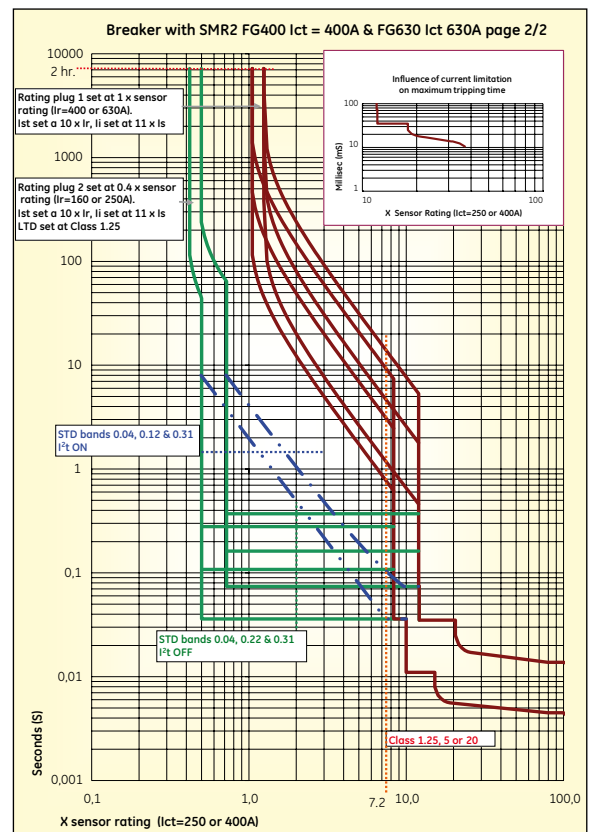
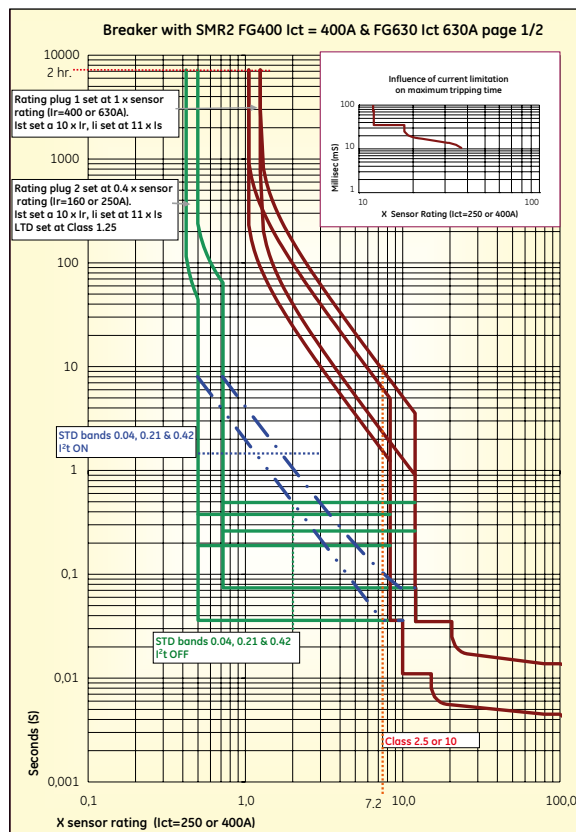
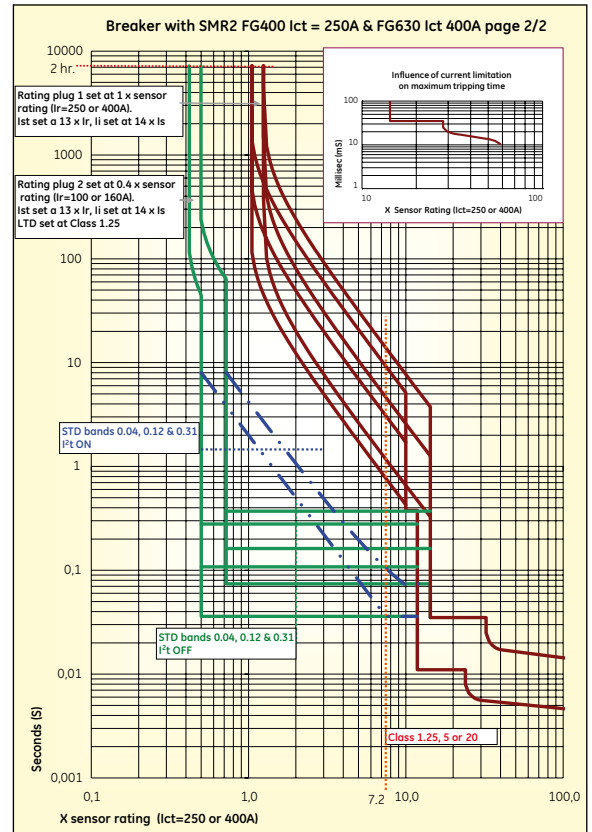
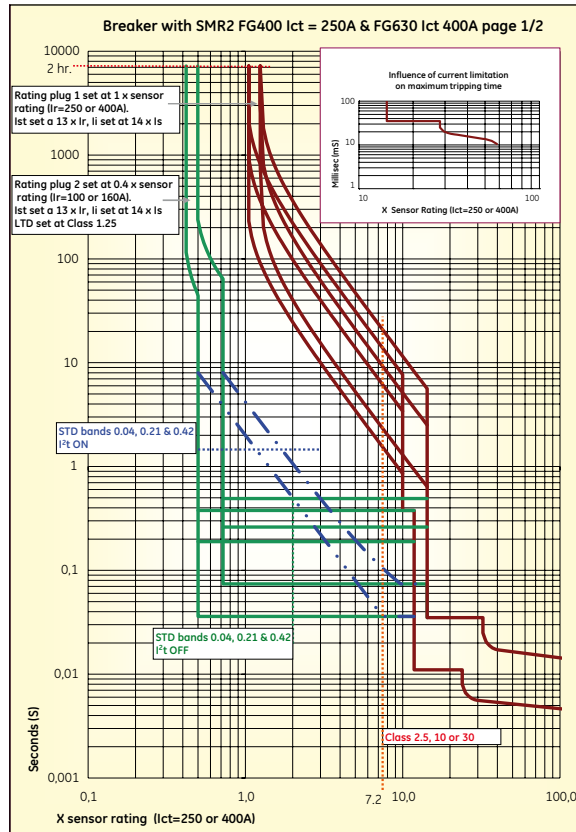
(1) Expected life span under normal circumstances three to five years. Replacement type 2 x BR1220 or equivalent.



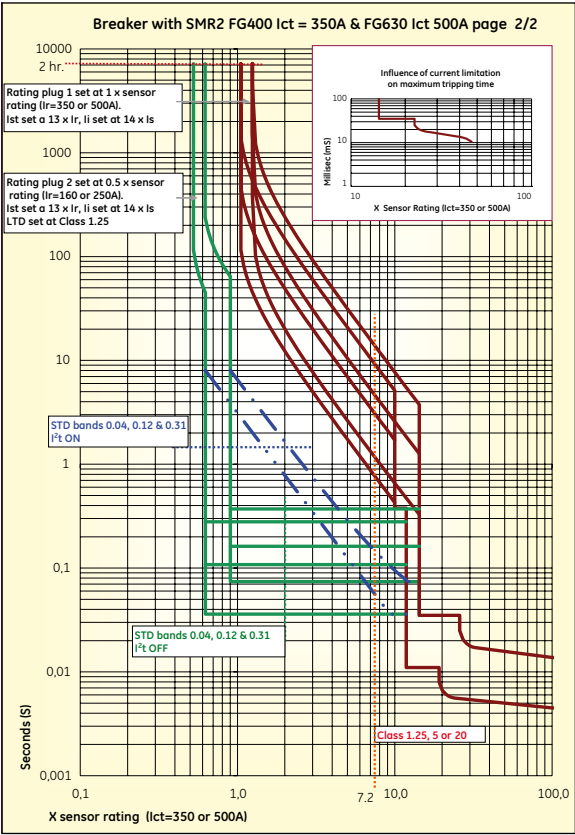
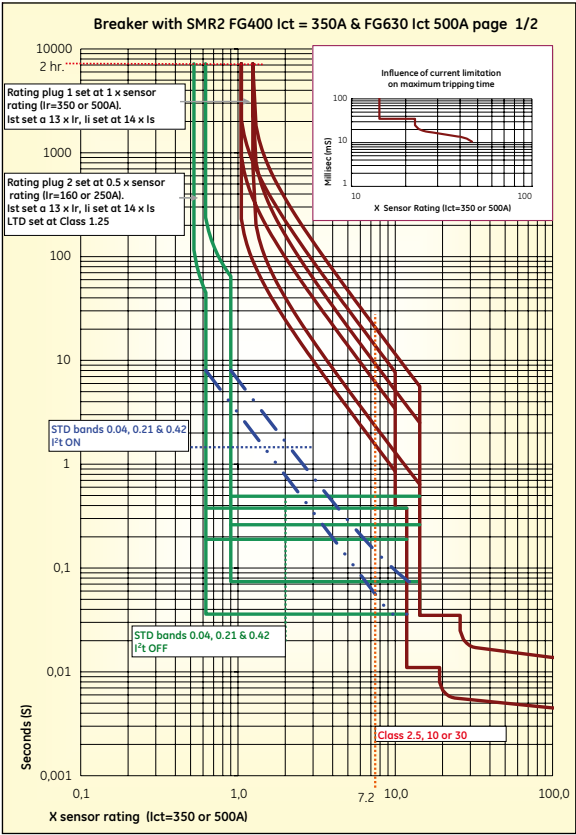


Time Current Curves

FG400 and FG630 Electronic Trip Unit SMR2



Time Current Curves



Electronic trip units

FK800 - FK1600 Electronic Trip Unit SMR1e, s and 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 pickup 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.

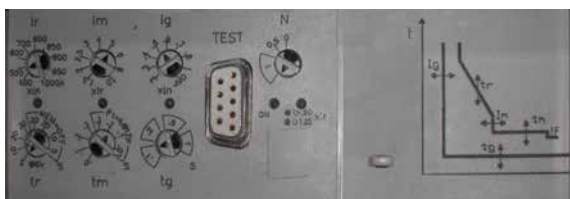
This easy-to-use trip unit with overload and selective short-circuit protection is equipped with an overload signalling option and has a built-in temperature sensor to prevent the breaker and electrical components in its immediate vicinity from overheating. The 4 pole units are equipped with a switchable 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 and 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 and 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 and 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 and 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			ST			Neutral Protection				
					pick-up band 1.05 - 1.3 Ir			pick-up band ± 20% Im			Switchable type				
					Ir setting	min (A)	max (A)	Im setting	min (A)	max (A)	4P4T	4P 3TN	4P3T		
SMR 1e	N	H	L	FK800	800		320	800		480	8000	=Ir	=Ir/2	Not protected	
				FK1250	1000	0.4-1 × In	400	1000	1.5-10 Ir	600	10000	=Ir	=Ir/2		
				1250		in 9 steps	500	1250	in 9 steps	750	12500	=Ir	=Ir/2		
				FK1600	1600		640	1600		960	16000	=Ir	=Ir/2		
				In (A)	LT			ST			Neutral Protection				
pick-up band 1.05 - 1.3 Ir			pick-up band ± 20% Im			Switchable type									
Ir setting	min (A)	max (A)	Im setting		min (A)	max (A)	4P4T	4P 3TN	4P3T						
SMR 1s	N	H		FK800	800		320	800		480	8000	=Ir	=Ir/2	Not protected	
				FK1250	1000		400	1000	1.5-10 Ir	600	10000	=Ir	=Ir/2		
				1250		500	1250	in 9 steps	750	12500	=Ir	=Ir/2			
				FK1600	1600		640	1600		960	16000	=Ir	=Ir/2		
				LTD ⁽¹⁾			STD ⁽²⁾								
				Setting	min	max	Setting	min	max						
				(sec.)	(sec.)	(sec.)	(sec.)	(sec.)	(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						
								In (A)	LT			ST			Neutral Protection
pick-up band 1.05 - 1.3 Ir			pick-up band ± 20% Im			Switchable type									
Ir setting	min (A)	max (A)	Im setting	min (A)	max (A)	4P4T	4P 3TN		4P3T						
SMR 1g	N	H		FK800	800		20	800		480	8000	=Ir	=Ir/2	Not protected	
				FK1250	1000	0.4-1 × In	400	1000	1.5-10 Ir	600	10000	=Ir	=Ir/2		
				1250		in 9 steps	500	1250	in 9 steps	750	12500	=Ir	=Ir/2		
				FK1600	1600	①	640	1600	③	960	16000	=Ir	=Ir/2		
				LTD ⁽¹⁾			STD ⁽²⁾								
				Setting	min	max	Setting	min	max						
				(sec.)	(sec.)	(sec.)	(sec.)	(sec.)	(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	max						
				Ig setting	min (A)	max (A)	(sec.)	(sec.)	(sec.)						
				FK800	800		160	800	0	0.015	0.05				
				FK1250	1000	0.2-1 × In	200	1000	0.1	0.095	0.17				
				1250		in 9 steps	250	1250	0.2	0.175	0.29				
				FK1600	1600	①	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

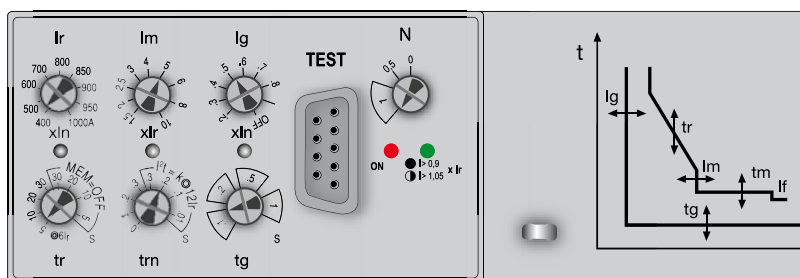
FK1250 frame size

1000 and 1250A, SMR 1e, s or g

FK1600 frame size

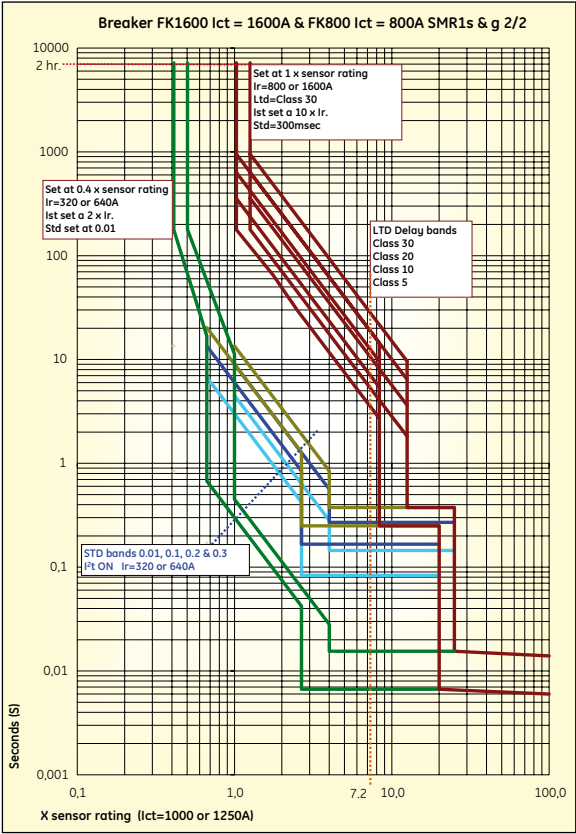
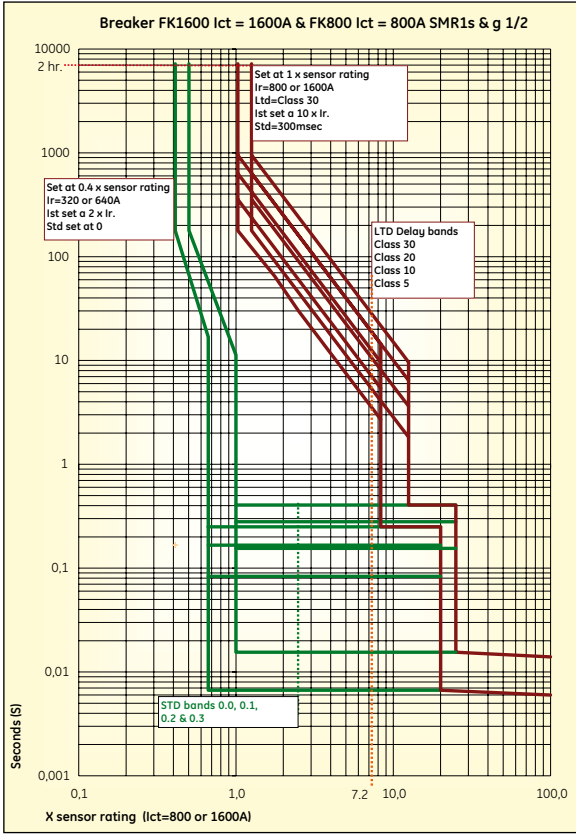
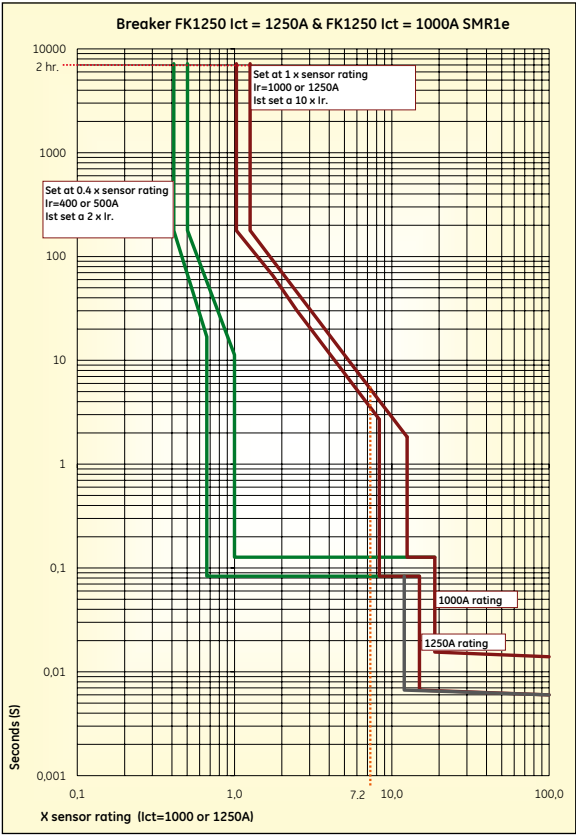
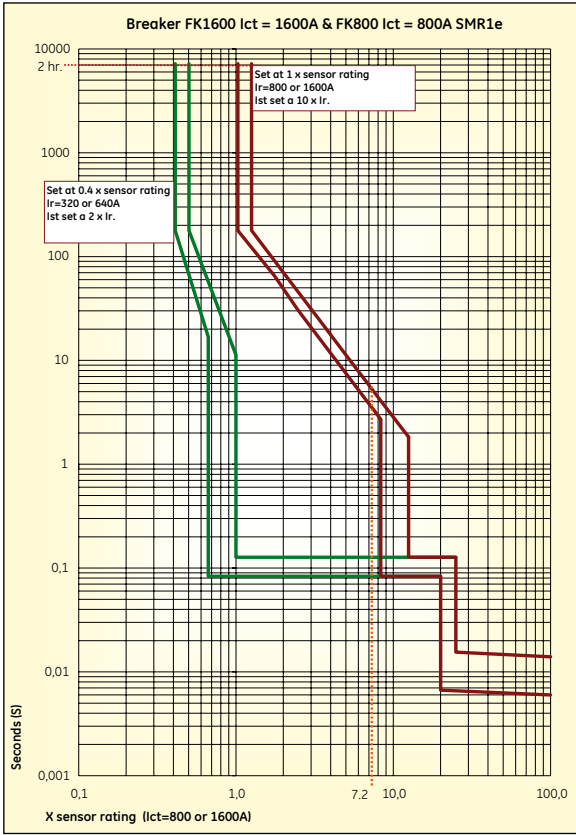
1600A, SMR 1e, s or g

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

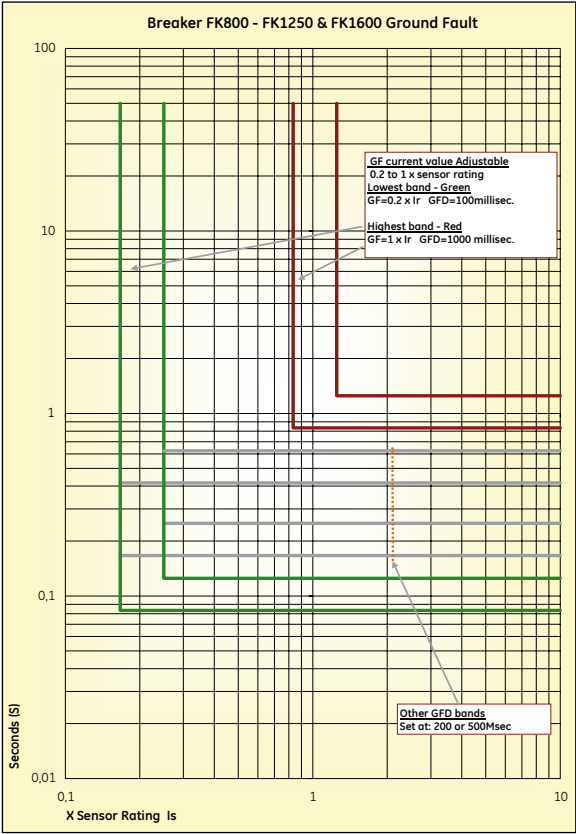
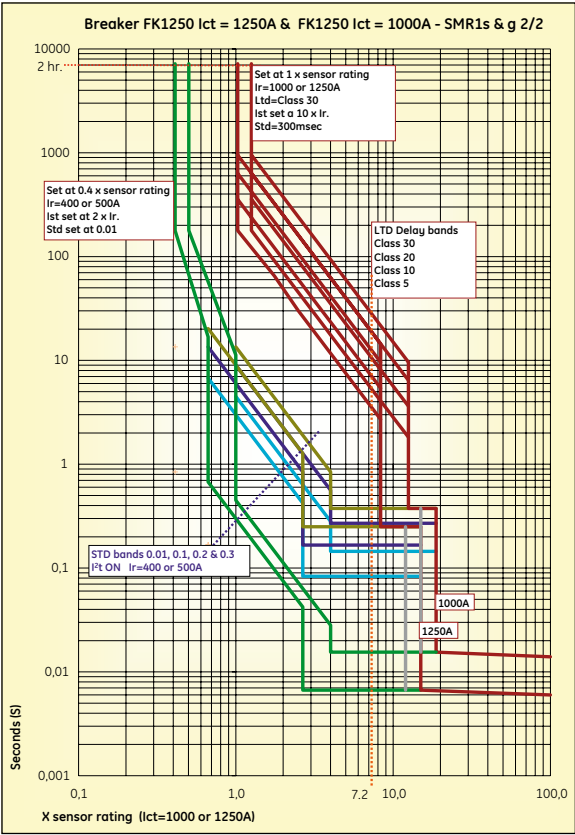
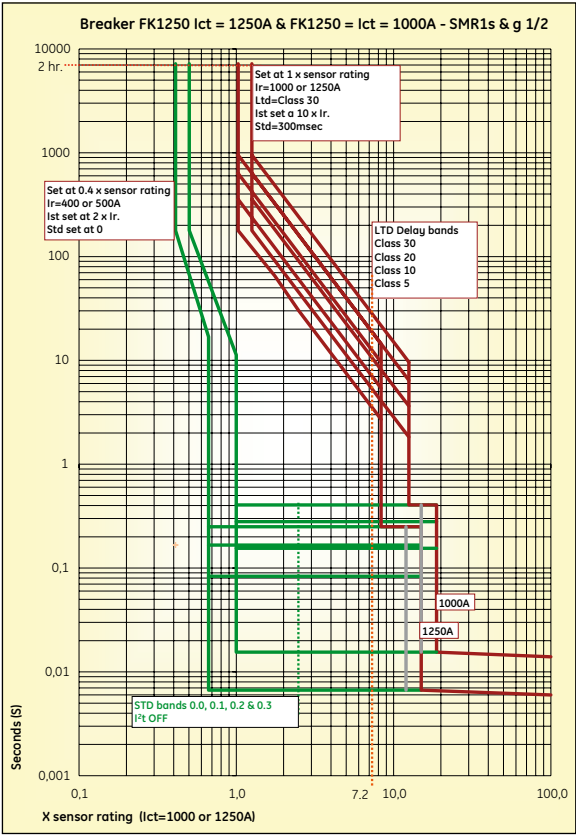


Time Current Curves

FK800 - FK1600
Trip Units SMR1e, s and g

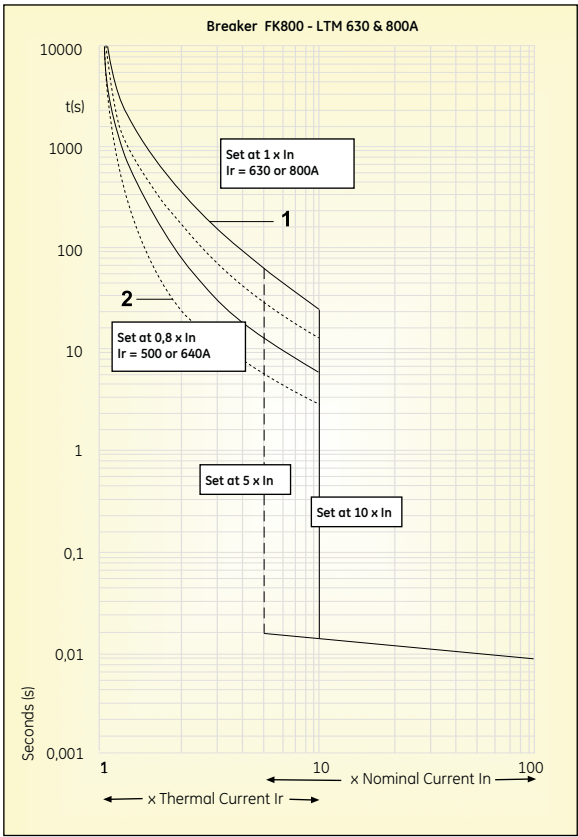


Time Current Curves

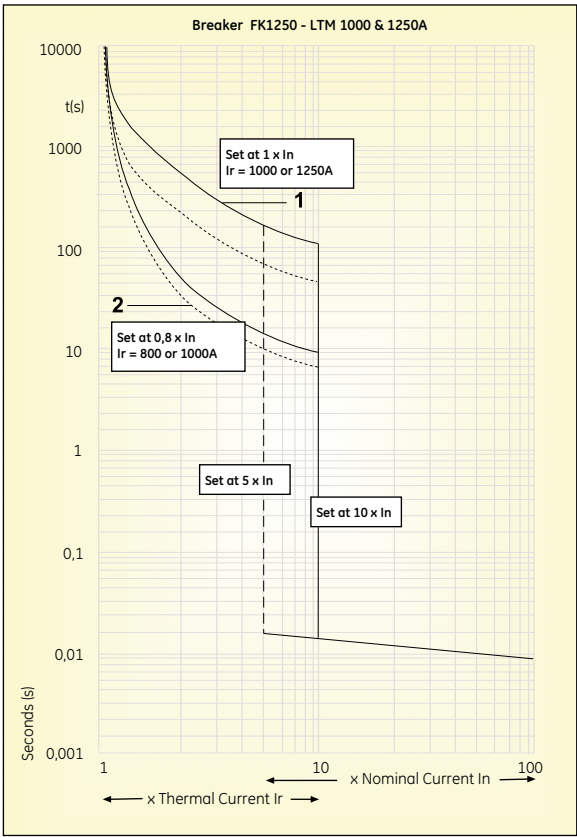


Time Current Curves (continued)

FK800 - FK1250
Trip Units LTM



curve #1 = characteristic with cold start
curve #2 = characteristic with hot start



curve #1 = characteristic with cold start
curve #2 = characteristic with hot start



Electronic Trip Units

Accessories for SMR1 and SMR2 types

Test kit for 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 and g Trip Unit and 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.

Rating plug tool SMR 2 (FAR)

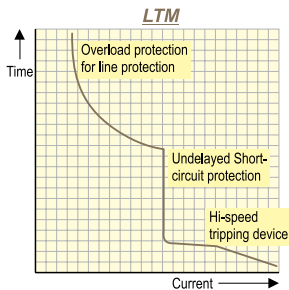


A rating plug can be removed by using two small screwdrivers. In case of repeated removal the **Record Plus*** rating plug removal tool is advised to enhance the ease and safety of this operation.

Trip units

Overview of available types

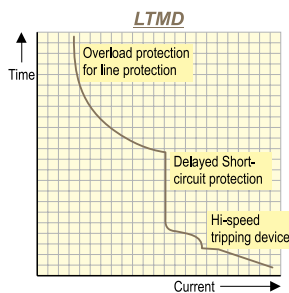
LTM - Line thermal magnetic



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.

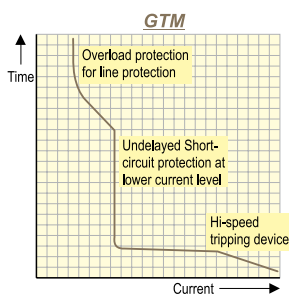
LTMD - Line thermal magnetic, selective type



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.

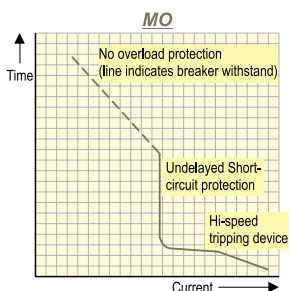
GTM - Line thermal magnetic



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.

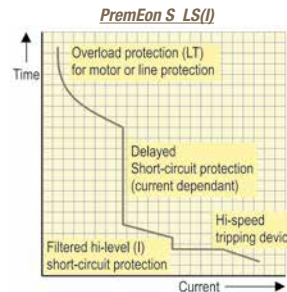
MO - Magnetic Only



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.

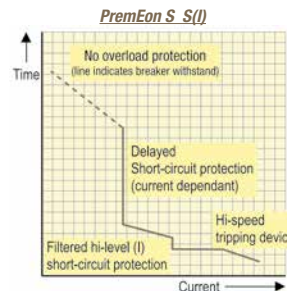
PremEon S - Selective electronic protection - LS(I)



trip unit designed to offer an overload (LT) and short-circuit protection (ST). The overload protection is adjustable from 0.3 to 1 x the chosen rating. To ensure full discrimination the short-circuit protection has a current dependant fixed time setting that varies

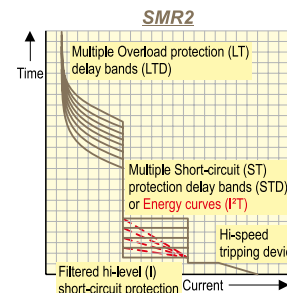
per frame size. The device is adjustable from 2 to 13⁽¹⁾ x the set LT current value. The unit is designed to protect all circuit types and to offer a high level of discrimination with downstream devices.

PremEon S - Selective electronic protection - S(I)



This trip unit offers short-circuit protection only, the device is adjustable from 2 to 13⁽¹⁾ 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).

SMR2 - Enhanced Electronic Protection



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.

(1) ST is adjustable from 2 to 10 x the set LT current value for frame FG 630A.

Internal Accessories

C.2 Auxiliary contacts

C.4 Releases

External Accessories

C.6 Residual current devices RCDs

C.8 Rotary handles

C.12 Electrical operators

C.16 Connectivity, 60 mm system

C.18 Changeover / Power transfer systems

Versions

C.21 Plug-in devices

C.23 Draw-out devices, FE and FG frame

C.25 Draw-out, FK frame

Installation

C.26 Padlocks, keylocks

C.27 Door flanges

C.28 Terminal shields

C.29 FD frame adaptors and other accessories

Mounting positions

C.31 Allowed mounting position per frame size

C.31 Breaker supply

Components and accessories**Connections**

C.32 Standard connection terminals

C.34 Rear connections facilities

C.36 Optional connection terminals

C.38 Optional connection - box clamps

C.40 Optional connection terminals - extenders variants

C.41 Phase separators and Back plates

The breaker

Order codes

Trip Units

Technical data

Application guide

Wiring diagrams

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Intro

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X

Auxiliary contacts

FD, FE and 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 ⚡ Trip unit operated types ⚡.

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 and 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
- **FAS10L** auxiliary contact left mounted NO
- **FAS01R** auxiliary contact right mounted NC

The FAS10 and FAS01 contacts blocks are also used in kits as carriage indication contacts for the draw-out versions of the FE and 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)

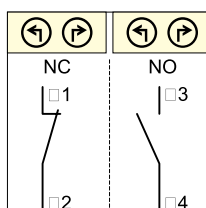
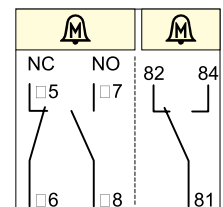
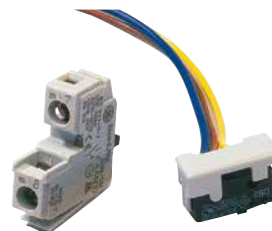
Indicates that the breaker has moved to its "Tripped" position.

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 ⚡. 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).



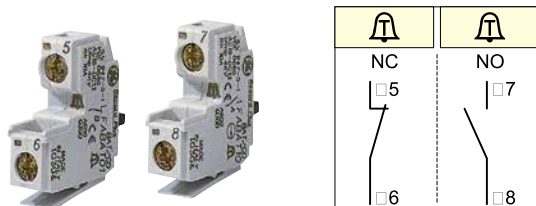
(1) See wiring diagram section for complete overview.

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.

2 versions are available:

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

**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	-	-	-	-

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.)

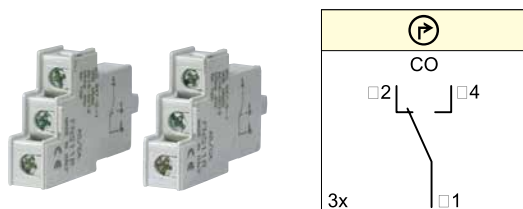
The contact numbering of each device is indicated in the schematics next to each photo. **eg. 5 or 6**

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**

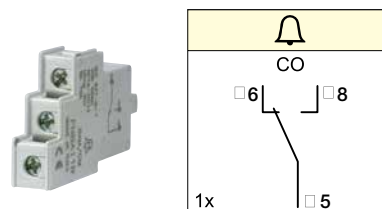
The combination of these two codes provides a standardized coding system of each connection point. **eg. 15 or 26**

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	-	-

Record Plus

Internal Accessories

Releases

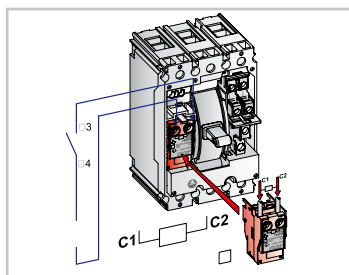
Shunt and undervoltage releases can be fitted easily and quickly in a specifically designed accessory compartment which is accessible by removing the breaker lid. This fully insulated compartment has several pouches one of which is reserved for a shunt or undervoltage release indicated by a symbol printed 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 and FG frame

Shunt release (SHT/EA)



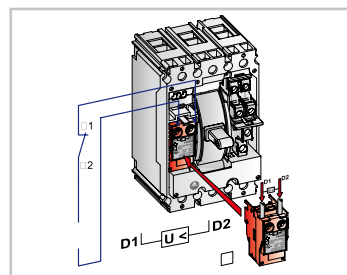
The **Record Plus*** shunt and undervoltage releases are common for all frame sizes up to 630A and all offer a unique combination of low power consumption and a kiss-free, lock out operation. Most types are common for equivalent AC and DC ratings and all are available in a wide range of voltages. When 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
400/440V 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

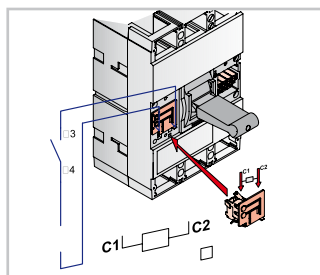
Undervoltage releases - Performance

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
400/440V AC	15	15	6.6	6.6

(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.

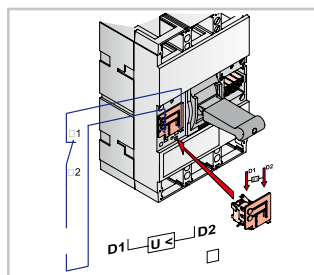
Switches, relay contacts and push buttons are used to operate the shunt release.

Voltage operational band	0.7 - 1.1 U_n
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 U_n
activates between	0.85 - 1.1 U_n
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

Record Plus

External accessories

Residual current devices

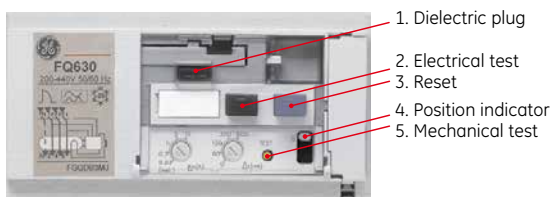
A **Record Plus*** circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). A line of three and four pole completely integrated add-on devices are available as side mounted models (FD frame size) or as units that are fitted below the trip unit 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⁽¹⁾ 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.

(1) Available for FD and FE frames

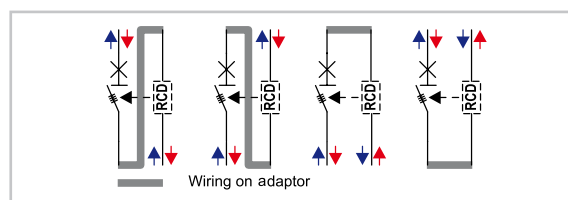
Designed to meet the latest IEC 947 (industrial), IEC 1009 (residential) and the IEC 755 standards, **Record Plus*** RCDs are available in a version suited for side or bottom mounting as three and four pole units. The tamper free setting area illustrated below is common for the whole line and includes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

	FDQDI or FDQDS	FDQDB ⁽¹⁾	FEQDB ⁽¹⁾	FEQDB ⁽¹⁾	FGQDB ⁽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 / 400-690V	220-440V / 400-690V	220-440V / 400-690V	220-440V / 400-690V	220-440V
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.

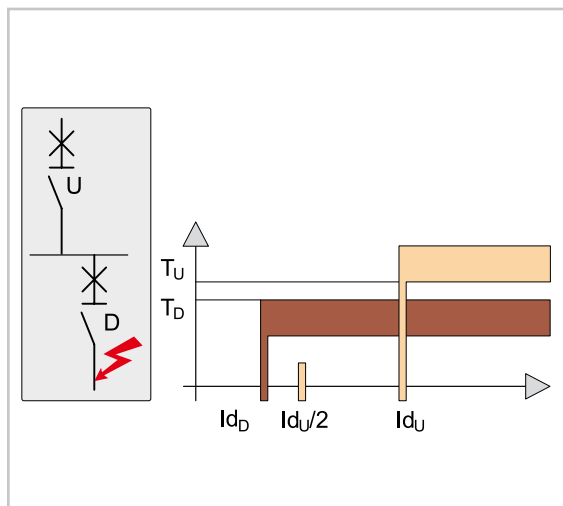
$$I_{dU} > 2 \times I_{dD}$$

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			T			T
ElfaPlus "S" type	30						T	T	T	T	T	T	T	T	T
	300							T	T		T	T		T	T
	1000								T			T			T
FD-Q RCD set at inst.	30		T		T	T	T	T	T	T	T	T	T	T	T
	300					T		T	T		T	T		T	T
	1000								T			T			T
FD-Q RCD set at: 60 msec.	30						T	T	T	T	T	T	T	T	T
	300							T	T		T	T		T	T
	1000								T			T			T
	3000											T			T
FD-Q RCD set at: 150 msec.	30									T	T	T	T	T	T
	300										T	T		T	T
	1000											T		T	T
	3000														T
FD-Q RCD set at: 300 msec.	30												T	T	T
	300													T	T
	1000														T
	3000														

T = Total (or Full) selectivity

Record Plus

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 mode 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.

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.

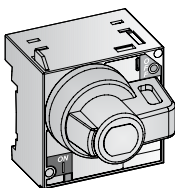
The Ronis key locks are available in a number of versions:

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

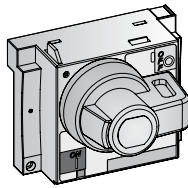
Record Plus* rotary handle mounted directly on the breaker front



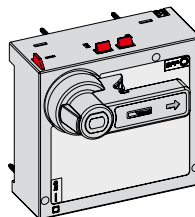
A specifically designed adaptor box with a handle is directly installed onto the breaker front. It is available in grey for normal applications and in a yellow/red execution for machine tool applications.



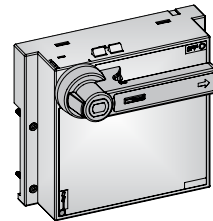
FD160



FE 160/250

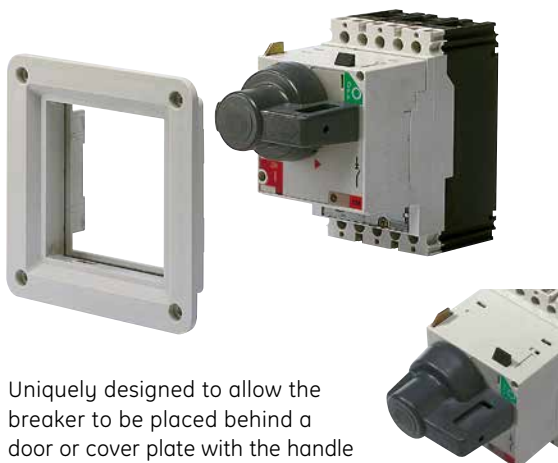


FG 400/630



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



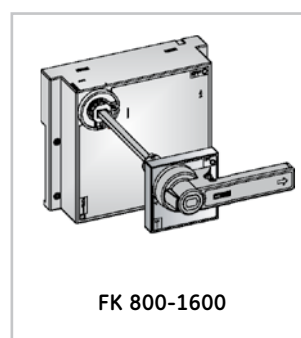
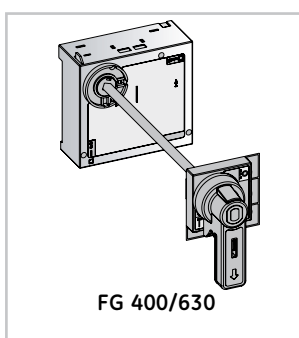
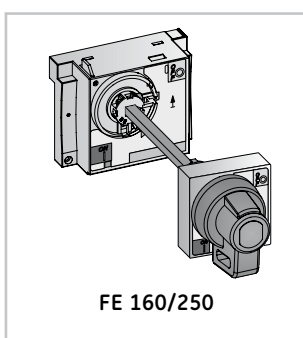
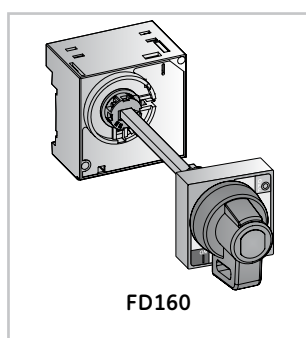
A handle and escutcheon is mounted on the door or panel front and connected to the breaker by an elongation shaft that goes into an adaptor box directly installed onto the breaker front. The design allows for a total depth of up to 350 mm (from the back of the breaker mounted behind the door or panel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



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

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:

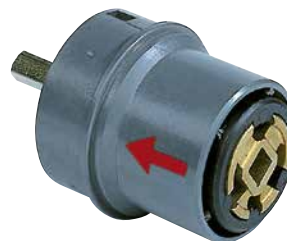
- A version where each lock has a different key number
- A version where the user can choose one of six keys for several locks

Side-by-side installation adapter boxes



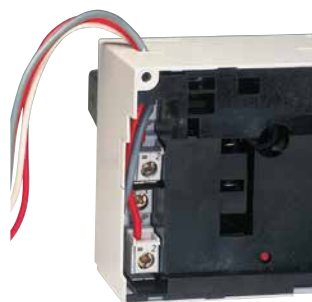
- A set of covers that bridge the gap between breakers with rotary handles on use through cover plate
- Provides an aesthetically pleasing finish to the breaker fronts
- Available for FD and FE frame sizes

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

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

External accessories

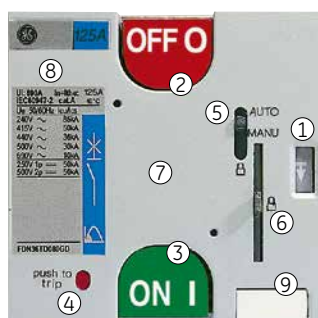
Electrical operators

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 FD (3-160A), FE (50-250A) and FK (630-1600A) frame sizes, a field mountable execution is available. For FG frame (250-630A) and FK frame Hi-end applications, factory mounted electrical operator can be mounted.

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 "OFF" push-button
- ③ Breaker "ON" 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

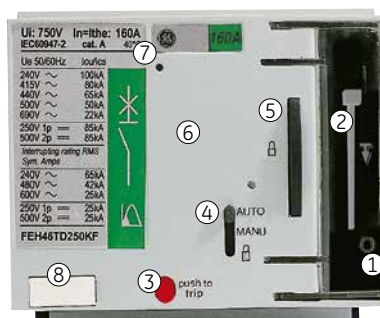
FD frame operator

Designed to be used in a side by side configuration with the FE frame operators the breaker and 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 and Manual position that will only allow local OFF and 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.

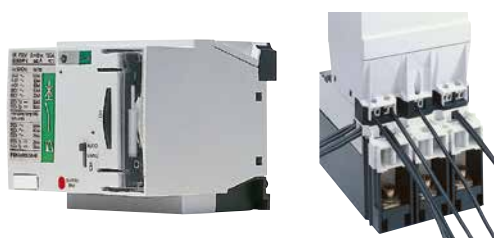


- ① Breaker Position Indicator - OFF- ON-Tripped-
- ② Breaker operating handle behind transparent door
- ③ Breaker "quick" Trip/OFF push-button
- ④ Manual-Automatic switch
- ⑤ Padlocking device (-O- Off only)
- ⑥ Area reserved for Optional field mountable KeyLock
- ⑦ Breaker data labels
- ⑧ Circuit indication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

FE frame operator

Designed to be used in a side by side configuration with the FD frame operators the breaker and 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 and 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

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 and 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 and 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 and 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 and 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	FE frame 3 or 4 pole	FG frame 3 or 4 pole	FK frame 3 or 4 pole	FK frame 3 or 4 pole
Electrical operator types Mounting	FDEMF Field	FEEMF Field	FGEMF Factory only	FKEMF Field	FNEMF Factory only
Rated voltages					
24V AC/DC	-	•	•	-	•
48V AC/DC	•	•	•	-	•
60V AC/DC	•	•	•	-	-
110-130V 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	8 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	8 seconds
Life span					
Mechanical endurance	100000	10000	5000	5000	5000
Operating frequency (per hr.)	120	120	60	30	30

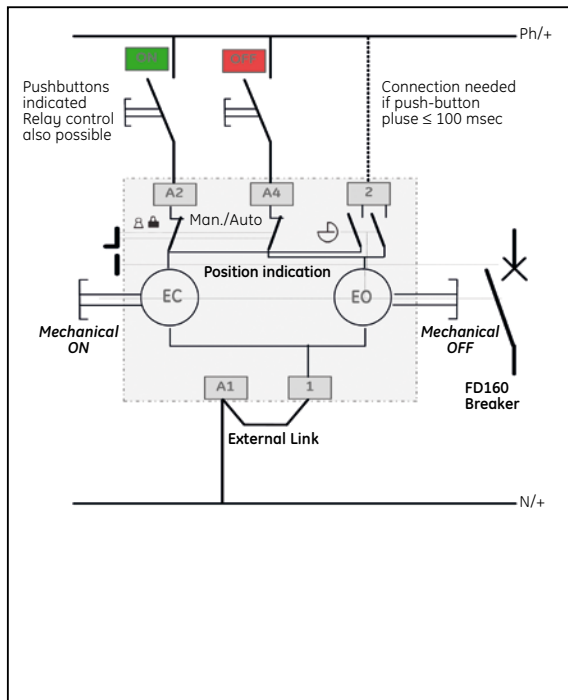


Electrical operators

Factory mountable (FG) and Field mountable (FK) models schematics

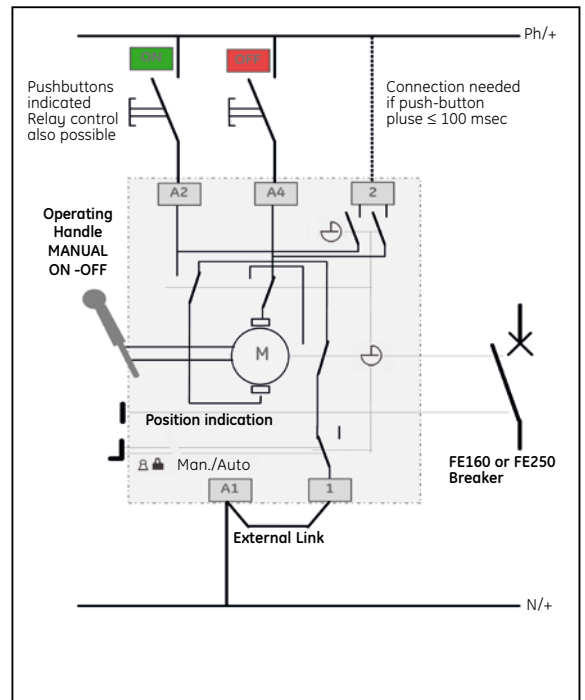
FD frame standard scheme

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



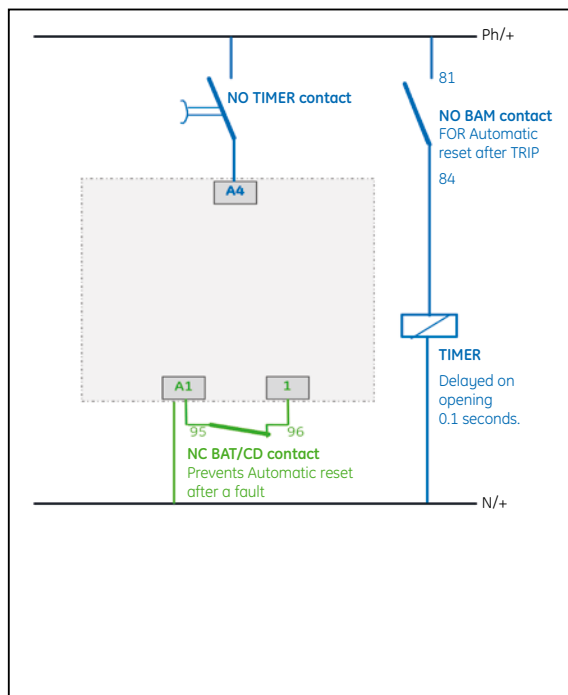
FE frame standard scheme

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



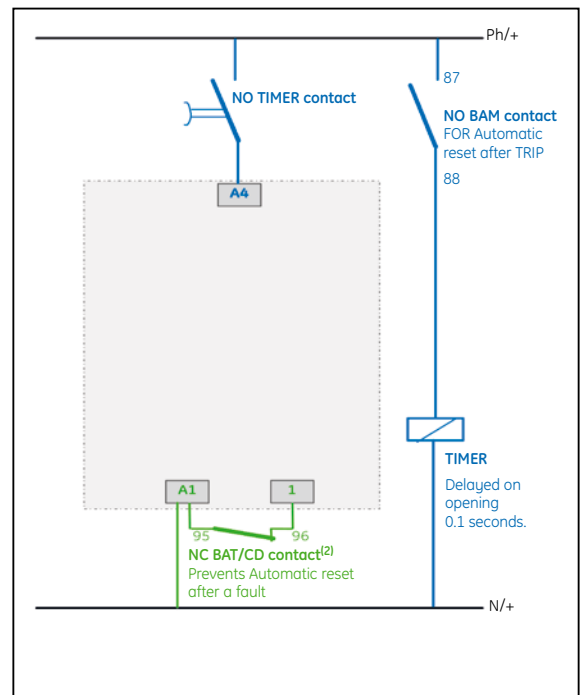
FD frame alternate options

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⁽¹⁾ of the options (depicted in blue and green) can be added to create the indicated functionality.



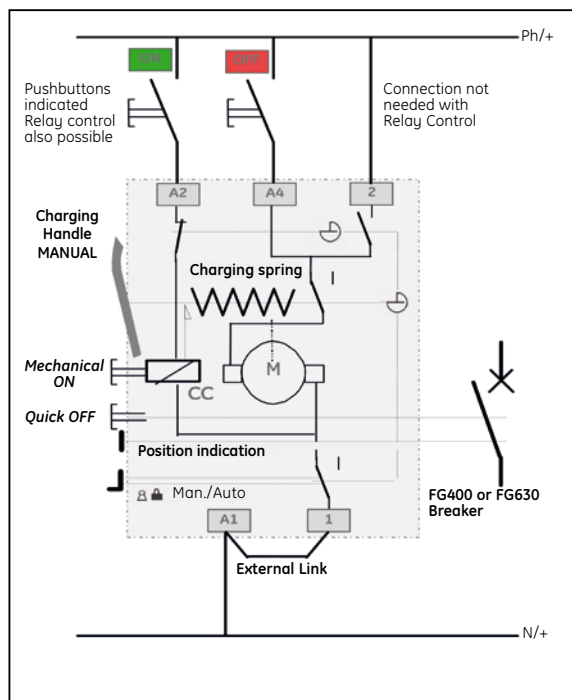
(1) Both options used together are available on Electronic types only.
 (2) For Thermal Magnetic types, a NC BAM/CDM is to be used.
 It prevents Automatic reset after a trip, including push-to-trip button and shunt or undervoltage release (details page C.2).

Electrical operators

Factory mountable (FG) and Field mountable (FK) models schematics

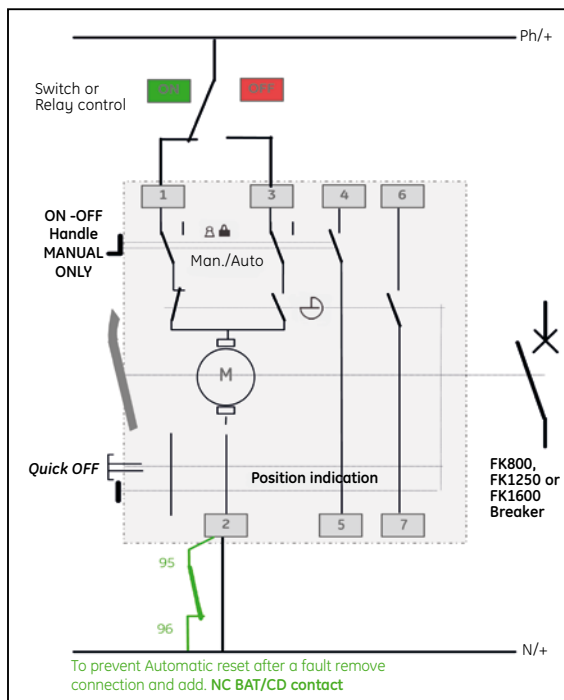
FG frame standard scheme

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



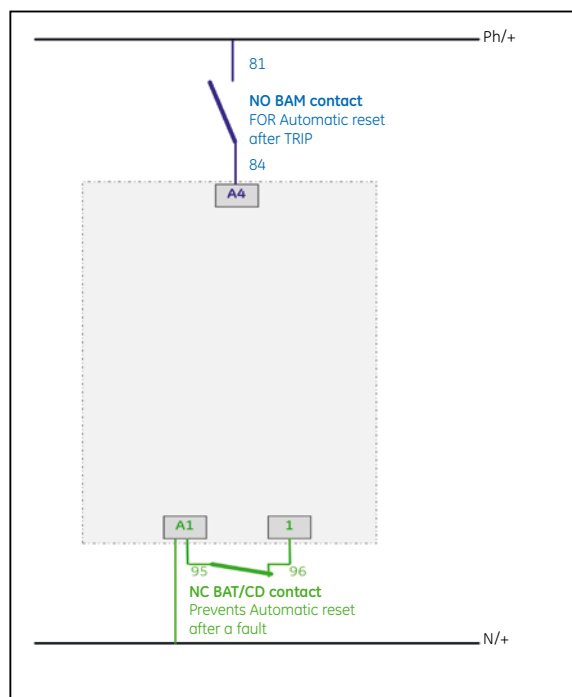
FK frame standard scheme for relay control

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.

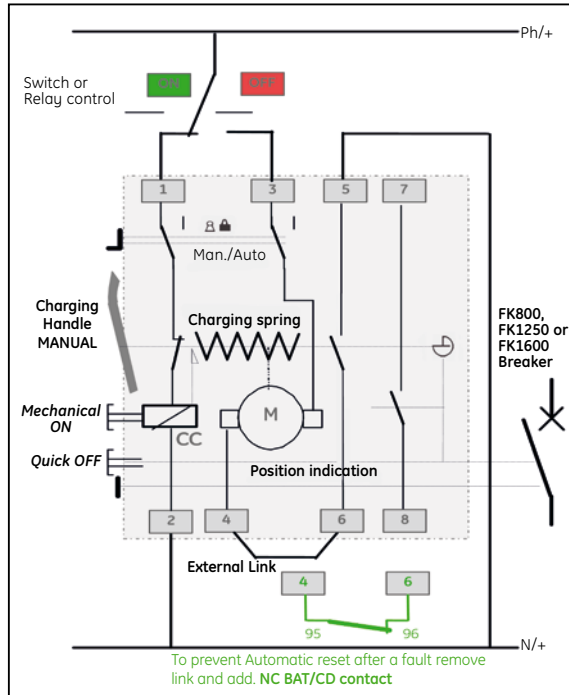


Electrical operators

Factory mountable models schematics

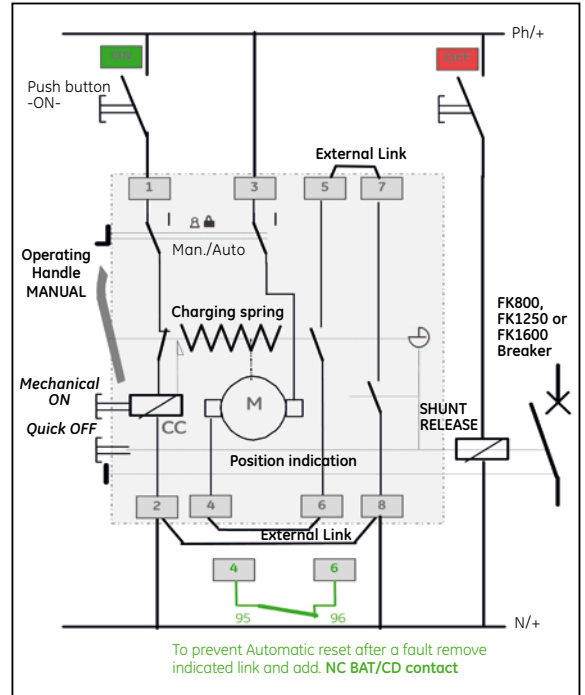
FK frame standard scheme for relay control

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

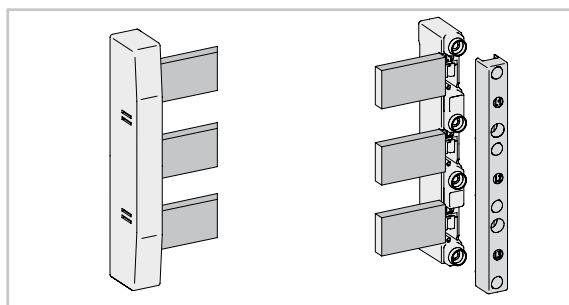
Record Plus* circuit breakers have been designed to be installed easily and quickly with conventional means. The devices can be screw mounted to a mounting plate or clicked to a symmetrical DIN rail and connected with busbars, cables, flex-bars and ring terminals in a multitude of configurations. Connectivity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

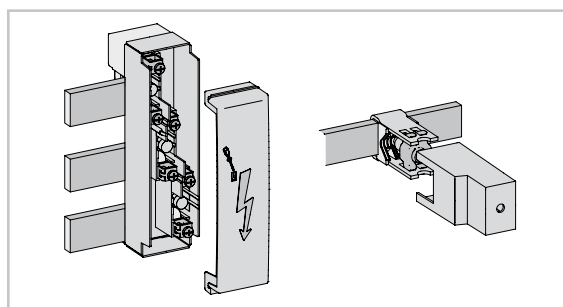
Busbar system

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
	30 x 10	63	30.0
300 mm	20 x 5	40	19.0
	20 x 10	43	20.5
	30 x 5	52	24.8
	30 x 10	56	26.7
400 mm	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.

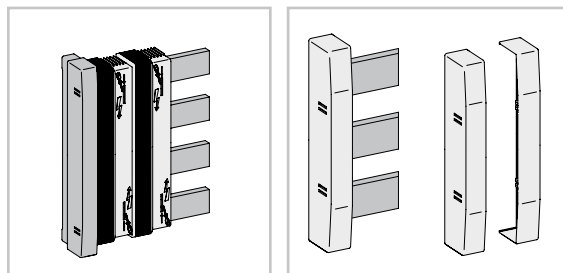
The side connection kit is made up of single pole connectors with terminal covers that allow for the connection of Cu conductors with a cross section of 25 to 300 mm².



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.



Record Plus

The system

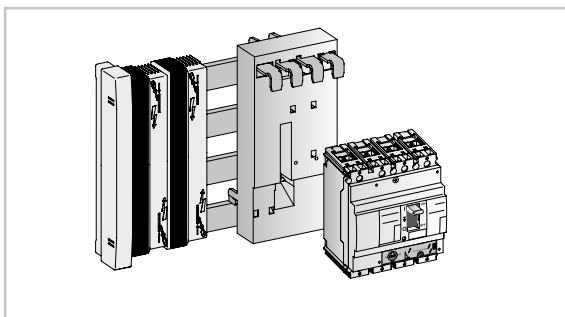
For the **Record Plus*** FD and FE frame adaptors exist rated at 160A (FD) and 250A (FE) and in a 3 and 4 pole version. Designed to allow the use of the breaker at its full rated breaking capacity of 150kA at 415V each unit is equipped with a plug/hang on connection system allowing one to place it on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

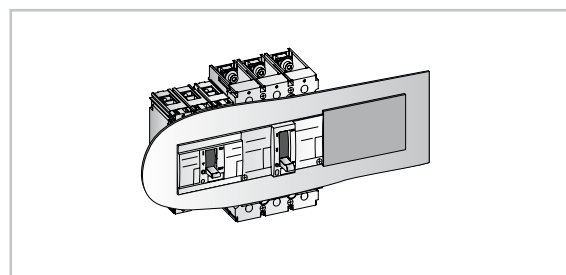
Adaptor

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.



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.

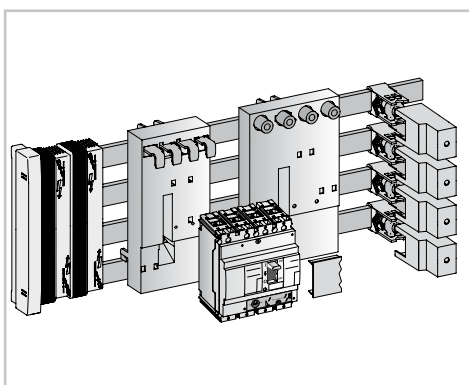


System

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

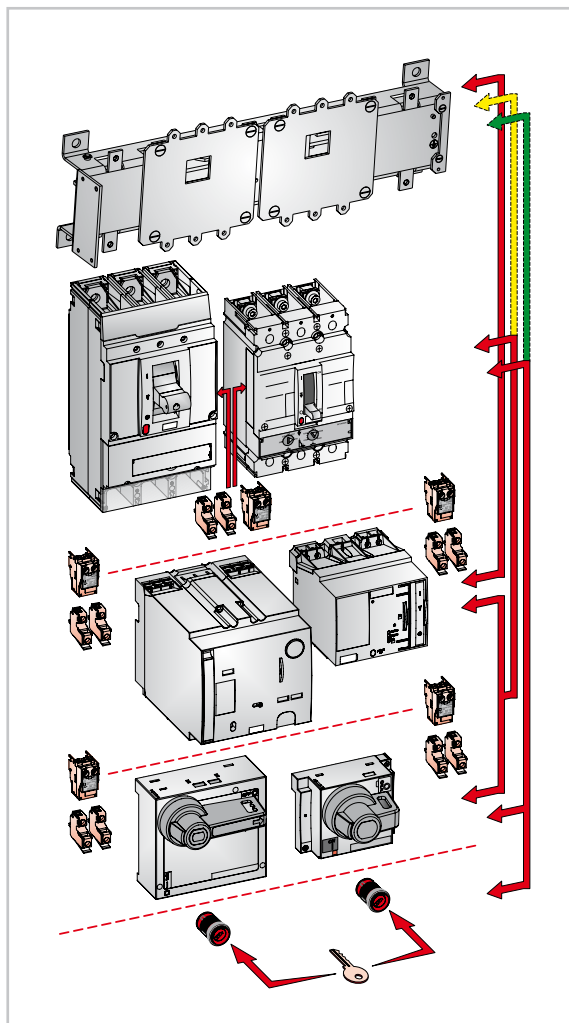
The breaker and adaptor combination is now quite simply plug/hung on to the busbars, connecting and fixing the breaker in one simple operation.

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).



External accessories

Interlocking systems

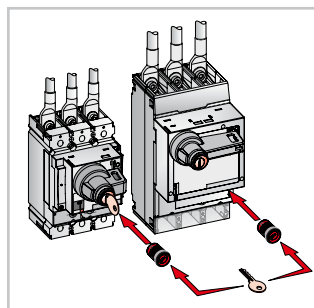


Mechanical interlocking

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.

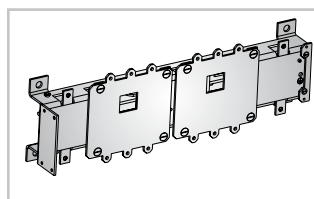
Two systems are available

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.

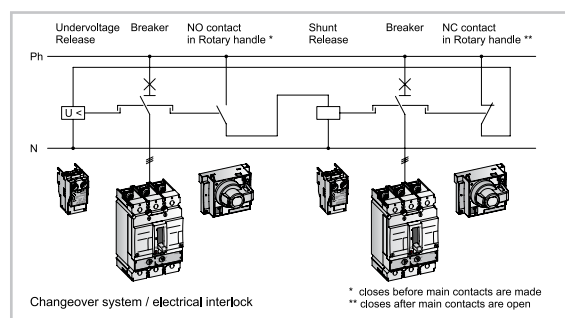


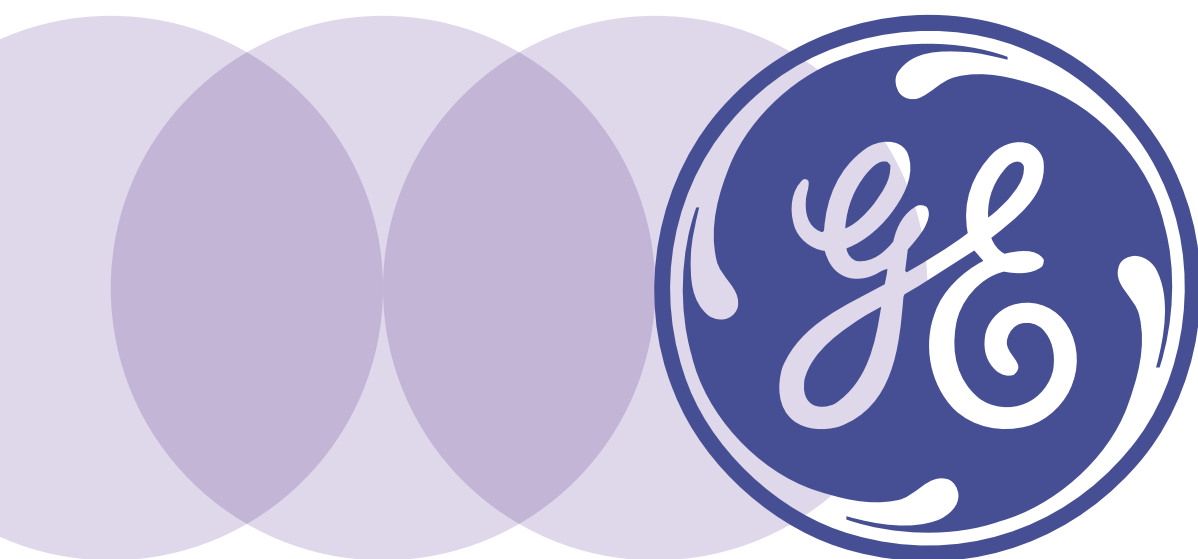
The device allows the interlocking of two breakers of equivalent or different frame sizes. The following combinations are possible:

- 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.





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.

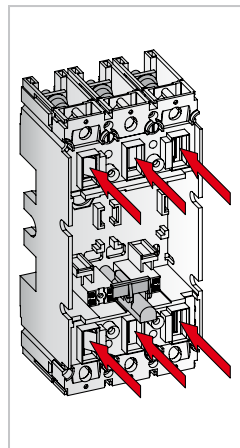
The **Record Plus*** plug-in version is available for:

FD frame sizes FD160 (maximum 125Amps)

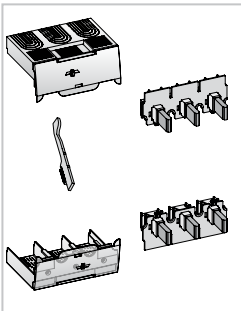
FE frame sizes FE160/250 (maximum 250Amps)

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 an other amp rating interchange prevention kits are available.

Please refer to page C.24.



Draw-out

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) and 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 and lugs available for the standard fixed front connection breaker can be used with this plug-in base.

see page C.23 for more details.

FK frame (max. 800A) and 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.25 for more details

Versions

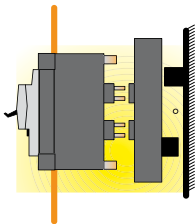
Draw-out, FE and FG frame

Standard draw-out device



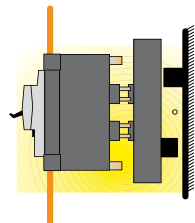
The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type. It includes a racking handle and can be used 'behind door' without any additional accessories.

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.

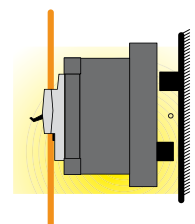
Draw-out position...TEST



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 eucheneon



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

The eucheneon 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 eucheneon to be accessed on the door front. The kit includes an elongated toggle handle, an extension frame, a doorflange and the through door eucheneon with it's locking and position indication features.



The F-WN kit allows the a through door Rotary handle operator and the draw-out eucheneon to be accessed on the door front.

The kit includes an extension frame, a doorflange and the through door eucheneon 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 eucheneon to be accessed on the door front.

The kit includes an extension frame, a doorflange and the through door eucheneon with it's locking and position indication features.

Draw-out device Accessories.

Door mounted Rotary handle option



Combined with the F-WE kit the draw-out eucheneon 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.

Record Plus

Draw-out, FE and FG frame

Accessories

Auxiliary disconnect plugs and sockets⁽¹⁾

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

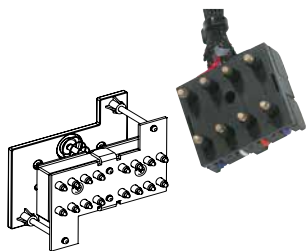


A set made up of a plug screwed to the breaker back (mobile part) and a socket that clicks into the plug-in base (fixed part). The socket comes with connected colour coded wiring which allows for an easy identification of the

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 and Y	X, Y and Z

Draw-out FE and FG frame 8 pole plug⁽¹⁾



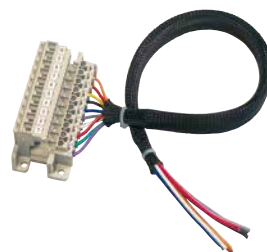
Meeting the same standard specifications as the 8 pole plug for the Plug-in version (see above) the kit now includes an adapted fixed part that allows an ACB TEST position to be created.

The accessory is available as 16 pole (2 x 8 pole units) or 24 pole kit (3 x 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 and Y	X, Y and 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 and ER	EL and ER	EL and 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 the 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

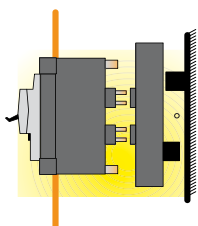
Draw-out, FK frame

Standard Draw-out device



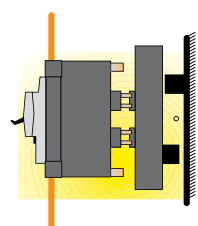
The draw-out device is supplied as complete entity including a mobile and fixed part allowing the conversion of a standard fixed front connection breaker to a draw-out type. It includes a racking handle and can be used 'behind or through door' without any additional accessories. The draw-out device is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

Draw-out position...Withdrawn



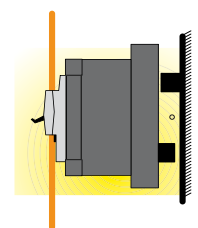
In this position the Mains and Auxiliary contacts are disconnected and the breaker can be removed from the chassis. Both the Mains and Auxiliary contacts are protected against inadvertent contact.

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.

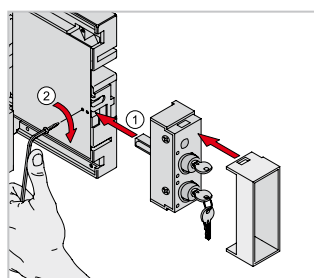
Operation

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

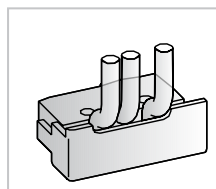


Each draw-out device is supplied with a eucheneon, fitted on the right hand side of the door frame.

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 and A	X, Y, Z, A and B

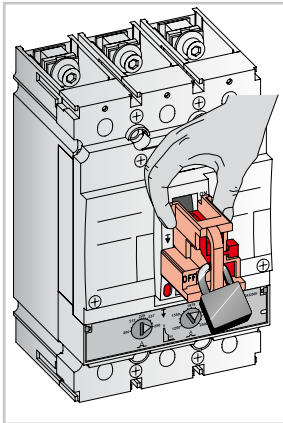
(1) In order to ensure a consistant and traceable wiring diagram of all internal accessories in each frame sizes a standard scheme is included in the wiring diagram chapter F of this catalogue (use is optional).

Installation

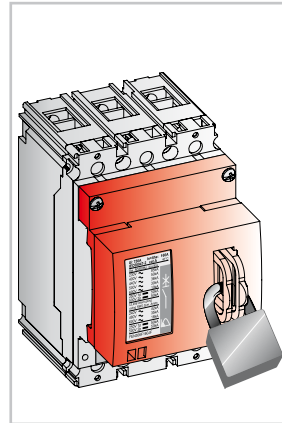
Padlocking device for toggle handle

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 (max 5 mm for FK frame). 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 (max 5 mm).



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.

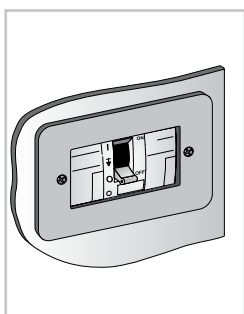
For **Record Plus*** breakers installed through doors, cover plates or panels the following door flanges are available:



Toggle area

Fixation via front with 2 or 4 screws, universal for 3 and 4 pole breakers.

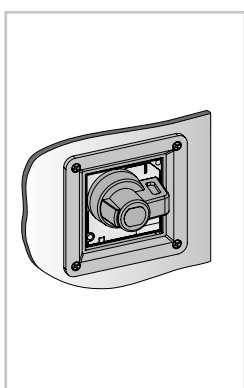
	Type
FE frame	FEFT
FG frame	FGFT
FK frame	FNFT



Front face

Fixation via front with 4 screws, available for 3 and 4 pole breakers

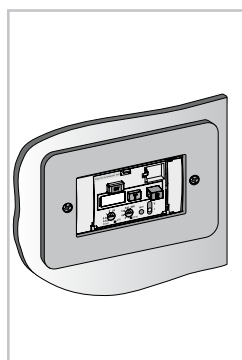
	Type
FD frame 3p	FDFF3
FD frame 4p	FDFF4
FE frame 3p	FEFF3
FE frame 4p	FEFF4



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 and FE frame	FDFH
FG frame	FGFH
FK frame	FNFH

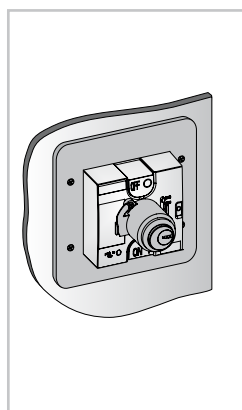


RCD bottom mounted type

(universal for FD, FE and FG)

Fixation via front with 4 screws

	Type
FD frame 3p	FDFF3
FD frame 4p	FDFF4
FE frame 3p	FEFF3
FE frame 4p	FEFF4
FG frame 3p	FGFF3
FG frame 4p	FGFF4



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)

Record Plus

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.

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.



Long terminal shields

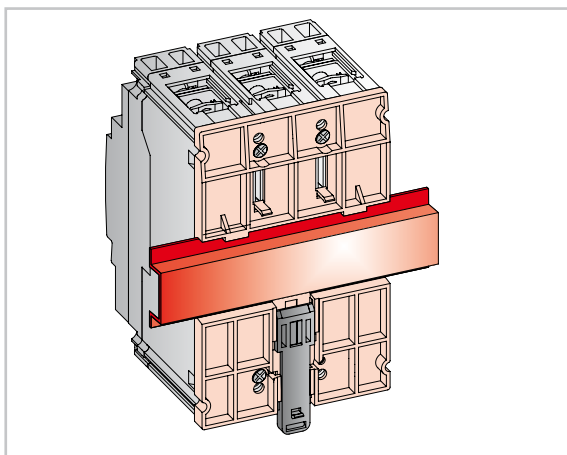
	FD	FE	FG ⁽²⁾	FK
With two terminal shields mounted, Breaker height is increased by: (mm)	97	122	83	160

(2) The FG type is of medium length. Special long and widened version available on request.

FD frame adaptors

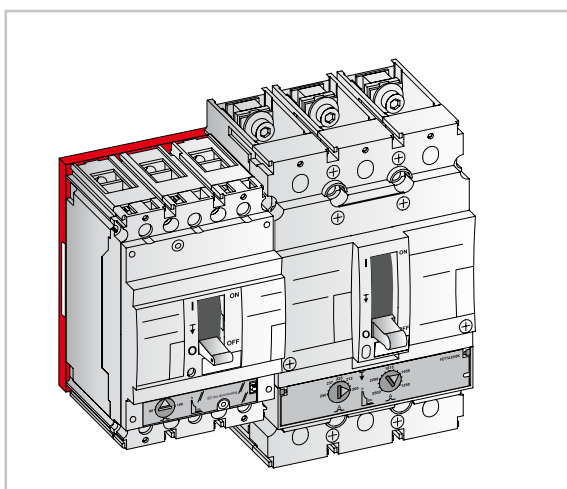
DIN-rail mounting

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.



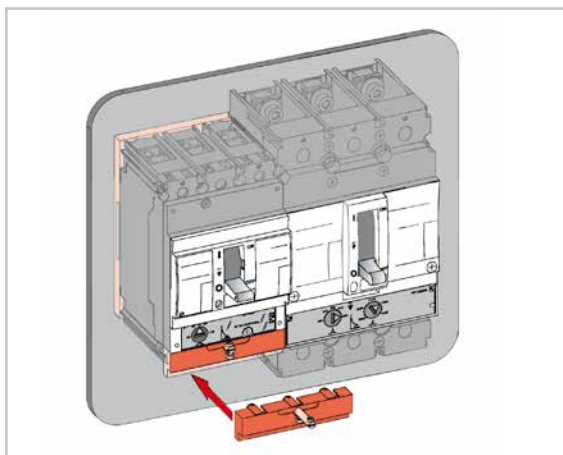
Side by side mounting with FE frame breakers

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 heightner. This change in depth of the D frame allows side by side mounting with E frames. When reversed the adaptor turns into a heightner 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.



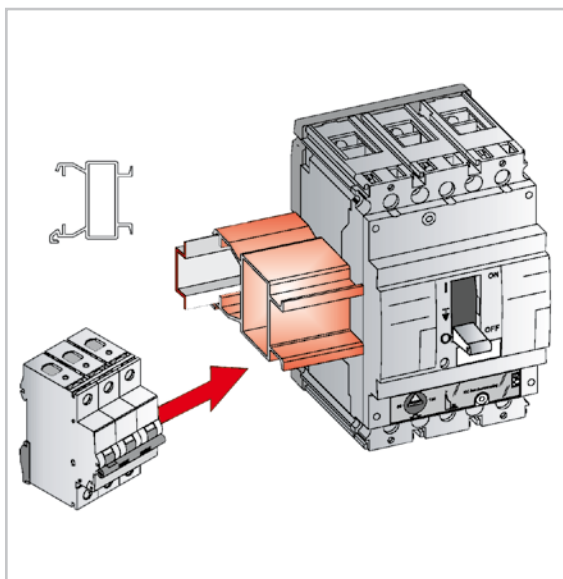
Adaptor - Cut-out filler

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 MCBs

The FD frame has a 45 mm cut-out allowing its use next to Elfa Plus MCBs and other modular devices. To bridge the difference in depth between the FD frame and the modular devices a special heightning kit is available in a standard length of 354 mm.



FD frame

Ua: 00V0 UPHINE: 1.20A
40°C

Ua
50/60Hz ~ 100V
250V ~ 89A
415V ~ 50A
440V ~ 50A
500V ~ 50A
600V ~ 60A

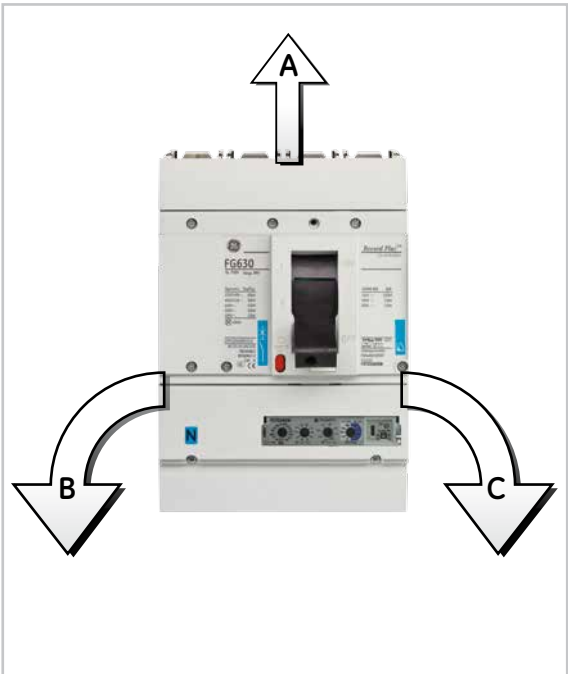
007
BS CH JS US VDE VDE
IE 00947-2
cat. A

Ua
DC ~ 100V
250V 100V
40A
500V 20A
40A

430758
Cat. No
FD448TD125SD

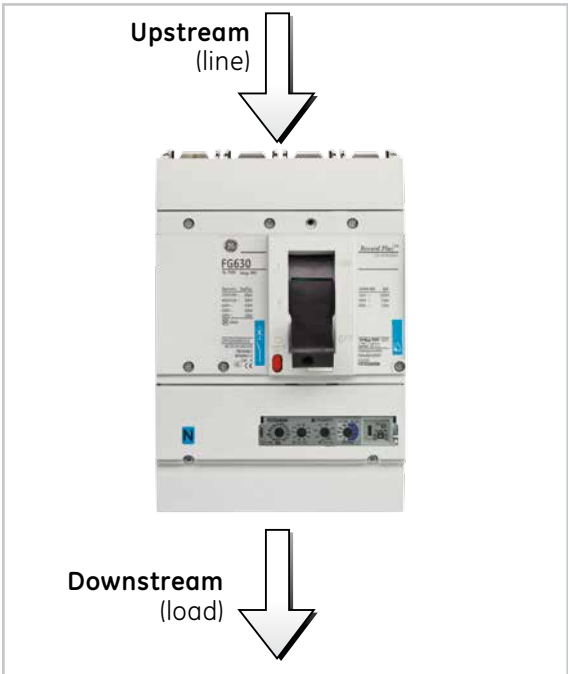
Mounting positions

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
FG400 / FG630	Fix	X	X	X
	Plug in	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	P
	Downstream	A	A	A	A	P
< 500 V	Upstream	A	A	A	A	P
	Downstream	A	A	A	A	P
≥ 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 and L types Upstream FEED ONLY

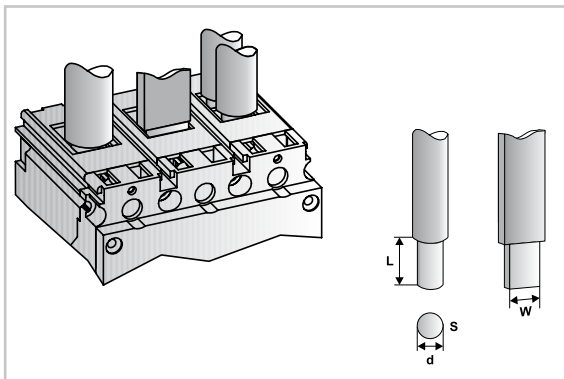
Standard connection terminals

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.



FD frame box terminals⁽¹⁾

	FDC and 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

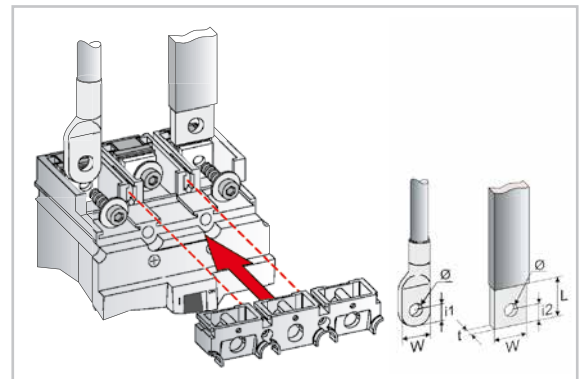
(1) For aluminium conductors use external box clamps.

FE frame

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.



FE frame with removable cover

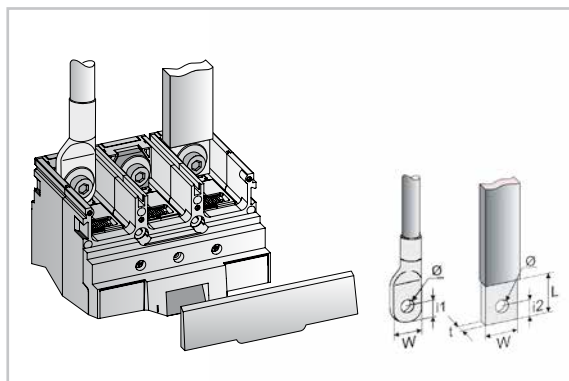
	FE
W max (mm)	25
t max (mm)	5
i1 max (mm)	11.5
i2 max (mm)	9.8
Ø max (mm)	9.5
L Distance to insulation (min.)	25
Torque (Allen key in breaker) (Nm max.)	25

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

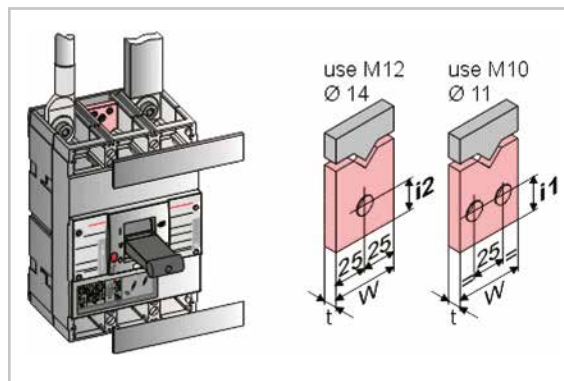
	FG
W max (mm)	32
t max (mm)	12
i1 max (mm)	19
i2 max (mm)	17.5
Ø max (mm)	11
L Distance to insulation (min.)	33
Torque (Allen key in breaker) (Nm max.)	42

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. The use of phase barriers is mandatory with FK frame devices.



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)	14
Torque (Allen key in breaker) (Nm max. M12)	25

W = Width of bar or ring terminal / lug
t = Thickness of bar or lug
Ø = Hole diameter

Record Plus

Connections

Rear connection facilities

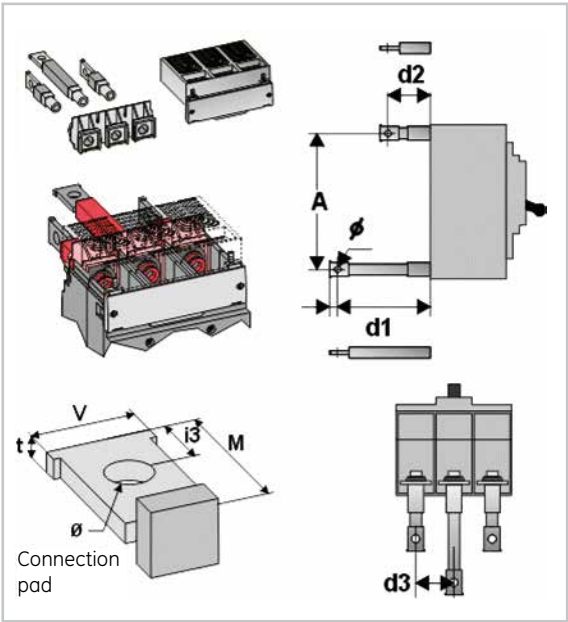
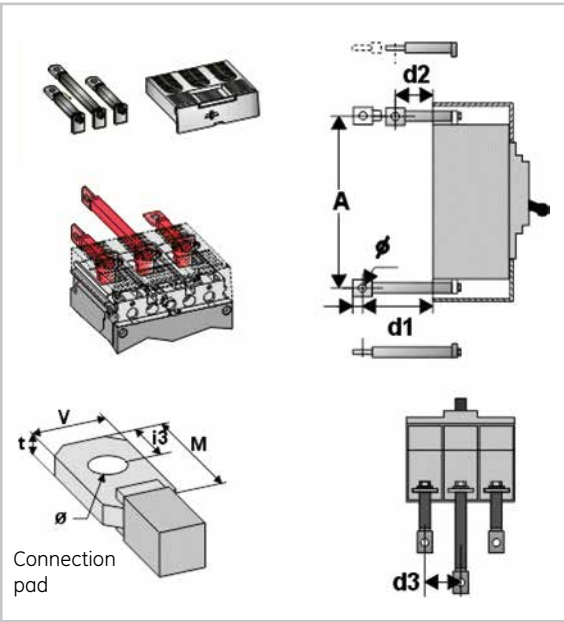
A rear connection kit changes the standard connection configuration of a fixed, plug-in or draw-out breaker from front to rear access. Delivered as a multi-pole set they allow an easy and quick change in configuration of the standard fixed-front connection breaker to a model where the connection is accessible 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
Ø hole max (mm)	7
Torque (Allen key in breaker) (Nm max.)	8
Torque of connection bolt M6 (Nm max.)	8

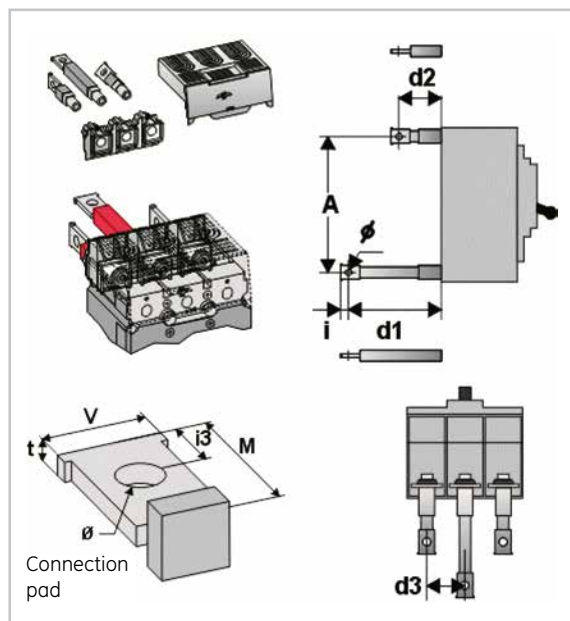
FE frame rear connection

	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
Ø 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.

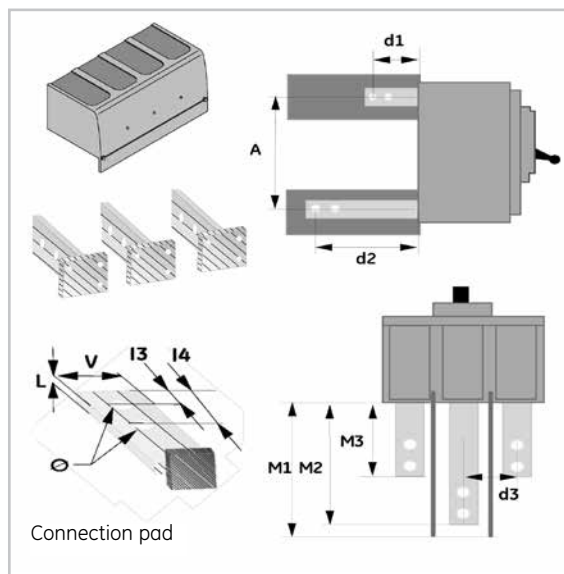


FG frame rear connection

	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

Record Plus

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

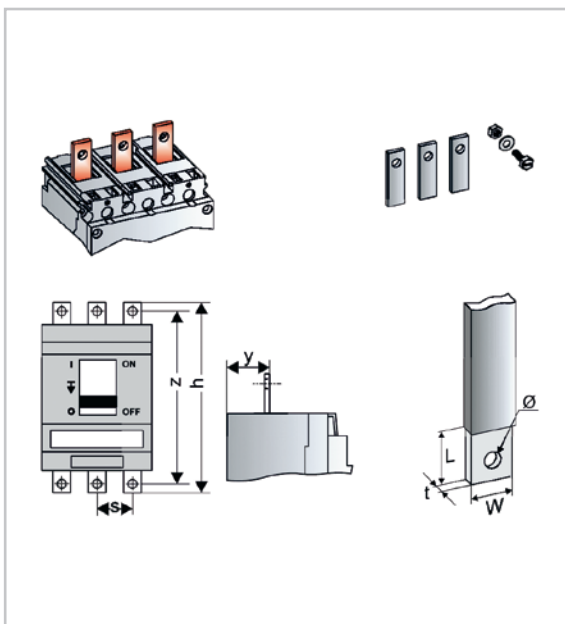
the breaker. The kits are made up of single pole connectors that are fitted to the standard breaker terminal. The connectors are supplied with all the necessary connection and fixation hardware.

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 and 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⁾



FD and FE extenders

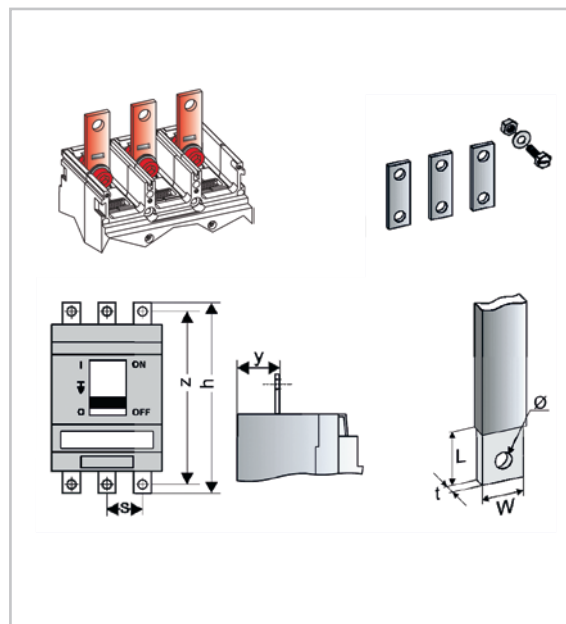
	FD	FE
h = height dimension of breaker with extenders at its top AND bottom.	190	230
z (mm)	170	212
s (mm)	27	35
y max (mm)	28.5	25.5
W max (mm)	14	20
t max (mm)	5	8
L max (mm)	16	18
Ø hole max (mm)	7	9
Torque (Allen key in breaker) (Nm max.)	8	25
Torque of connection bolt (Nm max.)	8	25

(1) Use is recommended

FG frame and FK frame

The single pole connectors that are fitted to the standard terminal.

The connectors can be used with standard external box clamps. The use of phase barriers is mandatory with FK frame devices.



FG and FK extenders

	FG	FK
h = height dimension of breaker with extenders at its top AND bottom.	354	452
z (mm)	314	408
s (mm)	45	70
y max (mm)	29.5	56
W max (mm)	30	50
t max (mm)	12	20(10) ⁽¹⁾
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) 1600A, parallel 10mm bus.

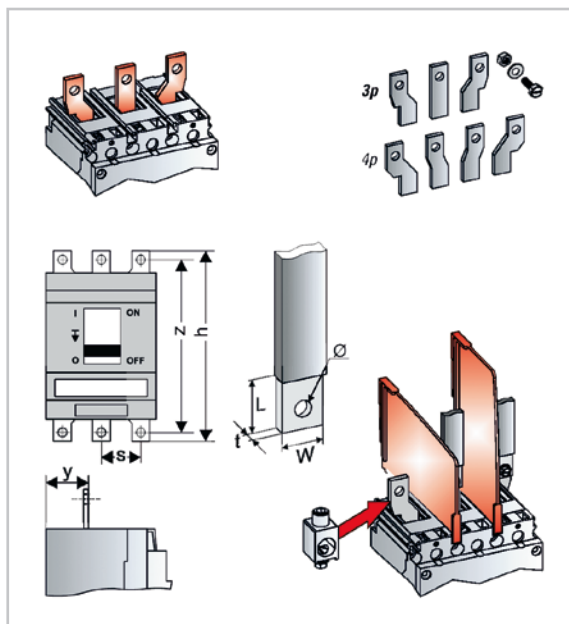
(2) Two holes in each connection pad.

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 and 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 and FE spreaders

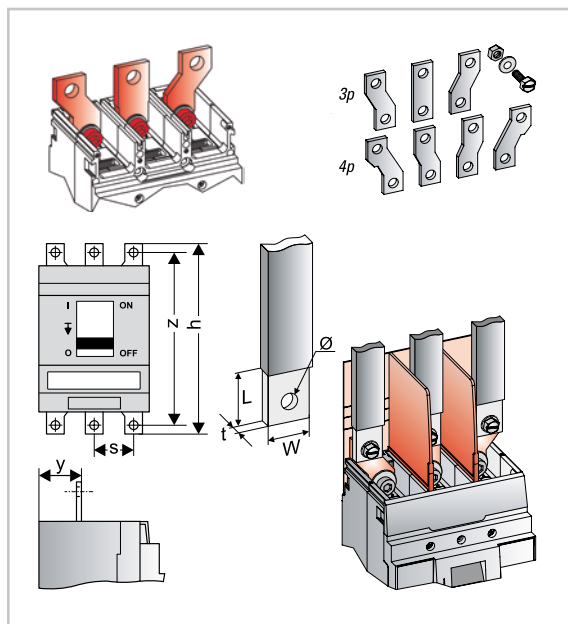
	FD	FE
h = height dimension of breaker with extenders at its top AND bottom.	190	230
z (mm)	170	212
s (mm)	35	45
y max (mm)	18.5	25.5
W max (mm)	14	18
t max (mm)	5	8
L max (mm)	16	18
Ø hole max (mm)	7	9
Torque (Allen key in breaker) (Nm max.)	8	25
Torque of connection bolt (Nm max.)	8	25

(1) Use is recommended

FG frame and FK frame

The single pole connectors that are fitted to the standard terminal.

The connectors can be used with standard external lugs. The use of phase barriers is mandatory with FK frame devices.



FG and FK spreaders

	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) ⁽¹⁾
L max (mm)	32	-
Ø hole max (mm) ⁽²⁾	13	2 x 11
Torque (Allen key in breaker) (Nm max.)	42	M10-14
Torque of connection bolt (Nm max.)	42	M10-14

(1) 1600A, parallel 10mm bus.

(2) Two holes in each connection pad.

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

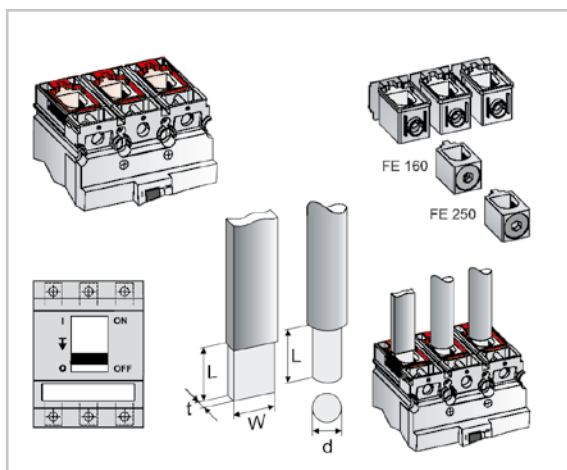
Fit onto the breaker without changing its profile or external dimensions. Available as a three or four pole set allowing the line or load side of the breaker to be equipped. The set consists of multi-pole units that displace the standard connection configuration. The sets can also be used on the plug-in / draw-out base and RCD units. All clamps are suitable for copper and aluminium conductors.

FE frame (FE160 and 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 and FK frame

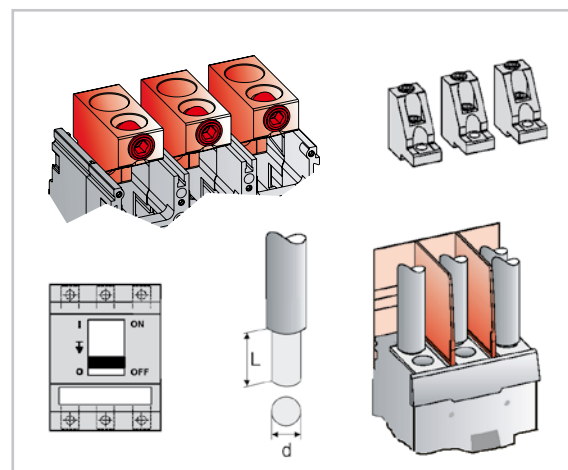
The set consists of basic single pole units that displace are mounted above the standard connection pad (FG and FK frame). Each box terminal allows the connection of two to four cable cores per item. The internal lugs are used in the same way on the plug-in / draw-out base and RCD units. All types can also be mounted to extenders, spreaders or rear connection pads. The use of phase barriers is mandatory with FK frame devices



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 (mm ²)	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 and FK external box clamps

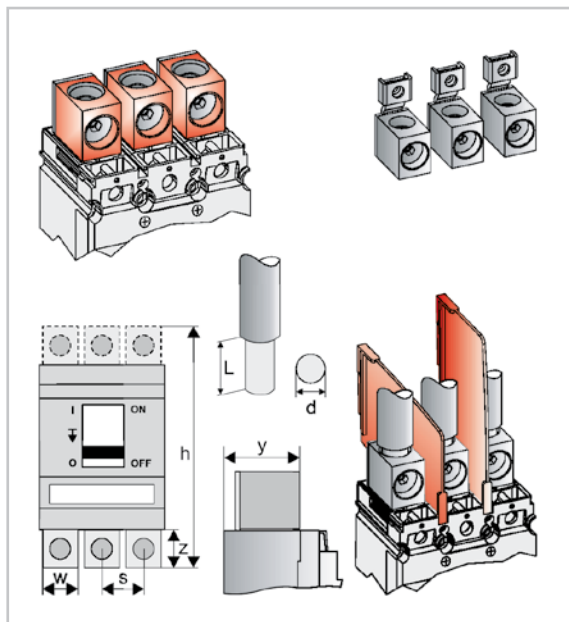
	FG	FK ⁽²⁾	FK ⁽³⁾
h = height dimension of breaker with box clamps mounted at top and bottom.	333	381	354
S max (mm ²)	25 - 240 for L1 50 - 300 for L2	240	240
Hole L1 = distance to insulation L (min.)	22	-	-
Hole L2 = distance to insulation L (min.)	40	-	-
Distance to insulation L (min.)	-	27.5	36
Torque (Nm max.)	31(L1) 42(L2)	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.

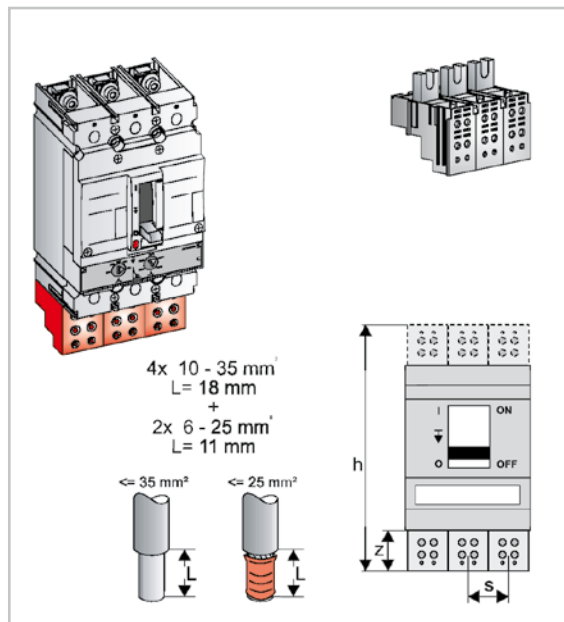


FD and FE external box clamps

	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

Record Plus

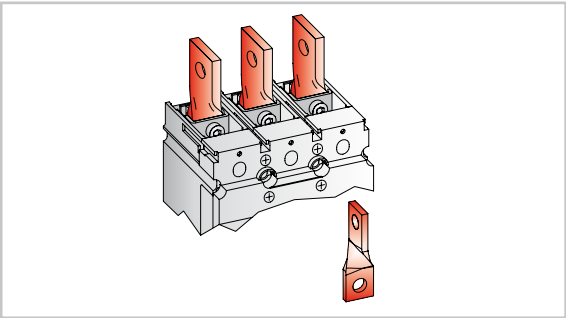
Connections

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.

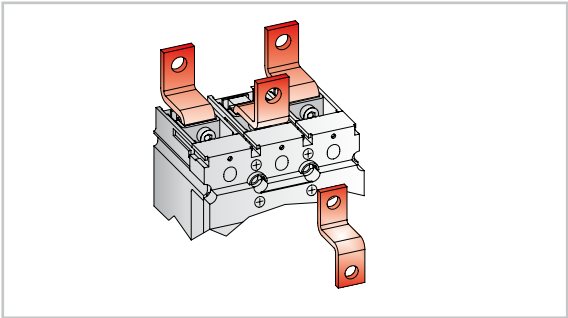


Twisted extenders

	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.

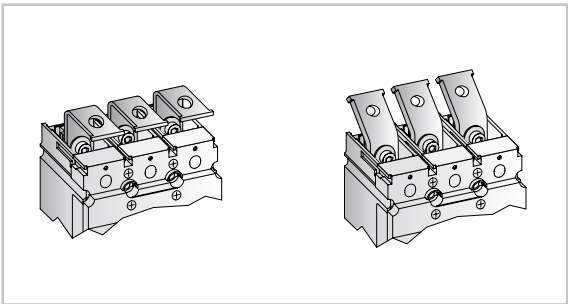


Heightened extenders

	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

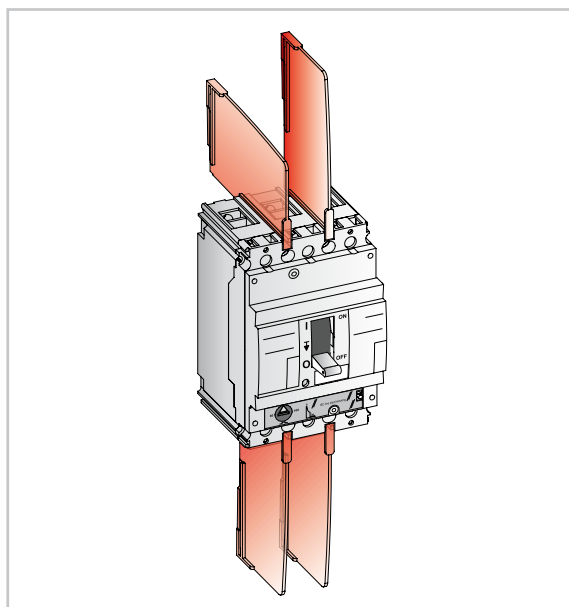
Phase separators

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.

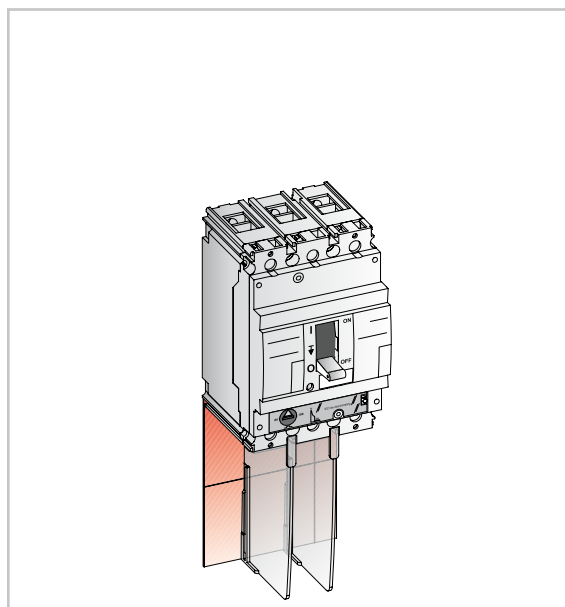
For the **Record Plus*** FD, FE, FG and FK frame, phase separators are available in one set containing 12 pieces.



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.



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EN 60947-2 Standard

Circuit Breaker type		FD160				FD160				FE160					
Denomination		N	H	C	E	S	N	H	L	N	H	L			
Poles	Number of	1			3, 4		2 ^[1]	3, 4			3, 4				
Rated insulation voltage	Ui (Volts)	750		500	750	750		750			750				
Rated impulse withstand voltage	Uimp (Kilovolt)	3		6	8	8		8			8				
Rated operational voltage Ue	Volts AC	240		500	690	690		690			690				
	Volts DC	250		-	-	500		500			500				
Line Protection device															
Category of use		A		A		A		A		A		A			
Suitable for use as a isolator	Positive ON and OFF	yes		yes		yes		yes		yes		yes			
Rated current Ith = Ie	A at 40°C	160		160		160		160		160		160			
Ultimate breaking capacity Icu (kA)	230/240V AC	25	50	25	40	50	85	100	200	85	100	200	85	100	200
	400/415V AC	-	-	18	25	36	50	80	150	50	80	150	50	80	150
	440V AC	-	-	14	14	25	30	65	130 ^[2]	42	65	130	42	65	130
	500V AC	-	-	10	12	18	22	36	50 ^[2]	30	50	100	30	50	100
	690V AC	-	-	-	4.5	6	8	10	12	10	22	75	10	22	75
	250V DC Two pole	-	50	-	-	25	40	65	100	50	85	100	50	85	100
	500V DC Three Pole	-	-	-	-	25	40	65	100	50	85	100	50	85	100
	≤ 500V	100%	100%	75%	75%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Service breaking capacity Ics (%Icu)	690V AC	-	-	-	-	50%	50%	50%	50%	100%	75%	25%	100%	75%	25%
	400/415V AC	-	-	36	52.5	75	110	176	330	110	176	330	110	176	330
Making capacity Icm (kA peak)	500V AC	-	-	17	24	36	46	75	110	63	110	220	63	110	220
	230V AC	25	50	16	25	30	50	80	150	50	80	150	50	80	150
Single phase breaking capacity I _{IT} (kA)	400/415V AC	-	-	-	4.5	6	8	10	12	15	22	36	15	22	36
	230V AC	25	50	16	25	30	50	80	150	50	80	150	50	80	150
Endurance (CO operations)	Mechanical	10000		10000		25000		40000		20000		30000		16000	
	Electrical at In and 415V AC	5000		5000		10000		20000		30000		16000		10000	
	Electrical at In/2 and 415V AC	10000		10000		20000		30000		16000		10000		6000	
Endurance (On-Tripped operations)	Mechanical	4000		4000		10000		16000		10000		6000		4000	
Trip Units	Interchangeable	no		no		no		yes		yes		yes		yes	
	Thermal Magnetic line	LTM				GTM				LTM					
	Thermal Magnetic generator					LTMD				GTM					
	Thermal Magnetic discriminating					Mag Break*				Mag Break* or PremEon S					
	Magnetic Only									PremEon S					
	Electronic discriminating														
	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		160
Rated making capacity	Icm (kA peak)			1.7					2.8		4.2
Short-term withstand current Icw (A)	Icw eff. 1 second			1.2					2		3
	Icw eff. 3 seconds			1.2					2		3

EN 60947-4 Standard

Use in motor circuits		FD160					FE160				
Rated current Ith		A at 65°C					125				
Endurance (CO operations)	Mechanical								25000		40000
	Electrical at In class AC23								10000		20000
	Operations per hour								120		120
	Short Circuit only (separate overload device)								Mag Break*		Mag Break* or PremEon S
Protection	Overload class 10 and Short circuit										PremEon S
	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		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		140x170		
		x85		x85		x85	x95		x95		
Weights (kg)	Fixed front connection	0.4		0.9		1.3	1.5		2		

(1) N type only

(2) The 160A current rating of the L type is limited to 65kA at 440V and 36kA at 500V



FE250				FG400				FG630				FK800				FK1250				FK1600		
V	N	H	L	N	H	L		N	H	L		N	H	L		N	H	L		N	3, 4	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			-				-				750 ⁽⁵⁾				750 ⁽⁵⁾				-	
A				B				B ⁽³⁾				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 ⁽⁴⁾		10	22	40 ⁽⁴⁾		20	25	30		20	25	30		20	25	
25	50	85	100									50	60	-		50	60	-		-	-	
-	50	85	100									36	50	-		36	50	-		-	-	
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	16	16		10	16	16		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				no				no				no		
LTM												LTM				LTM						
GTM																						
LTMD																						
Mag Break* or PremEon S				Mag Break* or PremEon S				Mag Break*				Mag Break*										
PremEon S				PremEon S				SMR1e				SMR1e				SMR1s and g						
-				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		
V	N	H	L	N	H	L		N	H	L		N	H	L		N	H	L		N	3, 4	H
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* or PremEon S	PremEon S	PremEon S	Mag Break*	Mag Break	
PremEon S	PremEon S or SMR2	PremEon S or SMR2	SMR1s or SMR1g	SMR1s or SMR1g	
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	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	
	105x170	140x170	140x265		185x265	140x265		185x265	210x320		280x320	210x320		280x320	210x320		280x320	
	x95	x95	x115		x115	x115		x115	x160		x160	x160		x160	x160		x160	
	1.5	2.0	4.5		6.0	4.5		6.0	12.2		15.1	18.0		23.4	18.0		23.4	

(3) Limited to 500Amp

(4) At a voltage of 690V AC the uses of a long widened terminal shield is mandatory (see page D.9)

(5) 4 poles in series are needed for 750V DC, Icu N type 20kA, Icu H type 36kA

(6) Please contact GE



Power dissipation

Standards

The standard for low voltage equipment is defined in the EN 61439-1, 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 QuiXtra 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.



Heat dissipation tables: enclosure 36 modules

According IEC 60890, temperature rise in Kelvin

Rear against wall - external dimensions

Watt	900x876x250		1050x876x250		1200x876x250		1350x876x250		1500x876x250		1650x876x250	
	36 Mod/5Row		36 Mod/6Row		36 Mod/7Row		36 Mod/8Row		36 Mod/9Row		36 Mod/10Row	
	Half	Top	Half	Top	Half	Top	Half	Top	Half	Top	Half	Top
10	3	4	2	3	2	3	2	3	2	3	2	2
20	5	7	4	6	4	5	3	5	3	5	3	4
30	7	9	6	8	5	7	4	7	4	6	4	6
40	8	12	7	11	6	9	6	8	5	8	5	7
50	10	14	9	13	8	11	7	10	6	9	6	9
60	12	16	10	15	9	13	8	12	7	11	6	10
70	13	18	12	17	10	15	9	13	8	12	7	11
80	15	20	13	18	11	16	10	15	9	14	8	13
90	16	22	14	20	12	18	11	16	10	15	9	14
100	18	24	15	22	13	20	12	17	11	16	10	15
120	20	28	18	26	15	23	13	20	12	19	11	18
140	23	32	20	29	17	26	15	23	14	22	13	20
160	26	36	22	32	19	29	17	25	16	24	14	22
180	28	39	25	35	21	31	18	28	17	26	16	24
200	31	43	27	39	23	34	20	30	19	29	17	27
220	33	46	29	42	25	37	22	33	20	31	18	29
240	35	49	31	45	27	40	23	35	22	33	20	31
260	38	53	33	48	29	42	25	38	23	36	21	33
280	40	56	35	51	30	45	26	40	24	38	22	35
300	42	59	37	53	32	47	28	42	26	40	24	37
320	45	62	39	56	34	50	29	44	27	42	25	39
340	47	65	41	59	35	52	31	47	29	44	26	41
360	49	68	43	62	37	55	32	49	30	46	27	43
380	51	71	45	65	39	57	34	51	31	48	28	45
400	-	-	47	67	40	60	35	53	33	50	30	47
420	-	-	49	70	42	62	37	55	34	52	31	48
440	-	-	-	-	44	64	38	57	35	54	32	50
460	-	-	-	-	45	67	39	59	36	56	33	52
480	-	-	-	-	47	69	41	61	38	58	34	54
500	-	-	-	-	48	71	42	64	39	60	36	56
520	-	-	-	-	-	-	43	66	40	62	37	57
540	-	-	-	-	-	-	45	68	41	64	38	59
560	-	-	-	-	-	-	46	70	43	66	39	61
580	-	-	-	-	-	-	-	-	44	68	40	63
600	-	-	-	-	-	-	-	-	45	70	41	64
650	-	-	-	-	-	-	-	-	-	-	44	69
700	-	-	-	-	-	-	-	-	-	-	47	73
750	-	-	-	-	-	-	-	-	-	-	-	-

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.⁽¹⁾

(1) 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 (Y)
		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 (Y)
		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 (Y)			
		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)	Mag Break* (MO)								FE160 frame electronic type (PremEon S)			
					50	80	100	125	160	25	63	125	160
Fixed version	R in mΩ per pole				1.70	0.60	0.60	0.40	0.40	0.40	0.40	0.40	0.40
	Dissipation Watt single pole				4.25	3.84	6.00	6.25	6.25	0.25	0.25	1.59	6.25
	Dissipation Watt three poles				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				1.77	0.67	0.67	0.47	0.47	0.47	0.47	0.47	0.47
	Dissipation Watt single pole				4.43	4.29	6.70	7.34	7.34	0.29	0.29	1.87	7.34
	Dissipation Watt three poles				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				1.78	0.68	0.68	0.48	0.48	0.48	0.48	0.48	0.48
	Dissipation Watt single pole				4.45	4.35	6.80	7.50	7.50	0.30	0.30	1.91	7.50
	Dissipation Watt three poles				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				1.85	0.75	0.75	0.55	0.55	0.55	0.55	0.55	0.55
	Dissipation Watt single pole				4.63	4.80	7.50	8.59	8.59	0.34	0.34	2.18	8.59
	Dissipation Watt three poles				13.88	14.40	22.50	25.78	25.78	1.03	1.03	6.55	25.78

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 (PremEon S)			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 and FG 630 frame

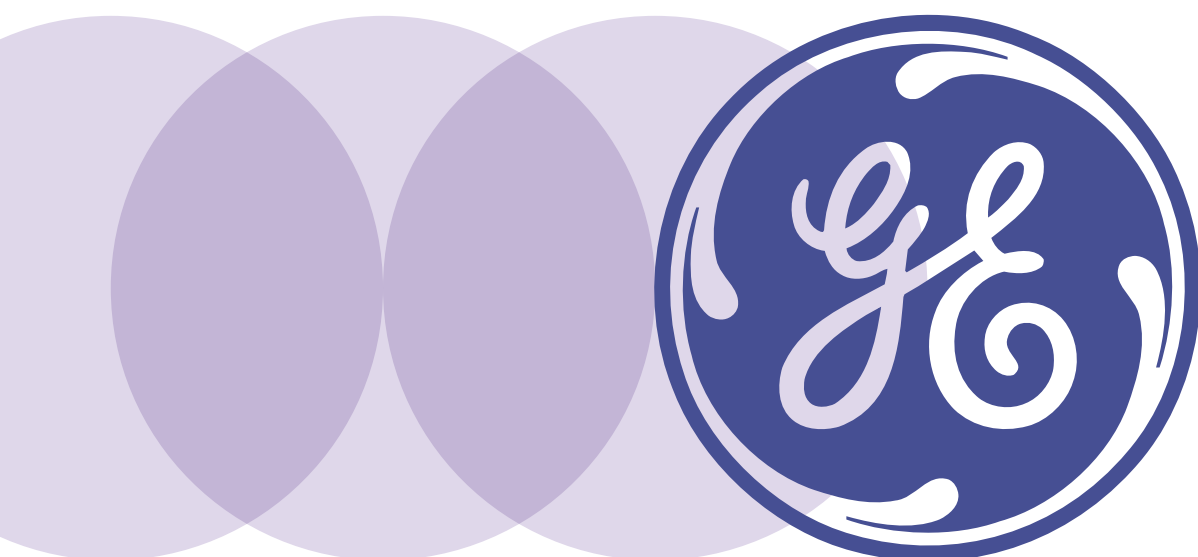
	In (A)	FG400/630 frame electronic type (PremEon S & SmR2)				Mag Break* (MO)		Switch (Y)	
		250	400	500	630	400	500	400	630
Fixed version	R in mΩ per pole	0.11	0.11	0.10	0.10	0.11	0.10	0.11	0.10
	Dissipation Watt single pole	6.88	17.60	25.00	39.69	17.60	23.75	17.60	39.69
	Dissipation Watt three poles	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 and 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	70.00	108.40	32.00	70.31	32.00	78.13	102.40
	Dissipation Watt three poles	83.35	134.40	210.00	328.10	96.00	210.94	96.00	234.38	307.20

	In (A)	FK800, 1250-1600 frame electronic type (SMR1e, s and g)				Switch (Y)
		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	44.80	70.00	108.40	153.60	
	Dissipation Watt three poles	134.40	210.00	328.10	460.80	





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 and 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
	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
FD160	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
	125	125	121	118	114	110	106	103	118	114	110	107	103	100	96
	160	160	155	150	146	141	136	131							
FE160 and 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
	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
FK800 and FK1250	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
	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 FE160 and FE250 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
	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
FD160 with RCD	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
	125	119	115	110	108	104	101	97	110	107	104	101	97	94	91
	160	152	147	141	138	134	129	125	141	137	133	129	124	120	116
FE160 and FE250 with RCD	125	125	121	118	114	110	106	103	118	114	110	107	103	100	96
	160	152	147	141	138	134	129	125	141	137	133	129	124	120	116
	200	190	184	177	173	168	162	156	177	171	166	161	156	150	145
	250	238	230	221	216	210	202	195	221	214	208	201	194	188	181

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
	400	400	400	400	390	380	370	360	400	390	380	370	360	350	340
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
	630	630	614	599	583	567	551	536	583	568	554	539	524	510	481
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
	800	800	800	760	760	760	680	-	760	741	722	703	722	646	-
FK800	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	-
	1600	1600	1600	1520	1440	1408	1280	-	1520	1488	1444	1408	1368	1216	-
	2500	2500	2500	2320	2240	2208	2080	-	2320	2288	2244	2208	2168	1916	-
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
	160	160	156	152	148	144	141	137	152	148	144	141	137	133	129
FE250 with RCD	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
	250	250	244	238	244	238	231	225	238	232	226	220	214	208	202
	400	400	370	360	350	340	330	320	400	390	380	370	360	350	340
FG400 with RCD	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
	350	350	350	350	341	333	324	315	350	341	333	324	315	306	297
	400	400	370	360	350	340	330	320	400	390	380	370	360	350	340
	630	630	614	599	583	567	551	536	583	568	554	539	524	510	481
FG630 with RCD	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
	500	500	500	500	500	500	500	481	500	481	468	455	442	429	416
	630	630	614	599	583	567	551	536	583	568	554	539	524	510	481
	800	800	760	760	760	760	680	-	760	741	722	703	722	646	-

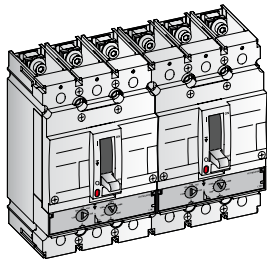
(1) Is = Sensor rating

Clearances

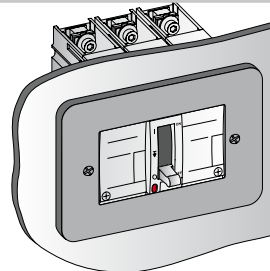
Minimum distances

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 and a limited amount of conductive fragments.

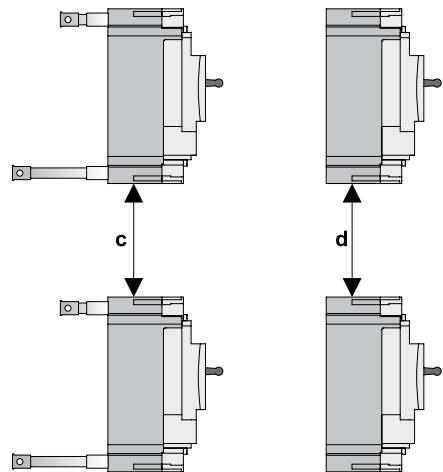
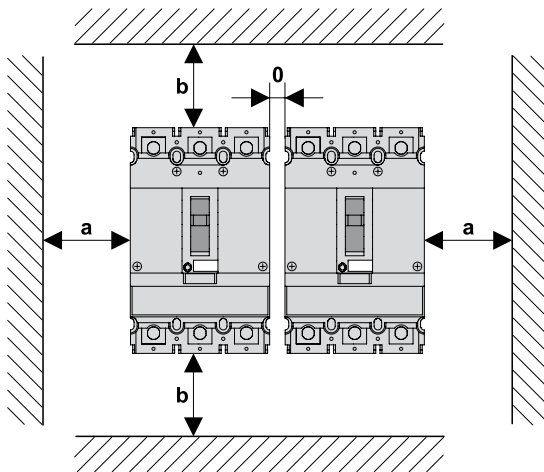
The **Record Plus*** circuit breaker has been designed to limit the venting phenomanae to a minimum. However, it is necessary to take the following minimum distances into account:



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	Voltage ≤ 480V	0	15		
		Voltage < 600V ⁽¹⁾	3	35		
		Voltage = 690V ⁽¹⁾	5	(2)		
	To breaker housing		15	(2)	35	35
FE160 and FE250	To painted metal, non conductive materials and isolated conductors. To unpainted metal	Voltage ≤ 480V	0	20		
		Voltage < 600V ⁽¹⁾	5	35		
		Voltage = 690V ⁽¹⁾	10	(2)		
	To breaker housing		20	(2)	35	35
FG400 and FG630	To painted metal, non conductive materials and isolated conductors. To unpainted metal	Voltage ≤ 480V	0	30		
		Voltage < 600V ⁽¹⁾	5	60		
		Voltage = 690V ⁽³⁾	10	(2)		
	To breaker housing		20	(2)	60	60
FK800, FK1250 and FK1600	To painted metal, non conductive materials and isolated conductors. To unpainted metal	Voltage ≤ 480V ⁽¹⁾	0	40		
		Voltage < 600V ⁽¹⁾	15	80		
		Voltage = 690V ⁽¹⁾	20	80		
	To breaker housing		30	80	140	140
	To conductors protruding from breaker				140	140

(1) The use of phase separators and back plates is obligatory.
(2) Size determined by phase separators.

(3) At 690Volts the FG400L and 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

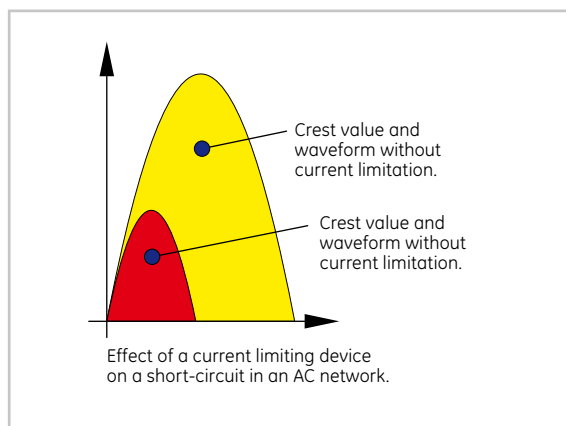
A high level short-circuit produces magnetic fields that prevent electrical equipment as meters and computers from operating correctly.

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 insulation. They are limited to prevent the insulation conductor from exceeding their limit temperature.

Clause 434.5.2 of the IEC 60364-4-43 ed. 03 - 2008 defines that for protection devices interrupting within 0.1 seconds ($t \leq 0.1$ 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 its insulation

S: cross section of the conductor

If the protection device is NOT current limiting.

Clause 434.5.2 of the IEC 60364-4-43 ed. 03 - 2008 applies. Here for interruption times up to 5 seconds, the regulation requires that the following formula is met.

$$t = (K \times S/I)^2$$

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 its 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

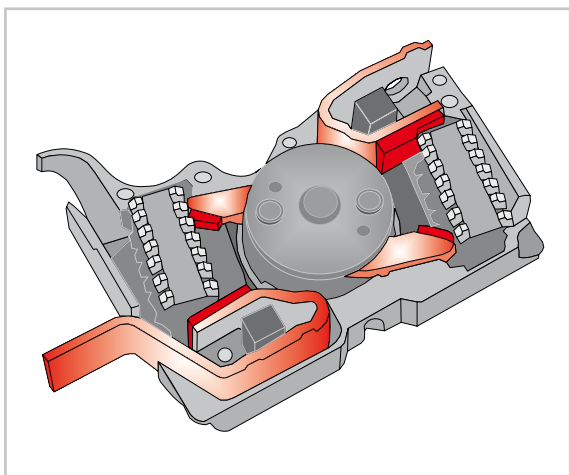
Insulation and maximum temperature	Copper (Cu)	Aluminium (Al)
PVC - 70° < 300 sq.mm	115	76
PVC - 70° ≥ 300 sq.mm	103	68
PVC - 90° < 300 sq.mm	100	86
PVC - 90° ≥ 300 sq.mm	86	57
XLPE and EPR 90°	143	94
Rubber 60°	141	93
Mineral, bare unsheathed 105°	135 or 115 ⁽¹⁾	-

(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 and 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 and 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* MCCBs 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.

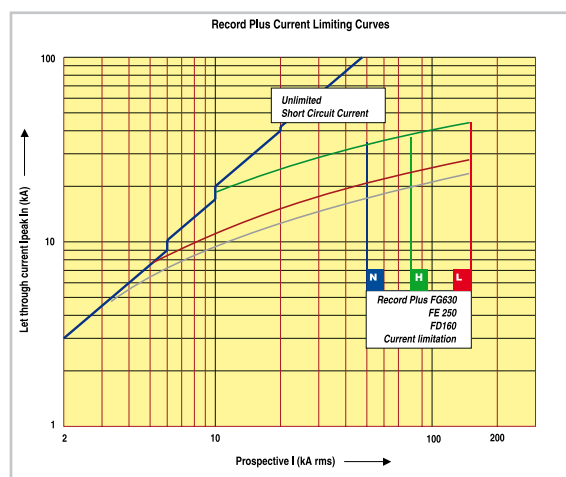


However, in some cases it is still necessary to check if the electrical conductors are protected correctly. This can be verified by taking the cable stress limits published on the previous page and comparing them with the let-through energy values found in the graphs. (page D.14 and D.15)

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)



Current limitation data at 400/415V

Technical data

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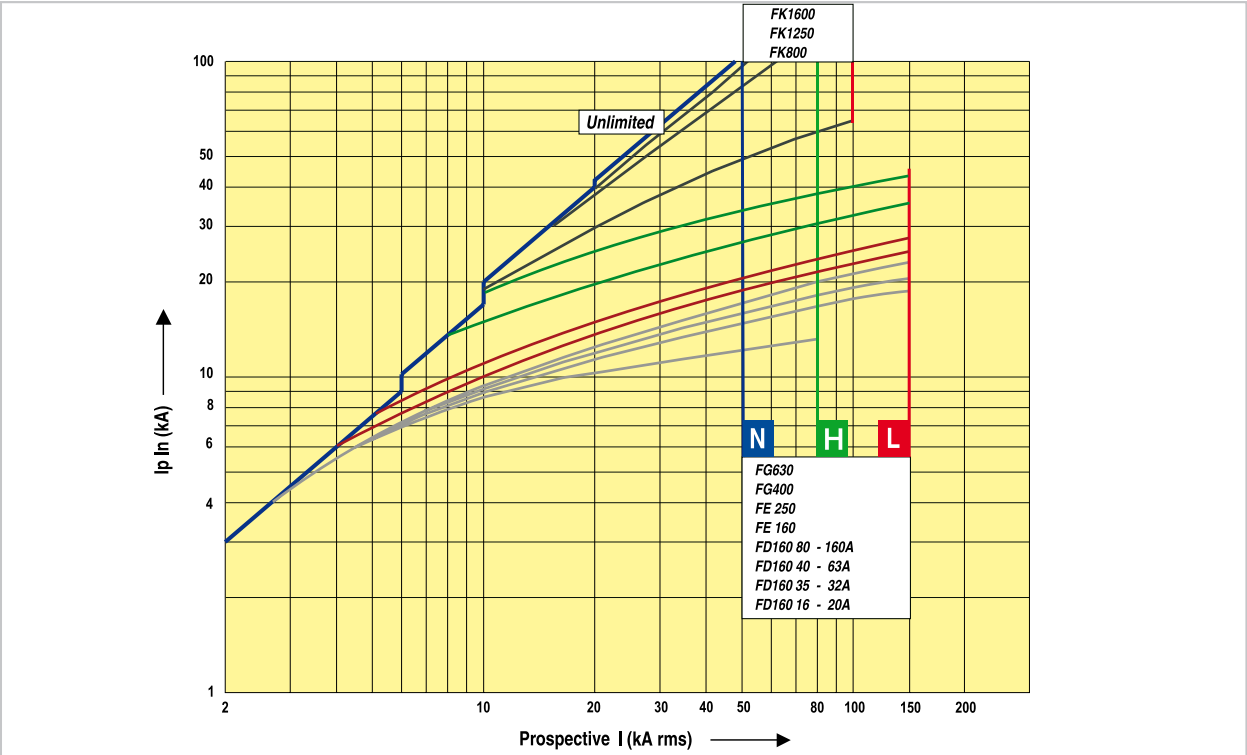
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E

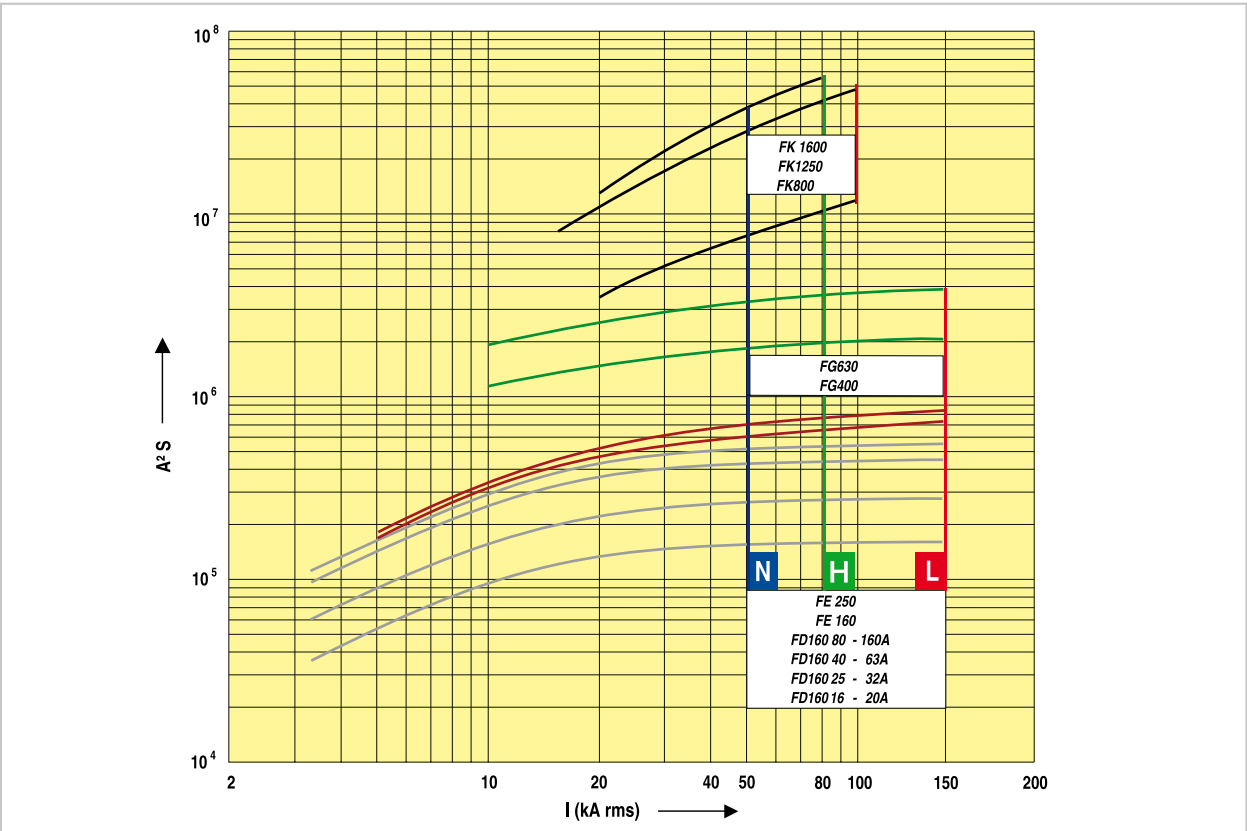
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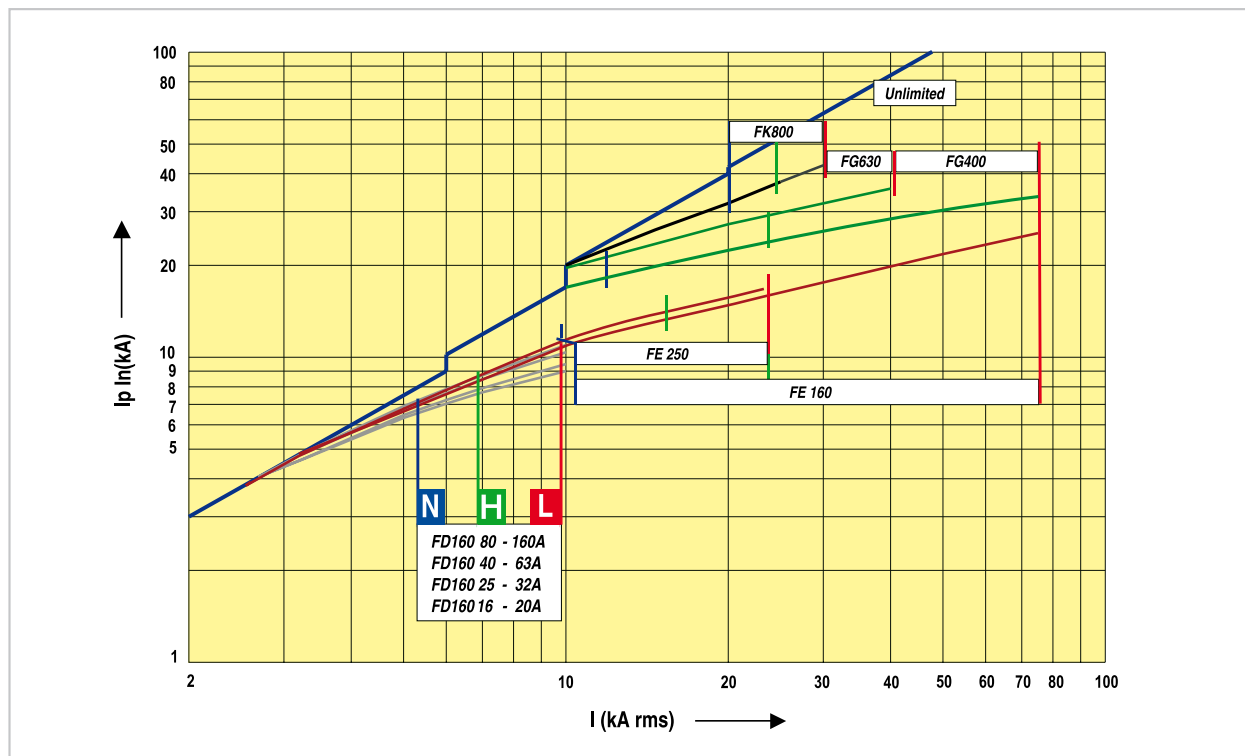
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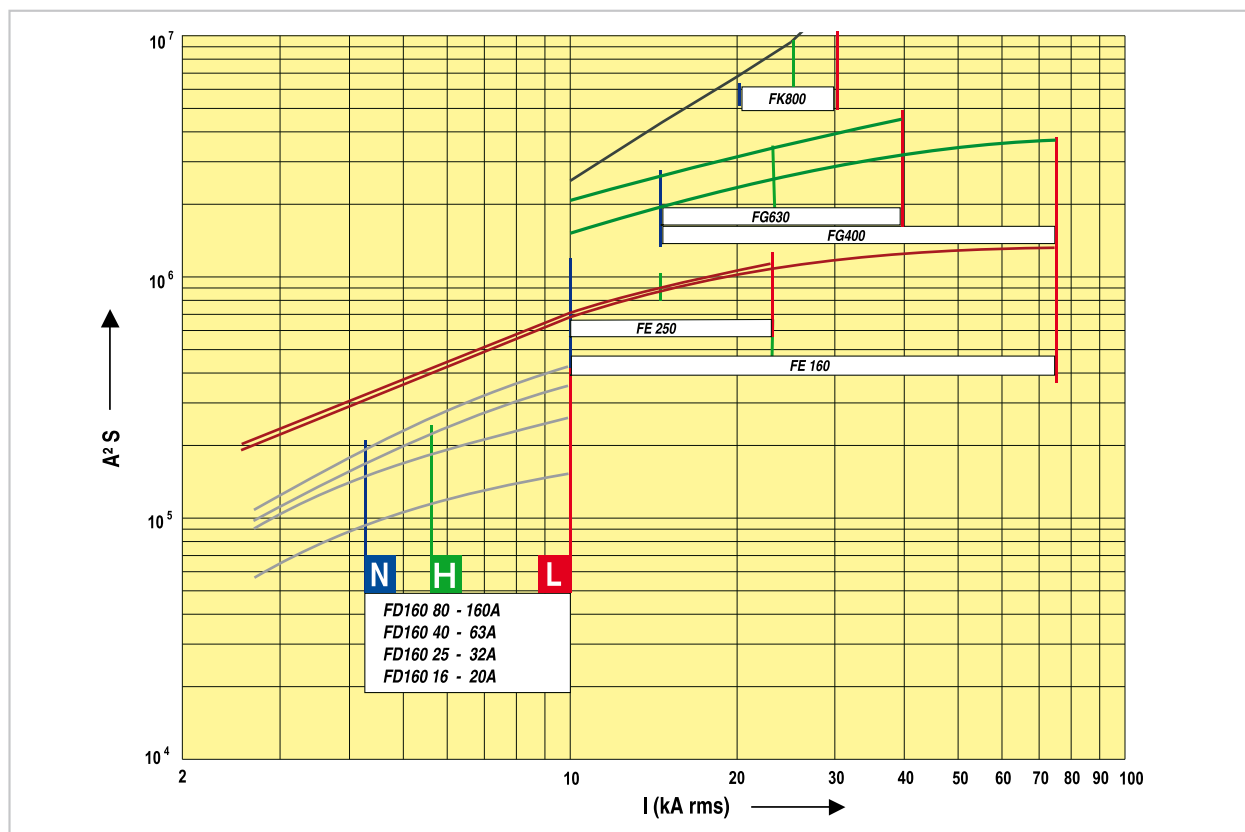
Thermal stress (Energy)
Limitation data at 400/415V



Current limitation data at 690V



Thermal stress (Energy) Limitation data at 690V

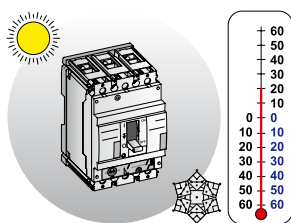


Environmental considerations

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.

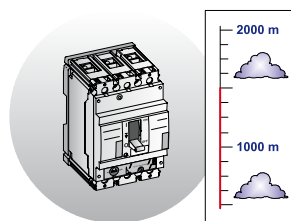


To achieve the same reaction time on a set current value it becomes necessary to derate. The time current curves published in this catalogue are always valid for operating temperatures between 10 and 40°C.

Storage temperature

A **Record Plus*** breaker is able to withstand non-operational storage temperature ranges of -40 to +85°C.

Influence of altitude

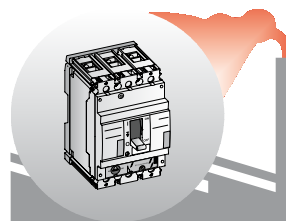


Up to altitudes of 2000 m above sea level no derating of breaker current or rated voltage is applicable. For altitudes above 2000 m the following factors apply:

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 68-2-14	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

Shock and vibration

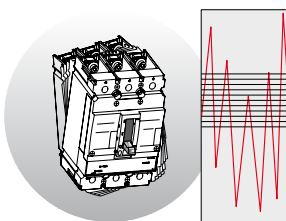
The **Record Plus*** line has been designed to withstand shock and vibration to the following standards:

IEC 68-2-6

Germanischer Lloyd

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.⁽¹⁾



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.

The product is shock resitant and can withstand the following impacts in any possible orientation: 20g, 6ms, 10g, 11ms⁽¹⁾

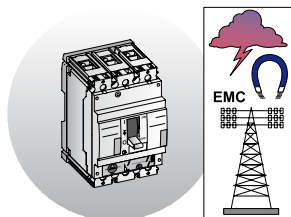
(1) Not applicable to PremEon S trip unit

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 and 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

Radiated, radio frequency, electromagnetic field immunity test

EN 60947-2 Annex F, Sub-clause F7 and the IEC 1000-4-3

Electrical fast transient/burst

EN 60947-2 Annex F, Sub-clause F5 and the IEC 1000-4-4

Surge immunity test

EN 60947-2 Annex F, Sub-clause F5 and the IEC 1000-4-5

Dry heat test

EN 60947-2 Annex F, Sub-clause F8

Thermal shock test

EN 60947-2 Annex F, Sub-clause F9

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 (Icu or Ics), 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 (Icc 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	Icc max at V/2	Icc max at V	Icc 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 (Icu=Ics) and the number of poles needed to participate in the interruption.

Example

Rated voltage 500V DC; Rated current 200A Icc max 50kA

network A: center point connected to ground

FE250N 4x250 - 2 poles for each polarity

network B: one pole connected to ground

FE250N 3x250 - 3 poles on unearthed polarity

network C: insulated network

FE250N 4x250 - 2 poles for 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 (2p)	25 (3p)	-	= AC	1.2
FD160N	16÷160	40 (1p)	40 (2p)	40 (3p)	40 (3p)	= AC	1.2
FD160H	16÷160	65 (1p)	65 (2p)	65 (3p)	65 (3p)	= AC	1.2
FD160L	16÷160	100 (1p)	100 (2p)	100 (3p)	100 (3p)	= AC	1.2
FE160N	25÷160	50 (1p)	50 (2p)	50 (3p)	50 (3p)	= AC	1.2
FE160H	25÷160	85 (1p)	85 (2p)	85 (3p)	85 (3p)	= AC	1.2
FE160L	25÷160	100 (1p)	100 (2p)	100 (3p)	100 (3p)	= AC	1.2
FE250V	125÷250	25 (1p)	25 (2p)	25 (3p)	-	= AC	1.2
FE250N	125÷250	50 (1p)	50 (2p)	50 (3p)	50 (3p)	= AC	1.2
FE250H	125÷250	85 (1p)	85 (2p)	85 (3p)	85 (3p)	= AC	1.2
FE250L	125÷250	100 (1p)	100 (2p)	100 (3p)	100 (3p)	= AC	1.2
FG400N							
FG400H							
FG400L							
FK800N	500÷800	50 (1p)	50 (2p)	36 (3p)	36 (3p)	no protection	1.2
FK800H	500÷800	60 (1p)	60 (2p)	60 (3p)	50 (3p)	no protection	1.2
FK1250N	640÷1250	50 (1p)	50 (2p)	36 (3p)	36 (3p)	no protection	1.2
FK1250H	640÷1250	60 (1p)	60 (2p)	60 (3p)	50 (3p)	no protection	1.2

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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 and 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 a 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).

Protection against short-circuits

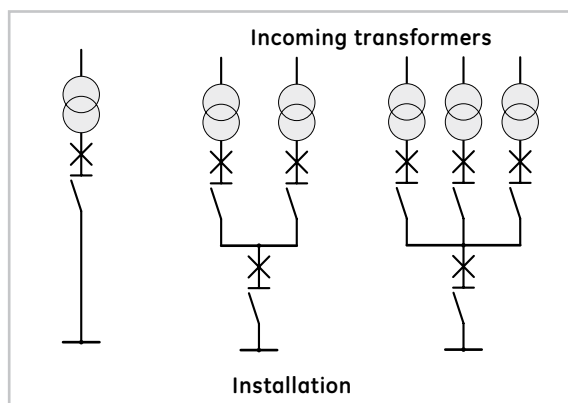
Maximum short-circuit ratings

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

$$Z_Q = \frac{(m \times U_o \times \sqrt{3})^2}{S_{k_Q}} \text{ m}\Omega$$

MV/LV transformer impedance

$$Z_r = \frac{(m \times U_o \times \sqrt{3})^2}{S_{rT}} \times \frac{U_{kr}}{100\%} \text{ m}\Omega$$

Maximum short-circuit calculation

$$I_{k_{3\max}} = \frac{(C_{\max} \times m \times U_o \times \sqrt{3})^2}{\sqrt{R^2 + X^2}} \text{ kA}$$

Calculated maximum short-circuit values (3 phase 400V network)

MV/LV Transformer(s)		Medium Voltage power S_{K_0} in MVA						
S_T kVA	U_{kr} %	100	150	200	300	400	500	
Maximum short-circuit Values in kA ($I_{k_{3max}}$)								
100	4	3.5	3.6	3.6	3.6	3.6	3.6	
160	4	5.6	5.7	5.7	5.7	5.7	5.8	
250	4	8.5	8.7	8.8	8.9	8.9	9.0	
315	4	10.6	10.9	11.0	11.1	11.2	11.2	
400	4	13.2	13.6	13.8	14.0	14.2	14.2	
500	4	16.2	16.8	17.1	17.4	17.6	17.7	
630	4	19.8	20.7	21.2	21.7	22.0	22.2	
630	5	16.3	16.9	17.2	17.6	17.7	17.8	
630	6	13.8	14.3	14.5	14.7	14.8	14.9	
800	6	17.1	17.8	18.2	18.5	18.7	18.8	
1000	6	20.8	21.8	22.3	22.9	23.2	23.4	
1250	6	25.1	26.6	27.4	28.3	28.7	29.0	
1600	6	30.6	32.9	34.2	35.6	36.3	36.8	
2000	6	36.4	39.7	41.6	43.6	44.7	45.4	
2500	6	42.9	47.5	50.2	53.2	54.8	55.9	
2 x 400	4	24.2	25.7	26.4	27.2	27.7	27.9	
2 x 500	4	29.1	31.2	32.3	33.5	34.2	34.6	
2 x 630	4	34.9	37.9	39.6	41.4	42.4	43.0	
2 x 630	5	29.3	31.4	32.5	33.8	34.4	34.8	
2 x 630	6	25.3	26.8	27.6	28.5	29.0	29.3	
2 x 800	6	30.6	32.9	34.2	35.6	36.3	36.8	
2 x 1000	6	36.4	39.7	41.6	43.6	44.7	45.4	
2 x 1250	6	42.9	47.5	50.2	53.2	54.8	55.9	
2 x 1600	6	50.7	57.3	61.3	65.9	68.4	70.0	
2 x 2000	6	58.3	67.3	72.8	79.4	83.1	85.5	
2 x 2500	6	66.3	78.1	85.7	94.9	100.3	103.9	
3 x 400	4	33.6	36.4	37.9	39.6	40.5	41.1	
3 x 500	4	39.7	43.7	45.9	48.5	49.8	50.7	
3 x 630	4	46.8	52.3	55.6	59.4	61.4	62.7	
3 x 630	5	40.0	43.9	46.2	48.8	50.2	51.0	
3 x 630	6	34.9	37.9	39.6	41.4	42.4	43.0	
3 x 800	6	41.6	46.0	48.5	51.3	52.8	53.8	
3 x 1000	6	48.6	54.6	58.2	62.3	64.6	66.0	
3 x 1250	6	56.1	64.3	69.3	75.3	78.6	80.8	
3 x 1600	6	64.8	76.1	83.3	91.9	97.0	100.3	
3 x 2000	6	72.9	87.5	97.2	109.2	116.4	121.2	
3 x 2500	6	81.0	99.4	112.1	128.6	138.7	145.6	

Terminology

S_{k_Q} = 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
U_o = 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

$$\rho_0 = 18.51 \text{ m}\Omega \text{ mm}^2/\text{m. for copper cores}$$

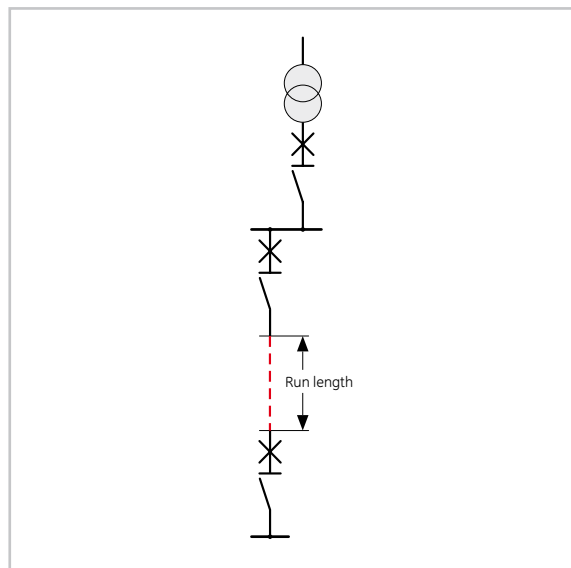
$$29.41 \text{ m}\Omega \text{ mm}^2/\text{m. for aluminum cores}$$

Reactance of multicore cables λ 0.08 m Ω /m.

Examples

$Ik_{3 \text{ max.}}$ at cable run start 50kA
54 meters of 185 mm² cable
 $Ik_{3 \text{ max.}}$ at cable run end 22kA

$Ik_{3 \text{ max.}}$ at cable run start 120kA
12 meters of 185 mm² cable
 $Ik_{3 \text{ max.}}$ at cable run end 80kA



Short-circuit values within circuits

$Ik_{3 \text{ max.}}$ without cable run	$Ik_{3 \text{ max.}}$ 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		Required minimum length in meters of cable run of the mentioned cross section to achieve the $Ik_{3 \text{ max.}}$ mentioned above									
Cu mm ²	AL mm ²	0.5	0.5	0.5	1	1	1	1	1.5	2	3.5
1.5		0.5	0.5	0.5	1	1.5	1.5	1.5	2	3.5	5.5
2.5	4	0.5	0.5	1	1.5	2	2.5	2.5	4	5	9
4	6	1	1	1.5	2.5	3	3.5	3.5	5	8	13
6	10	1	2	2	4	5	5.5	6	8	13	21
10	16	1.5	2.5	3.5	6	8	9	10	13	20	35
16	25	2.5	4	5	9	12	13	15	20	32	55
25	35	3	4	7	13	16	18	20	28	42	70
35	50	4	6	9	18	22	25	29	39	60	100
50	70	6	8	12	24	30	35	40	55	85	135
70	95	6	8	13	25	32	36	40	55	85	140
2 x 35	2 x 50	7	11	16	32	39	46	51	70	110	180
95	150	8	12	18	35	44	52	58	80	120	200
2 x 50	2 x 70	9	13	19	38	48	55	62	85	130	220
120	185	10	15	23	46	58	66	75	100	155	255
150	240	11	16	24	50	60	70	80	110	170	270
2 x 70	2 x 95	12	18	27	54	65	76	84	116	180	300
185		14	21	32	62	78	88	98	135	210	340
240		14	21	32	62	78	88	98	135	210	340
2 x 95	2 x 150	16	24	35	70	85	100	110	150	230	380
300		17	27	42	80	95	110	125	170	260	430
2 x 120	2 x 185	20	30	48	91	115	135	150	200	310	510
2 x 150		21	33	51	95	120	140	155	210	320	540
3 x 95	3 x 150	23	35	53	105	130	155	170	235	360	590
2 x 185		25	38	57	115	145	165	185	255	390	645
3 x 120		28	41	62	125	155	180	200	270	410	675
2 x 240		30	45	68	140	170	200	220	300	460	765
3 x 150	3 x 240	35	53	79	160	195	230	255	350	530	880
3 x 185		41	60	91	185	230	265	295	410	620	
3 x 240											

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 it's 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 $A^2 S$).

Record Plus Circuit breaker application

To meet this condition it is necessary to verify if the $I^2 t$ 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 and 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	66
PVC - 90° > 300 sq.mm	86	57
XLPE and 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 aluminum 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 and 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 and 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:

$$k_1 = 1.74$$

For a single phase circuit with neutral and a voltage of 230V between phase and neutral:

$$k_1 = 1.00$$

For a 3 phase circuit with neutral, a voltage of 400V between phase and a neutral with 0.5 x the phase cross section:

$$k_1 = 0.67$$

For a number of multi-core cables in parallel

$$k_2 \text{ for 2 cores} = 2.00$$

$$k_2 \text{ for 3 cores} = 2.65$$

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	1783	1493	1280	1120	896	746	640	560
95	1.05	5929	3953	2964	2295	1976	1694	1482	1186	988	847	741
120	1.05	7263	4842	3632	2900	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 and 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			
	$50V < U_0 \leq 120V$ AC	$120V < U_0 \leq 230V$ AC	$230V < U_0 \leq 400V$ 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.

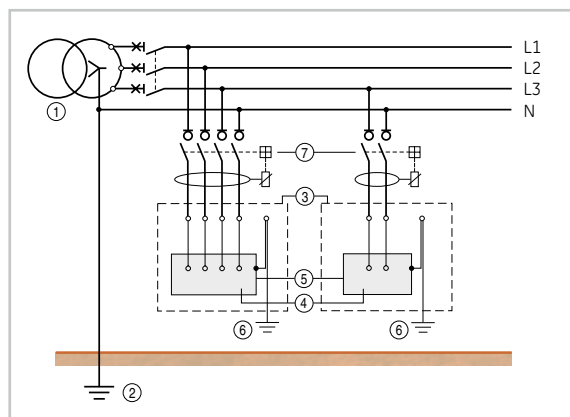
(1) Also applies to IT systems with a distributed or non distributed neutral or mid point conductor

(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)

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

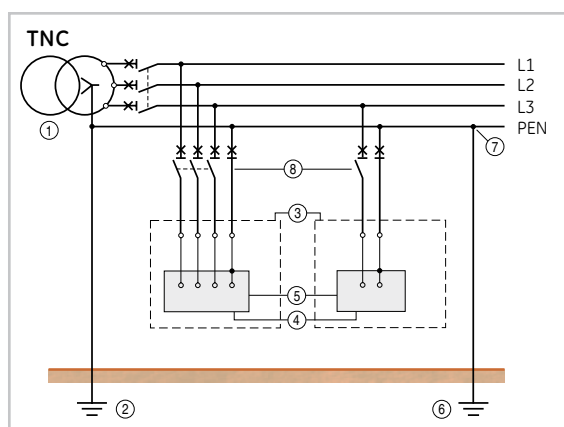
Notes

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 $5 \times I_{\Delta n}$).

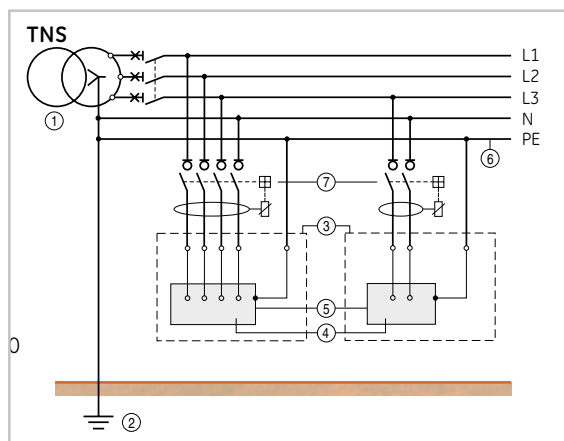
TN system characteristics

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 exists 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 RCDs 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

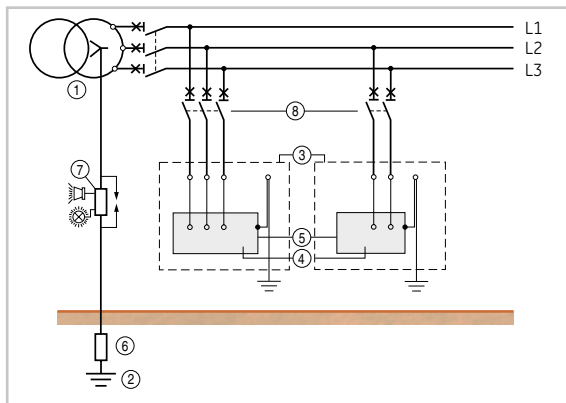
- the Source
- the line conductor up to the point of the fault
- the protective conductor of the exposed parts

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 RCDs 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 and 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 and Z'_s values meeting IEC 60364-4-41 clause 411

Record Plus Circuit breakers: FD160, FE160, FE250, FK800 and FK1250 with LTM and 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 and 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 and IT networks with add on Residual current devices type FDQ, FEQ and 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



Breaker FE160 with PremEon S Trip Unit $I_n=25A$, $I_r=25A^{[1]}$ meeting table 41.1.

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TN	127 TT	230 TT & TN	250 TT & TN	400 TN	400 TT
2	56	0.80	2.286					
2.5	69	0.20	1.829	1.829	3.312	3.600	5.760	
3	83	0.10	1.524	1.524	2.760	3.000	4.800	
4	111	0.07	1.143	1.143	2.070	2.250	3.600	3.600
5	139	0.07	0.914	0.914	1.656	1.800	2.880	2.880
6	167	0.07	0.762	0.762	1.380	1.500	2.400	2.400
8	222	0.07	0.572	0.572	1.035	1.125	1.800	1.800
10	278	0.04	0.457	0.457	0.828	0.900	1.440	1.440
12	333	0.07	0.381	0.381	0.690	0.750	1.200	1.200
13	361	0.04	0.352	0.352	0.637	0.692	1.108	1.108

Breaker FE160 with PremEon S trip unit $I_n=63A$, $I_r=32A^{[1]}$ meeting table 41.1.

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TN	127 TT	230 TT & TN	250 TT & TN	400 TN	400 TT
2	71	0.80	1.786					
2.5	89	0.20	1.429	1.429	2.588	2.813	4.500	
3	107	0.10	1.191	1.191	2.156	2.344	3.750	
4	142	0.07	0.893	0.893	1.617	1.758	2.813	2.813
5	178	0.07	0.714	0.714	1.294	1.406	2.250	2.250
6	213	0.07	0.595	0.595	1.078	1.172	1.875	1.875
8	284	0.07	0.446	0.446	0.809	0.879	1.406	1.406
10	356	0.04	0.357	0.357	0.647	0.703	1.125	1.125
12	427	0.07	0.298	0.298	0.539	0.586	0.938	0.938
13	462	0.04	0.275	0.275	0.498	0.541	0.865	0.865

Breaker FE160 with PremEon S trip unit $I_n=63A$, $I_r=63A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	140	1.00	0.907	1.571	1.643	1.786	2.857	
2.5	175	1.00	0.726	1.257	1.314	1.429	2.286	
3	210	1.00	0.605	1.048	1.095	1.190	1.905	
4	280	1.00	0.454	0.786	0.821	0.893	1.429	
5	350	1.00	0.363	0.629	0.657	0.714	1.143	
6	420	1.00	0.302	0.524	0.548	0.595	0.952	
8	560	1.00	0.227	0.393	0.411	0.446	0.714	
10	700	1.00	0.181	0.314	0.329	0.357	0.571	
12	840	1.00	0.151	0.262	0.274	0.298	0.476	
13	910	1.00	0.140	0.242	0.253	0.275	0.440	

Breaker FE160 with PremEon S type trip unit $I_n=125A$, $I_r=125A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	278	1.00	0.457	0.792	0.828	0.900	1.440	
2.5	347	1.00	0.366	0.634	0.662	0.720	1.152	
3	417	1.00	0.305	0.528	0.552	0.600	0.960	
4	556	1.00	0.229	0.396	0.414	0.450	0.720	
5	694	1.00	0.183	0.317	0.331	0.360	0.576	
6	833	1.00	0.152	0.264	0.276	0.300	0.480	
8	1111	1.00	0.114	0.198	0.207	0.225	0.360	
10	1389	1.00	0.091	0.158	0.166	0.180	0.288	
12	1667	1.00	0.076	0.132	0.138	0.150	0.240	
13	1806	1.00	0.070	0.122	0.127	0.138	0.222	

Breaker FE160 with PremEon S type trip unit $I_n=160A$, $I_r=160A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	356	1.00	0.357	0.619	0.647	0.703	1.125	
2.5	444	1.00	0.286	0.495	0.518	0.563	0.900	
3	533	1.00	0.238	0.413	0.431	0.469	0.750	
4	711	1.00	0.179	0.309	0.323	0.352	0.563	
5	889	1.00	0.143	0.248	0.259	0.281	0.450	
6	1067	1.00	0.119	0.206	0.216	0.234	0.375	
8	1422	1.00	0.089	0.155	0.162	0.176	0.281	
10	1778	1.00	0.071	0.124	0.129	0.141	0.225	
12	2133	1.00	0.060	0.103	0.108	0.117	0.188	
13	2311	1.00	0.055	0.095	0.100	0.108	0.173	

(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 $8 \times I_r$ Breaker FE250 with PremEon S trip unit $I_n=125A$, $I_r=125A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	278	1.00	0.46	0.79	0.83	0.90	1.44	
2.5	347	1.00	0.37	0.63	0.66	0.72	1.15	
3	417	1.00	0.30	0.53	0.55	0.60	0.96	
4	556	1.00	0.23	0.40	0.41	0.45	0.72	
5	694	1.00	0.18	0.32	0.33	0.36	0.58	
6	833	1.00	0.15	0.26	0.28	0.30	0.48	
8	1111	1.00	0.11	0.20	0.21	0.23	0.36	
10	1389	1.00	0.09	0.16	0.17	0.18	0.29	
12	1667	1.00	0.08	0.13	0.14	0.15	0.24	
13	1806	1.00	0.07	0.12	0.13	0.14	0.22	

Breaker FE250 with PremEon S trip unit $I_n=160A$, $I_r=160A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	356	1.00	0.36	0.62	0.65	0.70	1.13	
2.5	444	1.00	0.29	0.50	0.52	0.56	0.90	
3	533	1.00	0.24	0.41	0.43	0.47	0.75	
4	711	1.00	0.18	0.31	0.32	0.35	0.56	
5	889	1.00	0.14	0.25	0.26	0.28	0.45	
6	1067	1.00	0.12	0.21	0.22	0.23	0.38	
8	1422	1.00	0.09	0.15	0.16	0.18	0.28	
10	1778	1.00	0.07	0.12	0.13	0.14	0.23	
12	2133	1.00	0.06	0.10	0.11	0.12	0.19	
13	2311	1.00	0.05	0.10	0.10	0.11	0.17	

Breaker FE250 or FG400 with PremEon S trip unit $I_n=250A$, $I_r=250A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	556	1.00	0.23	0.40	0.41	0.45	0.72	
2.5	694	1.00	0.18	0.32	0.33	0.36	0.58	
3	833	1.00	0.15	0.26	0.28	0.30	0.48	
4	1111	1.00	0.11	0.20	0.21	0.23	0.36	
5	1389	1.00	0.09	0.16	0.17	0.18	0.29	
6	1667	1.00	0.08	0.13	0.14	0.15	0.24	
8	2222	1.00	0.06	0.10	0.10	0.11	0.18	
10	2778	1.00	0.05	0.08	0.08	0.09	0.14	
12	3333	1.00	0.04	0.07	0.07	0.08	0.12	
13	3611	1.00	0.04	0.06	0.06	0.07	0.11	

Breaker FG400 with PremEon S trip unit $I_n=400A$, $I_r=400A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist ($\times I_r$)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of					
			127 TT & TN	220 TT & TN	230 TT & TN	250 TT & TN	400 TT & TN	400 TT & TN
2	889	1.00	0.14	0.25	0.26	0.28	0.45	
2.5	1111	1.00	0.11	0.20	0.21	0.23	0.36	
3	1333	1.00	0.10	0.17	0.17	0.19	0.30	
4	1778	1.00	0.07	0.12	0.13	0.14	0.23	
5	2222	1.00	0.06	0.10	0.10	0.11	0.18	
6	2667	1.00	0.05	0.08	0.09	0.09	0.15	
8	3556	1.00	0.04	0.06	0.06	0.07	0.11	
10	4444	1.00	0.03	0.05	0.05	0.06	0.09	
12	5333	1.00	0.02	0.04	0.04	0.05	0.08	
13	5778	1.00	0.02	0.04	0.04	0.04	0.07	

Breaker FG630 with PremEon S trip unit $I_n=630A$, $I_r=630A^{[1]}$ Disconnection time $\leq 1\text{sec.}(TT)$ or $5\text{sec.}(TN)$

Short time setting Ist (x Ir)	Ia current (A)	Max. time (s)	Zs value in Ω at a U0 in Volts a.c. of				
			127	220	230	250	400
			TT&TN	TT&TN	TT&TN	TT&TN	TT&TN
2	1400	1.00	0.09	0.16	0.16	0.18	0.29
2.5	1750	1.00	0.07	0.13	0.13	0.14	0.23
3	2100	1.00	0.06	0.10	0.11	0.12	0.19
4	2800	1.00	0.05	0.08	0.08	0.09	0.14
5	3500	1.00	0.04	0.06	0.07	0.07	0.11
6	4200	1.00	0.03	0.05	0.05	0.06	0.10
7	4900	1.00	0.03	0.04	0.05	0.05	0.08
8	5600	1.00	0.02	0.04	0.04	0.04	0.07
9	6300	1.00	0.02	0.03	0.04	0.04	0.06
10	7000	1.00	0.02	0.03	0.03	0.04	0.06

Breakers meeting IEC 60364-4-41 clause 411 and table 41.1

Breaker FG400 with SMR2 type trip unit $I_n = 400A$, $I_r = 250A^{[1]}$
Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)

Disconnection time ≤ 1 sec. (TT) or 5 sec. (TN)								
Short time setting 1st (x Ir)	Ia current (A)	Max. time (s)	Zs value in Ω at a U0 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 125
	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

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 and 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)

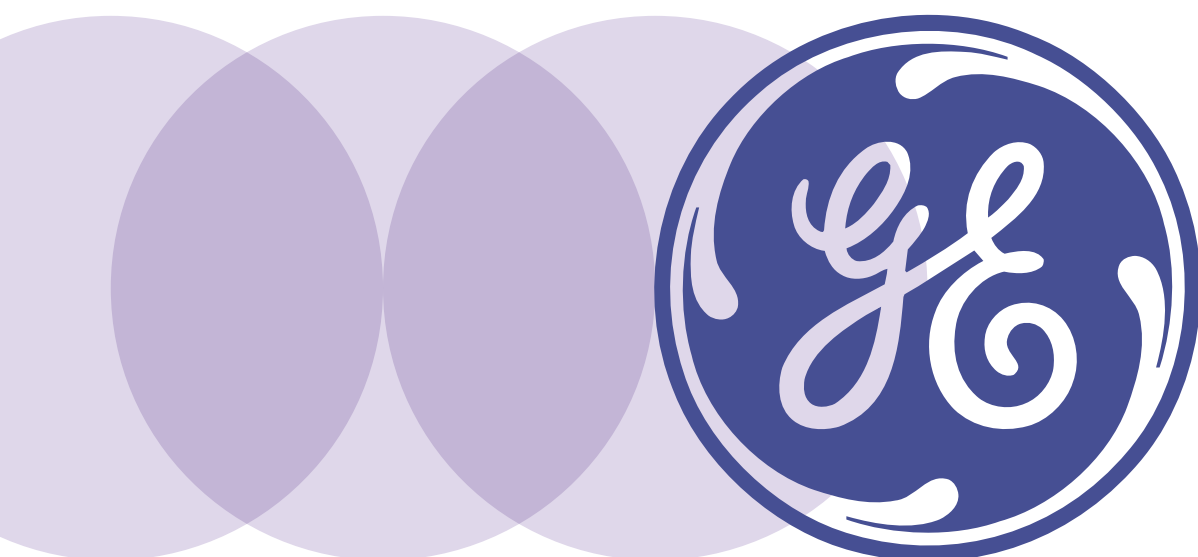
GF sum setting (Id) (x In)	I_a current (A)	Max. time (s)	Z_s value in Ω at a U_0 in Volts a.c. of				
			127	220	230	250	400
			TT & TN	TT & TN	TT & TN	TT & TN	TT & TN
0.2	240	0.60	0.529	0.917	0.958	1.042	1.667
0.3	360	0.60	0.353	0.611	0.639	0.694	1.111
0.4	480	0.60	0.265	0.458	0.479	0.521	0.833
0.5	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



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.17)

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**.

Fig. 1

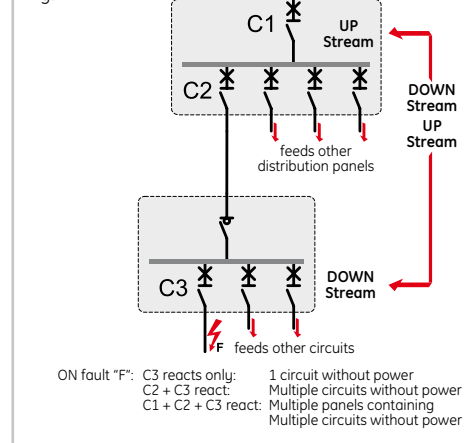


Fig. 2

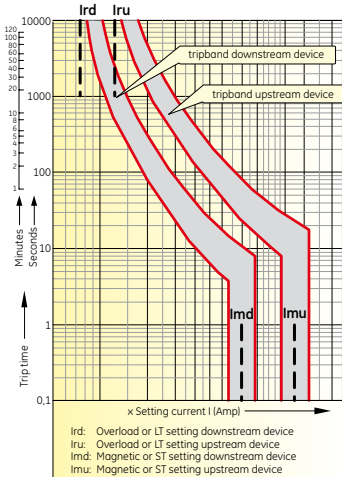
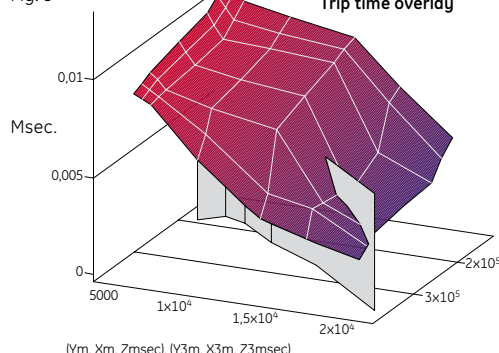


Fig. 3



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 FD & FE frame			Record Plus FE & FG frame			Record Plus FG frame		
Type	Trip Unit or Curve type	Setting code	selectivity determined by:	Trip Unit type	Setting code	Factor	Trip Unit type	Setting code	Factor	Trip Unit type	Setting code	Factor
Redline ⁽⁶⁾ & Series Hti MCBs Surion Manual Motor starter Record Plus FD & FE frame Record Plus FE frame Record Plus FG frame	B, C and D curve	In	Tables D1-D6, Factor between setting (s) & Minimum band setting	LTM,LTMD & GTM	I _r	>2	PremEon S	I _r	>2	SMR2 ⁽¹⁾	I _r	>2
		Im			I _m	>2		I _{st}	>1.5		I _{st}	>1.5
		In			I _m	>2		I _r	>2		I _r	>2
		Im			I _m	>2		I _{st}	>1.5		I _{st}	>1.5
	Magnetic Only or Thermal Magnetic LTM, LTMD & GTM	I _r		>1.6	I _r	>2	I _r	>2				
		Im		>2.5	I _{st}	>1.5	I _{st}	>1.5				
		I _r		>1.5	I _r	>1.3	I _r	>1.3				
		I _{st}		>1.5	I _{st}	>1.3	I _{st}	>1.3				
PremEon	I _r		LTM,LTMD & GTM	I _m		PremEon S	I _{st}		SMR2 ⁽²⁾	I _r		
PremEon	I _{st}					PremEon S	I _{st}		SMR2 ⁽²⁾	I _{st}		
							PremEon S	I _r	>1.3	SMR2 ⁽²⁾	I _r	>1.3
								I _{st}	>1.3		I _{st}	>2
								I _{st}	>1.3		I _{st}	>2
				Record Plus FK frame			EntelliGuard G with GTU					
Type	Trip Unit or Curve type	Setting code	selectivity determined by:	Trip Unit type	Setting code	Factor / band	Trip Unit type	Setting code	Factor / Band			
Redline* & Series Hti MCBs	B, C and D curve	In	Tables D1-D6, Factor between setting (s) & Minimum band setting	SMR1e,s,g	I _r	>2	GTU C curve	I _r	>2			
		Im			I _{st}	>1.5		I _{st}	>1.5			
	LTDB	class 5 ⁽³⁾		LTDB	Band C.5							
	STDB	Band 0.1 ⁽³⁾		STDB	minimum							
Surion Manual Motor starter	Magnetic Only or Thermal Magnetic	In		SMR1e,s,g	I _r	>2	GTU C curve	I _r	>2			
		Im			I _{st}	>1.5		I _{st}	>1.5			
					LTDB	class 5 ⁽³⁾	LTDB	Band C.21				
					STDB		STDB	minimum				
Record Plus FD & FE frame	LTM, LTMD & GTM	I _r		SMR1e,s,g	I _r	>2	GTU C curve	I _r	>2			
		Im			I _{st}	>1.5		I _{st}	>1.5			
					LTDB	class 5 ⁽³⁾	LTDB	Band C.21				
					STDB	Band 0.1 ⁽³⁾	STDB	Band 02				
Record Plus FE frame	PremEon S	I _r		SMR1e,s,g	I _r	>2	GTU C curve	I _r	>1.3			
		I _{st}			I _{st}	>1.3		I _{st}	>1.3			
				LTDB	class 5 ⁽³⁾	LTDB	Band C.15					
				STDB	Band 0.1 ⁽³⁾	STDB	Band 05					
Record Plus FG frame	PremEon S	I _r	SMR1e,s,g	I _r	>2	GTU C curve	I _r	>1.3				
		I _{st}		I _{st}	>1.3		I _{st}	>1.3				
				LTDB	class 5 ⁽³⁾	LTDB	Band C.15					
				STDB	Band 0.1 ⁽³⁾	STDB	Band 08					
Record Plus FG frame	SMR2	I _r	SMR1e,s,g	I _r	>2	GTU C curve	I _r	>2				
		I _{st}		I _{st}	>1.5		I _{st}	>1.5				
		LTDB		LTDB	class ⁽⁴⁾	LTDB	Band ⁽⁴⁾					
		STDB		STDB	Band ⁽⁴⁾	STDB	Band ⁽⁴⁾					
Record Plus FK frame	SMR1e, s, g	I _r	SMR1e,s,g	I _r	>1.5	GTU C curve	I _r	>2				
		I _{st}		I _{st}	>1.5		I _{st}	>1.5				
		LTDB		LTDB	class ⁽⁴⁾	LTDB	Band ⁽⁴⁾					
		STDB		STDB	Band ⁽⁴⁾	STDB	Band ⁽⁴⁾					
EntelliGuard G	GTU C curve or F curve	I _r					GTU C curve or F curve	I _r	>1.25			
		I _{st}						I _{st}	>1.25			
		LTDB						LTDB	Band ⁽⁵⁾			
		STDB						STDB	Band ⁽⁵⁾			

Table D1 - Selectivity/Discrimination

Upstream	Downstream	In (A)	Record Plus* type												
			FDC & FDE 160 LTM				FDS, N, H & L 160 LTMD				FE160N, H & L LTM				FE160N, H & L Prem
			16A	20A	25A	32A	16A	20A	25A	32A	25A	32A	40A	50A	25A
			Selectivity limit in kA ⁽¹⁾												
Redline EPC30 G30 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	T	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Redline EPC45 G45 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	T	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Redline EPC60 & DME60 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	T	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	T	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Redline DM60 & DMT60 DM100 & DMT100 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Redline G60 EPC101N DME100 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Redline G100 GT25 B/C curve	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Surion GPS1BS & GPS1M GPS2BS & GPS2MS	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Surion GPS1BH & GPS1MH GPS2BH & GPS2MH	≤6	0.16	0.2	0.25	0.32	0.16	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	10	--	0.2	0.25	0.32	--	0.2	0.25	0.32	0.2	0.26	0.32	0.5	6	
	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	0.32	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Record Plus* FD160C & FD160E LTM	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Record Plus* FD160S, N, H & L LTM D	16	--	--	--	0.32	--	--	--	0.32	--	0.26	0.32	0.5	6	
	20	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
	25	--	--	--	--	--	--	--	--	--	--	--	0.5	--	
Record Plus* FE160 LTM	25	--	--	--	0.32	--	--	--	0.32	--	--	--	0.5	--	
	32	--	--	--	--	--	--	--	--	--	--	--	--	--	

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device

Remark; For MCBs 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 D2 - Selectivity/Discrimination

Upstream	Downstream	In (A)	Record Plus* type																				
			FDC & FDE 160 LTM					FDS 160 LTMD					FDN, H & L 160 LTMD										
			40A	50A	63A	80A	100A	125A	40A	50A	63A	80A	100A	125A	40A	50A	63A	80A	100A	125A			
		160A					Selectivity limit in kA ⁽¹⁾												160A				
Redline	≤16	0.6	2.5	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
	20	0.6	2.5	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	T	T	T	T	T	1.6	T	T	T	T	T			
	B/C curve	32	--	--	1.2	3	T	T	--	--	T	T	T	T	--	--	T	T	T	T			
		40	--	--	--	3	T	T	--	--	--	T	T	T	--	--	--	T	T	T			
Redline	≤16	0.6	2.5	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
	EPC45	20	0.6	2.5	3	T	T	T	3.5	T	T	T	T	T	3.5	T	T	T	T	T			
	G45	25	--	0.8	1.2	T	T	T	1.6	3.5	T	T	T	T	1.6	3.5	T	T	T	T			
	B/C curve	32	--	--	1.2	3	T	T	--	--	T	T	T	T	--	--	T	T	T	T			
		40	--	--	--	3	4	T	--	--	--	T	T	T	--	--	--	T	T	T			
Redline	≤16	0.6	2.5	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
	EPC60 & DME60	20	0.6	2.5	3	T	T	T	3.5	T	T	T	T	T	3.5	T	T	T	T	T			
	B/C curve	25	--	0.8	1.2	T	T	T	1.6	3.5	T	T	T	T	1.6	3.5	T	T	T	T			
		32	--	--	1.2	3	T	T	--	--	T	T	T	T	--	--	T	T	T	T			
		40	--	--	--	3	4	6	--	--	--	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			
	DM60 & DMT60	20	0.6	2.5	3	6	8	T	3.5	T	T	T	T	T	3.5	T	T	T	T	T			
	DM100 & DMT100	25	--	0.8	1.2	6	6	T	1.6	3.5	T	T	T	T	1.6	3.5	T	T	T	T			
	B/C curve	32	--	--	1.2	3	6	8	--	--	10	T	T	T	--	--	10	T	T	T			
		40	--	--	--	3	4	6	--	--	--	T	T	T	--	--	--	T	T	T			
Redline	50	--	--	--	1.2	1.5	6	--	--	--	3.5	T	T	--	--	--	3.5	T	T	T			
		63	--	--	--	--	1.5	2	--	--	--	--	8	T	--	--	--	--	8	T			
	G60	≤16	0.6	2.5	6	6	10	T	10	10	T	T	T	T	10	10	T	T	T	T			
	EPC101N	20	0.6	2.5	3	6	8	T	3.5	10	T	T	T	T	3.5	10	T	T	T	T			
	DME100	25	--	0.8	1.2	6	6	T	1.6	3.5	T	T	T	T	1.6	3.5	T	T	T	T			
Redline	B/C curve	32	--	--	1.2	3	6	8	--	--	10	10	T	T	--	--	6	10	T	T			
		40	--	--	--	3	4	6	--	--	--	10	T	T	--	--	--	10	T	T			
		50	--	--	--	1.2	1.5	6	--	--	--	3.5	10	T	--	--	--	3.5	10	T			
		63	--	--	--	--	1.5	2	--	--	--	--	8	T	--	--	--	--	8	T			
	Redline	≤16	0.6	2.5	6	6	10	T	10	10	T	T	T	T	10	10	T	T	T	T			
G100		20	0.6	2.5	3	6	8	T	3.5	10	T	T	T	T	3.5	10	T	T	T	T			
GT25		25	--	0.8	1.2	6	6	T	1.6	3.5	15	T	T	T	1.6	3.5	15	T	T	T			
B/C curve		32	--	--	1.2	3	6	8	--	--	6	10	T	T	--	--	6	10	T	T			
		40	--	--	--	3	4	6	--	--	--	10	15	T	--	--	--	10	15	T			
Series Hti	50	--	--	--	1.2	1.5	6	--	--	--	3.5	10	T	--	--	--	3.5	10	T	T			
		63	--	--	--	--	1.5	2	--	--	--	--	8	T	--	--	--	--	8	T			
	C curve	80	--	--	--	--	--	1.9	--	--	--	--	--	2.5	--	--	--	--	--	2.5			
		100	--	--	--	--	--	1.9	--	--	--	--	--	2.5	--	--	--	--	--	2.5			
	Series S90	≤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			
Series S90	C curve	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			
		40	--	--	--	1.2	1.5	1.9	--	--	--	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			
		63	--	--	--	--	1.5	1.9	--	--	--	--	1.5	1.5	--	--	--	--	1.5	1.5			
		80	--	--	--	--	--	1.9	--	--	--	--	--	1.5	--	--	--	--	--	1.5			
Surion	100	--	--	--	--	--	--	--	--	--	--	--	1.5	--	--	--	--	--	--	1.5			
	≤20	0.6	2.5	6	6	10	T	10	10	T	T	T	T	10	10	T	T	T	T	T			
	GPS1BS & GPS1MS	25	--	1	1.2	6	6	T	--	3.5	15	15	T	T	--	3.5	15	15	T	T			
	GPS2BS & GPS2MS	32	--	--	1.2	3	6	10	--	--	6	6	T	T	--	--	6	6	T	T			
		40	--	--	--	3	4	6	--	--	--	6	T	T	--	--	--	6	T	T			
Surion	50	--	--	--	1.2	1.6	6	--	--	--	3.5	T	T	--	--	--	3.5	T	T	T			
		63	--	--	--	--	1.6	2	--	--	--	--	8	T	--	--	--	--	8	T			
	≤20	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	--	3.5	T	T	T	T			
	GPS2BH & GPS2MH	32	--	--	6	6	8	T	--	--	T	T	T	T	--	--	T	T	T	T			
Record Plus*	40	--	--	--	6	8	T	--	--	T	T	T	T	--	--	T	T	T	T	T			
		50	--	--	--	--	6	T	--	--	--	3.5	T	T	--	--	--	3.5	T	T			
		63	--	--	--	--	T	--	--	--	--	8	T	--	--	--	--	--	8	T			
		≤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			
	FD160E, S, N, H & L LTM/MO/GTM	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			
Record Plus*	40	--	--	--	0.8	1	1.3	--	--	--	1.2	1.5	3.5	--	--	--	1.2	1.5	3.5	3.5			
		50	--	--	--	0.8	1	1.3	--	--	--	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	3.5			

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device

Remark: For MCBs 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	Record Plus* type																							
		FE160N, H & L LTM					FE160N, H & L LTMD			FE160N, H & L Prem			FE250V LTM			FE250N, H & L LTMD				FE250N, H & L Prem					
		63A	80A	100A	125A	160A	100A	125A	160A	63A	125A	160A	63A	125A	160A	125A	160A	200A	250A	125A	160A	250A			
In (A)		Selectivity limit in kA ⁽¹⁾																							
Redline	EPC30	≤20	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T		
	G30	25	1.2	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
	B/C curve	32	1.2	T	T	T	T	T	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	T	T	T	T			
Redline	EPC45	≤20	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T			
	G45	25	1.2	T	T	T	T	T	T	T	T	T	T	T	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	T	T	T				
		40	--	3	4	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
Redline	EPC60 & DME60	≤20	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	B/C curve	25	1.2	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
		32	1.2	3	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
		40	--	3	4	6	6	T	T	T	--	T	T	T	T	T	T	T	T	T	T				
Redline	DM60 & DMT60	≤20	6	6	8	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	DM100 & DMT100	25	1.2	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	B/C curve	32	1.2	3	6	8	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
		40	--	3	4	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
Redline	G60	50	--	--	1.5	6	6	T	T	T	--	T	T	T	T	T	T	T	T	T	T				
	EPC101N	63	--	--	1.5	2	2	T	T	T	--	T	T	T	T	T	T	T	T	T	T				
	DME100	≤20	6	6	8	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	B/C curve	25	1.2	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
Redline	G100	32	1.2	3	6	8	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	GT25	40	--	3	4	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
	B/C curve	50	--	--	1.5	6	6	T	T	T	--	T	T	T	T	T	T	T	T	T	T				
		63	--	--	1.5	2	2	T	T	T	--	T	T	T	T	T	T	T	T	T	T				
Series Hti	C curve	80	--	--	1.5	2	2	--	T	T	--	T	T	1.9	2.5	3	T	T	T	T	T	T			
		100	--	--	--	--	2	--	--	T	--	--	T	1.9	2.5	3	--	T	T	T	--	T			
		125	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	T	T	T	--	T			
Series S90		≤40	--	1.2	1.5	1.9	1.9	T	T	T	T	T	T	1.9	2.5	3	T	T	T	T	T	T			
		50	--	--	1.5	1.9	1.9	T	T	T	--	T	T	1.9	2.5	3	T	T	T	T	T	T			
		63	--	--	--	1.9	1.9	--	T	T	--	T	T	1.9	2.5	3	T	T	T	T	T	T			
		80	--	--	--	--	1.9	--	--	T	--	T	T	1.9	2.5	3	--	T	T	T	T	T			
Surion	GPS1BS & GPS1MS	100	--	--	--	--	--	--	--	--	--	--	T	1.9	2.5	3	--	--	T	T	--	T			
	GPS2BS & GPS2MS	≤20	6	6	10	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
		25	1.2	6	6	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T				
		32	1.2	3	6	10	10	T	T	T	T	T	T	10	T	T	T	T	T	T	T				
Surion	GPS1BH & GPS1MH	40	--	--	4	6	6	T	T	T	T	T	T	6	10	T	T	T	T	T	T				
	GPS2BH & GPS2MH	50	--	--	1.6	6	6	T	T	T	--	T	T	6	6	10	T	T	T	T	T				
		63	--	--	--	2	2	--	T	T	--	T	T	2	6	6	T	T	T	T	T				
		160	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--				
Record Plus*	FD160E, S, N, H & L LTM/MO/GTM	≤40	--	0.8	1	1.2	1.6	T	T	T	36	36	36	1.6	2	2.5	42	42	42	42	50	50	T		
		50	--	--	1	1.2	1.6	T	T	T	--	36	36	1.6	2	2.5	42	42	42	42	50	50	T		
		63	--	--	--	1.2	1.6	T	T	T	--	36	36	1.6	2	2.5	42	42	42	42	50	50	T		
		80	--	--	--	1.2	1.6	--	T	T	--	36	36	1.6	2	2.5	42	42	42	42	50	50	T		
		100	--	--	--	--	1.6	--	--	T	--	--	36	1.6	2	2.5	--	42	42	42	--	50	T		
		125	--	--	--	--	--	--	--	--	--	--	--	--	2	2.5	--	--	42	42	--	--	T		
Record Plus*	FD160S, N, H & L LTMD	≤40	0.6	0.8	1	1.2	1.6	30	30	30	36	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		50	--	0.8	1	1.2	1.6	30	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		63	--	--	1	1.2	1.6	30	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		80	--	--	--	1.2	1.6	--	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		100	--	--	--	--	1.6	--	--	30	--	--	36	1.6	2	2.5	--	42	42	42	--	50	50		
		125	--	--	--	--	--	--	--	--	--	--	--	--	2	2.5	--	--	42	42	--	--	50		
Record Plus*	FE160 N, H & L LTM/MO/GTM	≤40	0.6	0.8	1	1.2	1.6	30	30	30	36	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		50	--	0.8	1	1.2	1.6	30	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		63	--	--	1	1.2	1.6	30	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		80	--	--	--	1.2	1.6	--	30	30	--	36	36	1.6	2	2.5	42	42	42	42	50	50	50		
		100	--	--	--	--	1.6	--	--	30	--	--	36	1.6	2	2.5	--	42	42	42	--	50	50		
		125	--	--	--	--	--	--	--	--	--	--	--	--	2	2.5	--	--	42	42	--	--	50		
Record Plus*		160	--	--	--	--	--	--	--	--	--	--	--	--	--	2.5	--	--	--	42	--	--	50		

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device

Table D4 - Selectivity/Discrimination

Upstream	Downstream	In (A)	Record Plus* type															
			FE160N, H & L Prem			FE250N, H & L LTMD				FE250N, H & L Prem			FG400N, H & L Prem & 2			FG630N, H & L Prem & 2		
			63A	80A	160A	125A	160A	200A	250A	125A	160A	250A	250A	350A	400A	400A	500A	630A
Selectivity limit in kA ⁽¹⁾																		
Redline	≤16	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	EPC30, 45, 60 & 101N	20	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	G30, 45, 60 & 100	25	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	GT25	32	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	DME60, DM60 & DMT60	40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
Series Hti	DM100, DMT100 & DME100	50	--	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	
	80	--	T	T	--	T	T	T	T	T	T	T	T	T	T	T	T	
	C curve	100	--	--	T	--	T	T	T	--	T	T	T	T	T	T	T	
	125	--	--	--	--	--	T	T	--	T	T	T	T	T	T	T	T	
Series S90	≤40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	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	
Surion	≤25	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	GPS1BS & GPS1MS	32	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	GPS2BS & GPS2MS	40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	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	
Record Plus*	≤25	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	GPS1BH & GPS1MH	32	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	GPS2BH & GPS2MH	40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	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	
	≤40	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
	FD160E	50	--	T	T	T	T	T	T	T	T	T	T	T	T	T	T	
Record Plus*	LTM	63	--	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	
	≤40	36	36	36	42	42	42	42	50	50	50	T	T	T	T	T	T	
	FD160S, N, H & L	50	--	36	36	42	42	42	42	50	50	50	T	T	T	T	T	
Record Plus*	LTMD/MO/GTM	63	--	36	36	42	42	42	42	50	50	50	T	T	T	T	T	
	80	--	--	36	42	42	42	42	50	50	50	T	T	T	T	T	T	
	100	--	--	36	--	42	42	42	--	50	50	T	T	T	T	T	T	
	125	--	--	--	--	42	42	42	--	--	50	T	T	T	T	T	T	
	160	--	--	--	--	--	42	42	--	--	50	T	T	T	T	T	T	
	≤40	36	36	36	42	42	42	42	50	50	50	T	T	T	T	T	T	
	FE160 N, H & L	50	--	36	36	42	42	42	42	50	50	50	T	T	T	T	T	
Record Plus*	LTM/MO/GTM	63	--	36	36	42	42	42	42	50	50	50	T	T	T	T	T	
	80	--	36	36	42	42	42	42	50	50	50	T	T	T	T	T	T	
	100	--	--	36	--	42	42	42	--	50	50	T	T	T	T	T	T	
	125	--	--	--	--	--	42	42	--	--	50	T	T	T	T	T	T	
	160	--	--	--	--	--	--	42	--	--	50	T	T	T	T	T	T	
	≤40	0.8	1.8	2.2	1.3	1.6	2.5	2.5	1.8	2.2	3.5	T	T	T	T	T	T	
	FE160 N, H & L	63	--	1.8	2.2	1.3	1.6	2.5	2.5	1.8	2.2	3.5	T	T	T	T	T	
Record Plus*	LTMD/PremEon S	80	--	1.8	2.2	1.3	1.6	2.5	2.5	1.8	2.2	3.5	T	T	T	T	T	
	100	--	--	2.2	--	1.6	2.5	2.5	--	2.2	3.5	T	T	T	T	T	T	
	125	--	--	--	--	--	2.5	2.5	--	--	3.5	T	T	T	T	T	T	
	160	--	--	--	--	--	--	2.5	--	--	3.5	T	T	T	T	T	T	
	250	--	--	--	--	--	--	--	--	--	--	3.5	10	15	T	T	T	
Record Plus*	FE250 N, H & L	160	--	--	--	--	--	--	--	--	--	3.5	10	15	T	T	T	
	LTMD/PremEon S	200	--	--	--	--	--	--	--	--	--	--	10	15	T	T	T	
	250	--	--	--	--	--	--	--	--	--	--	--	10	15	T	T	T	
	250	--	--	--	--	--	--	--	--	--	--	--	5	6	5	7	7	
PremEon S & SMR2	350-400	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7		

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device



Table D5 - Selectivity/Discrimination

	Upstream		Record Plus* type			
			FK800N, H & L SMR1	FK1250N, H & L SMR1	FK1600N & H SMR1	
Downstream	In (A)		800A	1000A	1250A	1600A
			Selectivity limit in kA ⁽¹⁾			
Redline						
EPC30, 45, 60 & 101N - G30, 45, 60 & 100 - GT25 - DME60, DM60, DMT60, DM100, DMT100 & DME100	B/C curve	ALL	T	T	T	T
Redline						
Series HTI & Series S90		ALL	T	T	T	T
Surion						
GPS1BS, GPS1MS, GPS2BS, GPS2MS						
GPS1BH, GPS1MH, GPS2BH & GPS2MH		ALL	T	T	T	T
Record Plus*						
FD160E, S N & L types						
LTM/LTMD/MO/GTM	Trip Units	ALL	T	T	T	T
Record Plus*						
FE160 N, H & L types						
LTM/LTMD/MO/GTM/PremEon S	Trip Units	ALL	T	T	T	T
Record Plus*						
FE250 V, N, H & L types						
LTM/LTMD/MO/GTM/PremEon S	Trip Units	ALL	T	T	T	T
Record Plus*						
FG400 N, H & L types						
PremEon S/SMR2	Trip Units	ALL	T	T	T	T
Record Plus*						
FG630 N, H & L types		400	T	T	T	T
PremEon S/SMR2	Trip Units	500	15	T	T	T
		630	15	T	T	T
Record Plus*						
FK800 N, H & L types						
LTM/MO/SMR1e, s & g	Trip Units	800	--	--	15	25
Record Plus*						
FK1250 N, H & L types		1000	--	--	--	25
LTM/MO/SMR1e, s & g	Trip Units	1250	--	--	--	25

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device

Table D6 - Selectivity/Discrimination

	Upstream	Trip unit or curve	EntelliGuard Power Circuit Breaker Type								
			GG04S-GG20S	GG04N-GG20H	GG04E-GG20E	GG04M-GG20M	GG(H)25N-GG(H)40N	GG(H)25H-GG(H)40H	GG(H)25-GG(H)40M	GG32G & GG40G	GG50M-GG64L
Downstream			Selectivity limit in kA ⁽¹⁾								
Redline											
EPC30, 45, 60 & 101N - G30, 45, 60 & 100 - GT25 - DME60, DM60, DMT60, DM100, DMT100 & DME100	B/C curve	ALL	T	T	T	T	T	T	T	T	T
Redline											
Series HTI & Series S90		ALL	T	T	T	T	T	T	T	T	T
Surion											
GPS1BS, GPS1MS, GPS2BS, GPS2MS											
GPS1BH, GPS1MH, GPS2BH & GPS2MH		ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FD160E, S N & L types											
LTM/LTMD/MO/GTM	Trip Units	ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FE160 N, H & L types											
LTM/LTMD/MO/GTM/PremEon S	Trip Units	ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FE250 V, N, H & L types											
LTM/LTMD/MO/GTM/PremEon S	Trip Units	ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FG400 N, H & L types											
PremEon S/SMR2	Trip Units	ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FG630 N, H & L types											
PremEon S/SMR2	Trip Units		T	T	T	T	T	T	T	T	T
Record Plus*											
FK800V, N, H & L types											
LTM/MO/SMR1e, s & g	Trip Units	ALL	T	T	T	T	T	T	T	T	T
Record Plus*											
FK1250V, N, H & L types											
LTM/MO/SMR1e, s & g	Trip Units	ALL	T	T	T	T	T	T	T	T	T

(1) Where T is mentioned Selectivity is full up until the Icu of the downstream device

Indicated selectivity limits only applies when Instantaneous (I) is ON, If OFF reduce values by 10%.



Table D7 - Selectivity/Discrimination

Upstream MCCB	Trip Unit	Rating (A)	Stand LT	Stand Ist/Im	Downstream gL/gG fuse Max rating
Record Plus* FD160	LTMD	63	max	10x	20A
		80	max	10x	25A
		100	max	10x	32A
		125	max	10x	40A
		160	max	8x	50A
FE160	LTMD	63	max	10x	25A
		80	max	10x	32A
		100	max	10x	40A
		125	max	10x	50A
		160	max	10x	63A
FE160	PremEon	25	20A	12x	10A
		25	25A	12x	13A
		63	32A	12x	16A
		63	40A	12x	20A
		63	50A	12x	25A
		63	63A	12x	32A
		125	80A	12x	40A
		125	100A	12x	50A
		125	125A	12x	63A
		160	160A	12x	80A
FE250	LTMD	125	max	10x	50A
		160	max	10x	63A
		200	max	10x	80A
		250	max	10x	100A
FE250	PremEon	125	80A	8x	40A
		125	100A	10x	50A
		125	125A	10x	63A
		160	125A	8x	63A
		160	160A	10x	80A
		250	200A	8x	100A
		250	250A	10x	125A
		250	160A	8x	80A
FG400	PremEon	250	200A	8x	100A
		250	250A	8x	125A
		400	320A	8x	160A
		400	400A	8x	200A
FG630	PremEon	400	320A	7x	160A
		400	400A	7x	200A
		630	500A	7x	250A
		630	630A	7x	315A

Table D7 - Selectivity/Discrimination

Upstream MCCB or PCB	Trip Unit	Rating (A)	Stand LT	Stand LTDB	Stand Ist/Im	Stand STDB	Stand I	Downstream gL/gG fuse Max rating
Record Plus* FG400	SMR2	250	160A	cl.20	8x	120ms	8x	80A
		250	200A	cl.20	8x	120ms	8x	100A
		250	250A	cl.20	8x	120ms	8x	125A
		400	320A	cl.20	7x	120ms	8x	160A
		400	400A	cl.20	9x	120ms	10x	200A
FG630	SMR2	400	320A	cl.20	7x	120ms	10x	160A
		400	400A	cl.20	9x	120ms	10x	200A
		630	500A	cl.20	7x	120ms	10x	250A
		630	630A	cl.20	8x	120ms	11x	315A
FK800	SMR1e	800	640A	--	6x	--	--	250A
		800	800A	--	6x	--	--	315A
	SMR1s/g	800	640A	cl.20	8x	100ms	10x	315A
		800	800A	cl.20	8x	100ms	10x	315A
FK1250	SMR1e	1000	800A	--	6x	--	--	250A
		1000	1000A	--	6x	--	--	315A
		1250	1000A	--	6x	--	--	400A
		1250	1250A	--	6x	--	--	500A
FK1250	SMR1s/g	1000	800A	cl.20	8x	100ms	10x	400A
		1000	1000A	cl.20	8x	100ms	10x	500A
		1250	1000A	cl.20	8x	100ms	10x	500A
		1250	1250A	cl.20	8x	100ms	10x	630A
FK1600	SMR1e	1600	1250A	--	6x	--	--	500A
		1600	1600A	--	6x	--	--	630A
	SMR1s/g	1600	1250A	cl.20	8x	100ms	10x	630A
		1600	1600A	cl.20	8x	100ms	10x	800A



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.

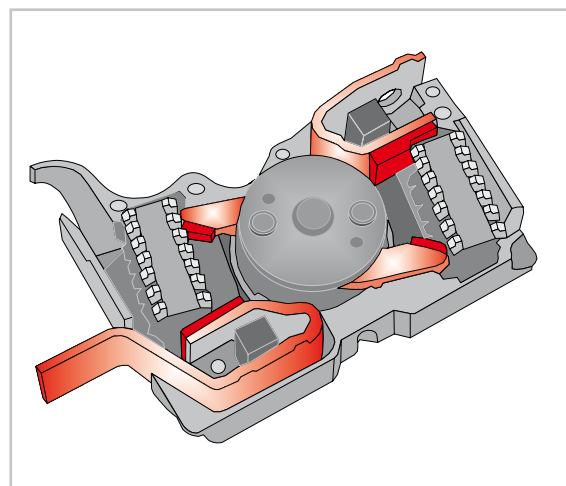
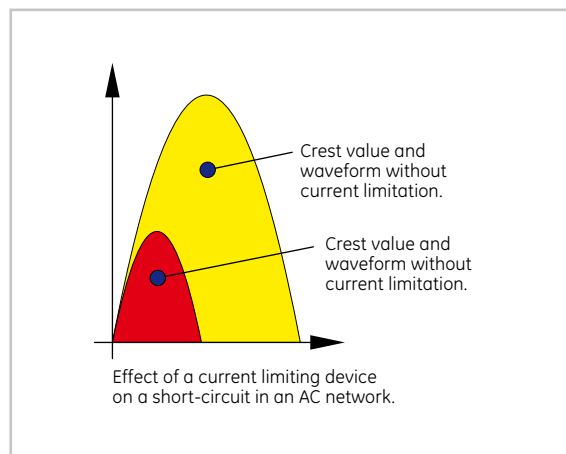
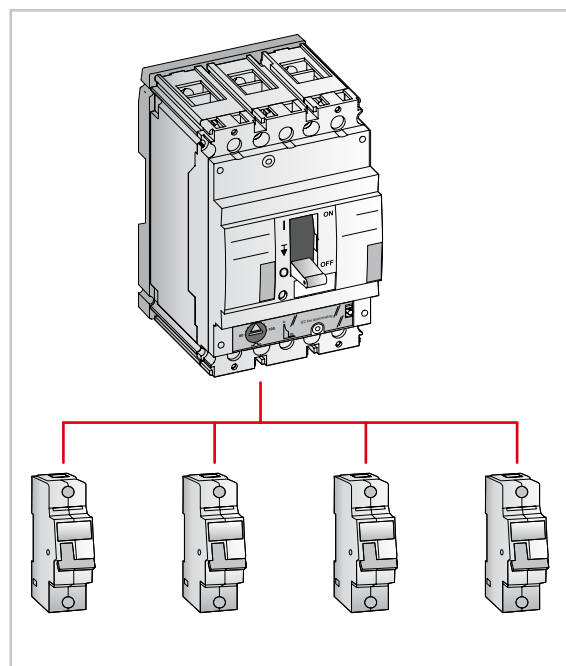


Table B1: Back Up protection for 3- or 4-wire systems at a phase-to-phase voltage of 220/240VAC

Upstream Downstream		Upstream Record Plus* type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		FD160C		FD160E		FD160S		FD160N		FD160H		FD160L		FE160N		FE160H		FE160L		FE250V		FE250N		FE250H		FE250L		FG400N		FG400H		FG400L		FG630N		FG630H		FG630L		FK800N		FK800H		FK800L		FK1250N		FK1250H		FK1250L		FK1600N		FK1600H																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Icu		25	40	50	85	100	200	85	100	200	65	85	100	200	85	100	200	65	85	100	200	85	100	200	85	100	200	85	100	200	85	100	200	85	100	170	85	100	170	85	100	170	85	100	170	85	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
In (kA)		Icu of the combination in kA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Table B1a: Back Up protection for 4-wire systems at a phase-to-neutral voltage downstream of 220/240VAC

Upstream Downstream		Upstream Record Plus* type																												
		FD160C	FD160E	FD160S	FD160N	FD160H	FD160L	FE160N	FE160H	FE160L	FE250V	FE250N	FE250H	FE250L	FG400N	FG400H	FG400L	FG630N	FG630H	FG630L	FK800N	FK800H	FK800L	FK1250N	FK1250H	FK1250L	FK1600N	FK1600H		
		Icu	25	40	50	85	100	200	85	100	200	65	85	100	200	85	100	200	85	100	200	85	100	170	85	100	170	85	100	
		In (kA)	Icu of the combination in kA																											
Redline																														
EPC30 1N		3	15	15	15	15	15	15	12	12	12	10	10	10	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
EPC45 1N		6	15	18	18	18	18	18	15	15	15	12	12	12	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
EPC61N		10	16	20	23	23	23	23	20	20	20	16	16	16	16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
DP45 1N		6	15	18	18	18	18	18	15	15	15	12	12	12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
DME60 1N		6	15	18	22	22	22	22	18	18	18	15	15	15	15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
DM60 & DMT60 1N		10	22	25	30	36	85	85	36	85	85	30	36	65	65	16	16	16	14	14	14	--	--	--	--	--	--	--	--	
DME100 1N		10	18	22	25	25	25	25	22	22	22	18	28	18	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
DM100 & DMT100 1N		15	25	36	42	50	100	100	42	100	100	30	36	65	65	18	18	18	16	16	16	--	--	--	--	--	--	--	--	
G30 1P		5	18	22	30	36	85	85	36	65	65	30	30	50	50	14	14	14	12	12	12	--	--	--	--	--	--	--	--	
G30 1N		10	22	25	36	42	85	85	42	85	85	36	36	65	65	16	16	16	14	14	14	--	--	--	--	--	--	--	--	
G45 1P		6	18	22	30	36	85	85	36	65	65	30	30	50	50	14	14	14	12	12	12	--	--	--	--	--	--	--	--	
G45 1N		10	22	25	30	36	85	85	36	85	85	36	36	65	65	16	16	16	14	14	14	--	--	--	--	--	--	--	--	
G60 1P		10	25	36	42	50	100	100	50	100	100	36	42	85	85	22	22	22	18	18	18	--	--	--	--	--	--	--	--	
G60 1N		20	25	36	42	50	100	100	50	100	100	36	42	85	85	22	22	22	18	18	18	--	--	--	--	--	--	--	--	
G100 1P		15	25	36	42	50	100	100	42	100	100	30	36	65	65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
G100 1N		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	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Series HTI 1p		10	22	25	30	36	85	85	36	85	85	36	36	65	65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Series S90		25	--	36	42	85	100	100	85	100	100	36	50	85	85	--	--	--	--	--	--	--	--	--	--	--	--	--	--	



Table B2 : Back Up protection for 3- or 4-wire systems at a phase-to-phase voltage of 400/415VAC

Upstream Downstream		Upstream Record Plus* type																												
		FD160C	FD160E	FD160S	FD160N	FD160H	FD160L	FE160N	FE160H	FE160L	FE250V	FE250N	FE250H	FE250L	FG400N	FG400H	FG400L	FG630N	FG630H	FG630L	FK800N	FK800H	FK800L	FK1250N	FK1250H	FK1250L	FK1600N	FK1600H		
		Icu	18	25	36	50	80	150	50	80	150	36	50	80	150	50	80	150	50	80	150	50	80	150	50	80	150	50	80	
		In (kA)	Icu of the combination in kA																											
Redline																														
EPC32, 33 & 34		4.5	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	--	--	--	--	--	--	--	--	
EPC 62, 63 & 64		10	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		10	18	22	25	30	36	43	30	36	42	22	30	36	36	16	16	16	12	12	12	--	--	--	--	--	--	--	--	
G100		15	18	25	30	36	42	50	36	42	50	25	30	36	36	22	22	22	16	16	16									
GT25		25	--	--	30	36	42	50	36	42	50	--	36	42	42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
GT25		20	--	--	30	36	42	50	36	42	50	--	36	42	42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
GT25		15	18	25	30	36	42	50	36	42	50	25	30	36	36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Series HTI		10	15	18	25	30	36	42	30	36	42	18	30	36	36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Series S90		15	18	25	30	36	42	50	36	42	50	25	30	36	36	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
Surion																														
GPS1B/MS ≤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	--	--	100	--	--	100	--	--	
FE160N		50	--	--	--	--	--	--	--	80	150	--	--	80	150	--	80	150	--	80	150	--	80	100	--	80	100	--	80	
FE160H		80	--	--	--	--	--	--	--	--	150	--	--	--	150	--	--	150	--	--	150	--	--	100	--	--	100	--	--	
FE250N		50	--	--	--	--	--	--	--	--	--	--	--	80	150	--	80	150	--	80	150	--	80	100	--	80	100	--	80	
FE250H		80	--	--	--	--	--	--	--	--	--	--	--	--	150	--	--	150	--	--	150	--	--	100	--	--	100	--	--	
FG400N		50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80	150	--	80	150	--	80	100	--	80	100	--	80	
FG400H		80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	150	--	--	150	--	--	100	--	--	100	--	--	
FG630N		50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80	150	--	80	100	--	80	100	--	80	
FG630H		80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	150	--	--	100	--	--	100	--	--	
FK800N		50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80	100	--	80	100	--	80	
FK800H		80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	--	--	100	--	--	
FK1250N		50	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80	100	--	80	100	--	80	
FK1250H		80	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	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 EntelliGuard 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		Record Plus* type																							
		FDC160 LTM				FDE160 LTM				FDS160 LTMD				FDN160 LTMD				FDH160 LTMD				FDL160 LTMD			
Downstream		63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A
	In (A)	160A				160A				160A				160A				160A				160A			
	Selectivity limit in kA / Icu of combination in kA at 400-415V AC																								
Redline G & EPC30 /45 B/C curve	≤16A	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
	20A	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
	25A	--	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	15/36	15/36	30/36	30/36
	32A	--	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	10/36	10/36	36/36	30/36
	40A	--	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
Redline G60 B/C curve	≤16A	6/18	6/18	10/18	18/18	6/22	6/22	10/22	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	36/42	36/42	36/42	36/42
	20A	3/18	6/18	8/18	18/18	3/22	6/22	8/22	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	36/42	36/42	36/42	36/42
	25A	--	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
	32A	--	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	36/36	30/36	10/42	10/42	36/42	30/42
	40A	--	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
Redline G100 B/C curve	50A	--	--	15/18	6/18	--	--	15/22	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
	63A	--	--	--	--	--	--	--	--	--	--	8/25	22/25	--	--	8/30	22/30	--	--	8/36	22/36	--	--	8/42	22/42
	≤16A	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	36/50	36/50	36/50	36/50
	20A	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	36/50	36/50	36/50	36/50
	25A	--	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	30/42	30/42	15/50	15/50	30/50	30/50
Redline GT25 B/C curve	32A	--	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
	40A	--	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
	50A	--	--	15/18	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
	63A	--	--	--	2/18	--	--	--	2/25	--	--	8/30	22/30	--	--	8/36	22/36	--	--	8/42	22/42	--	--	8/50	22/50
	≤20A	--	--	--	--	--	--	--	--	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	36/65
Surion GPS1BS & GPS1MS	25A	--	--	--	--	--	--	--	--	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	30/65
	32A	--	--	--	--	--	--	--	--	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	30/50
	40A	--	--	--	--	--	--	--	--	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
	50A	--	--	--	--	--	--	--	--	--	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
	63A	--	--	--	--	--	--	--	--	--	--	8/30	22/30	--	--	8/36	22/36	--	--	8/42	22/42	--	--	8/50	22/50
Surion GPS2BS & GPS2MS	≤10A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12.5A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150
	16/20A	--	--	--	--	--	--	--	--	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65
	25/32A	--	--	--	--	--	--	--	--	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65
	40A	--	--	--	--	--	--	--	--	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	--	65/65	65/65	65/65
Surion GPS1BH & GPS1MH	50/63A	--	--	--	--	--	--	--	--	--	--	36/36	36/36	--	--	42/42	42/42	--	--	50/50	50/50	--	--	65/65	65/65
	≤10A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12.5A	--	--	--	--	--	--	--	--	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65
	16/20A	--	--	--	--	--	--	--	--	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65
	25/32A	--	--	--	--	--	--	--	--	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65
Surion GPS2BH & GPS2MH	40A	--	--	--	--	--	--	--	--	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	--	65/65	65/65	65/65
	50/63A	--	--	--	--	--	--	--	--	--	--	36/36	36/36	--	--	42/42	42/42	--	--	50/50	50/50	--	--	65/65	65/65
	≤10A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	12.5A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	16/20A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150
Surion GPS1BH & GPS1MH	25/32A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150
	40A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80/80	80/80	80/80	--	150/150	150/150	150/150
	50/63A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	80/80	80/80	--	--	150/150	150/150



Table DB1a Selectivity Plus

Upstream Downstream		Record Plus* type																							
		FDC160 LTM				FDE160 LTM				FDS160 LTMD				FDN160 LTMD				FDH160 LTMD				FDL160 LTMD			
		63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A	63A	80A	100A	125A
In (A)		160A				160A				160A				160A				160A				160A			
		Selectivity limit in kA / Icu of combination in kA at 230-240V AC																							
Redline	≤16A	6/15	6/15	10/15	10/15	6/15	6/15	10/15	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
EPC30 /45	20A	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
B/C curve	25A	--	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
	32A	--	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
	40A	--	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
Redline	≤16A	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
DME60,	20A	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
EPC61N & EPC60	25A	--	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	22/22
B/C curve	32A	--	3/15	6/15	10/15	--	3/18	6/18	10/18	10/22	10/22	22/22	22/22	10/22	10/22	22/22	22/22	10/22	10/22	22/22	22/22	10/22	10/22	22/22	22/22
	40A	--	3/15	4/15	10/15	--	3/18	4/18	10/18	3.5/22	10/22	15/22	25/22	3.5/22	10/22	15/22	25/22	3.5/22	10/22	15/22	25/22	3.5/22	10/22	15/22	25/22
Redline	≤16A	6/18	6/18	10/18	18/18	6/22	6/22	10/22	10/22	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25
DME100 & EPC101N	20A	3/18	6/18	8/18	18/18	3/22	6/22	8/22	10/22	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25	25/25
B/C curve	25A	--	6/18	6/18	18/18	--	6/22	6/22	10/22	15/25	25/25	25/25	25/25	15/25	25/25	25/25	25/25	15/25	25/25	25/25	25/25	15/25	25/25	25/25	25/25
	32A	--	3/18	6/18	18/18	--	3/22	6/22	10/22	10/25	10/25	25/25	25/25	10/25	10/25	25/25	25/25	10/25	10/25	25/25	25/25	10/25	10/25	25/25	25/25
	40A	--	3/18	4/18	18/18	--	3/22	4/22	10/22	3.5/25	10/25	15/25	25/25	3.5/25	10/25	15/25	25/25	3.5/25	10/25	15/25	25/25	3.5/25	10/25	15/25	25/25

Table DB2 Selectivity Plus

Upstream Downstream		Record Plus* type																											
		FE160N-LTMD/Prem				FE160H-LTMD/Prem				FE160L-LTMD/Prem				FE250N-LTMD/Prem				FE250H-LTMD/Prem				FE250L-LTMD/Prem							
		63A	100A	125A	160A	63A	100A	125A	160A	63A	100A	125A	160A	125A	160A	200A	250A	125A	160A	200A	250A	125A	160A	200A	250A				
In (A)		Selectivity limit in kA / Icu of combination in kA at 400-415V AC																											
Redline G & EPC30 /45 B/C curve	≤25A	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	22/22	22/22	22/22	22/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30				
	32A	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	22/22	22/22	22/22	22/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30				
	40A	--	25/25	25/25	25/25	--	30/30	30/30	30/30	--	36/36	36/36	36/36	22/22	22/22	22/22	22/22	25/25	25/25	25/25	25/25	30/30	30/30	30/30	30/30				
	≤25A	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36				
Redline G60 B/C curve	32A	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36				
	40A	--	30/30	30/30	30/30	--	36/36	36/36	36/36	--	42/42	42/42	42/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	50A	--	30/30	30/30	30/30	--	36/36	36/36	36/36	--	42/42	42/42	42/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	63A	--	--	30/30	30/30	--	--	36/36	36/36	--	--	42/42	42/42	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
Redline G100 B/C curve	≤25A	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36				
	32A	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	40A	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	50A	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
Redline GT25 B/C curve	63A	--	--	36/36	36/36	--	--	42/42	42/42	--	--	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	≤25A	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	42/42	42/42	42/42					
	32A	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	42/42	42/42	42/42					
	40A	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	36/36	36/36	36/36	36/36	42/42	42/42	42/42	42/42	42/42	42/42	42/42					
Surion GPS1BS & GPS1MS	50A	--	36/36	36/36	36/36	--	42/42	42/42	42/42	--	50/50	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	63A	--	--	36/36	36/36	--	--	42/42	42/42	--	--	50/50	50/50	30/30	30/30	30/30	30/30	36/36	36/36	36/36	36/36	36/36	36/36	36/36					
	≤10A	--	--	--	--	--	--	--	--	150/150	150/150	150/150	150/150	--	--	--	--	--	--	--	--	150/150	150/150	150/150					
	12.5A	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150					
GPS2BS & GPS2MS	16/20A	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65					
	25/32A	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65	65/65	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65					
	40A	--	42/42	42/42	42/42	--	50/50	50/50	50/50	--	65/65	65/65	65/65	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65					
	50/63A	--	--	42/42	42/42	--	--	50/50	50/50	--	--	65/65	65/65	42/42	42/42	42/42	42/42	50/50	50/50	50/50	50/50	65/65	65/65	65/65					
Surion GPS1BH & GPS1MH	≤10A	--	--	--	--	--	--	--	--	150/150	150/150	150/150	150/150	--	--	--	--	--	--	--	--	150/150	150/150	150/150					
	12.5A	--	--	--	--	--	--	--	--	150/150	150/150	150/150	150/150	--	--	--	--	--	--	--	--	150/150	150/150	150/150					
	16/20A	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150					
	25/32A	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150	150/150	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150					
GPS2BH & GPS2MH	40A	--	--	--	--	--	80/80	80/80	80/80	--	150/150	150/150	150/150	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150					
	50/63A	--	--	--	--	--	--	80/80	80/80	--	--	150/150	150/150	--	--	--	--	80/80	80/80	80/80	80/80	150/150	150/150	150/150					

Table DB2a Selectivity Plus

Upstream	Record Plus* type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
	FE160N-LTMD/Prem				FE160H-LTMD/Prem				FE160L-LTMD/Prem				FE250N-LTMD/Prem				FE250H-LTMD/Prem				FE250L-LTMD/Prem																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Downstream	63A				100A				125A				160A				63A				100A				125A				160A				125A				160A				200A				250A				125A				160A				200A				250A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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	Selectivity limit in kA / Icu of combination in kA at 230-240V AC																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Redline EPC30 /45 B/C curve	≤16A	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	12/12	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10	10/10

Table DB3 Selectivity Plus

Upstream	Type & In		Record Plus* type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
			FE160N-LTMD				FE160H-LTMD				FE160L-LTMD				FE250N-LTMD				FE250H-LTMD				FE250L-LTMD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			100A	125A	160A	100A	125A	160A	100A	125A	160A	125A	160A	200A	250A	125A	160A	200A	250A	125A	160A	200A	250A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Downstream	Type & In		Selectivity limit in kA / Icu of combination in kA at 400-415V AC																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Table DB4 Selectivity Plus

Upstream	Downstream	Type & In	Record Plus* type																							
			FE160N-Prem				FE160H-Prem				FE160L-Prem				FE250N-Prem				FE250H-Prem				FE250L-Prem			
			63A	125A	160A	63A	125A	160A	63A	125A	160A	125A	160A	200A	250A	125A	160A	200A	250A	125A	160A	200A	250A			
Selectivity limit in kA / Icu of combination in kA at 400-415V AC																										
Record Plus* LTM, LTMD, GTM & MO	FDC160 ≤63A	--	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				
	FDE160 ≤63A	--	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				
	FDS160 ≤63A	--	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				
	FDN160 ≤63A	--	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				
	FDH160 ≤63A	--	--	--	--	30/80	30/80	--	36/150	36/150	--	--	--	--	50/80	50/80	50/80	50/80	50/150	50/150	50/150	50/150				
Record Plus* LTM, LTMD, GTM & MO	FDC160 ≤100A	--	--	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 ≤100A	--	--	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 ≤100A	--	--	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 ≤100A	--	--	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 ≤100A	--	--	--	--	--	30/80	--	--	36/150	--	--	--	--	--	50/80	50/80	50/80	--	50/150	50/150	50/150				
Record Plus* LTM, LTMD, & GTM	FDC160 125A	--	--	--	--	--	--	--	--	--	--	30/30	30/30	--	--	36/36	36/36	--	--	42/42	42/42					
	FDE160 125A	--	--	--	--	--	--	--	--	--	--	--	36/36	36/36	--	--	42/42	42/42	--	--	50/50	50/50				
	FDS160 125A	--	--	--	--	--	--	--	--	--	--	--	42/42	42/42	--	--	50/50	50/50	--	--	50/65	50/65				
	FDN160 125A	--	--	--	--	--	--	--	--	--	--	--	50/50	50/50	--	--	50/80	50/80	--	--	50/150	50/150				
	FDH160 125A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50/150	50/150				
Record Plus* LTM, LTMD, & GTM	FDC160 160A	--	--	--	--	--	--	--	--	--	--	--	--	30/30	--	--	36/36	--	--	--	42/42					
	FDE160 160A	--	--	--	--	--	--	--	--	--	--	--	--	36/36	--	--	--	42/42	--	--	--	50/50				
	FDS160 160A	--	--	--	--	--	--	--	--	--	--	--	--	42/42	--	--	--	50/50	--	--	--	50/65				
	FDN160 160A	--	--	--	--	--	--	--	--	--	--	--	--	50/50	--	--	--	50/80	--	--	--	50/150				
	FDH160 160A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	50/80	--	--	--	50/150				

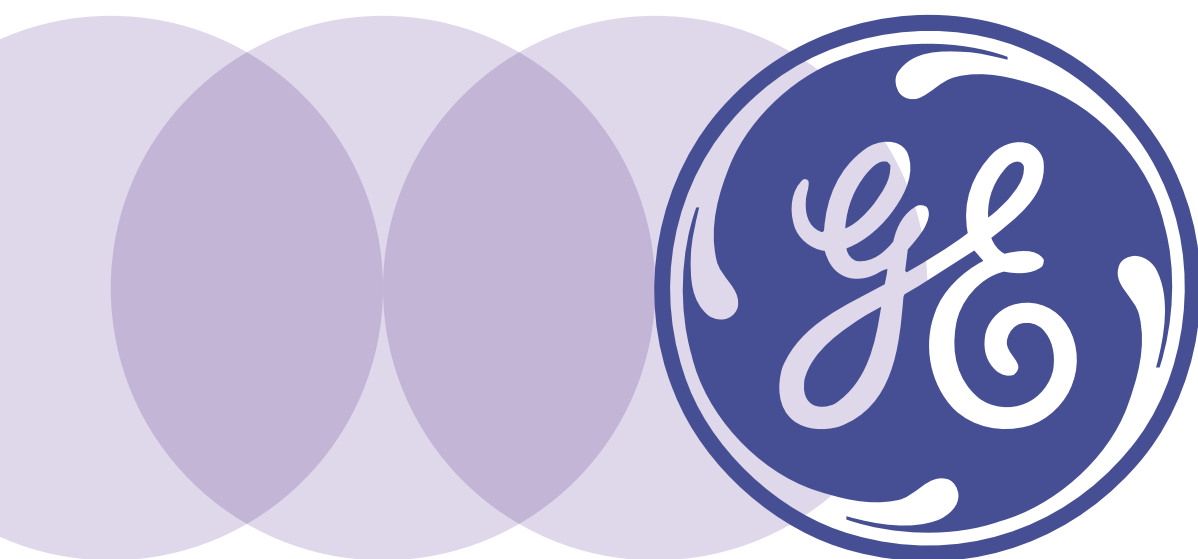
Table DB5 Selectivity Plus

Upstream	Downstream	Type & In	Record Plus* type											
			FG400N-Prem		FG400H-Prem		FG400L-Prem		FG630N-Prem		FG630H-Prem		FG630L-Prem	
			250A	400A	250A	400A	250A	400A	400A	500A	400A	500A	400A	500A
Selectivity limit in kA / Icu of combination in kA at 400-415V AC														
Record Plus*	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	
Record Plus*	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	
Record Plus*	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 \ Downstream	Type & In	Record Plus* type										
		FK800N-SMR	FK800H-SMR	FK800L-SMR	FK1250N-SMR		FK1250H-SMR		FK1250L-SMR		FK1600N-SMR	FK1600H-SMR
		800A	800A	800A	1000A	1250A	1000A	1250A	1000A	1250A	1600A	1600A
Selectivity limit in kA / Icu of combination in kA at 400-415V AC												
Record Plus*	FDN160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
LTM, LTMD, GTM & MO	FDH160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
Record Plus*	FDN160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
LTM, LTMD, GTM & MO	FDH160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
Record Plus*	FEN160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
LTM, LTMD, GTM, MO	FEH160	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
& PremEon S	FEN250	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
Record Plus*	FEH250	--	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
PremEon S & SMR2	FGN400	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
Record Plus*	FGH400	50/50	80/80	100/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
PremEon S & SMR2	FGN630	15/50	15/80	15/100	50/50	50/50	80/80	80/80	150/150	150/150	50/50	80/80
Record Plus*	FGH630	--	15/80	15/100	--	--	80/80	80/80	150/150	150/150	50/50	80/80
PremEon S	FKN800	--	--	--	--	25/50	--	25/80	--	150/150	50/50	80/80
Record Plus*	FKH800	--	--	--	--	--	--	25/80	--	50/150	50/50	80/80
PremEon S	FKN1250	--	--	--	--	--	--	--	--	--	25/50	25/80



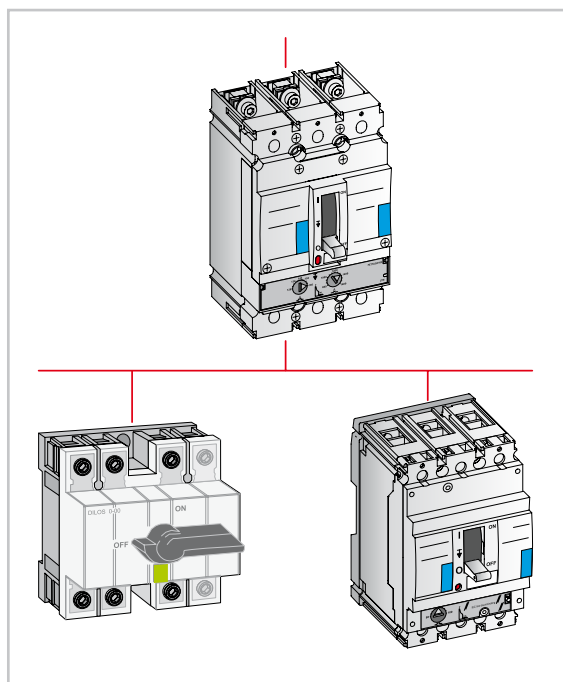


Coordination with loadbreak disconnect switches

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 incomer, 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 and 1H	18	FD63Y	36
FD160N	50	Dilos 2	18	FD160Y	36
FD160H	80	Dilos 1 and 1H	25	FD63Y	50
FD160L	150	Dilos 2	25	FD160Y	50
FE160N	50	Dilos 1 and 1H	30	FD63Y	80
FE160H	80	Dilos 2	30	FD160Y	80
FE160L	150	Dilos 1 and 1H	36	FD63Y	150
FE250N	50	Dilos 2	36	FD160Y	150
FE250H	80	Dilos 1 and 1H	25	FE160Y	50
FE250L	150	Dilos 2	25	FE160Y	50
FG400N	50	Dilos 1 and 1H	30	FE160Y	80
FG400H	80	Dilos 2	30	FE160Y	80
FG400L	150	Dilos 1 and 1H	36	FE160Y	150
FG630N	50	Dilos 2	36	FE160Y	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 4	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:

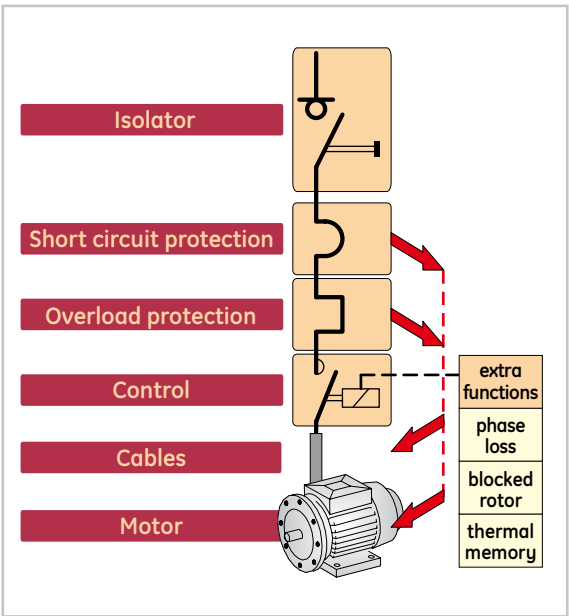
- Isolate the circuit from the network for maintenance.
- Protect against short-circuits in the equipment, the starter and the cables within the circuit.
- Protect against overloads in the equipment, the starter and the cables within the circuit.
- Protect against faults specific to the motor within 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 In	1.5 x In	7.2 x In
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

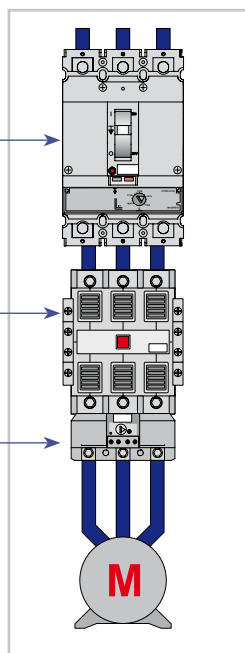
Motor starters are compiled with a number of GE components. This is to offer the required functionality of the motor starter circuit and to allow a choice in the execution thereof.

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.

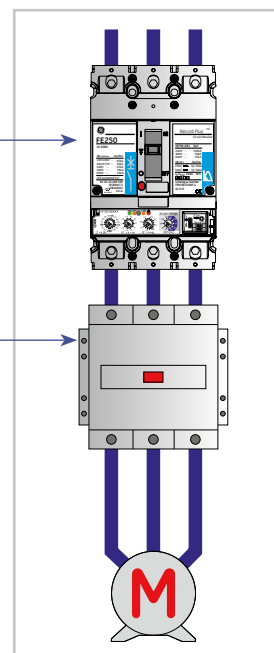
After a test with this current the following conditions must be met:

- 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.



Intro

A

B

C

D

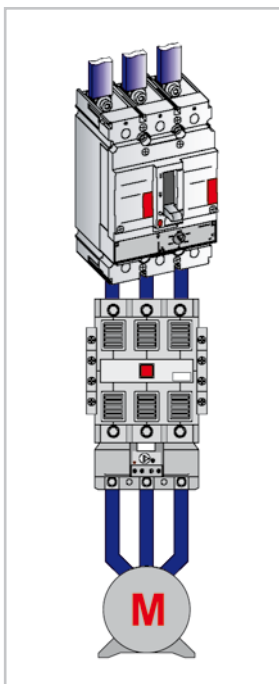
E

F

G

X

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 ⁽²⁾	FD160	50	80	130 ⁽²⁾
FE160/250 ⁽³⁾	85	100	130	FE160/250 ⁽⁵⁾	50	80	130
FG 400/630	85	100	130	FG 400/630	50	80	130
FK 800/1250	85	100	100	FK 800/1250	50	80	100

Selection of associated components ⁽¹⁾											
Motor			Breaker details			Contactor			Motor		
P(kw)	In	Type	Ie	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.
0.37	2.0	FD160	3.5	35	CL25+RT1K	-	-	-	-	-	-
0.55	2.8	FD160	3.5	35	CL25+RT1K	-	-	-	-	-	-
0.75	3.5	FD160	7	70	CL03+RT12L	0.75	2.0	FD160	3.5	35	CL25+RT1K
1.1	5.0	FD160	7	70	CL03+RT12L	1.1	2.6	FD160	3.5	35	CL25+RT1K
1.5	6.1	FD160	7	77	CL03+RT1M	1.5	3.6	FD160	7	70	CL03+RT1K
2.2	8.7	FD160	12.5	125	CL04+RT2AN	2.2	5.0	FD160	7	77	CL03+RT12L
3	11.5	FD160	12.5	150	CL04+RT2AN	3	6.6	FD160	7	84	CL03+RT1M
4	14.5	FD160	20	200	CL04+RT2B	4	8.3	FD160	12.5	125	CL06+RT2AN
5.5	20	FD160	20	260	CL04+RT2C	5.5	11.5	FD160	12.5	150	CL06+RT2AN
7.5	28	FD160	30	360	CL045+RT2D	7.5	16.1	FD160	20	200	CL06+RT2B
10	36	FD/FE160	50	500	CL06+RT2E	10	21	FD160	30	300	CL06+RT2C
11	39	FD/FE160	50	500	CL06+RT2E	11	22	FD160	30	300	CL06+RT2C
15	50	FD/FE160	50	650	CL06+RT2G	15	30	FD160	30	390	CL06+RT2D
18.5	64	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2J	18.5	37	FD/FE160	50	500	CL06+RT2G
22	75	FD/FE160	80 ⁽⁴⁾	960	CL09+RT2J	22	43	FD/FE160	50	550	CL06+RT2G
25	85	FD/FE160	100	1000	CL09+RT2L	25	49	FD/FE160	50	600	CL06+RT2G
30	100	FD160	100	1300	CL09+RT2M	30	58	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2H
30	100	FE160	100	1300	CK75C+RT2M	37	72	FD/FE160	80 ⁽⁴⁾	880	CL09+RT2J
37	125	FE160	125	1625	CK85B+RT3E	45	86	FD160	100	1100	CL09+RT2L
45	150	FE160	160	1920	CK85B+RT3F	45	86	FE160	100	1100	CK75C+RT2L
55	180	FE250	250	2400	CK95B+RT3F	55	104	FE160	125	1250	CK85B+RT3E
75	250	FG400	250	3250	CK10C+RT4P	75	144	FE160	160	1760	CK85B+RT3F
90	312	FG400	400	3840	CK10C+RT5C	90	179	FE250	250	2500	CK95B+RT4N
110	360	FG400	400	4500	CK12B+RT5C	110	207	FE250	250	2500	CK10C+RT4P
132	430	FG630	500	5400	CK12B+RT5D	132	247	FG400	250	3000	CK10C+RT4R
160	520	FK800	800	6760	CK13B+RT5E	160	300	FG400	400	3900	CK10C+RT5C
200	630	FK800	800	6930	CK13B+RT5E	200	360	FG400	400	4500	CK12B+RT5C
-	-	-	-	-	-	220	400	FG630	500	5000	CK12B+RT5D
-	-	-	-	-	-	250	462	FG630	500	6000	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) Lowest available rating in L type is 20A

(3) Lowest available rating in FE160 frame size is 50A

(4) FD160 type; contactor 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 ⁽²⁾	FD160	-	36	50 ⁽²⁾	FD160	-	6	10 ⁽²⁾
FE160/250 ⁽³⁾	42	65	130	FE160/250 ⁽³⁾	-	50	80	FE160/250 ⁽³⁾	-	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	le	st	Type+O.R.	P(kw)	In	Type	le	st	Type+O.R.	P(kw)	In	Type	le	st	Type+O.R.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.8	1.9	FD160	3.5	35	CL25+RT1K	0.8	1.5	FD160	3.5	35	CL25+RT1K	-	-	-	-	-	-
1.1	2.5	FD160	3.5	35	CL25+RT1K	1.1	2.0	FD160	3.5	35	CL25+RT1K	1.5	2.0	FD160	3.5	35	CL25+RT1K
1.5	3.4	FD160	3.5	70	CL25+RT1K	1.5	2.6	FD160	3.5	35	CL25+RT1K	2.2	2.9	FD160	3.5	35	CL25+RT1K
2.2	4.6	FD160	7	70	CL03+RT12L	2.2	3.8	FD160	7	70	CL03+RT12L	3	3.5	FD160	3.5	35	CL25+RT1K
3	6.0	FD160	7	77	CL03+RT1M	3	5.0	FD160	7	77	CL03+RT1M	3.7	4.6	FD160	7	70	CL03+RT12L
4	7.6	FD160	12.5	125	CL06+RT2AN	4	6.5	FD160	7	84	CL03+RT1M	4	5.0	FD160	7	70	CL03+RT12L
5.5	10.5	FD160	12.5	137.5	CL04+RT2AN	5.5	9.0	FD160	12.5	125	CL06+RT2AN	5.5	7.0	FD160	7	91	CL03+RT12M
7.5	14.6	FD160	20	200	CL04+RT2B	7.5	12	FD160	12.5	150	CL06+RT2BP	7.5	9.0	FD160	12.5	125	CL07+RT2AN
10	18.8	FD160	20	240	CL04+RT2B	10	15	FD160	20	200	CL06+RT2B	11	12.5	FD160	12.5	163	CL07+RT2BP
11	20	FD160	30	300	CL45+RT2C	11	18.4	FD160	30	300	CL06+RT2B	13	16	FD160	20	200	CL07+RT2B
15	27	FD160	30	330	CL45+RT2D	15	23	FD160	30	300	CL06+RT2C	15	18	FD160	20	220	CL07+RT2B
18.5	33	FD/FE160	50	500	CL06+RT2E	18.5	29	FD/FE160	50	500	CL06+RT2E	18.5	23	FD160	30	300	CL09+RT2C
22	39	FD/FE160	50	500	CL06+RT2E	22	33	FD/FE160	50	500	CL06+RT2E	22	25	FD160	30	300	CL09+RT2D
25	44	FD/FE160	50	550	CL06+RT2G	-	-	-	-	-	-	-	-	-	-	-	-
30	52	FD/FE160	80	800	CL09+RT2J	30	45	FD/FE160	50	550	CL06+RT2G	30	35	FD/FE160	50	500	CL09+RT2E
37	65	FD/FE160	80	880	CL09+RT2J	37	55	FD/FE160	80	800	CL09+RT2J	37	42	FD/FE160	50	550	CL09+RT2G
45	78	FD/FE160	80	960	CL09+RT2J	45	65	FD/FE160	80	960	CL09+RT2J	45	49	FD/FE160	50	600	CL09+RT2G
55	86	FD160	100	1200	CL09+RT2L	55	80	FD160	100	1100	CL09+RT2S	55	60	FD/FE160	80	800	CL09+RT2J
55	94	FE160	100	1200	CK75C+RT2L	55	80	FE160	100	1100	CK75C+RT2J	75	80	FD/FE160	80	1040	CL09+RT2L
75	131	FE160	160	1600	CK85B+RT3E	75	110	FE160	125	1375	CK85B+RT3D	90	100	FD160	100	1300	CL09+RT2L
90	163	FE250	250	2500	CK95B+RT3F	90	130	FE160	160	1600	CK95B+RT3E	90	100	FE160	100	1300	CK85B+RT2M
110	188	FE250	250	2500	CK95B+RT4P	110	156	FE160	160	1920	CK95B+RT3F	110	120	FE160	125	1500	CK85B+RT3E
132	225	FE250	250	3000	CK95B+RT4R	132	190	FE250	250	2400	CK95B+RT4P	132	140	FE250	160	1760	CK95B+RT3F
160	300	FG400	400	3840	CK10C+RT5C	160	228	FE250	250	2750	CK95B+RT4R	160	175	FE250	250	2000	CK95B+RT4N
200	360	FG400	400	4500	CK12B+RT5C	200	281	FG400	400	3600	CK10C+RT5C	200	220	FE250	250	2750	CK10C+RT4R
220	400	FG630	500	5100	CK12B+RT5D	220	310	FG400	400	3840	CK10C+RT5C	220	240	FG400	250	3000	CK10C+RT4R
250	462	FG630	500	6000	CK12B+RT5D	-	-	-	-	-	-	250	270	FG400	400	3360	CK10C+RT5C
300	509	FK800	800	6619	CK13B+RT5E	-	-	-	-	-	-	-	-	-	-	-	-
315	529	FK800	800	6880	CK13B+RT5E	315	445	FG630	500	6000	CK12B+RT5D	-	-	-	-	-	-
335	563	FK800	800	6754	CK13B+RT5E	335	460	FG630	500	6000	CK12B+RT5D	335	335	FG400	400	4200	CK10C+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	6930	CK13B+RT5E	375	400	FG630	500	5500	CK12B+RT5D
-	-	-	-	-	-	400	570	FK800	800	6840	CK13B+RT5E	-	-	-	-	-	-
-	-	-	-	-	-	450	630	FK800	800	7560	CK13B+RT6A	450	480	FG630	500	6000	CK12B+RT5D
-	-	-	-	-	-	-	-	-	-	-	-	500	530	FK800	800	6360	CK13B+RT5E
-	-	-	-	-	-	-	-	-	-	-	-	560	580	FK800	800	6380	CK13B+RT5E

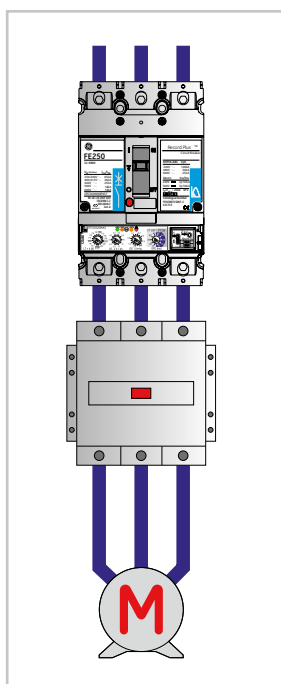
(1) The contactor has a breaking capacity that is sufficient to operate the specified motor up to the specified magnetic setting of the breaker

(2) Lowest available rating in L type is 20A

(3) Lowest available rating in FE160 frame size is 50A



Coordination type II - EN 60947-4 - Class 10 protection (with SMR2 other classes possible)



Short-circuit and Overload protection by means of Electronic MCCB.

Control by GE contactor

Upstream <i>Record Plus</i> * 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	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.		
3	11.5	FE160	25	150	CL08	-	-	-	-	-	-		
4	14.5	FE160	25	200	CL08	-	-	-	-	-	-		
5.5	20	FE160	25	260	CL08	5.5	11.5	FE160	25	150	CL08		
7.5	28	FE160	63	360	CL09	7.5	16.1	FE160	25	200	CL08		
10	36	FE160	63	500	CL09	10	21	FE160	25	300	CL08		
11	39	FE160	63	500	CL09	11	22	FE160	25	300	CL08		
15	50	FE160	63	650	CL09	15	30	FE160	63	390	CL09		
18.5	64	FE160	125	800	CK85B	18.5	37	FE160	63	500	CL09		
22	75	FE160	125	960	CK85B	22	43	FE160	63	550	CL09		
25	85	FE160	125	1000	CK85B	25	49	FE160	63	600	CL09		
30	100	FE160	125	1300	CK85B	30	58	FE160	63	800	CL09		
37	125	FE160	160	1625	CK95B	37	72	FE160	125	1100	CK85B		
45	150	FE160	160	1920	CK95B	45	86	FE160	125	1100	CK85B		
55	180	FE250	250	2400	CK95B	55	104	FE160	125	1250	CK85B		
75	250	FG400	250	3000	CK95B	75	144	FE160	160	1760	CK85B		
90	312	FG400	400	3840	CK10C	90	179	FE250	250	2500	CK95B		
110	360	FG400	400	4875	CK12B	110	207	FE250	250	2500	CK95B		
132	430	FG630	500	5400	CK12B	132	247	FG400	250	3000	CK95B		
-	-	-	-	-	-	160	300	FG400	400	3900	CK10C		
-	-	-	-	-	-	200	360	FG400	400	4500	CK12B		
-	-	-	-	-	-	220	400	FG630	500	5000	CK12B		
-	-	-	-	-	-	250	462	FG630	500	6000	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

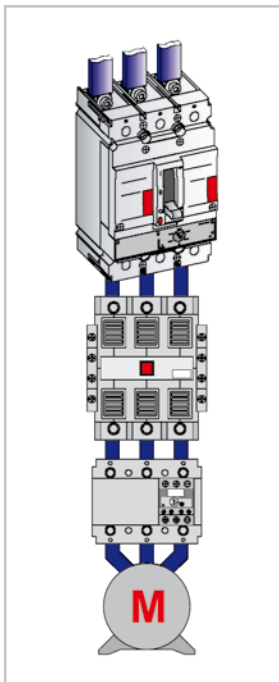
Coordination type II - EN 60947-4 - Class 10 protection (with SMR2 other classes possible)

Upstream Record Plus* Breaker selection				Upstream Record Plus* Breaker selection				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			
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	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.5	10.5	FE160	25	143	CL08	-	-	-	-	-	-	-	-	-	-	-	-
7.5	14.6	FE160	25	165	CL08	7.5	12	FE160	25	169	CL09	-	-	-	-	-	-
10	18.8	FE160	25	247	CL08	10	15	FE160	25	195	CL09	10	11.5	FE160	25	169	CK85B
11	20	FE160	25	260	CL08	11	18.4	FE160	25	247	CL09	-	-	-	-	-	-
15	27	FE160	63	336	CL09	15	23	FE160	25	300	CL09	15	17.1	FE160	25	234	CK85B
18.5	33	FE160	63	455	CL09	18.5	29	FE160	63	384	CL10	18.5	20	FE160	25	247	CK85B
22	39	FE160	63	520	CL09	22	33	FE160	63	420	CL10	-	-	-	-	-	-
25	44	FE160	63	585	CL09	-	-	-	-	-	-	-	-	-	-	-	-
30	52	FE160	63	672	CL09	30	45	FE160	63	585	CL10	30	35	FE160	63	455	CK85B
37	65	FE160	125	845	CK85B	37	55	FE160	63	728	CL10	37	42	FE160	63	546	CK85B
45	78	FE160	125	960	CK85B	-	-	-	-	-	-	45	49	FE160	63	650	CK85B
55	86	FE160	125	1170	CK85B	-	-	-	-	-	-	55	60	FE160	63	780	CK85B
75	131	FE160	160	1620	CK85B	75	110	FE160	125	1430	CK85B	75	80	FE160	125	1040	CK85B
90	163	FE250	250	2275	CK95B	90	130	FE160	160	1755	CK85B	90	100	FE160	125	1300	CK85B
110	188	FE250	250	2470	CK95B	110	156	FE160	160	1920	CK85B	110	120	FE160	125	1560	CK85B
132	225	FE250	250	2925	CK95B	132	190	FE250	250	2470	CK95B	132	140	FE160	160	1740	CK85B
160	300	FG400	400	3900	CK10C	160	228	FE250	250	2880	CK95B	160	175	FE250	250	2275	CK10C
200	360	FG400	400	4500	CK12B	200	281	FG400	400	3600	CK10C	200	220	FE250	250	2995	CK10C
220	400	FG630	500	5200	CK12B	220	310	FG400	400	3840	CK10C	220	240	FG400	250	3120	CK10C
250	462	FG630	500	6000	CK12B	-	-	-	-	-	-	250	270	FG400	400	3640	CK10C
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	315	445	FG630	500	5850	CK12B	-	-	-	-	-	-
-	-	-	-	-	-	335	460	FG630	500	6175	CK12B	335	335	FG400	400	4080	CK10C
-	-	-	-	-	-	355	500	FG630	500	6500	CK12B	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	375	400	FG630	500	5200	CK12B
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	450	480	FG630	500	6000	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 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				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 ⁽²⁾	FD160	50	80	130 ⁽²⁾
FE160/250 ⁽³⁾	85	100	130	FE160/250 ⁽³⁾	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	130

Selection of associated components ⁽¹⁾											
Motor		Breaker details			Contactor	Motor		Breaker details			Contactor
P(kw)	In	Type	Ie	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.
0.37	2.0	FD160	3.5	35	CL25+RT12J	-	-	-	-	-	-
0.55	2.8	FD160	3.5	35	CL25+RT12K	-	-	-	-	-	-
0.75	3.5	FD160	3.5	45.5	CL25+RT12K	0.75	2.0	FD160	3.5	35	CL25+RT12J
1.1	5.0	FD160	7	70	CL03+RT12L	1.1	2.6	FD160	3.5	35	CL25+RT12K
1.5	6.1	FD160	7	77	CL03+RT12M	1.5	3.6	FD160	7	70	CL03+RT12K
2.2	8.7	FD160	12.5	125	CL04+RT2AN	2.2	5.0	FD160	7	77	CL03+RT12L
3	11.5	FD160	12.5	150	CL04+RT2AN	3	6.6	FD160	7	84	CL03+RT12M
4	14.5	FD160	20	200	CL04+RT2B	4	8.3	FD160	12.5	125	CL04+RT2AN
5.5	20	FD160	20	260	CL04+RT2C	5.5	11.5	FD160	12.5	150	CL04+RT2AN
7.5	28	FD160	30	360	CL45+RT22D	7.5	16.1	FD160	20	200	CL04+RT2B
10	36	FD/FE160	50	500	CL06+RT22E	10	21	FD160	30	300	CL45+RT2C
11	39	FD/FE160	50	500	CL06+RT22E	11	22	FD160	30	300	CL45+RT2C
15	50	FD/FE160	50	650	CL06+RT22G	15	30	FD160	30	390	CL45+RT22D
18.5	64	FD/FE160	80 ⁽⁴⁾	800	CL09+RT22J	18.5	37	FD/FE160	50	500	CL06+RT22E
22	75	FD/FE160	80 ⁽⁴⁾	960	CL09+RT22J	22	43	FD/FE160	50	550	CL06+RT22G
25	85	FD/FE160	100	1000	CL09+RT22L	25	49	FD/FE160	50	600	CL06+RT22G
30	100	FD160	100	1300	CL09+RT22M	30	58	FD/FE160	80 ⁽⁴⁾	800	CL09+RT22H
30	100	FE160	100	1300	CK75C+RT22M	37	72	FD/FE160	80 ⁽⁴⁾	880	CL09+RT22J
37	125	FE160	125	1625	CK85B+RT32E	45	86	FD160	100	1100	CL09+RT22L
45	150	FE160	160	1920	CK85B+RT32F	45	86	FE160	100	1100	CK75C+RT22L
55	180	FE250	250	2400	CK95B+RT32F	55	104	FE160	125	1250	CK85B+RT32E
75	250	FG400	250	3250	CK10C+RT5LB	75	144	FE160	160	1760	CK85B+RT32F
90	312	FG400	400	3840	CK10C+RT5LB	90	179	FE250	250	2500	CK95B+RT32F
110	360	FG400	400	4500	CK12B+RT5LC	110	207	FE250	250	2500	CK10C+RT5LB
132	430	FG630	500	5400	CK12B+RT5LD	132	247	FG400	250	3000	CK10C+RT5LB
160	520	FK800	800	6760	CK13B+RT5LE	160	300	FG400	400	3900	CK10C+RT5LB
200	630	FK800	800	6930	CK13B+RT5LE	200	360	FG400	400	4500	CK12B+RT52LC
-	-	-	-	-	-	220	400	FG630	500	5000	CK12B+RT52LD
-	-	-	-	-	-	250	462	FG630	500	6000	CK12B+RT52LD
-	-	-	-	-	-	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) Lowest available rating in L type is 20A

(3) Lowest available rating in FE160 frame size is 50A

(4) FD160 type; contactor can be reduced to CL08

Coordination type II - EN 60947-4 - Class 20 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 ^[2]	FD160	-	36	50 ^[2]	FD160	-	6	10 ^[2]
FE160/250 ^[3]	42	65	130	FE160/250 ^[3]	-	50	80	FE160/250 ^[3]	-	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		
P(kw)	In	Type	Ie	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.	P(kw)	In	Type	Ie	st	Type+O.R.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.75	1.9	FD160	3.5	35	CL25+RT12K	0.8	1.5	FD160	3.5	35	CL25+RT12J	-	-	-	-	-	-
1.1	2.5	FD160	3.5	35	CL25+RT12K	1.1	2	FD160	3.5	35	CL25+RT12J	1.5	2	FD160	3.5	35	CL25+RT12K
1.5	3.4	FD160	3.5	52.5	CL25+RT12K	1.5	2.6	FD160	3.5	38.5	CL25+RT12K	2.2	2.9	FD160	3.5	35	CL25+RT12K
2.2	4.6	FD160	7	70	CL03+RT12L	2.2	3.8	FD160	7	70	CL03+RT12L	3	3.5	FD160	3.5	45.5	CL25+RT12K
3	6	FD160	7	77	CL03+RT12M	3	5	FD160	7	77	CL03+RT12M	3.7	4.6	FD160	7	70	CL03+RT12L
4	7.6	FD160	12.5	125	CL04+RT2AN	4	6.5	FD160	7	84	CL03+RT12M	4	5	FD160	7	70	CL03+RT12L
5.5	10.5	FD160	12.5	137.5	CL04+RT2AN	5.5	9	FD160	12.5	125	CL06+RT2AN	5.5	7	FD160	7	91	CL03+RT12M
7.5	14.6	FD160	20	200	CL04+RT2B	7.5	12	FD160	12.5	150	CL06+RT2BP	7.5	9	FD160	12.5	125	CL04+RT2AN
10	18.8	FD160	20	240	CL04+RT2B	10	15	FD160	20	200	CL04+RT2B	11	12.5	FD160	12.5	163	CL04+RT2BP
11	20	FD160	30	300	CL45+RT2C	11	18.4	FD160	20	300	CL04+RT2B	13	16	FD160	20	200	CL04+RT2B
15	27	FD160	30	330	CL45+RT2D	15	23	FD160	30	300	CL045+RT2C	15	18	FD160	20	220	CL04+RT2B
18.5	33	FD/FE160	50	500	CL06+RT2E	18.5	29	FD/FE160	30	500	CL045+RT2D	18.5	23	FD160	30	300	CL45+RT2C
22	39	FD/FE160	50	500	CL06+RT2E	22	33	FD/FE160	50	500	CL06+RT2E	22	25	FD160	30	300	CL45+RT2D
25	44	FD/FE160	50	550	CL06+RT2G	-	-	-	-	-	-	-	-	-	-	-	-
30	52	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2H	30	45	FD/FE160	50	550	CL06+RT2G	30	35	FD/FE160	50	500	CL09+RT2E
37	65	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2J	37	55	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2J	37	42	FD/FE160	50	550	CL09+RT2F
45	78	FD/FE160	80	960	CL09+RT2J	45	65	FD/FE160	100	960	CL09+RT2J	45	49	FD/FE160	50	600	CL09+RT2G
55	86	FD160	100	1200	CL09+RT2L	55	80	FD160	100	1100	CL09+RT2J	55	60	FD/FE160	80 ⁽⁴⁾	800	CL09+RT2J
55	94	FE160	100	1200	CK75C+RT2L	55	80	FE160	100	1100	CK75C+RT2J	75	80	FD/FE160	80 ⁽⁴⁾	1040	CL09+RT2L
75	131	FE160	160	1600	CK85B+RT3E	75	110	FE160	125	1375	CK85B+RT3D	90	100	FD160	100	1300	CK85B+RT2M
90	163	FE250	250	2500	CK95B+RT3F	90	130	FE160	160	1600	CK95B+RT3E	110	120	FE160	125	1500	CK85B+RT3E
110	188	FE250	250	2500	CK95B+RT5LB	110	156	FE160	160	1920	CK95B+RT3F	132	140	FE250	160	1760	CK95B+RT3F
132	225	FE250	250	3000	CK95B+RT5LB	132	190	FE250	250	2400	CK95B+RT5LB	160	175	FE250	250	2000	CK95B+RT3F
160	300	FG400	400	3840	CK10C+RT5LC	160	228	FE250	250	2750	CK95B+RT5LB	200	220	FE250	250	2750	CK10C+RT5LB
200	360	FG400	400	4500	CK12B+RT5LD	200	281	FG400	400	3600	CK10C+RT5LC	220	240	FG400	250	3000	CK10C+RT5LB
220	400	FG630	500	5100	CK12B+RT5LD	220	310	FG400	400	3840	CK10C+RT5LC	250	270	FG400	400	3360	CK10C+RT5LC
250	462	FG630	500	6000	CK12B+RT5LD	-	-	-	-	-	-	-	-	-	-	-	-
300	509	FK800	800	6619	CK13B+RT5LE	-	-	-	-	-	-	-	-	-	-	-	-
315	529	FK800	800	6880	CK13B+RT5LE	315	445	FG630	500	6000	CK12B+RT5LD	335	335	FG400	400	4200	CK10C+RT5LC
335	563	FK800	800	6754	CK13B+RT5LE	335	460	FG630	500	6000	CK12B+RT5LD	-	-	-	-	-	-
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	6930	CK13B+RT5LE	375	400	FG630	500	5500	CK12B+RT5LD
-	-	-	-	-	-	400	570	FK800	800	6840	CK13B+RT5LE	-	-	-	-	-	-
-	-	-	-	-	-	450	630	FK800	800	7560	CK13B+RT5LE	450	480	FG630	500	6000	CK12B+RT5LD
-	-	-	-	-	-	-	-	-	-	-	-	500	530	FK800	800	6360	CK13B+RT5LE
-	-	-	-	-	-	-	-	-	-	-	-	560	580	FK800	800	6380	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) Lowest available rating in L type is 20A

(3) Lowest available rating in FE160 frame size is 50A

(4) FD160 type; contactor can be reduced to CL08



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	Ir setting (min)
5	FD160N, FD160H or L	18A
7.5	FD160N, FD160H or L	27A
10	FD160N, FD160H or L	36A
12.5	FD160N, FD160H or L	45A
15	FD160N, FD160H or L	54A
20	FD160N, FD160H or L	72A
25	FD160N, FD160H or L	90A
30	FD160N, FD160H or L	108A
35	FD160N or FE160N, H or L	126A
40	FE160N, H or L	144A
45	FE250N, H or L	162A
50	FE250N, H or L	179A
60	FE250N, H or L	215A
75	FG400N, H or L	269A
90	FG400N, H or L	323A
100	FG400N, H or L	359A
120	FG630N, H or L	431A
150	FG630N, H or L	538A
180	FK800N or H	646A

Un = 400V (phase to phase voltage)

Capacitor rating (kVAr)	Record Plus breaker	Ir setting (min)
10	FD160N, FD160H or L	21A
15	FD160N, FD160H or L	31A
20	FD160N, FD160H or L	41A
25	FD160N, FD160H or L	52A
30	FD160N, FD160H or L	62A
35	FD160N, FD160H or L	72A
40	FD160N, FD160H or L	83A
45	FD160N, FD160H or L	93A
50	FD160N, FD160H or L	103A
60	FD160N, FD160H or L	124A
70	FD160N or FE160N, H or L	144A
80	FE250N, H or L	165A
90	FE250N, H or L	186A
100	FE250N, H or L	206A
120	FE250N, H or L	248A
140	FG400N, H or L	289A
160	FG400N, H or L	330A
180	FG400N, H or L	372A
200	FG630N, H or L	413A
250	FG630N, H or L	516A
300	FG630N, H or L	619A
350	FK800N or H	722A

- F.2 FE frame, plug-in and draw-out device (8 and 10 pole connectors)
- F.3 FG frame, plug-in and draw-out device (8 and 10 pole connectors)
- F.4 FK frame, 3 pole and 4 pole draw-out device (6 pole connectors)
- F.5 FG frame, SMR 2 trip unit connection

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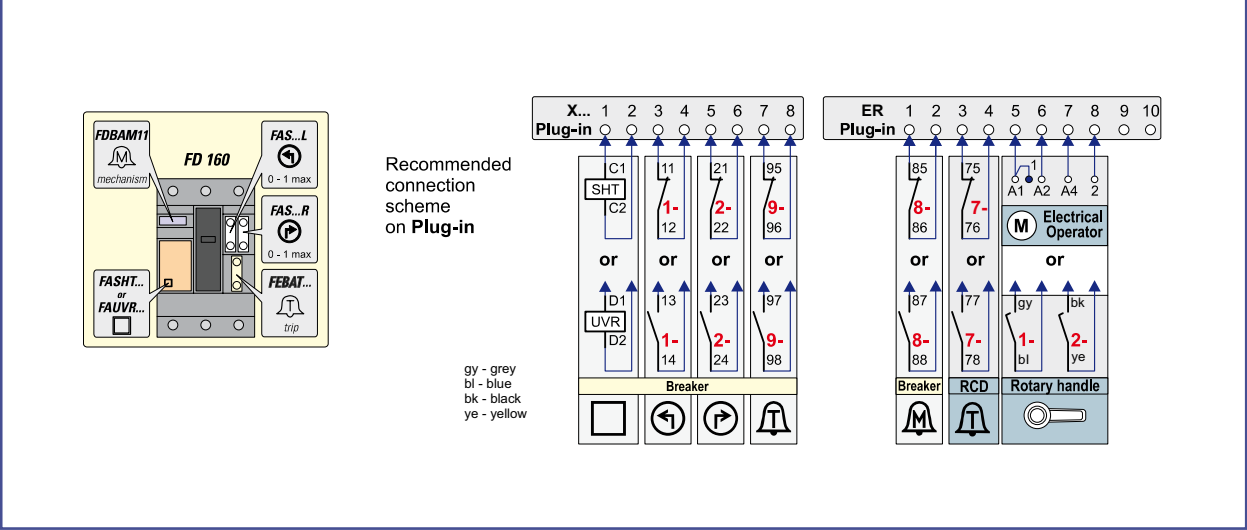
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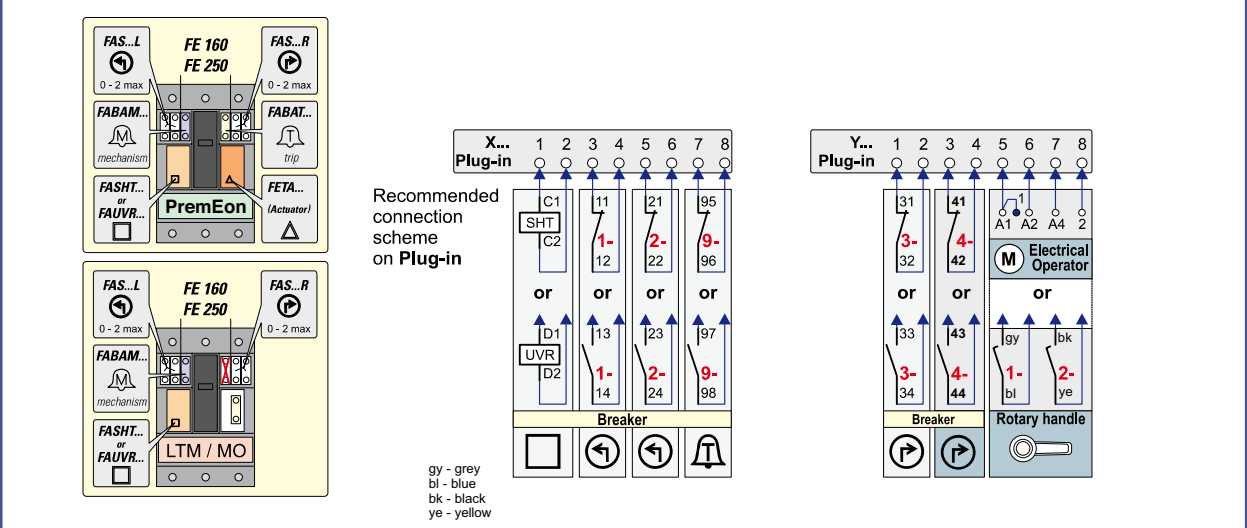


Recommended wiring diagrams

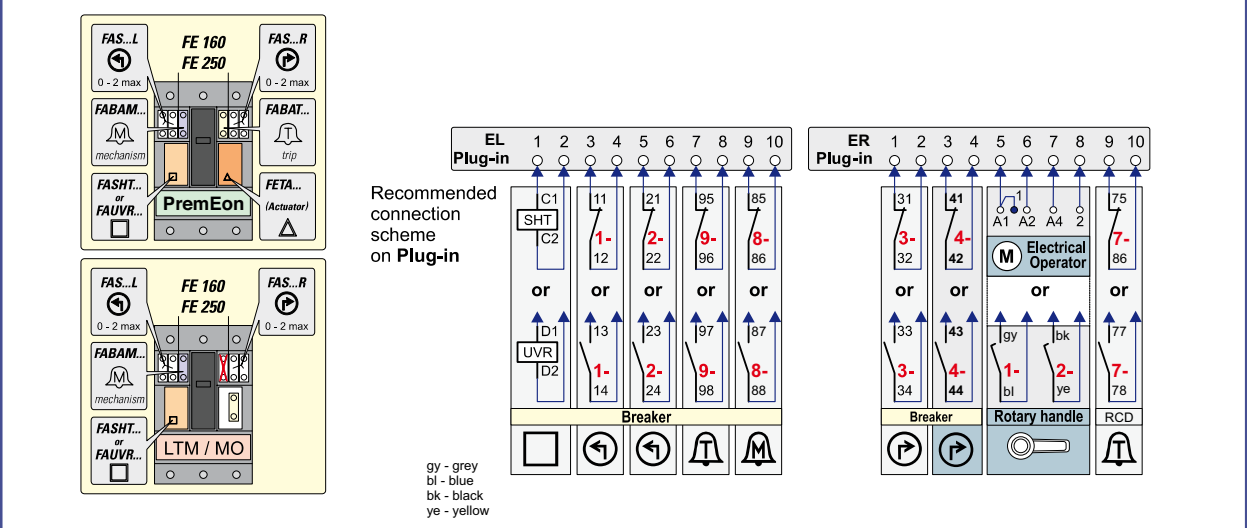
FD frame, plug in device (8 and 10 pole connectors)



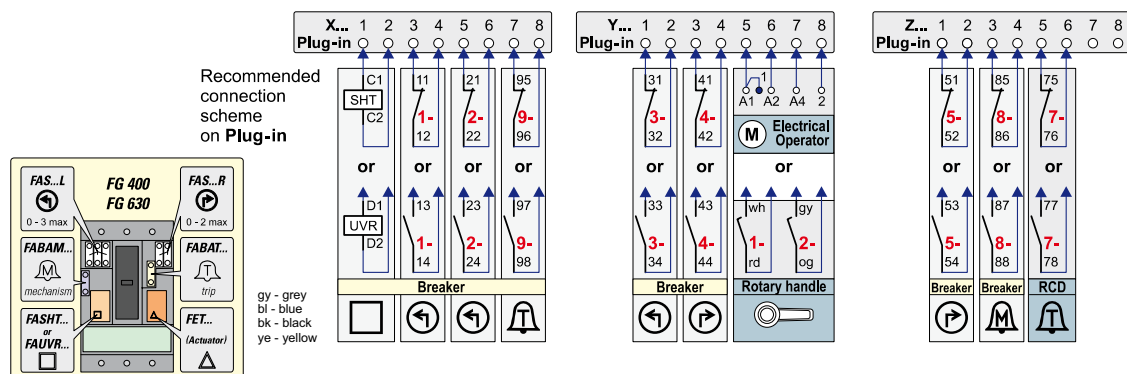
FE frame, plug-in and draw-out device (8 pole connectors)



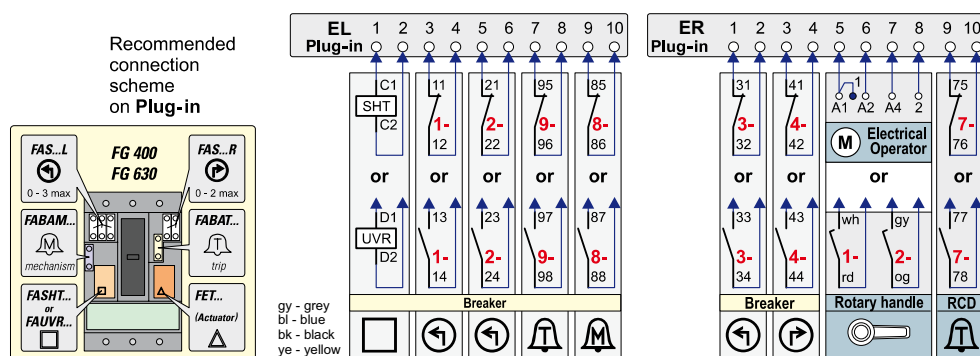
FE frame, plug-in and draw-out device (10 pole connectors)



FG frame, plug-in and draw-out device (8 pole connectors)



FG frame, plug-in and draw-out device (10 pole connectors)



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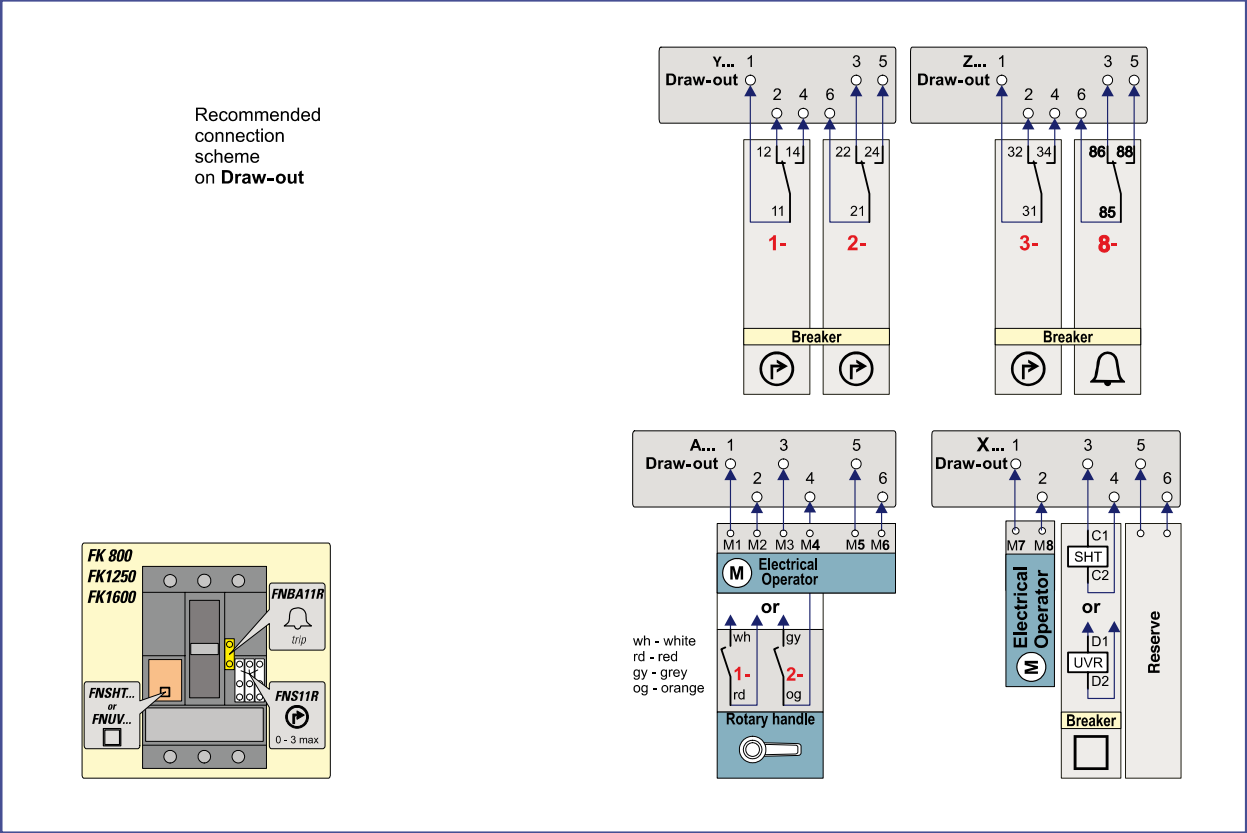
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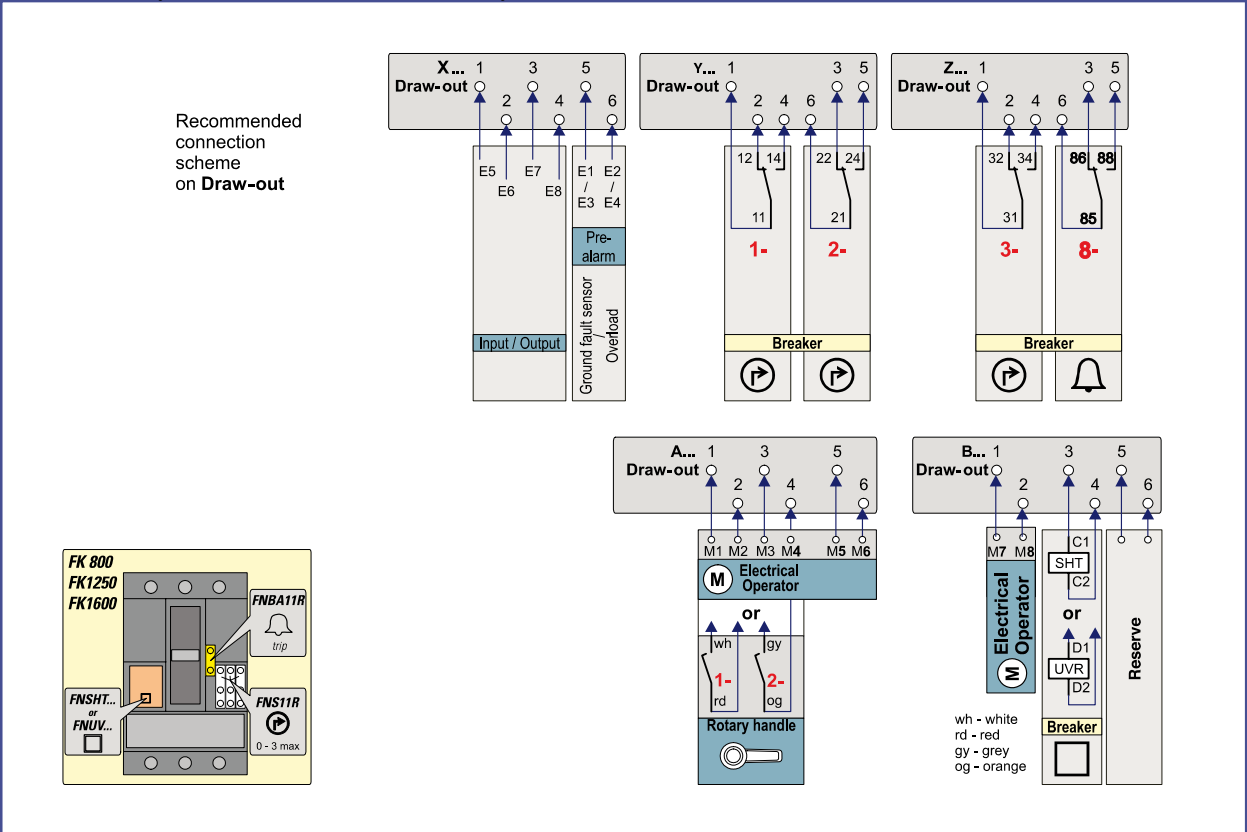
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Recommended Wiring diagrams

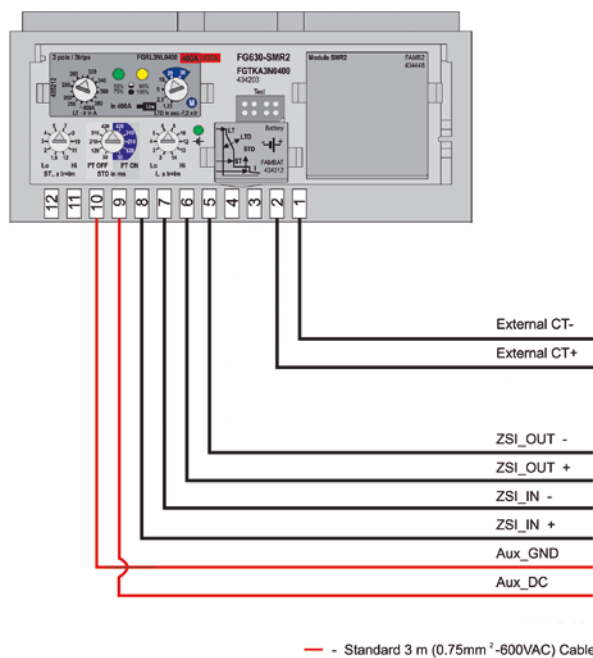
FK frame 3 pole, draw-out device (6 pole connectors)



FK frame 4 pole, draw-out device (6 pole connectors)



FG frame, SMR 2 trip unit connection



FD and FE frame

- G.2 Breakers
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- G.5 Electrical operators
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FG frame

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FK frame

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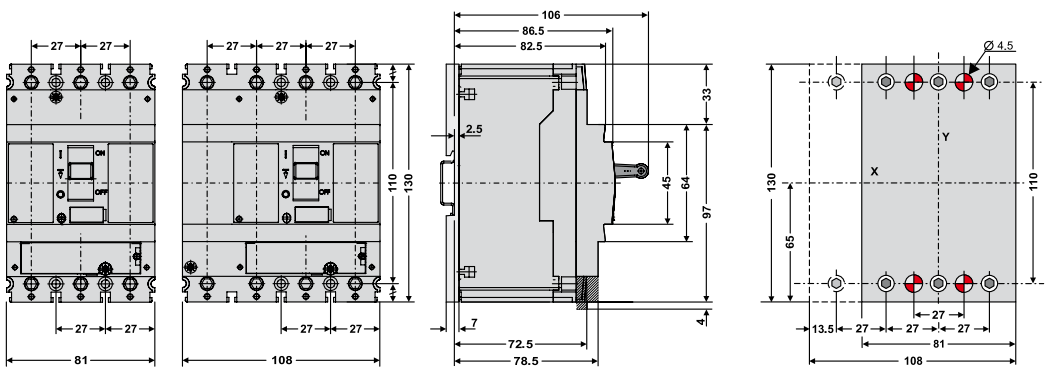
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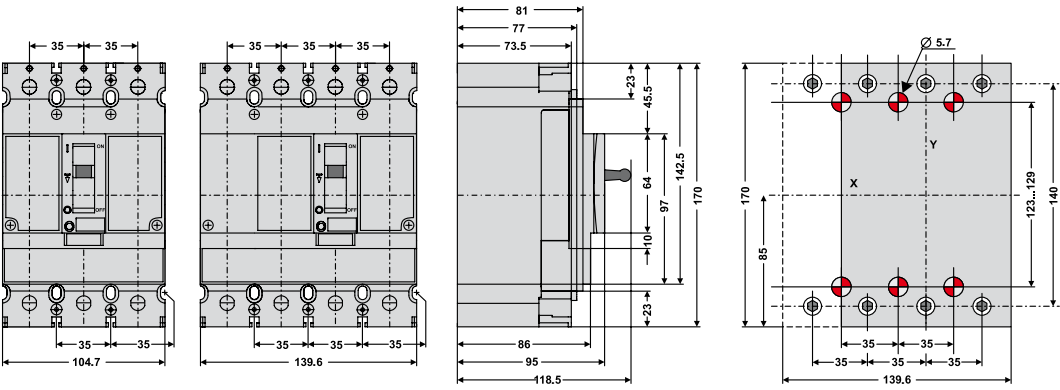
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Breakers - FD160 fixed, front connected



Breakers - FE160 and FE250 fixed, front connected



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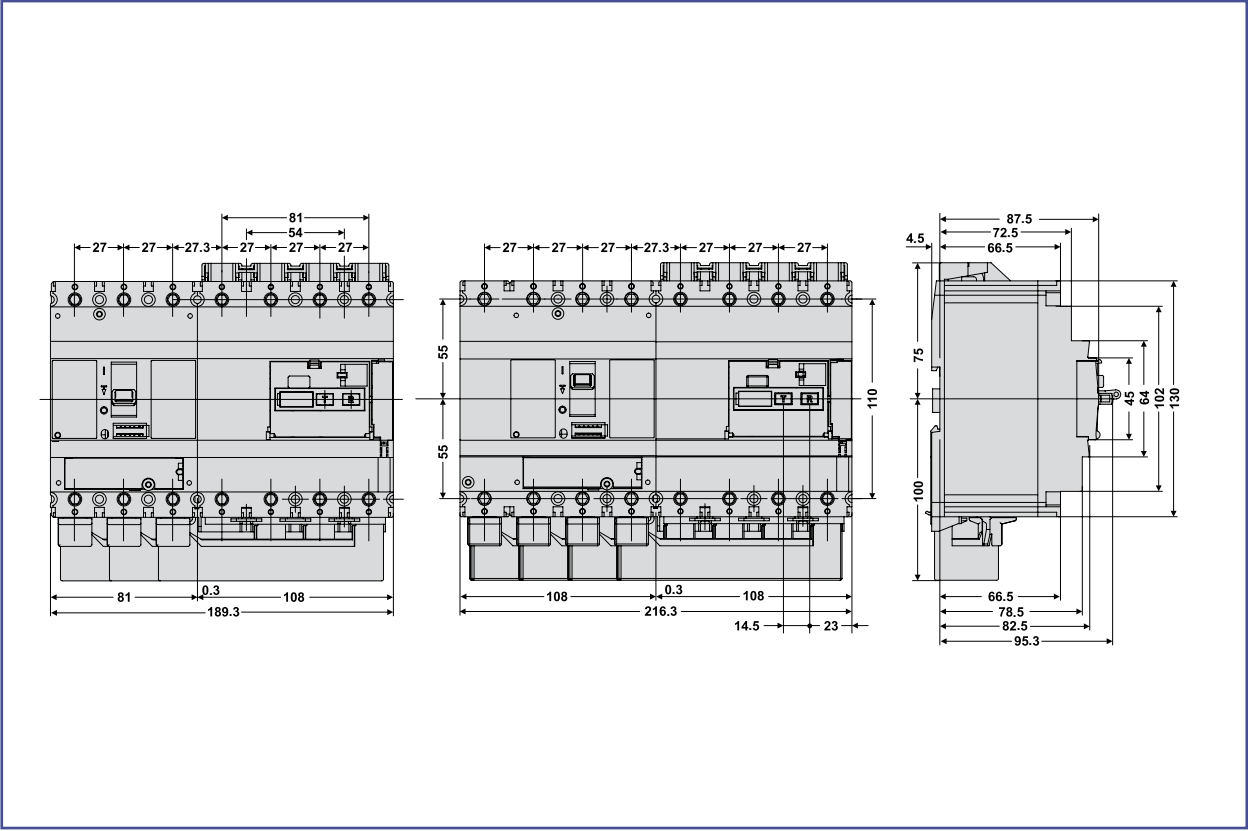
G

X

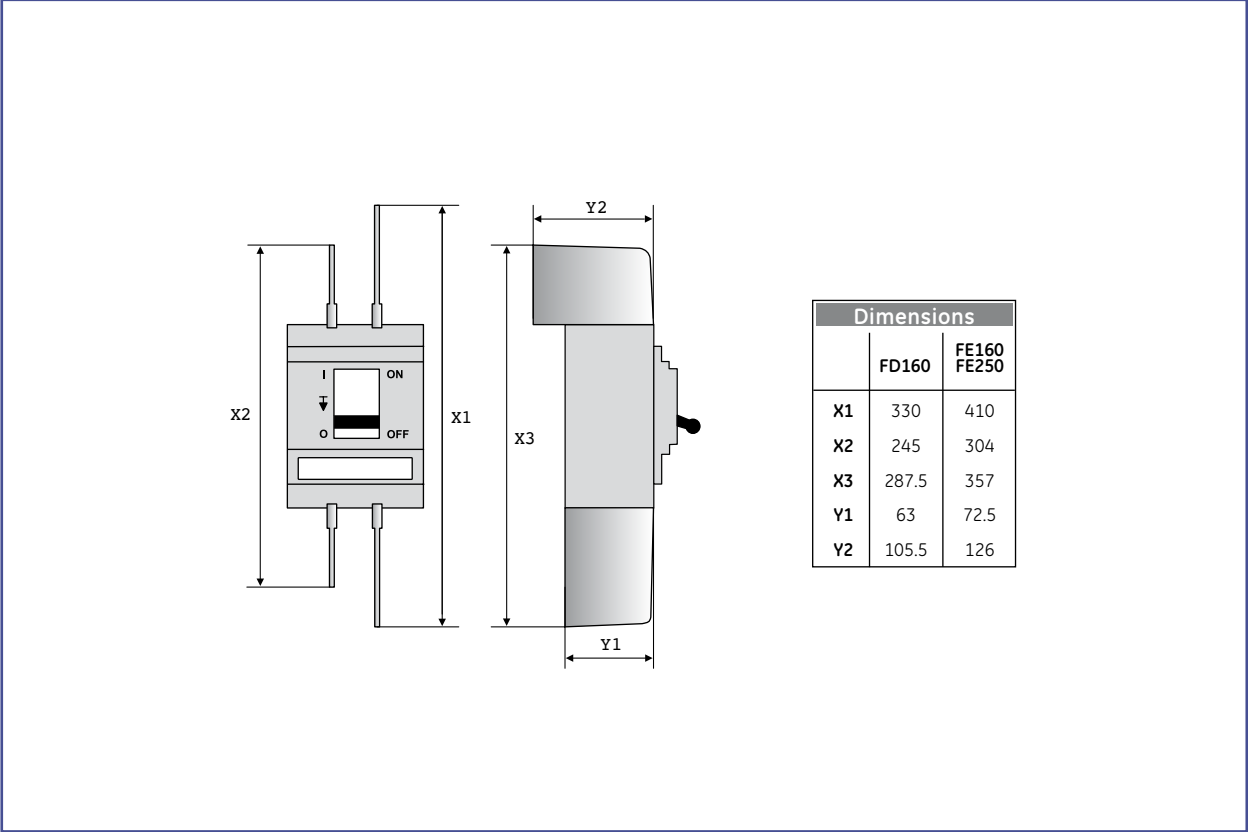


Dimensional Drawings

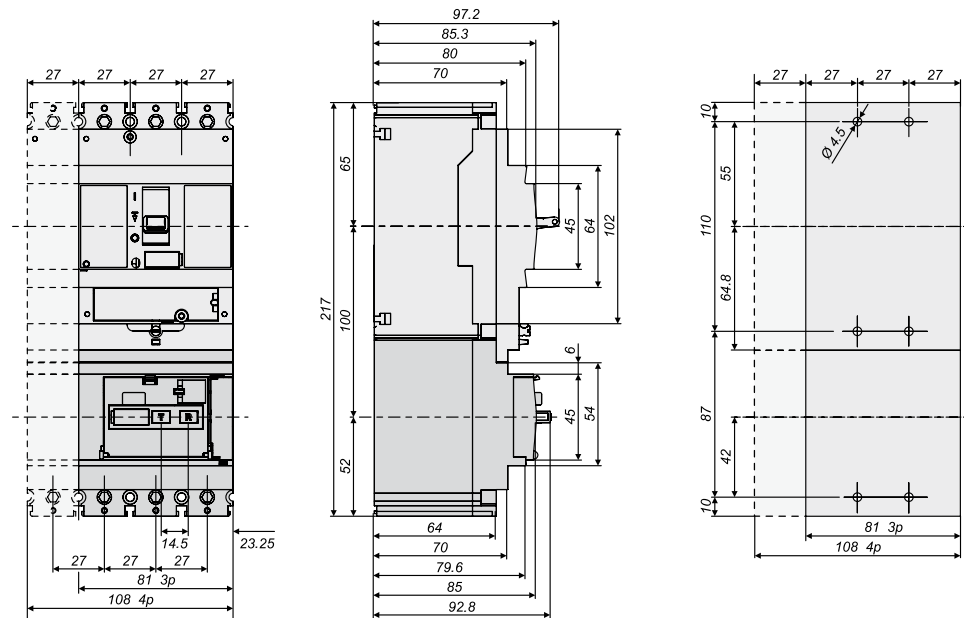
RCD side mounted - FD160



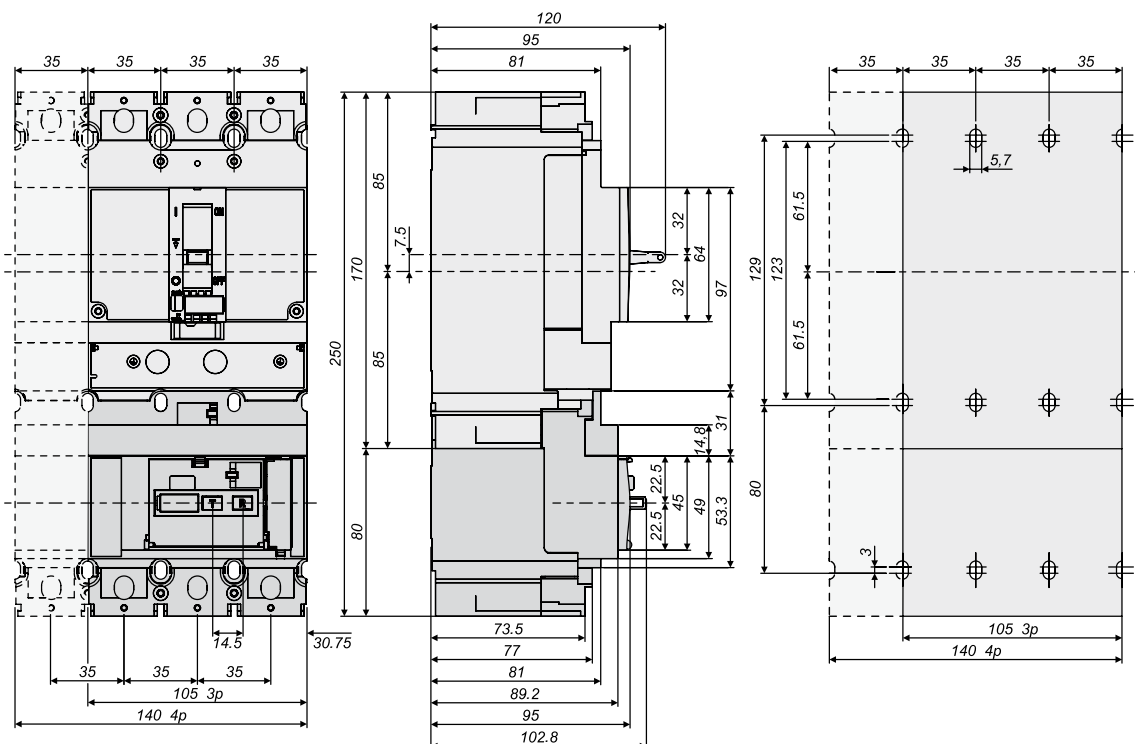
Breakers with phase separator - FD and FE frames



RCD bottom mounted - FD160

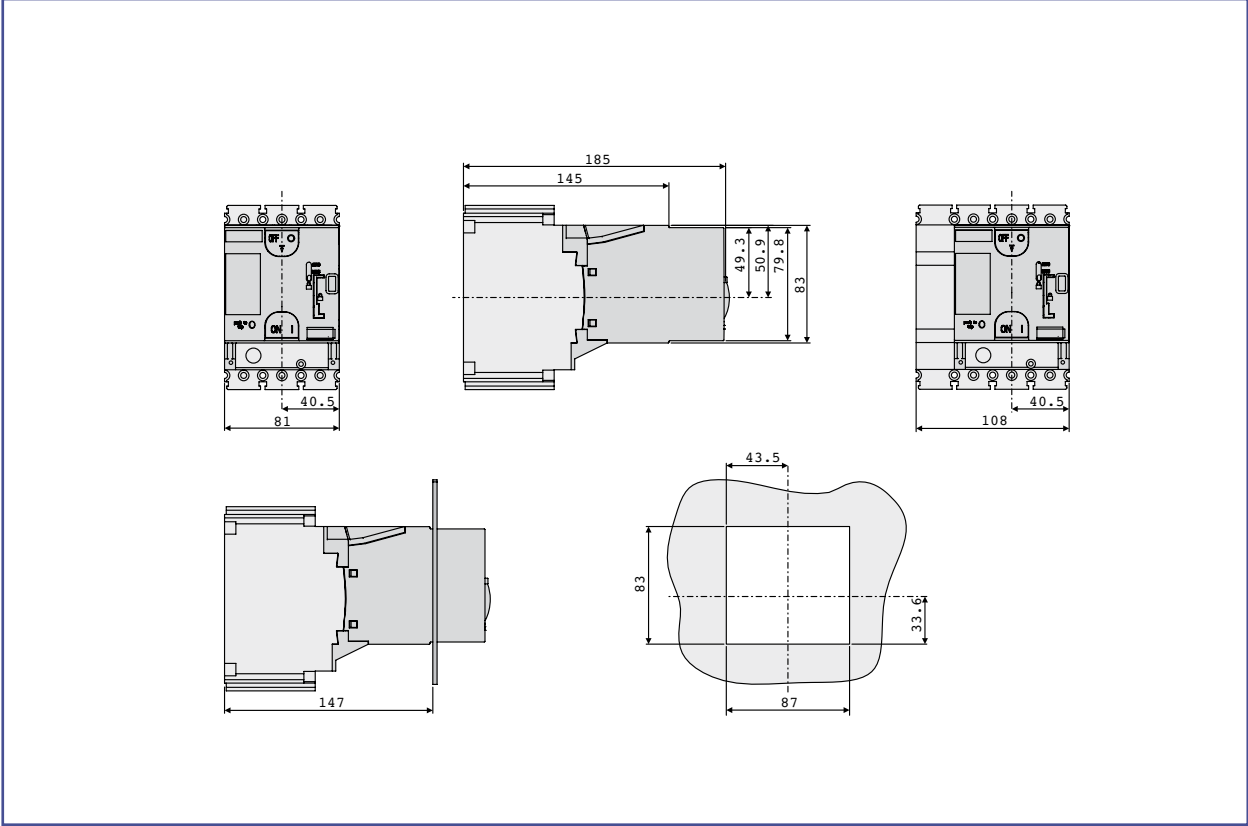


RCD bottom mounted - FE160 and FE250

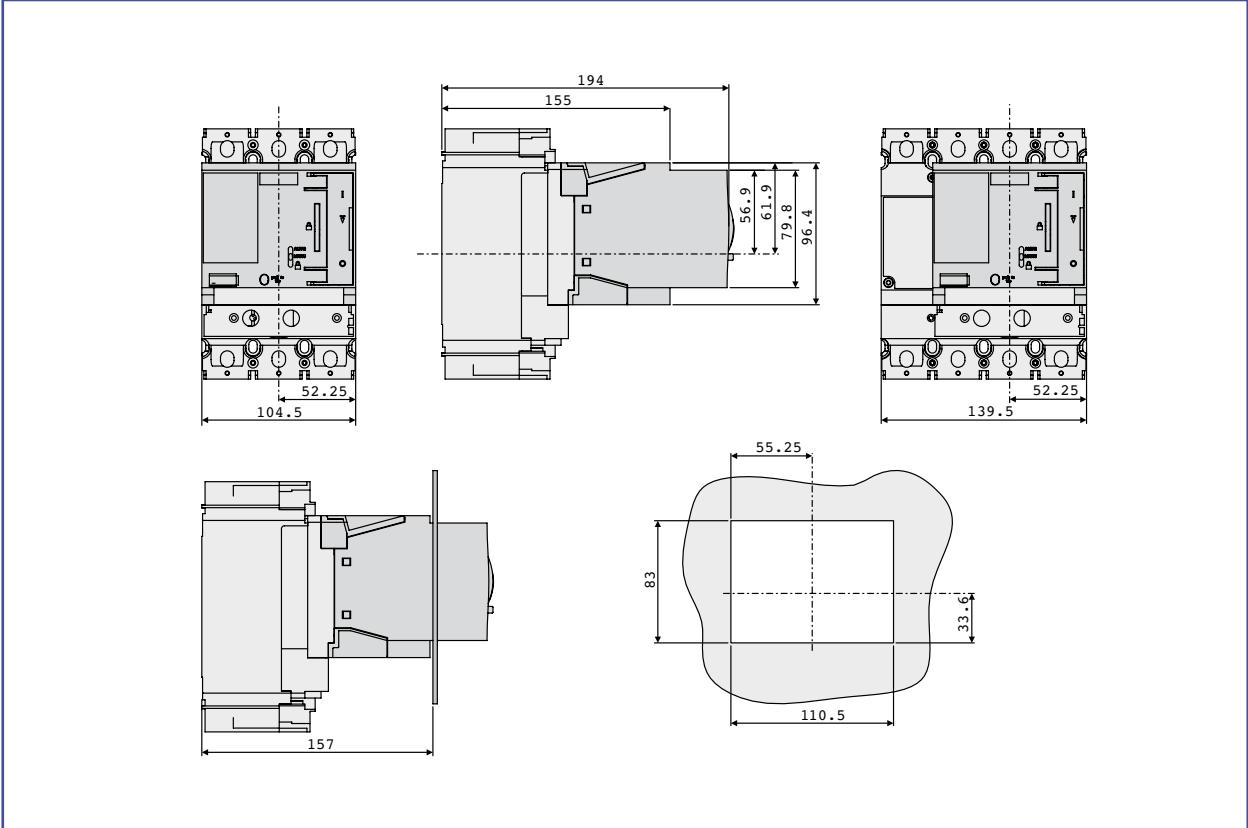


Dimensional Drawings

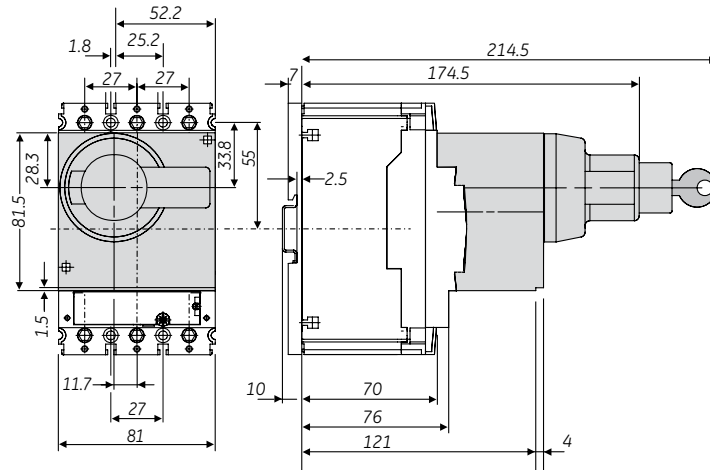
Breaker with electrical operator - FD160



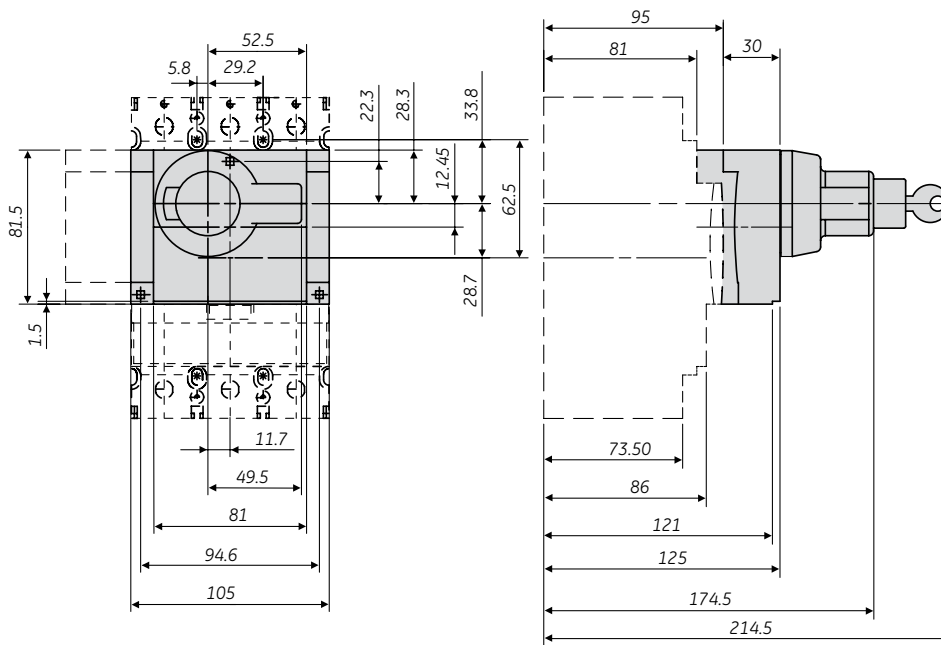
Breaker with electrical operator - FE160 and FE250



Rotary handle - Breaker and through panel mounted - FD160

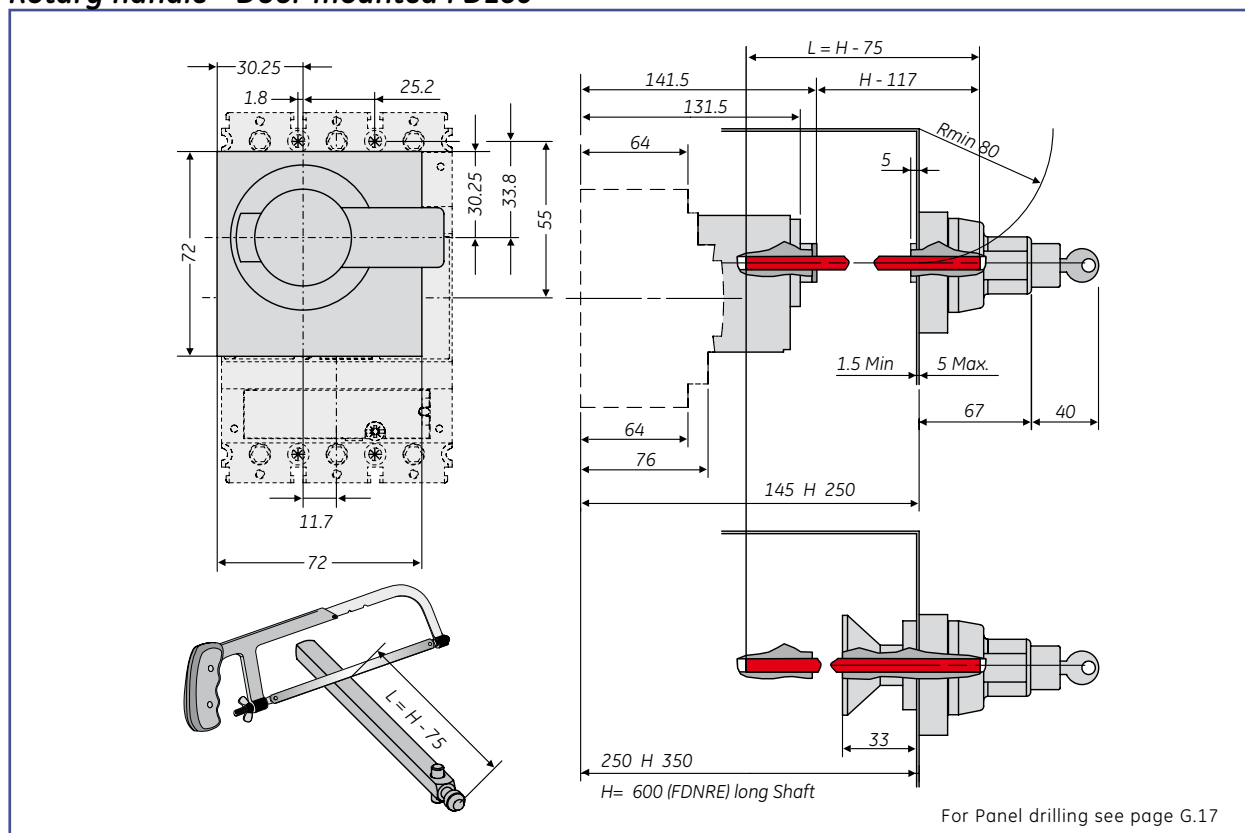


Rotary handle - Breaker and through panel mounted - FE160 and FE250

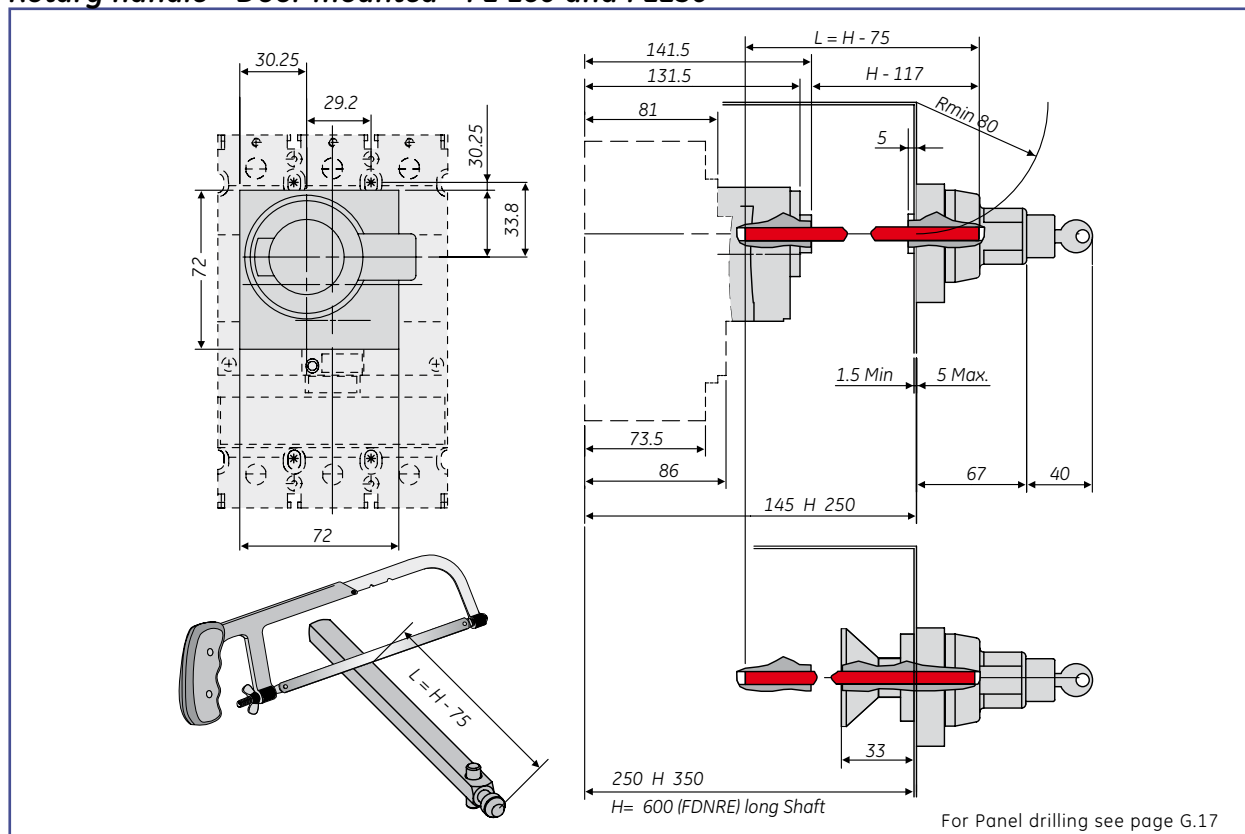


Dimensional Drawings

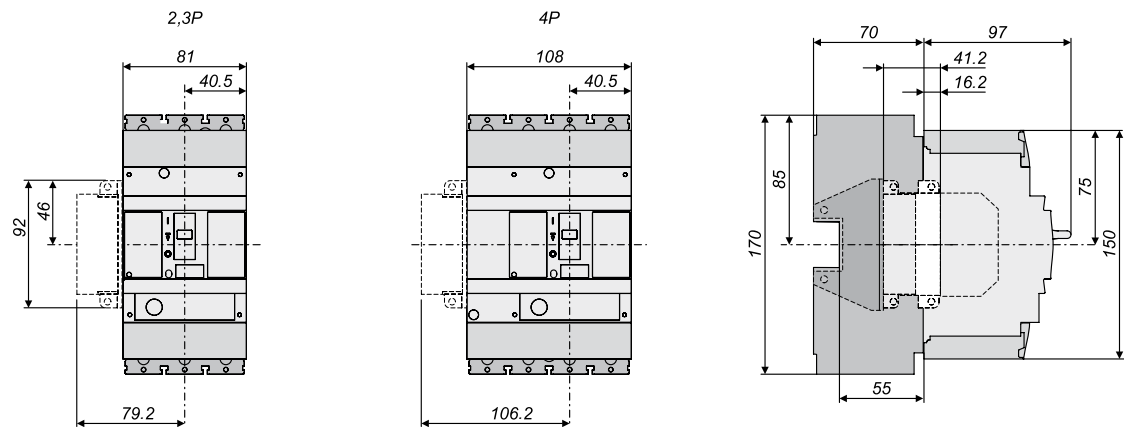
Rotary handle - Door mounted FD160



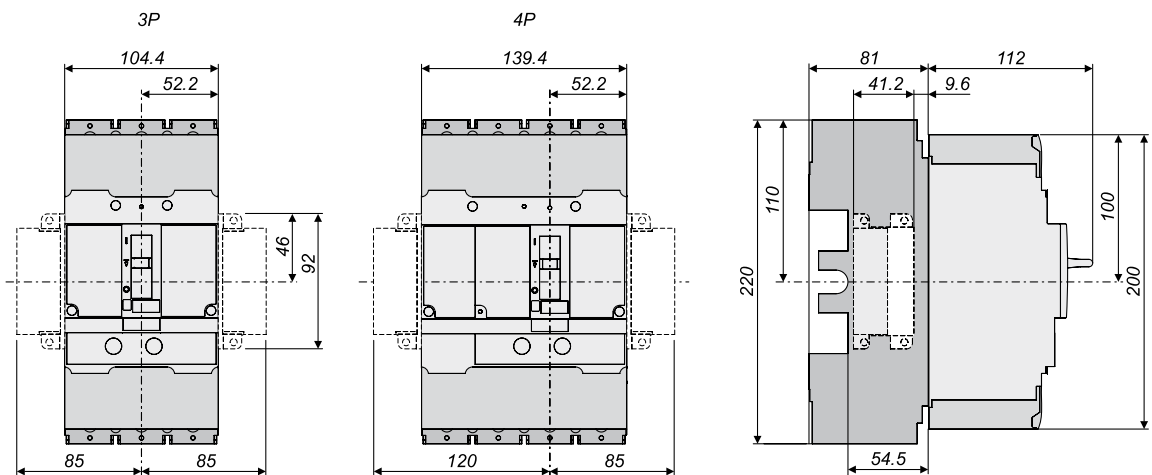
Rotary handle - Door mounted - FE 160 and FE250



Plug-in version - FD160

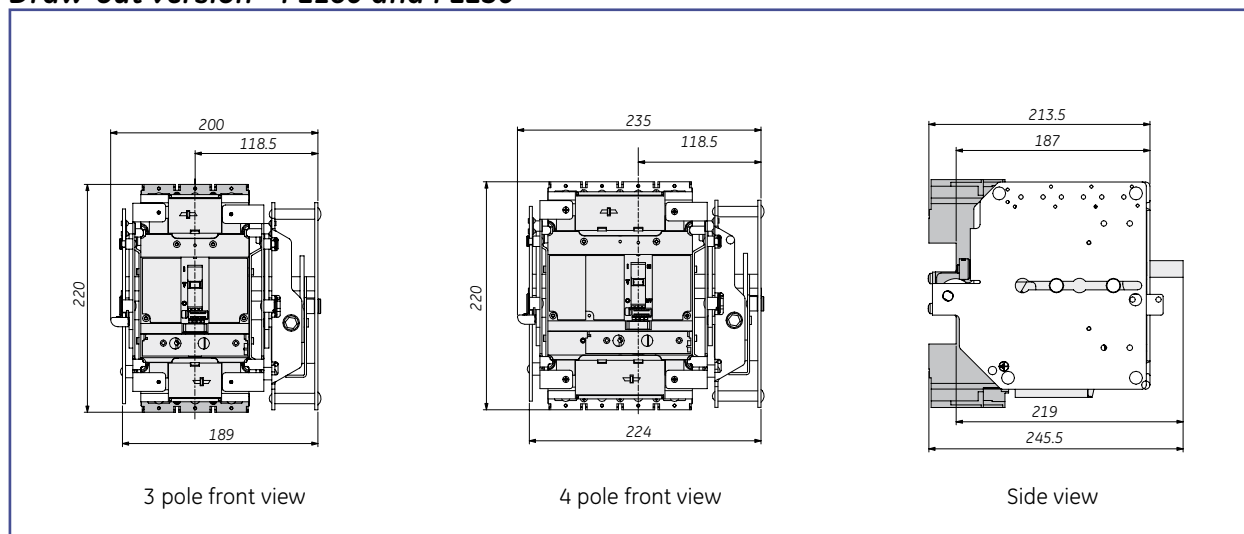


Plug-in version - FE160 and FE250

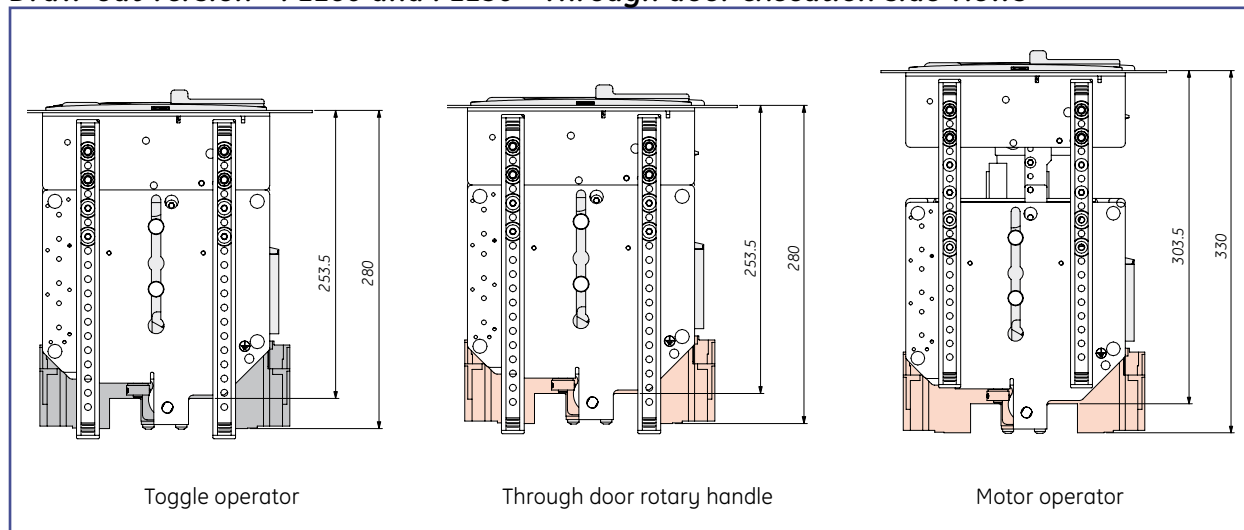


Dimensional Drawings

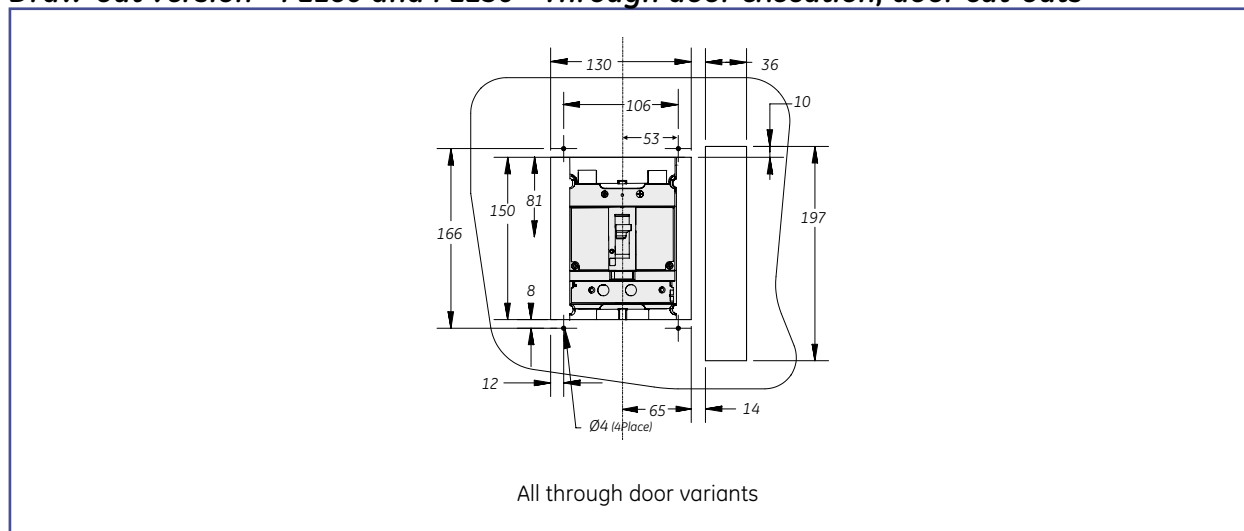
Draw-out version - FE160 and FE250



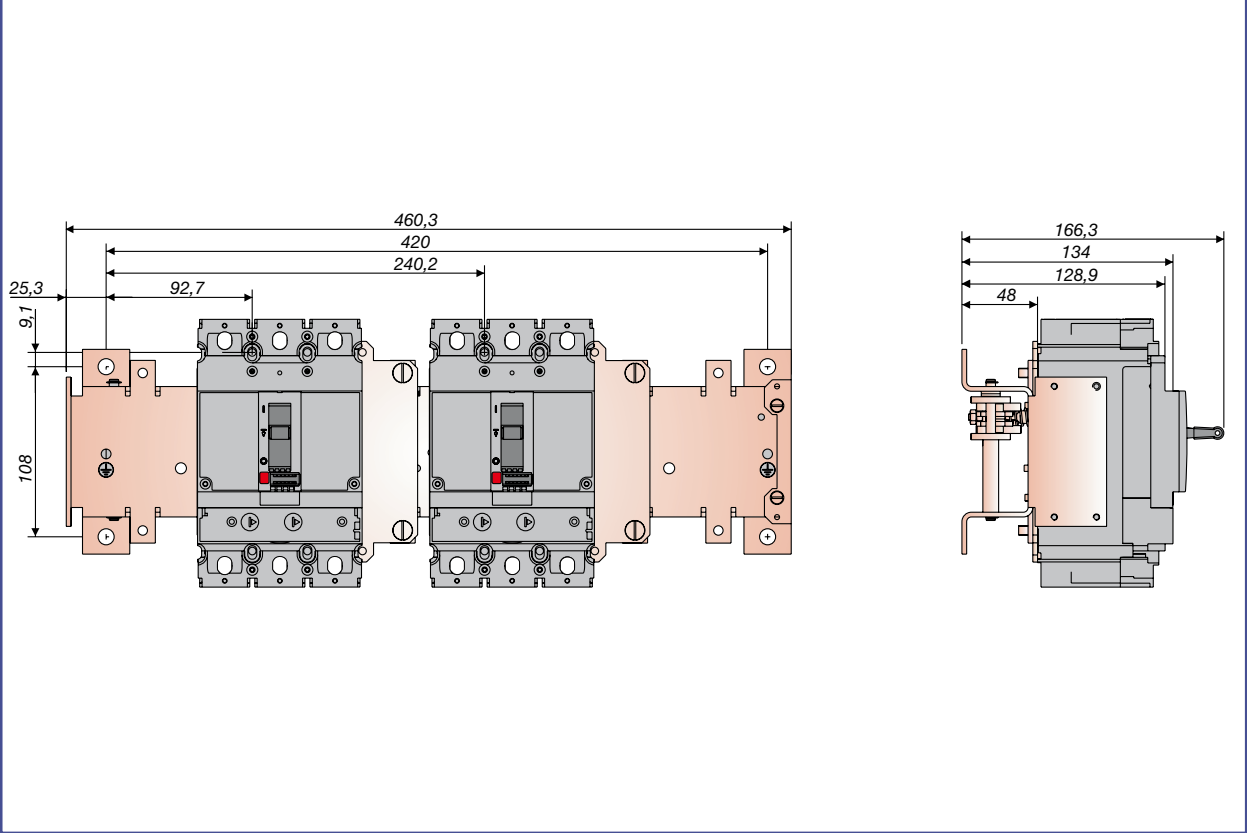
Draw-out version - FE160 and FE250 - Through door execution side views



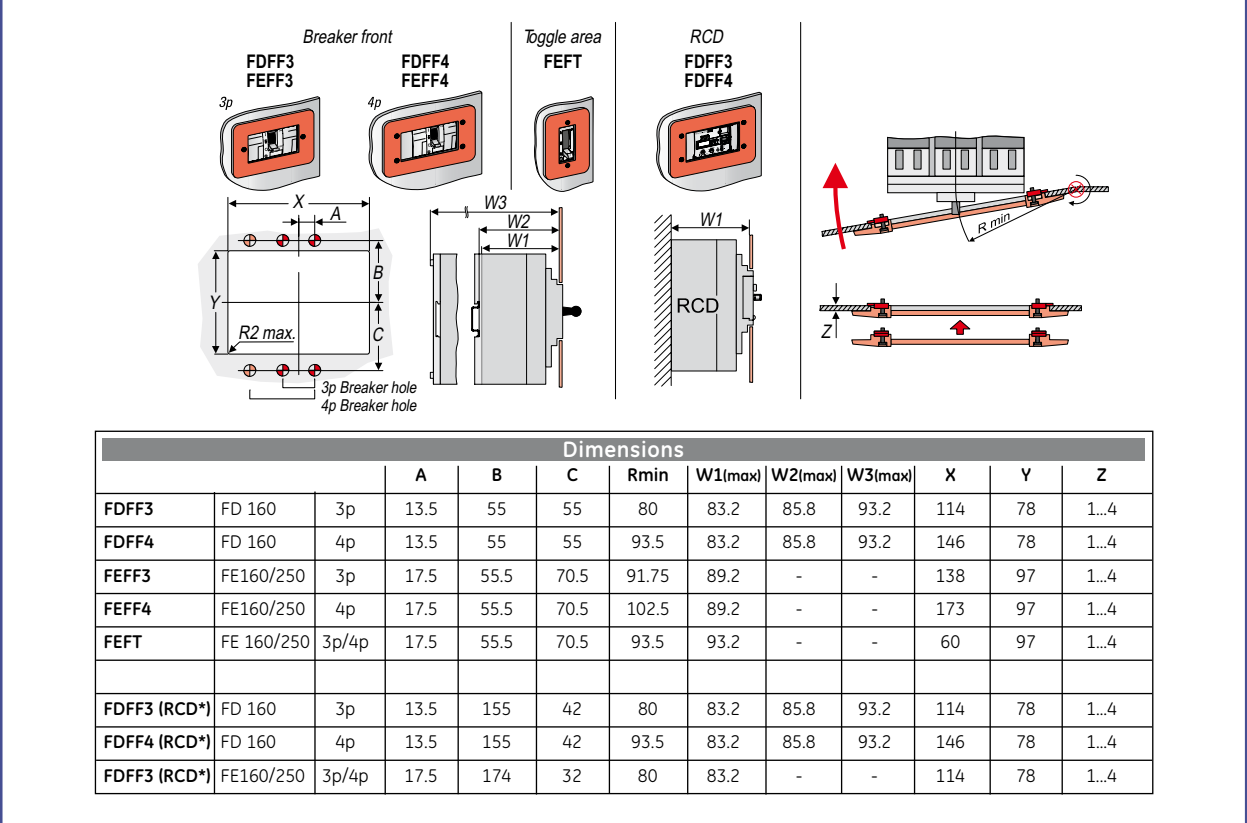
Draw-out version - FE160 and FE250 - Through door execution, door cut-outs



FE Frame, 2 pieces mechanically interlocked

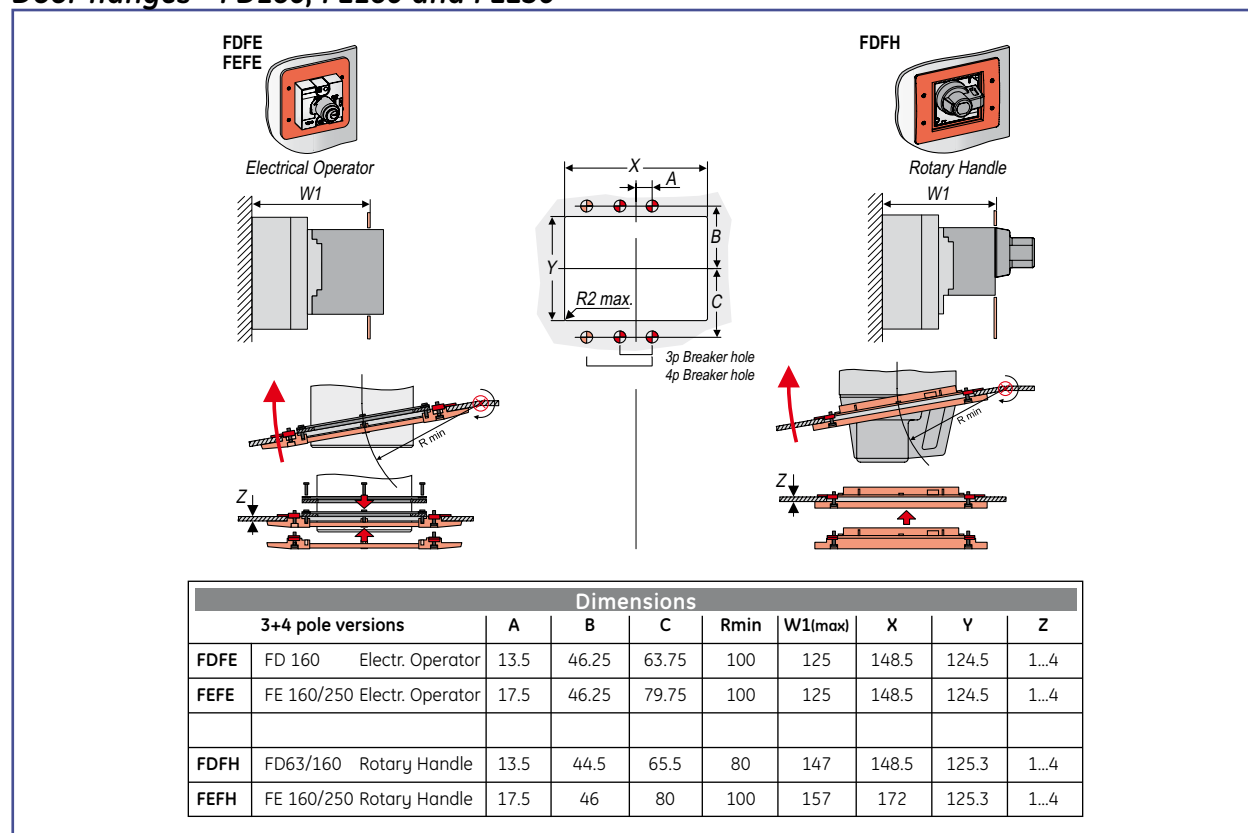


Door flanges - FD160, FE160 and FE250

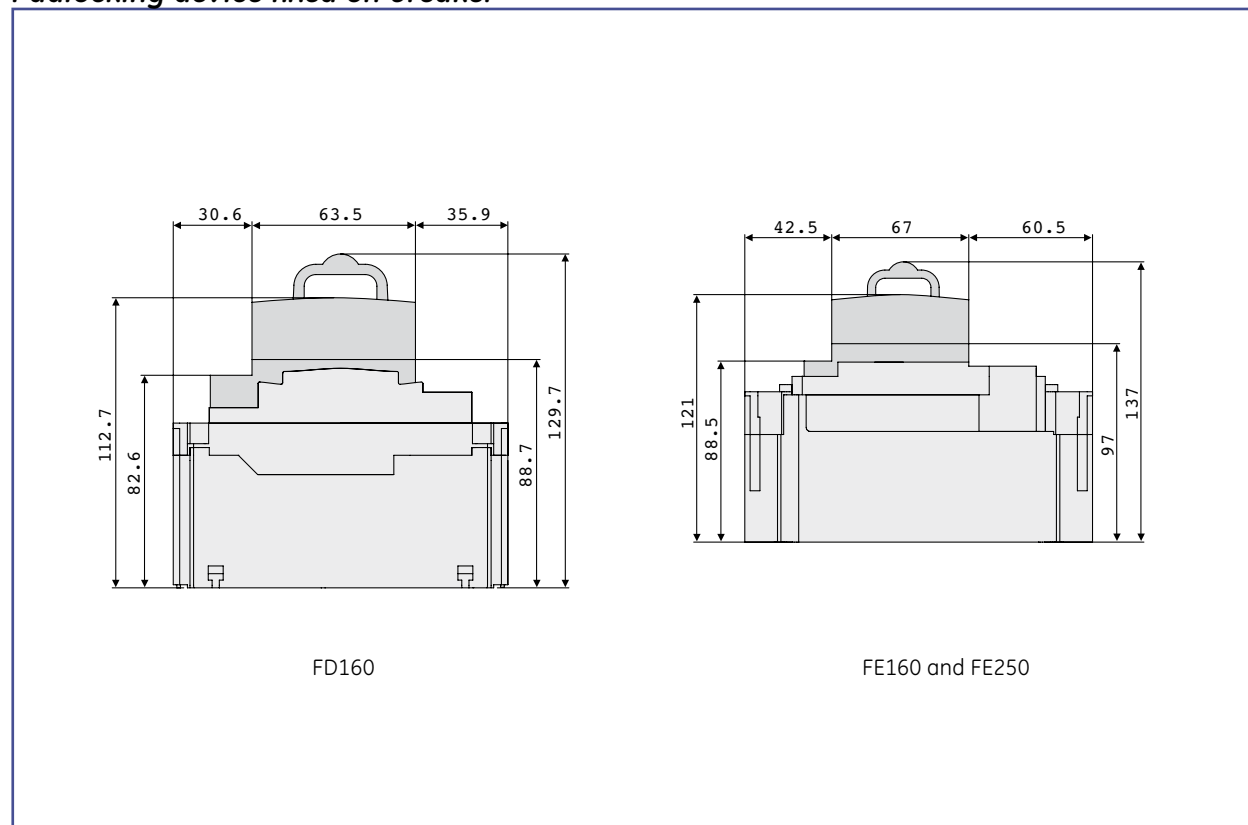


Dimensional Drawings

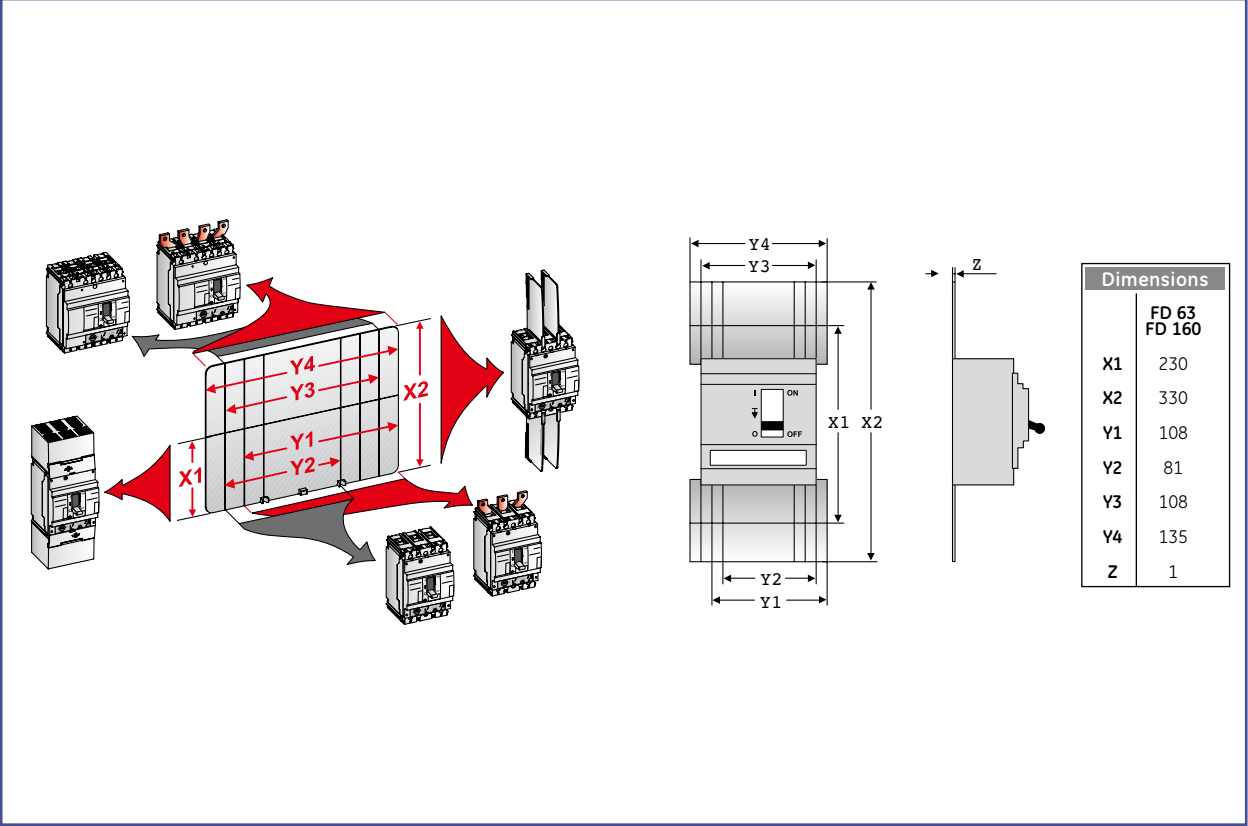
Door flanges - FD160, FE160 and FE250



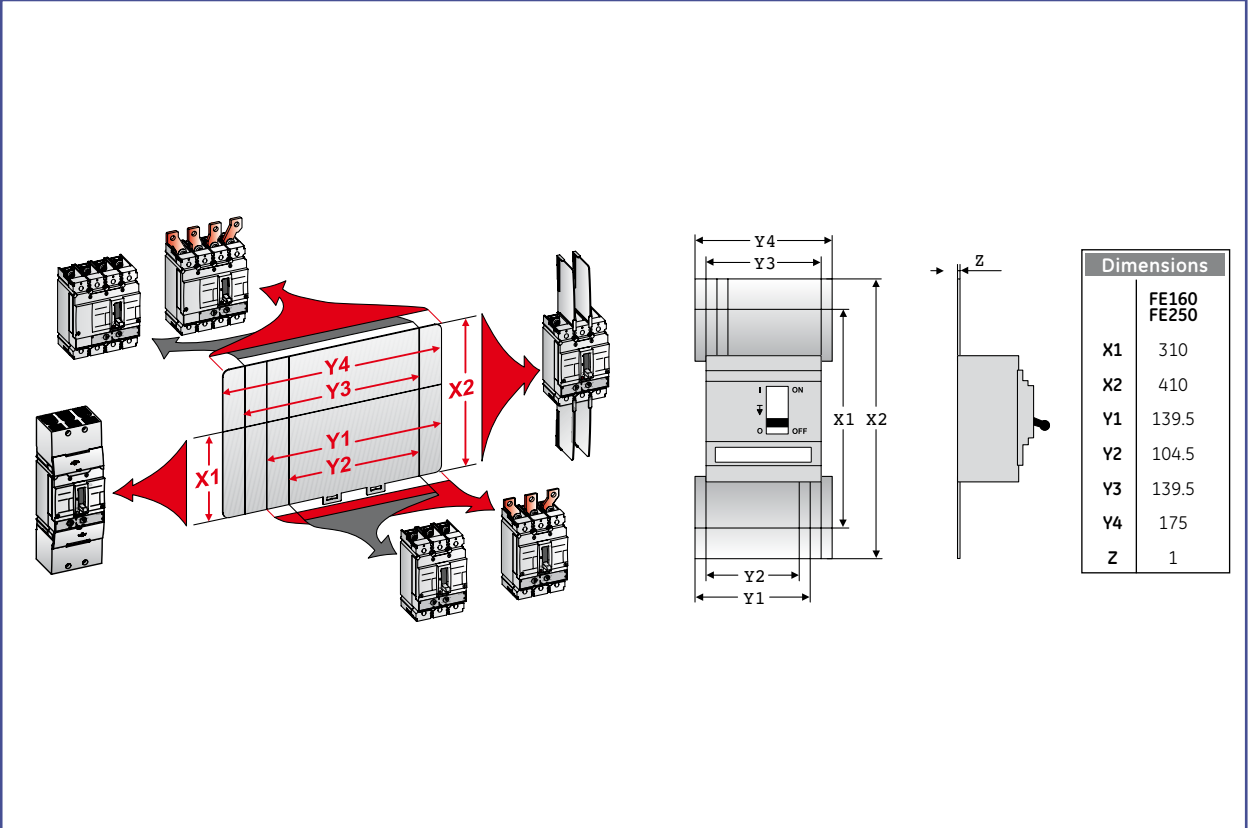
Padlocking device fixed on breaker



Backplate - FD160

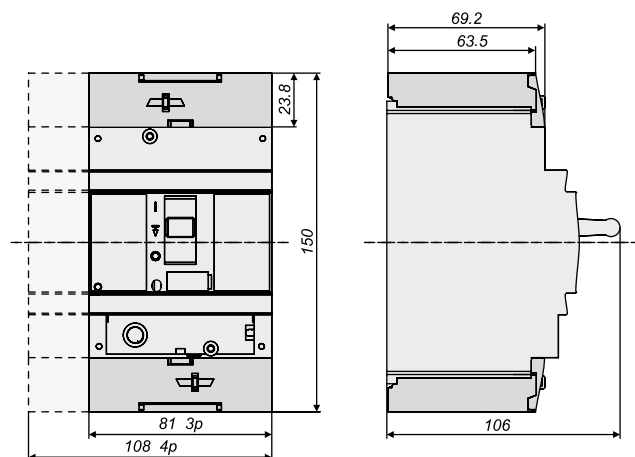


Backplate - FE160 and FE250

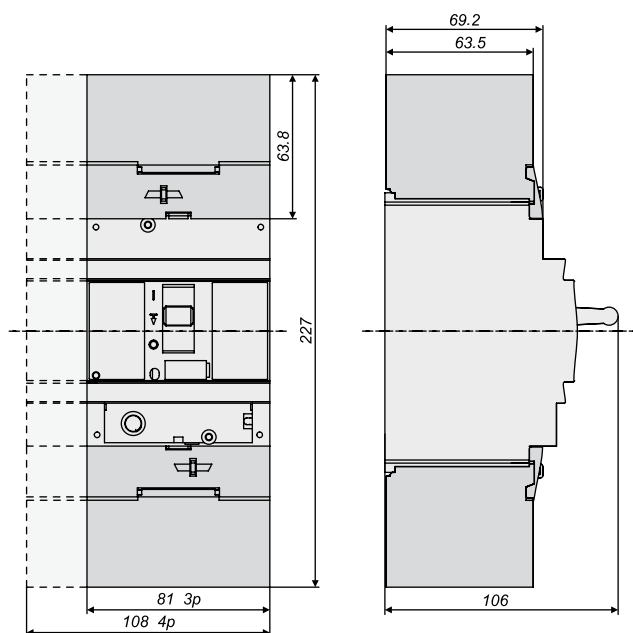


Dimensional Drawings

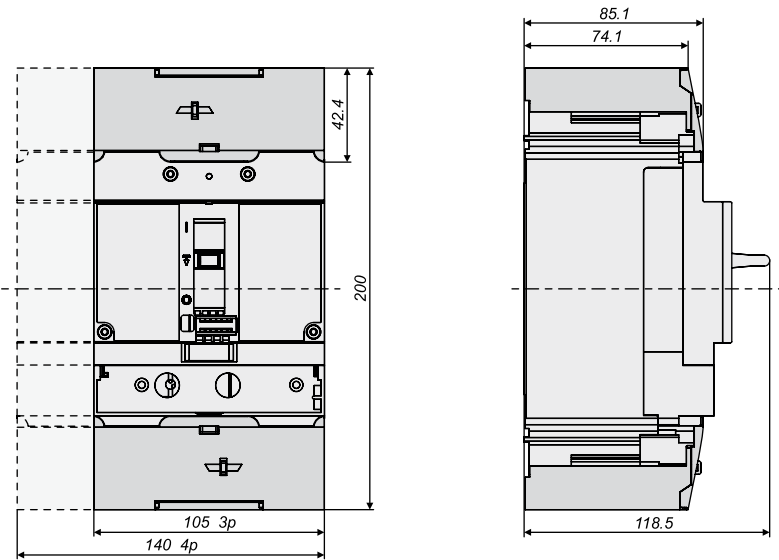
Breaker with short terminal shields - FD160



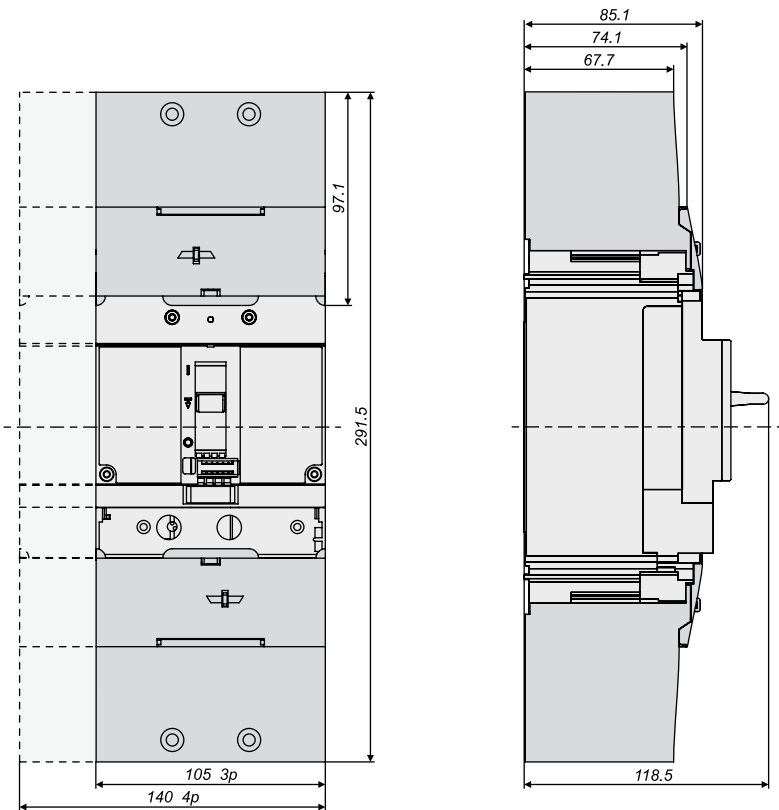
Breaker with long terminal shields - FD160



Breaker with short terminal shields - FE160 and FE250



Breaker with long terminal shields - FE160 and FE250



FG frame

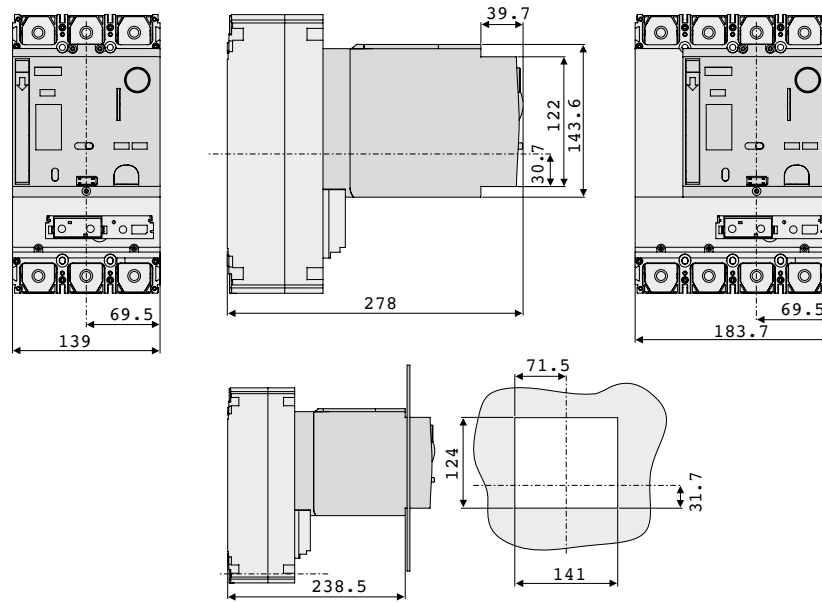
Intro



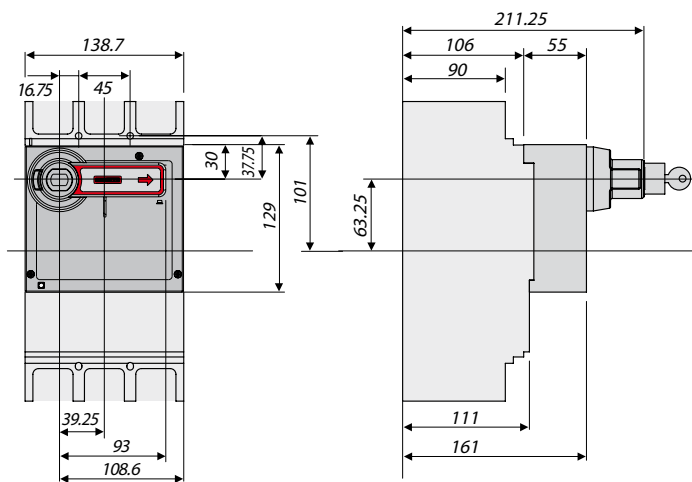
B



Breaker with electrical operator - FG400/630

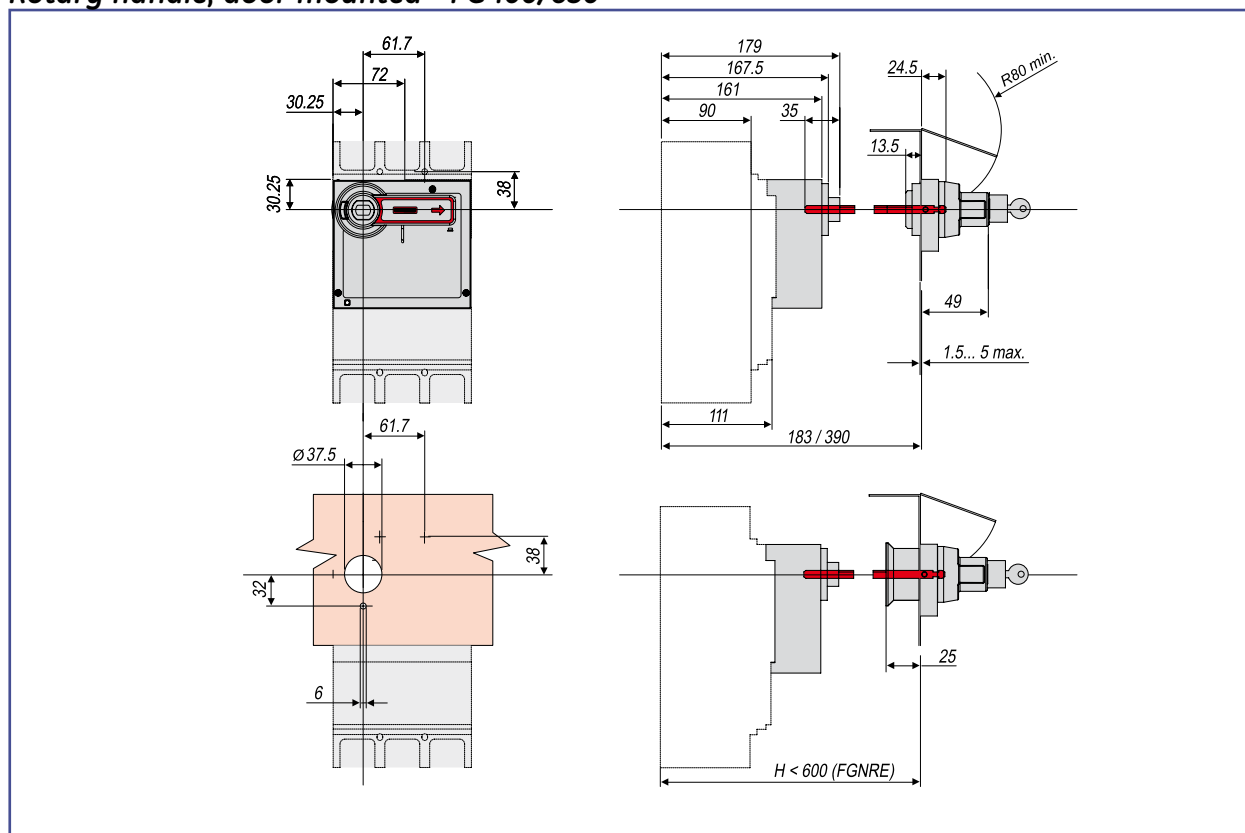


Rotary handle, breaker and through panel mounted - FG400/630

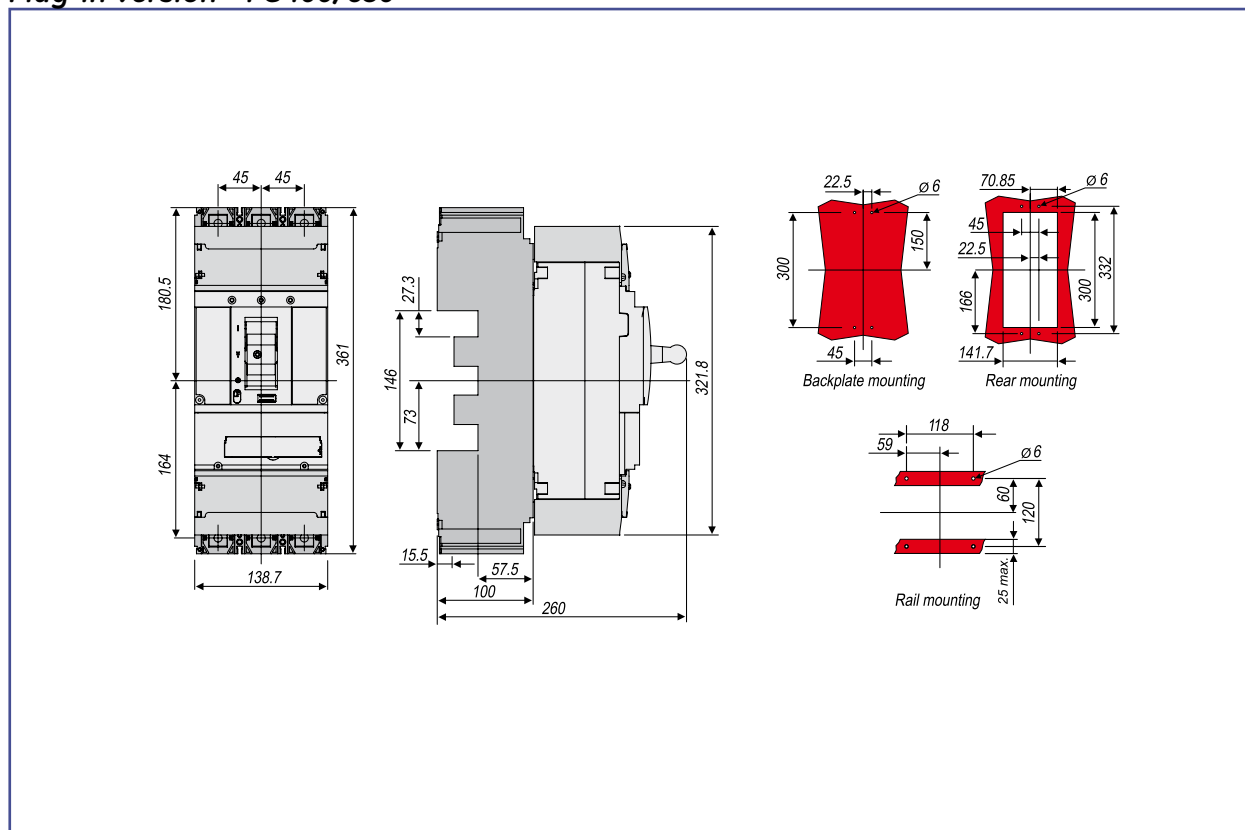


Dimensional Drawings

Rotary handle, door mounted - FG400/630



Plug-in version - FG400/630



FG frame

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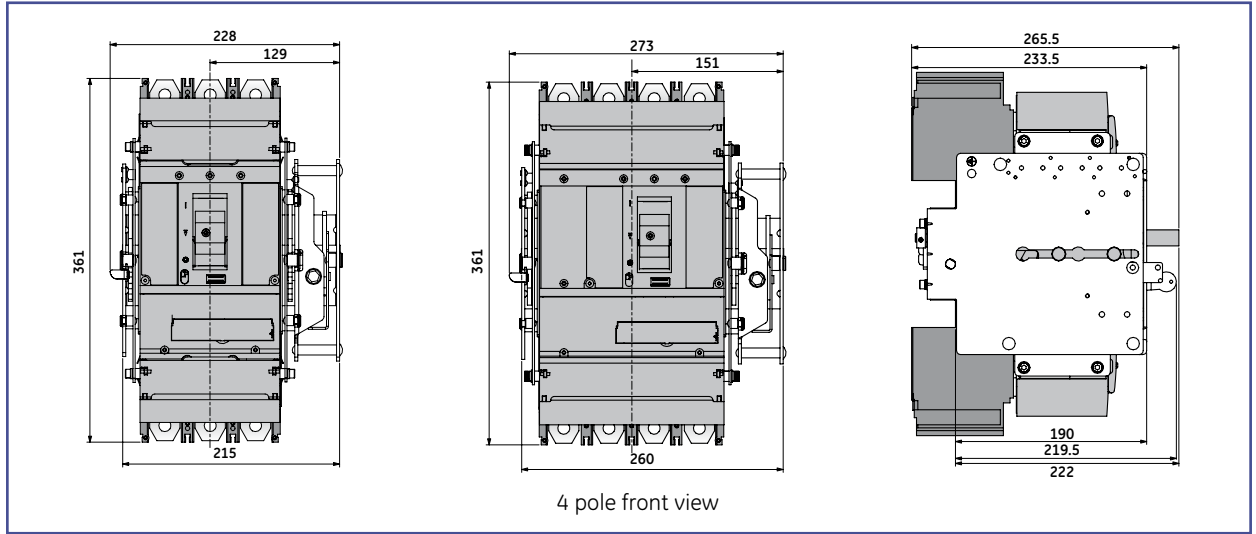
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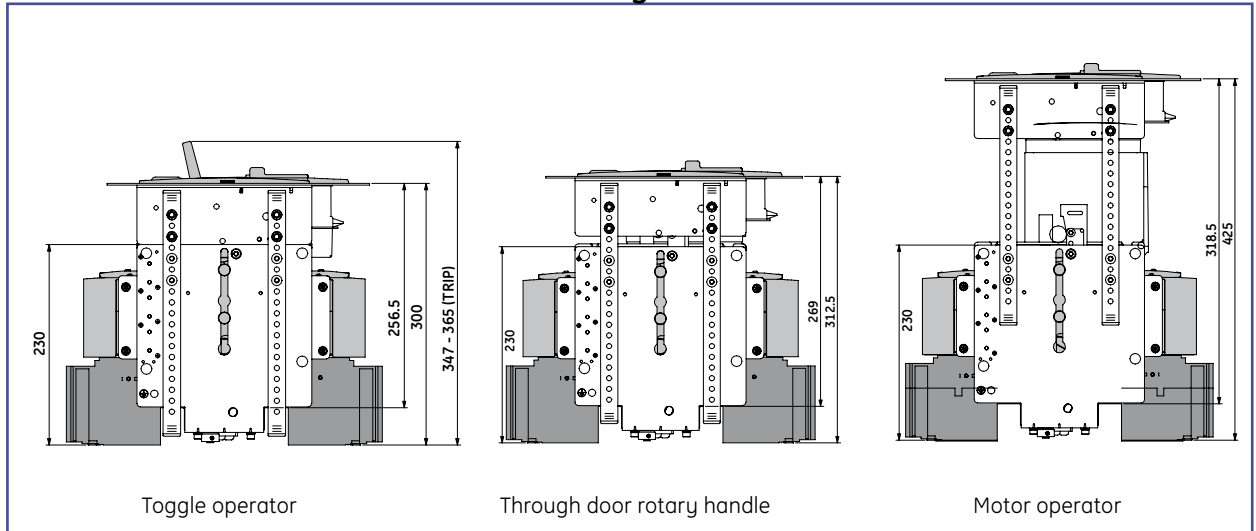
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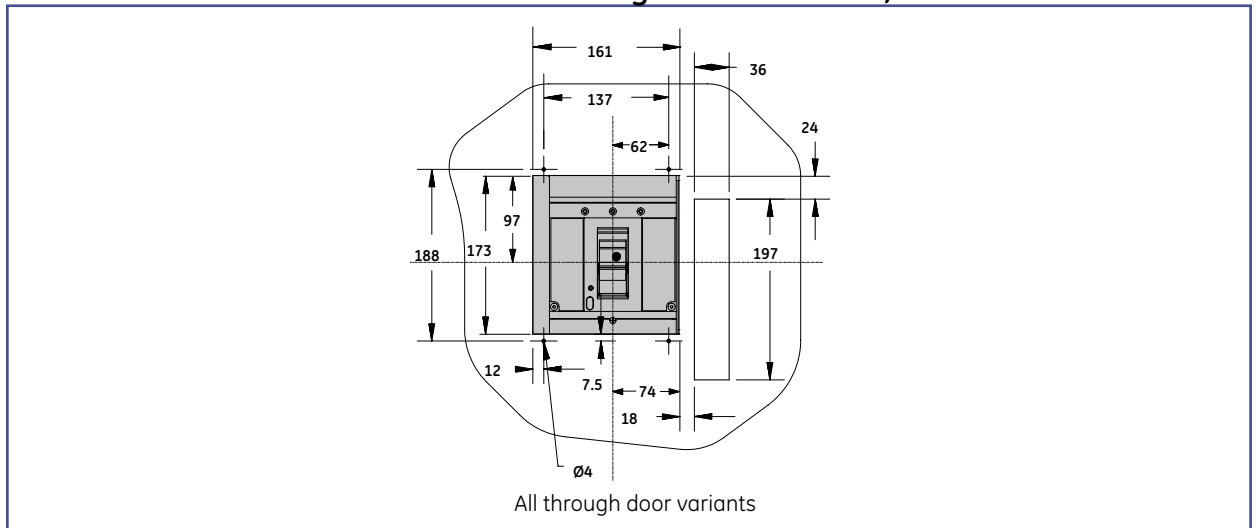
Draw-out version - FG400 and FG630



Draw-out version - FG400 and FG630 - Through door execution side views

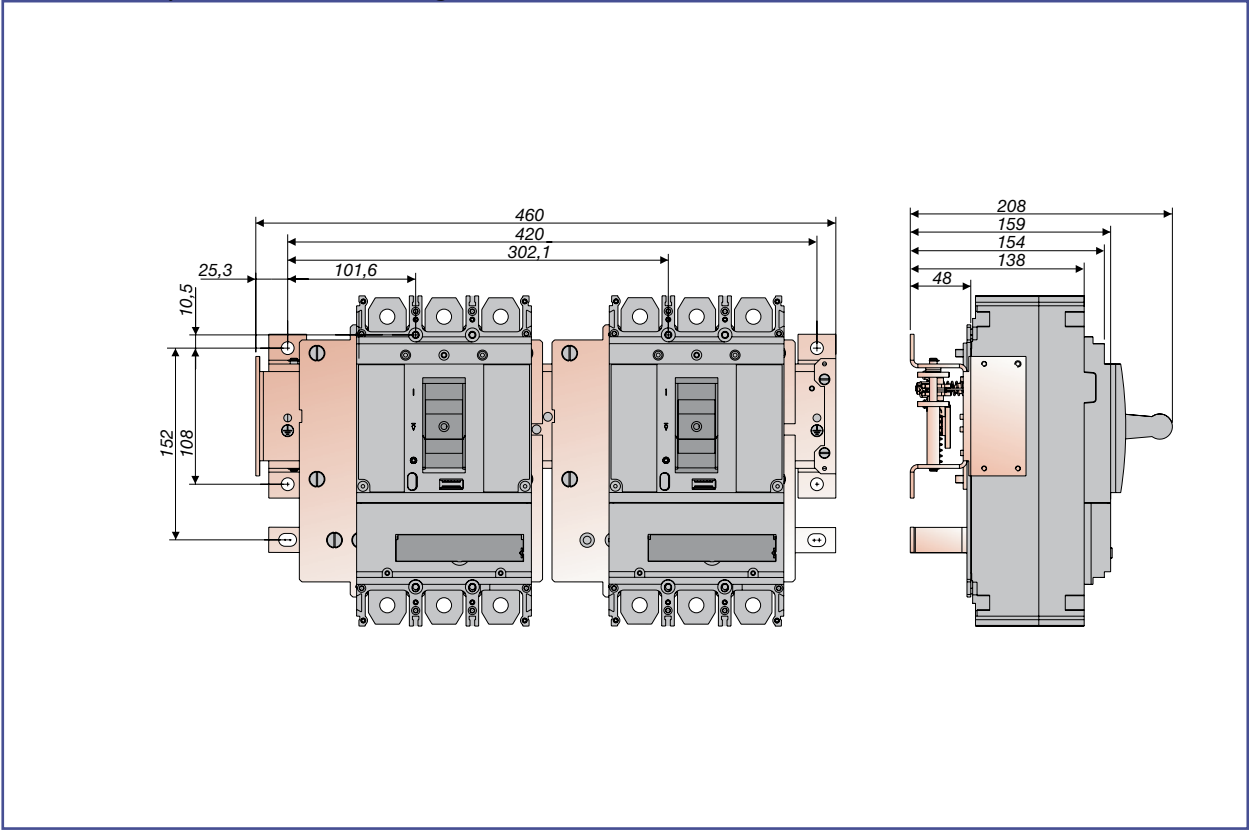


Draw-out version - FG400 and FG630 - Through door execution, door cut-outs

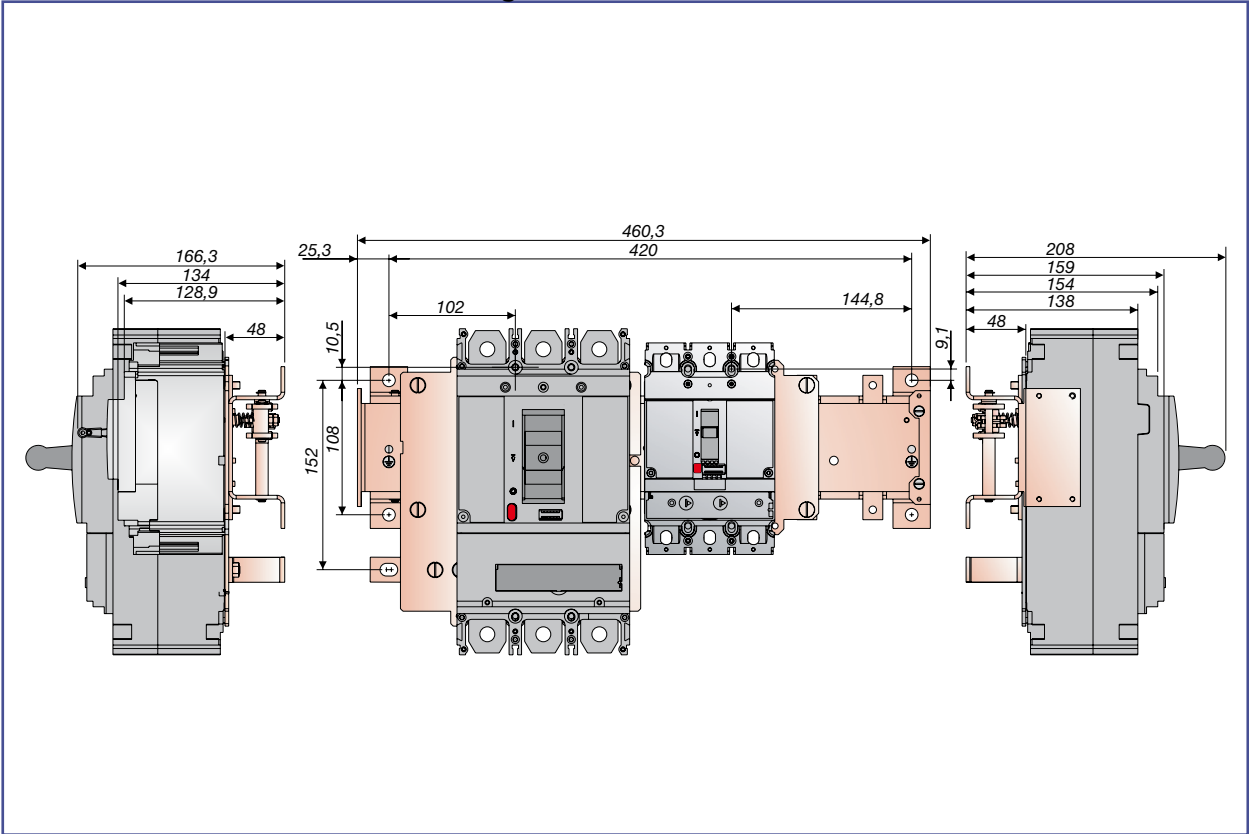


Dimensional Drawings

FG frame, 2 pieces mechanically interlocked



FG frame and FE frame mechanically interlocked



FG frame

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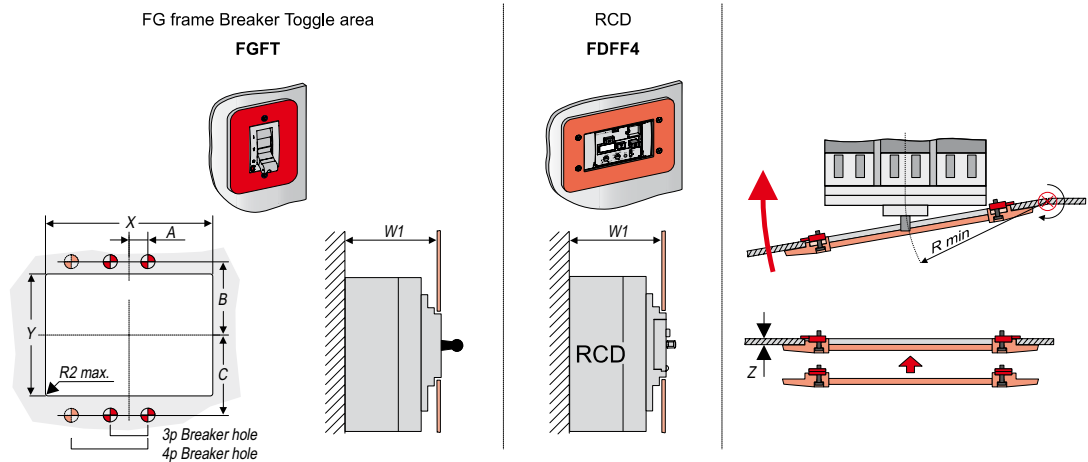
F

G

X

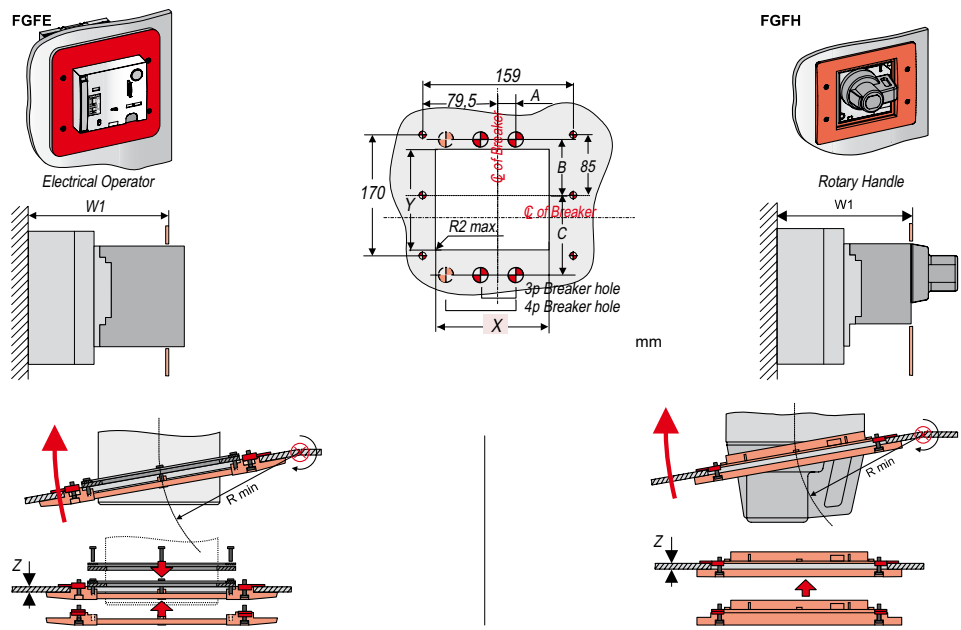


Door flanges - FG400/630



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

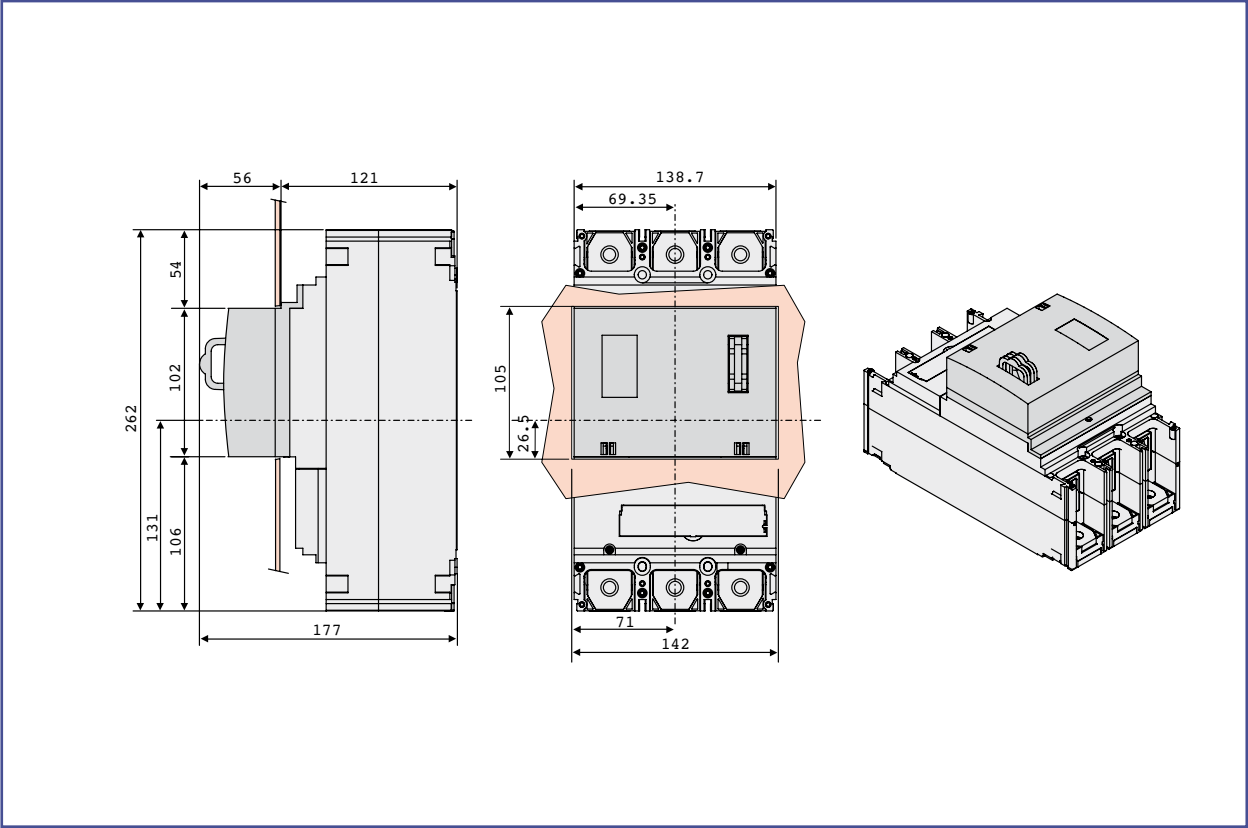


Dimensions										
			A	B	C	Rmin	W1(max)	X	Y	Z
FGFE	FG 400/630 Motor Operator	3+4 pole versions	22.5	70	130.8	100	238.5	143	125	1...4
FG FH	FG 400/630 Rotary Handle	3+4 pole versions	22.5	71.5	129	115	161	143	133	1...4

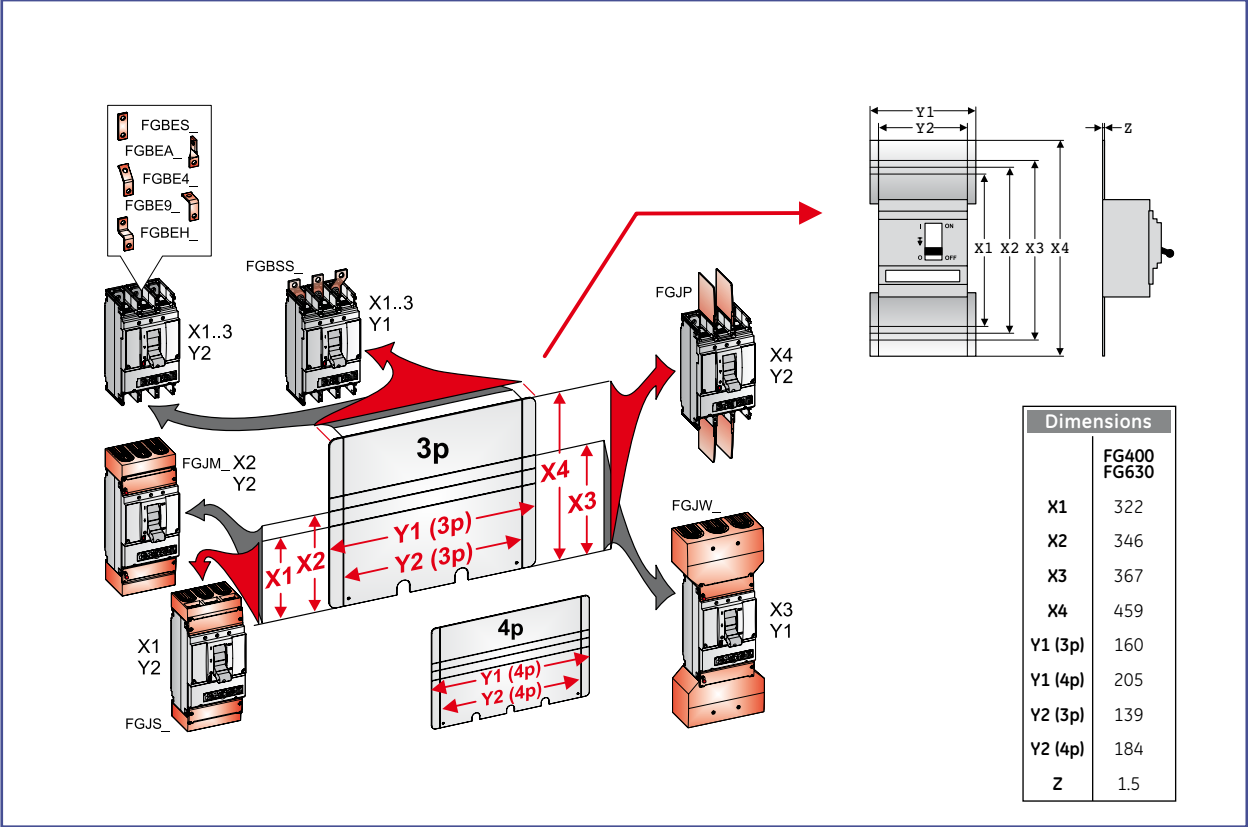


Dimensional Drawings

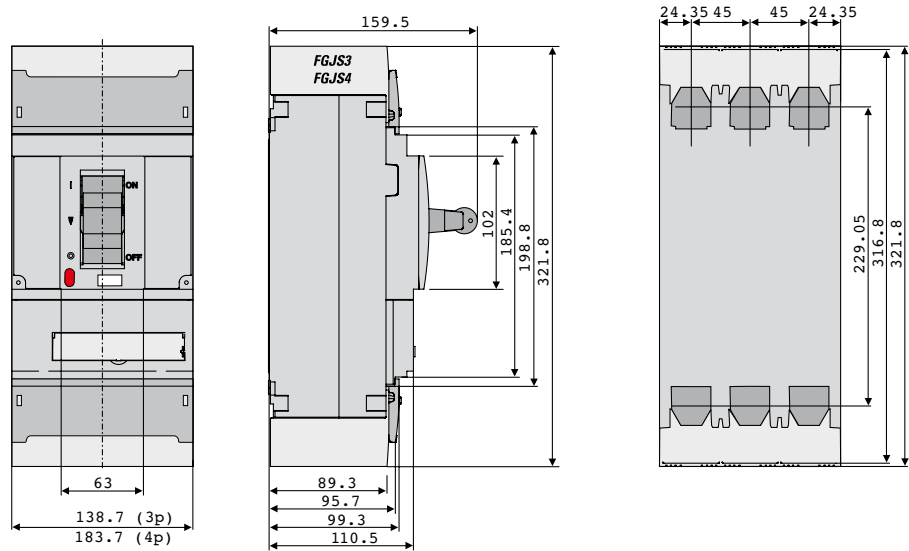
Padlock fixed - FG400/630



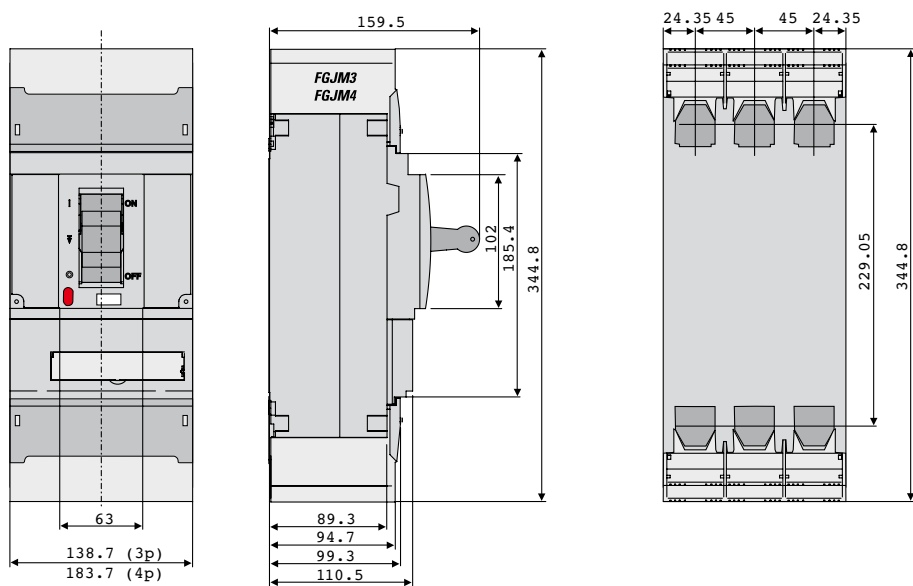
Backplate - FG400/630



Breaker with short terminal shields - FG400/630

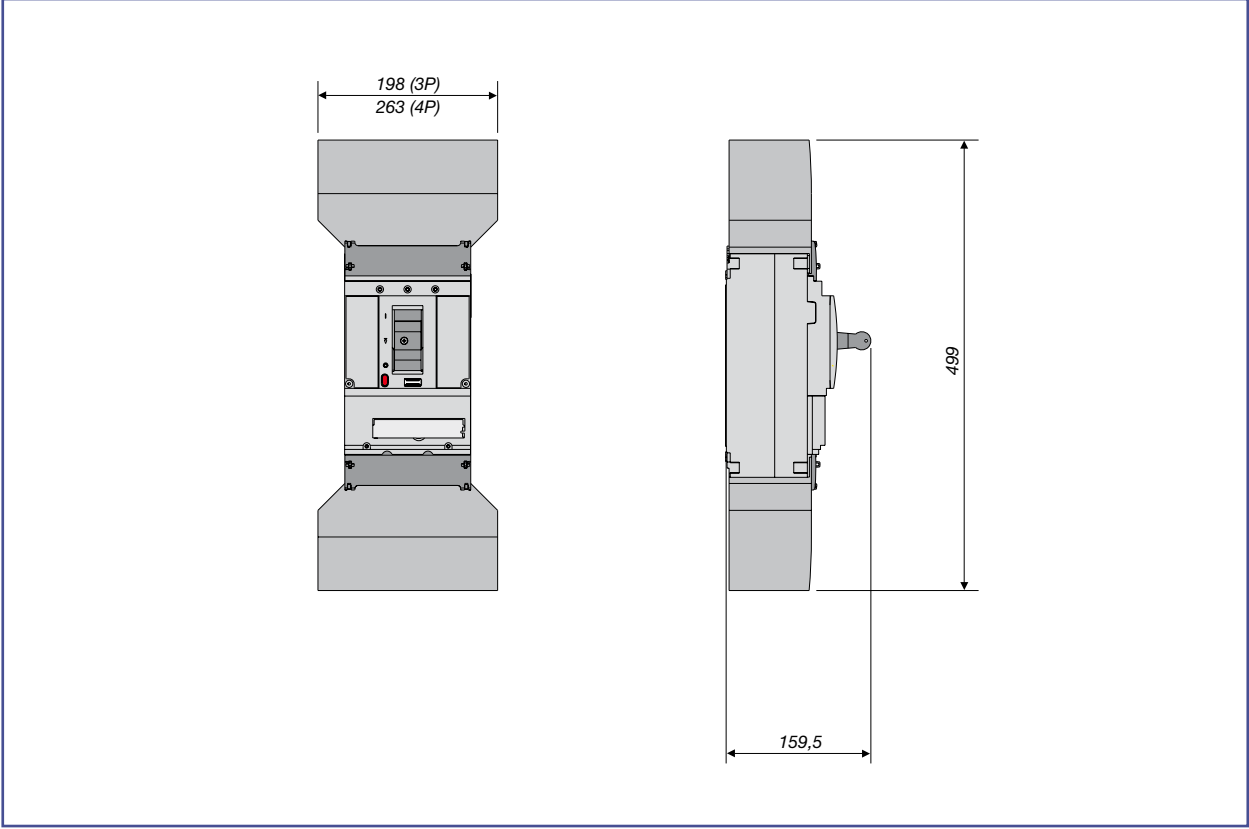


Breaker with medium terminal shields - FG400/630



Dimensional Drawings

Breaker with long and wide terminal shields - FG400/630



FG frame

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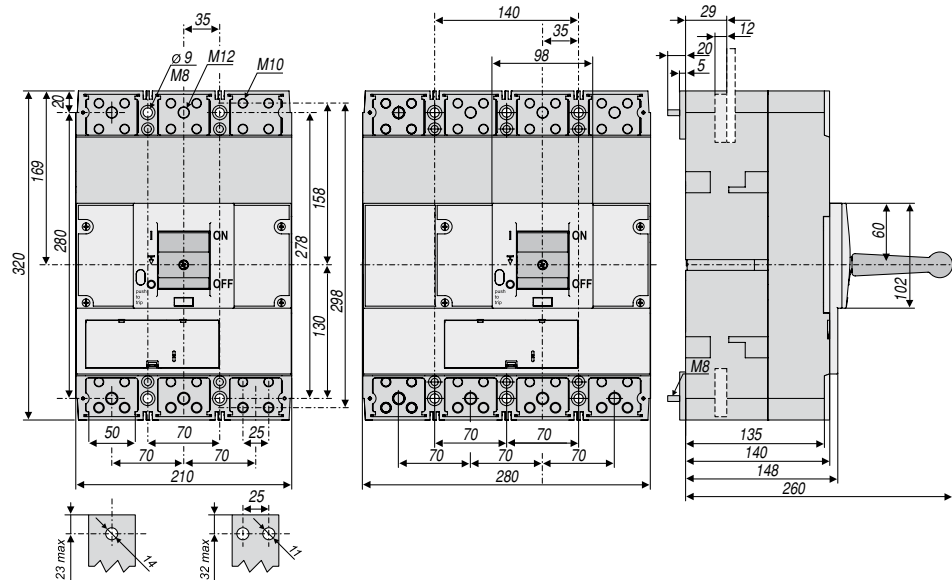
F

G

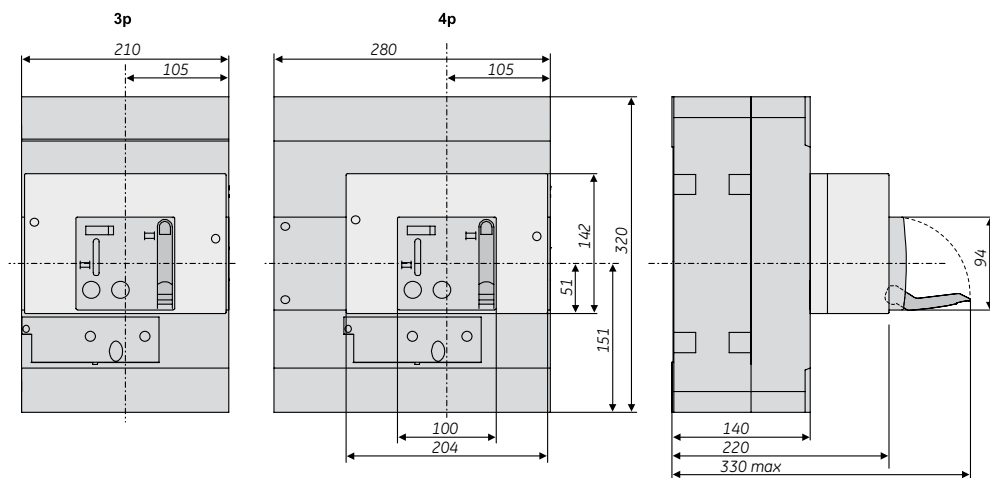
X



Breakers - FK800/1250/1600 fixed, front connected

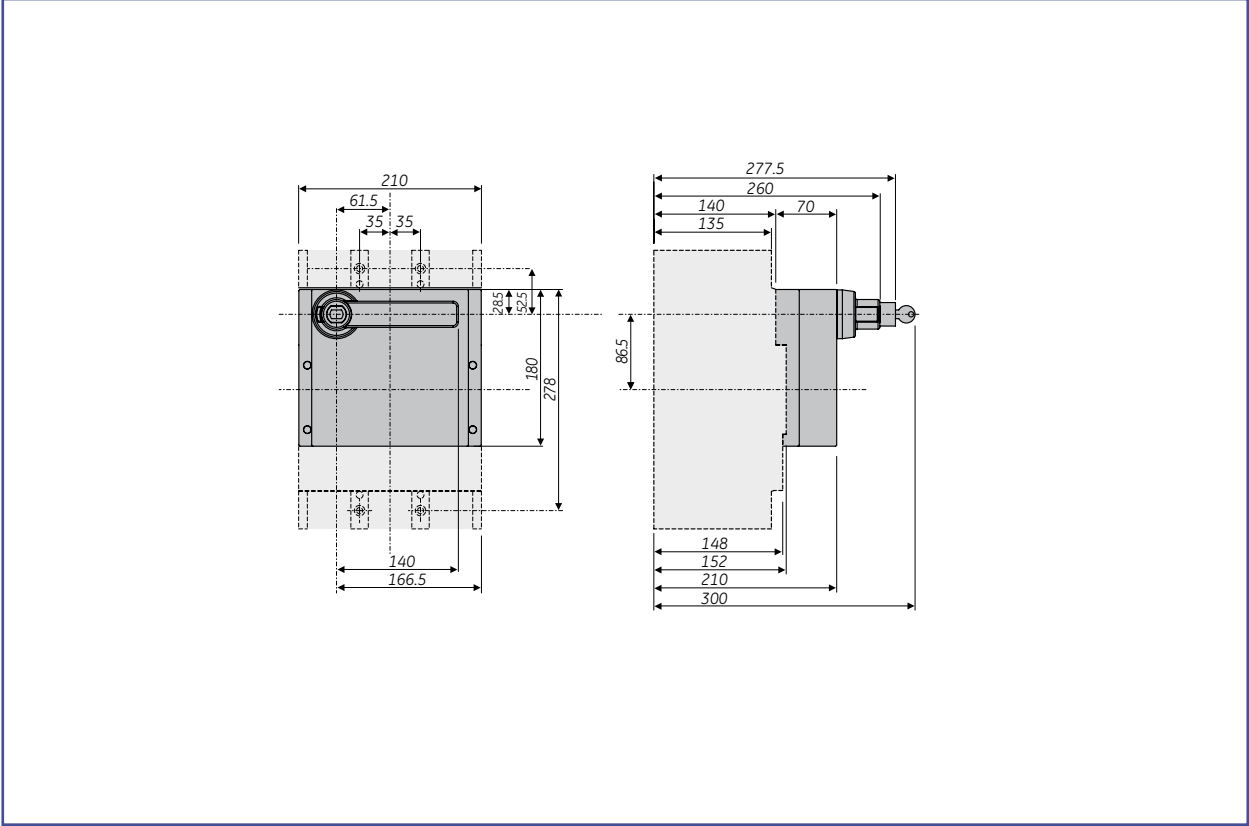


Breaker with electrical operator - FK800/1250/1600

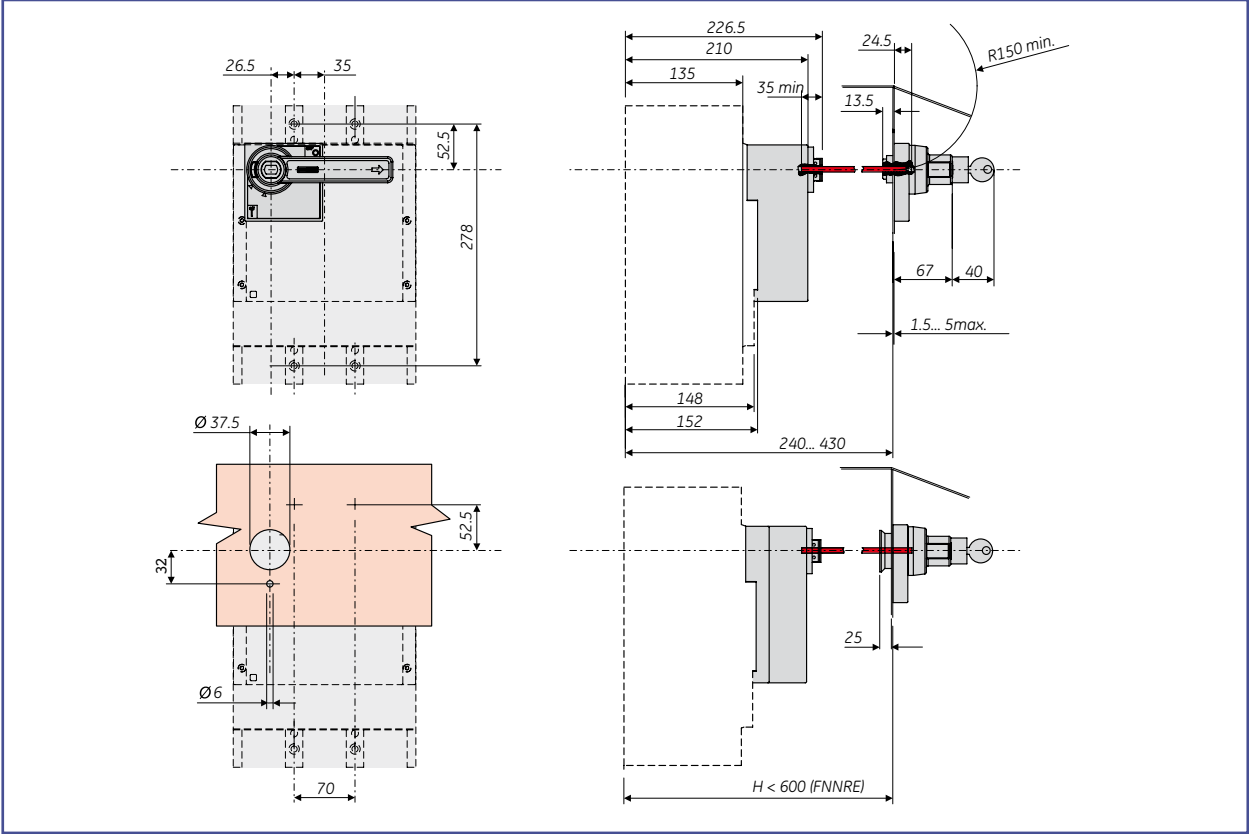


Dimensional Drawings

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

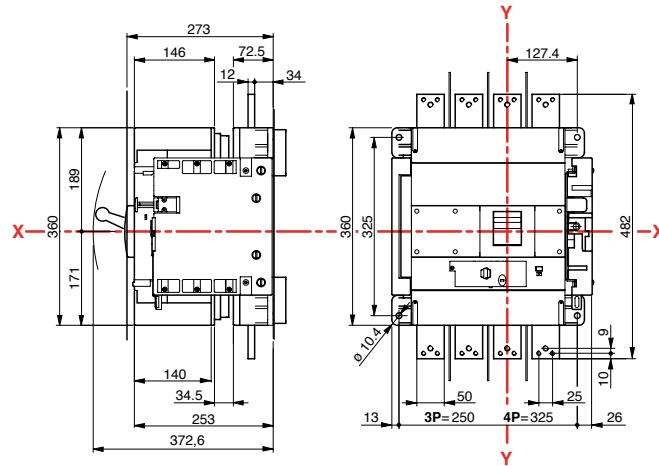
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G

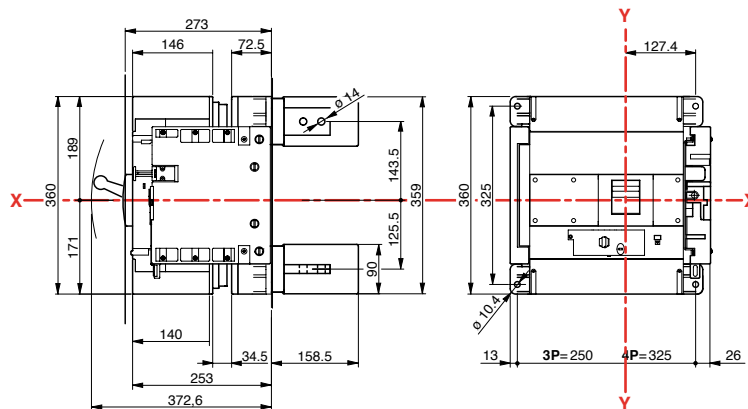
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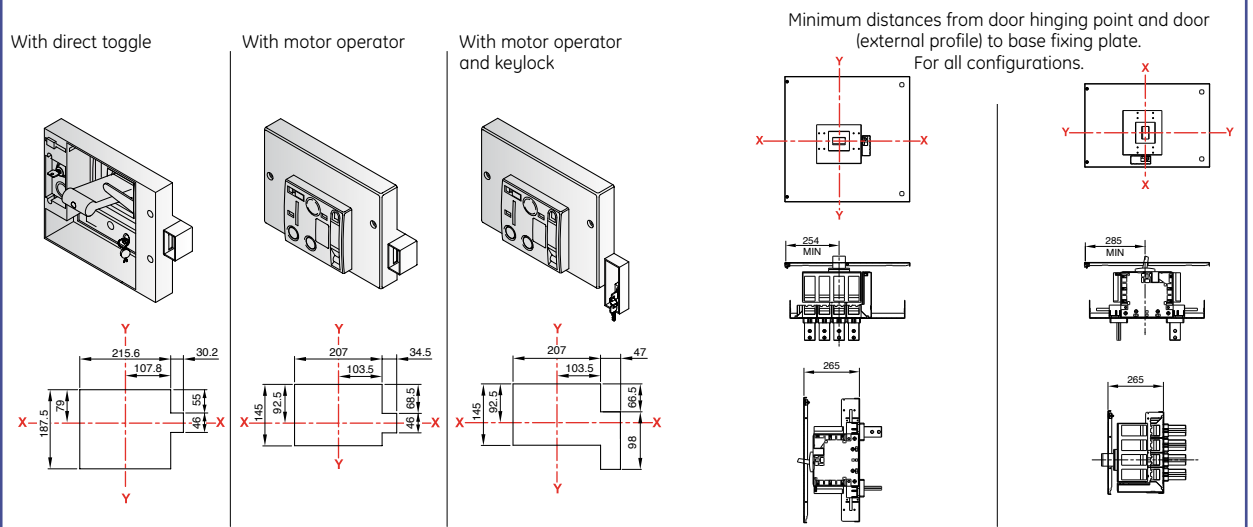
Draw-out version - FK800/1250/1600 - Front connection



Draw-out version - FK800/1250/1600 - Rear connection

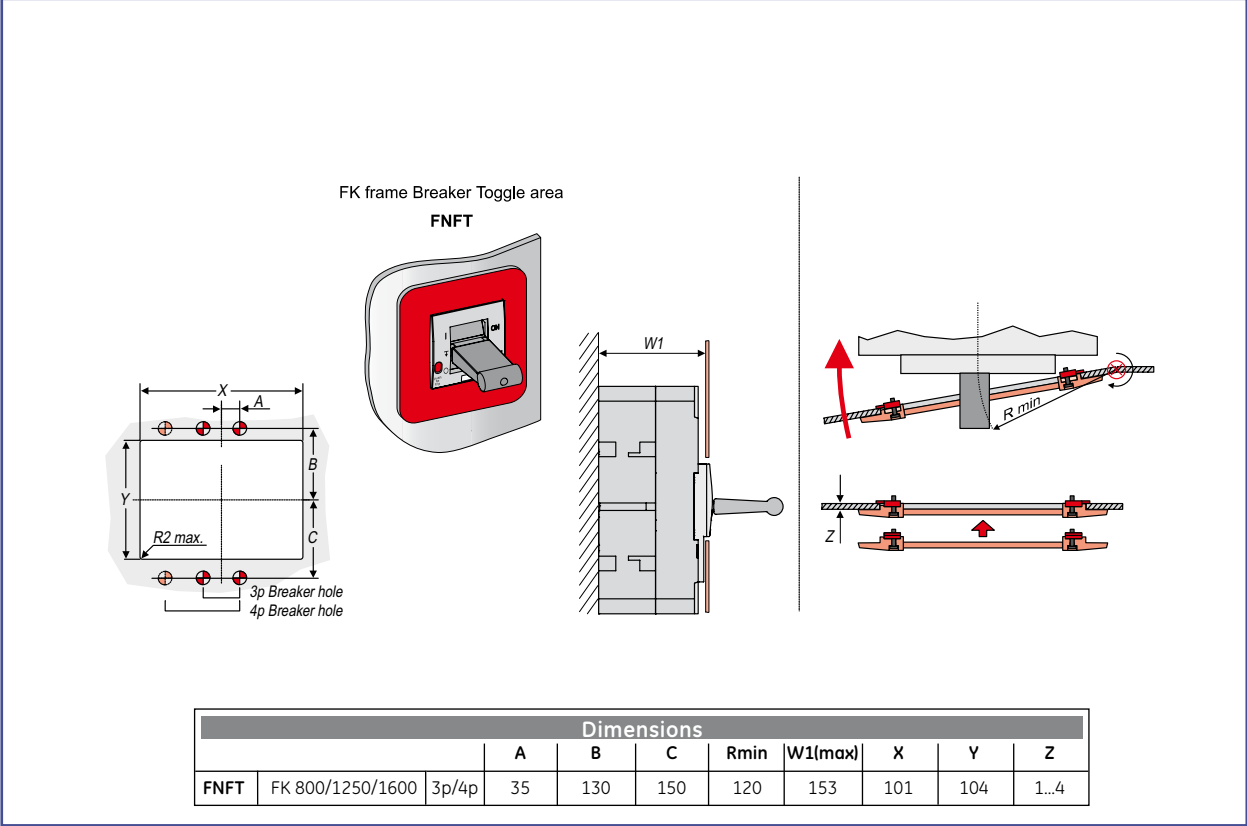


Draw-out version - FK800/1250/1600 - Panel/Door cut-out and distance

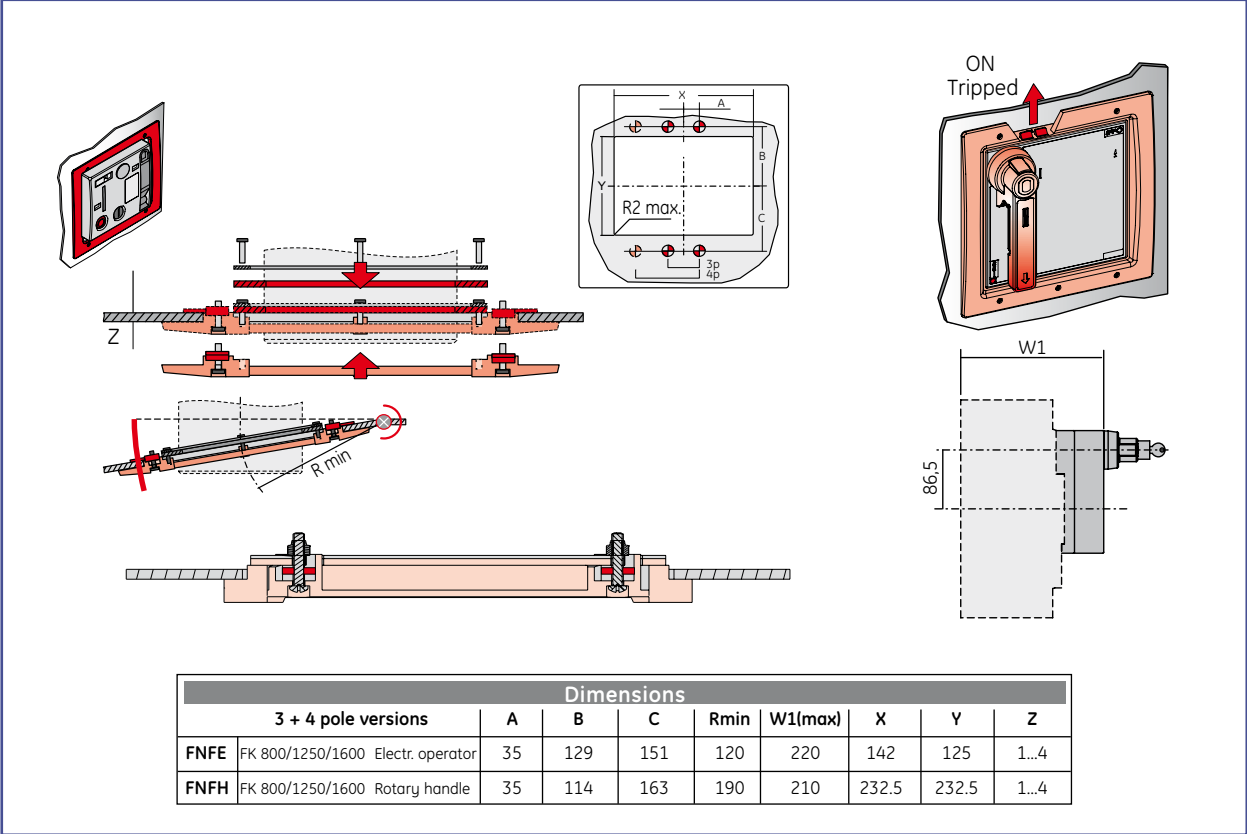


Dimensional Drawings

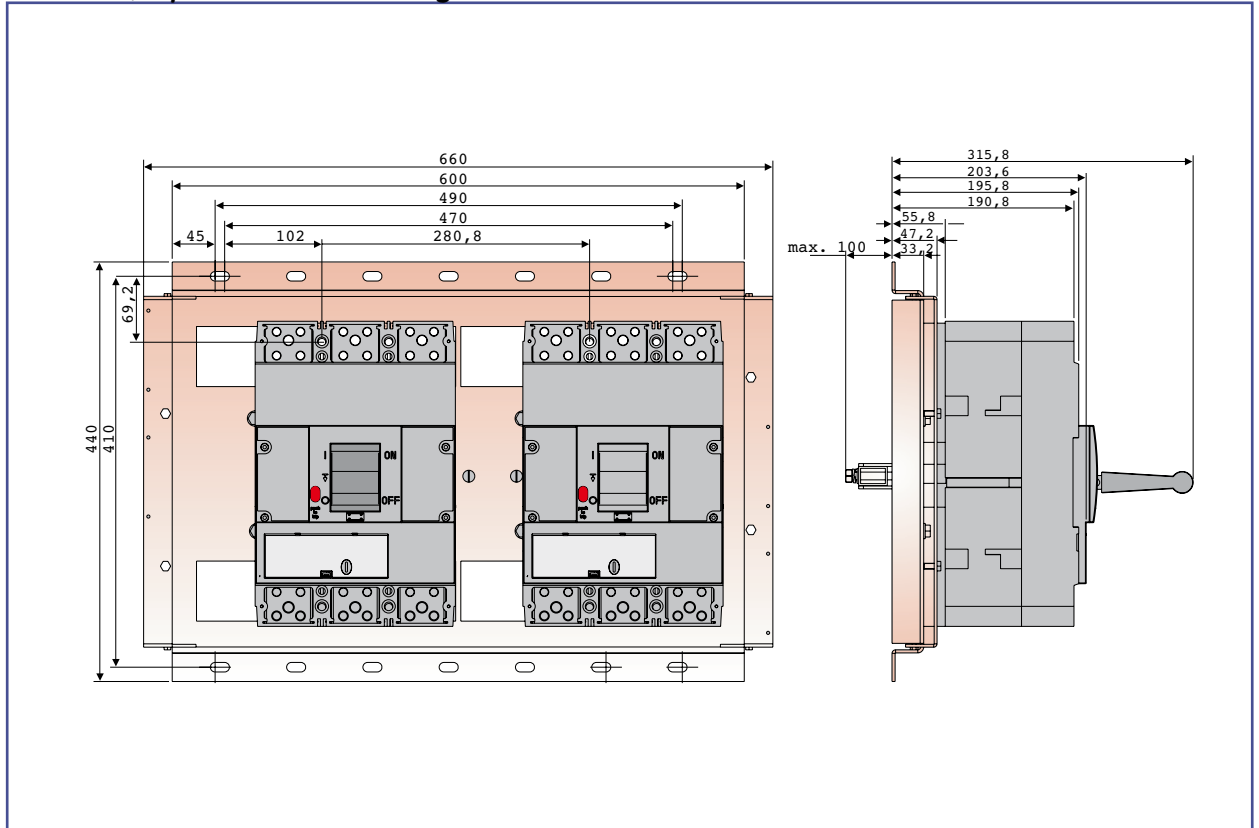
Door flanges - FK800/1250/1600



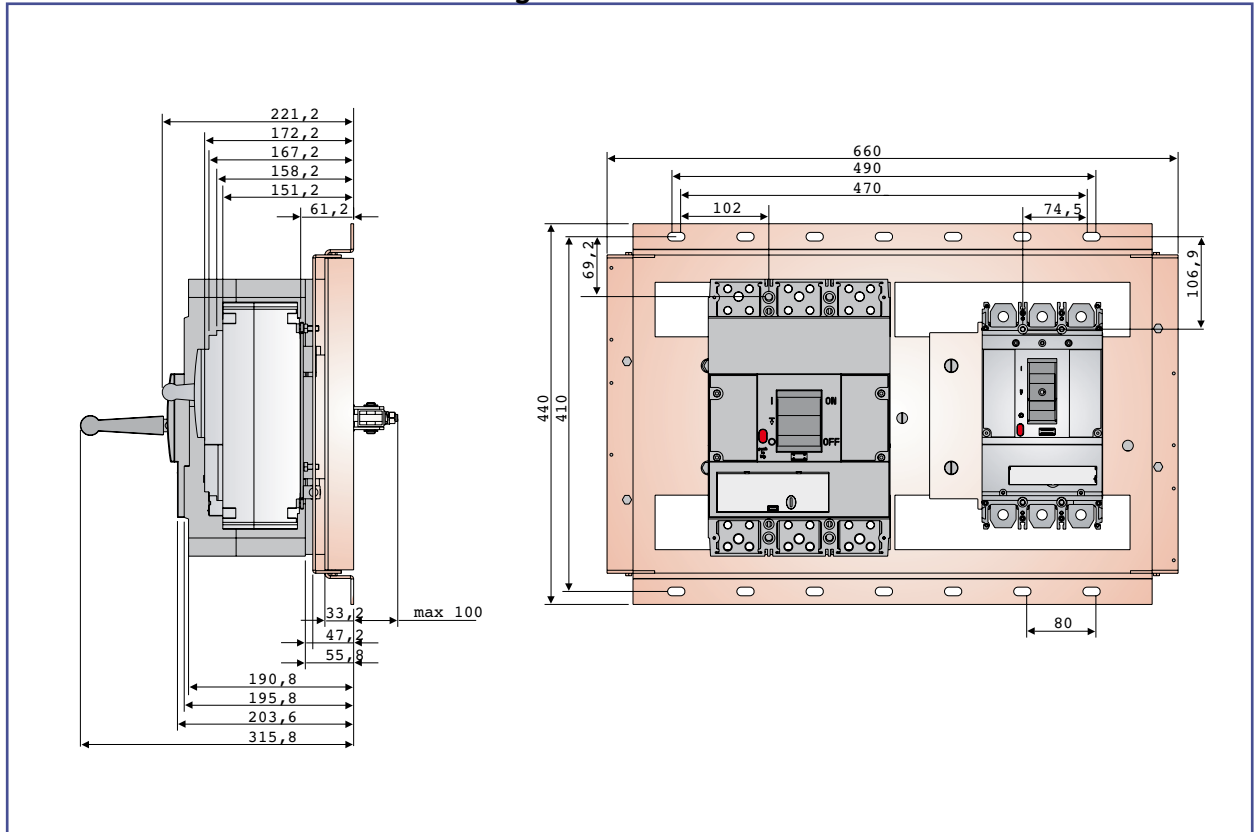
Door flanges - FK800/1250/1600



FK frame, 2 pieces mechanically interlocked

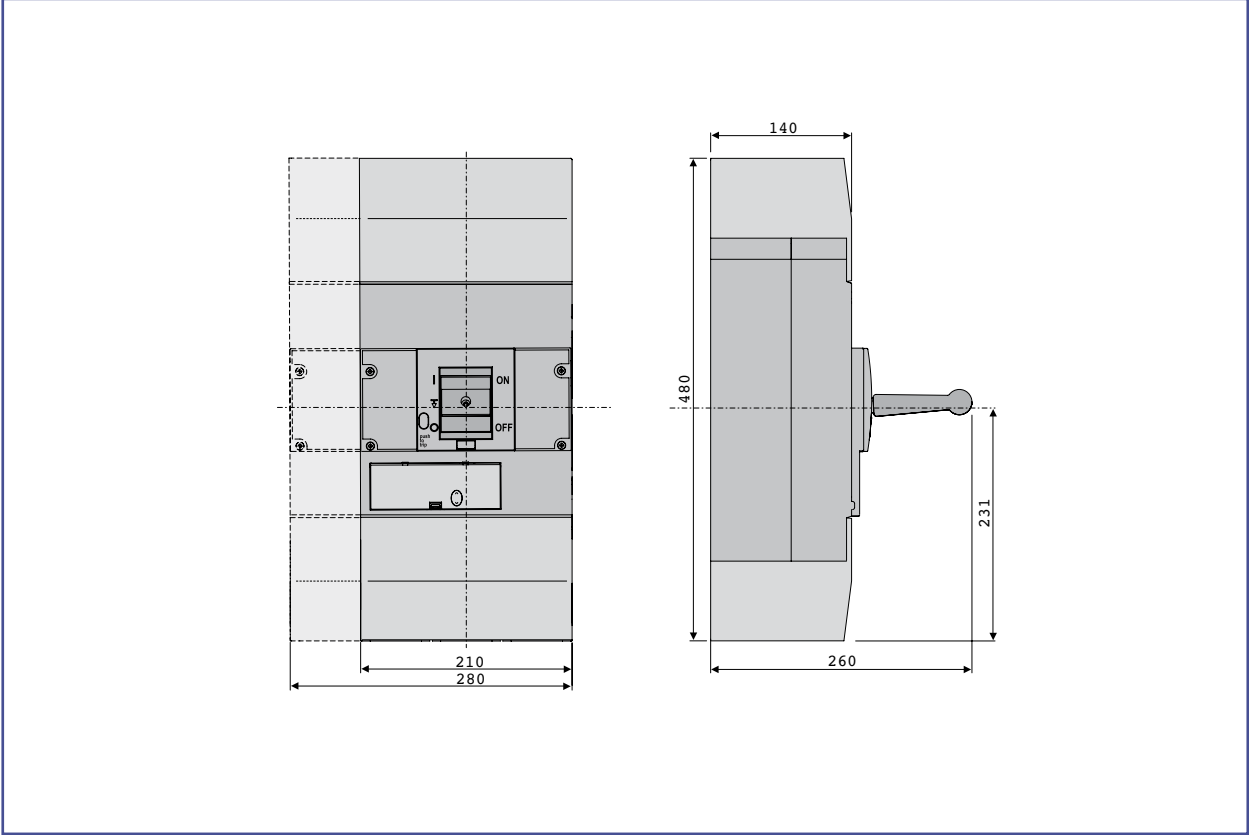


FK frame and FG frame. mechanically interlocked



Dimensional Drawings

Breaker with long terminal shields - FK800/1250/1600



FK frame

Intro

A

B

C

D

E

F

G

X



Connectivity 60 mm system - FD and FE frame 3 pole

Dimensions

Intro

A

B

C

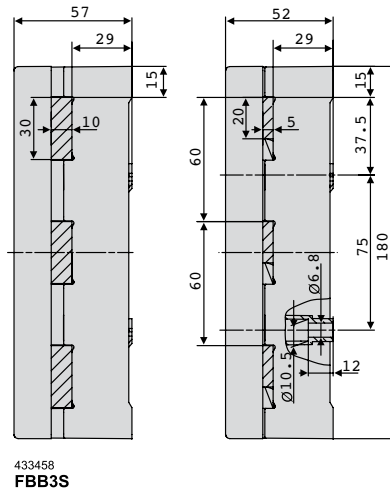
D

E

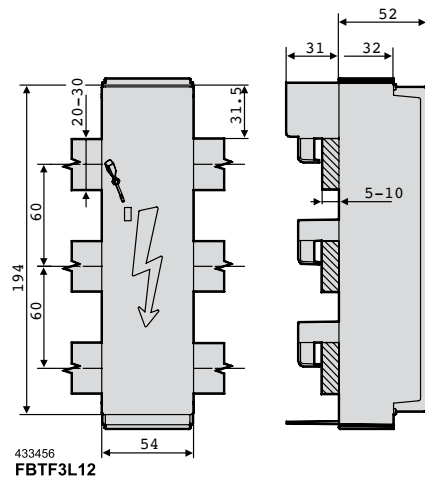
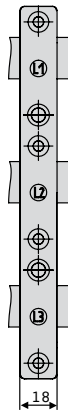
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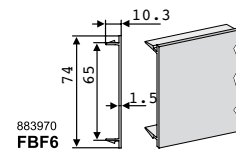
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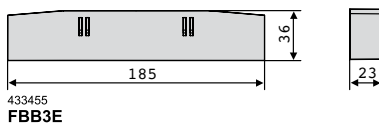
433458
FBB3S



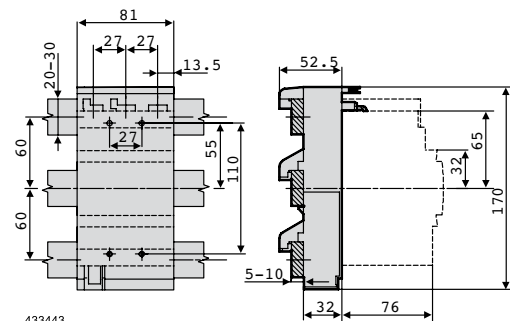
433456
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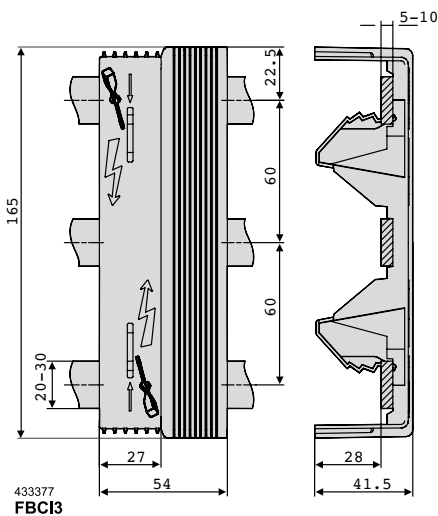
883970
FBF6



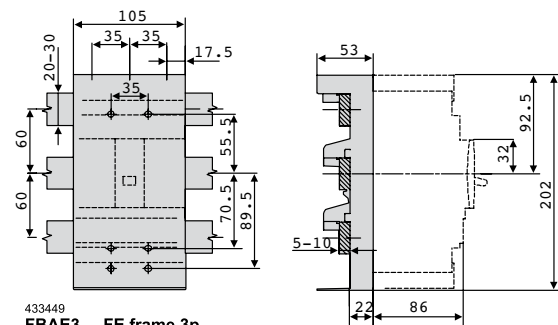
433455
FBB3E



433443
FBAD3 FD frame 3p



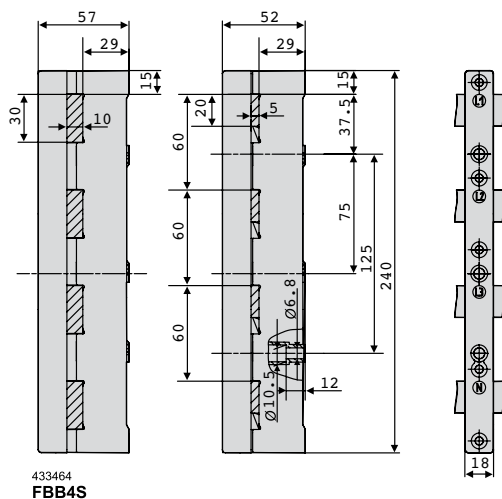
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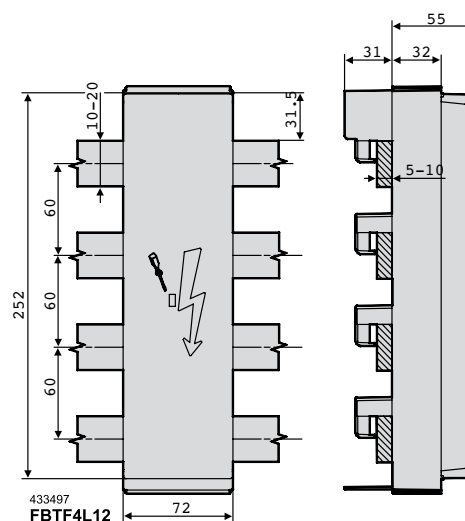
433449
FBAE3 FE frame 3p

Dimensional Drawings

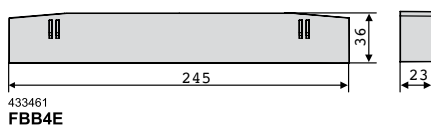
Connectivity 60 mm system - FD and FE frame 4 pole



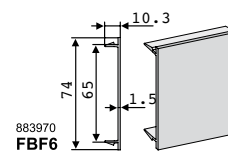
433464
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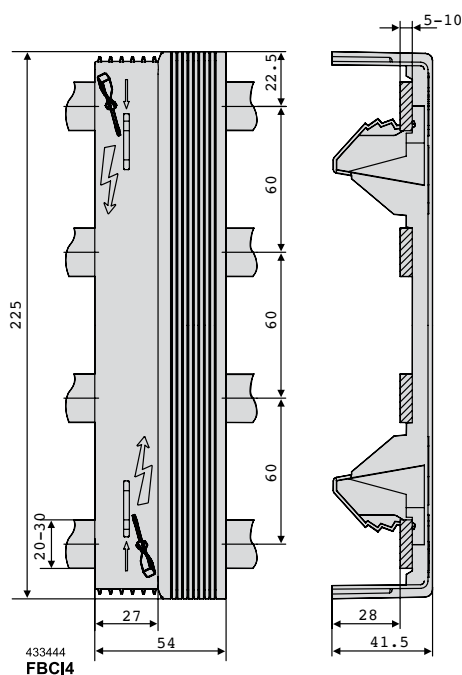
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FBT4L12



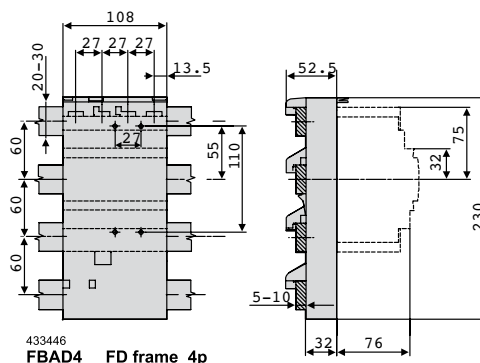
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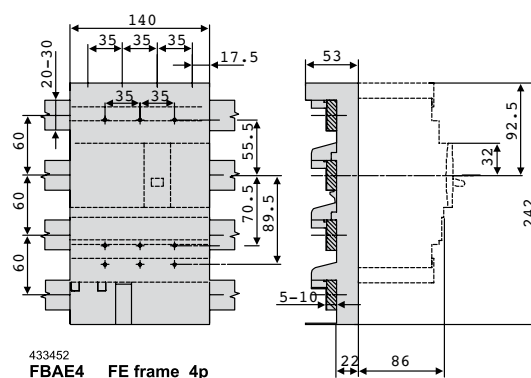
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FBF6



433444
FBC14



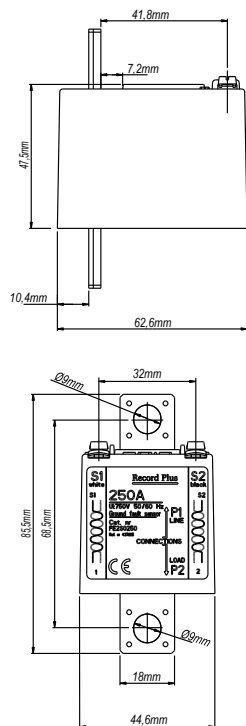
433446
FBAD4 FD frame 4p



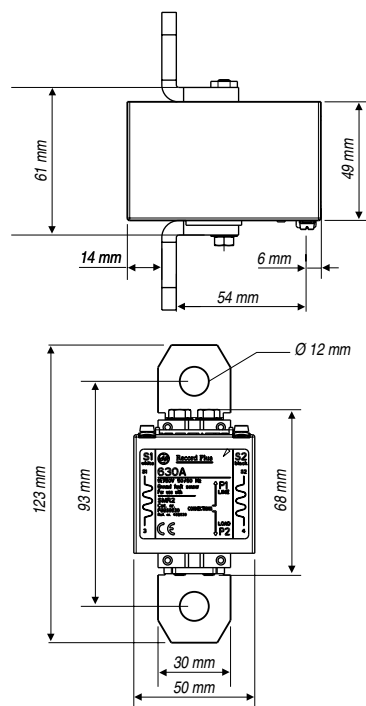
433452
FB4E4 FE frame 4p

FE and FG frame, external groundfault sensors

FE type

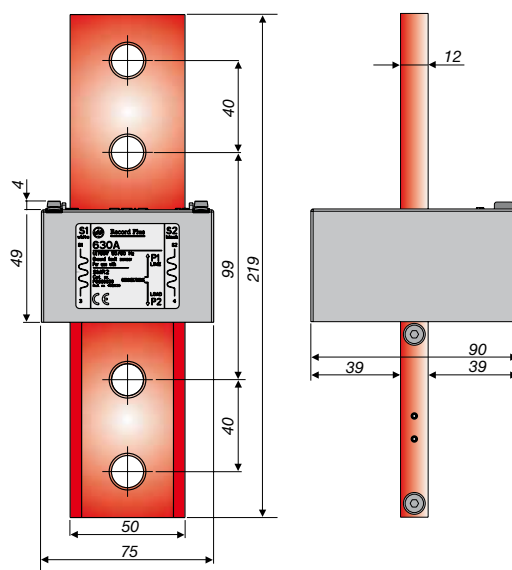


FG type



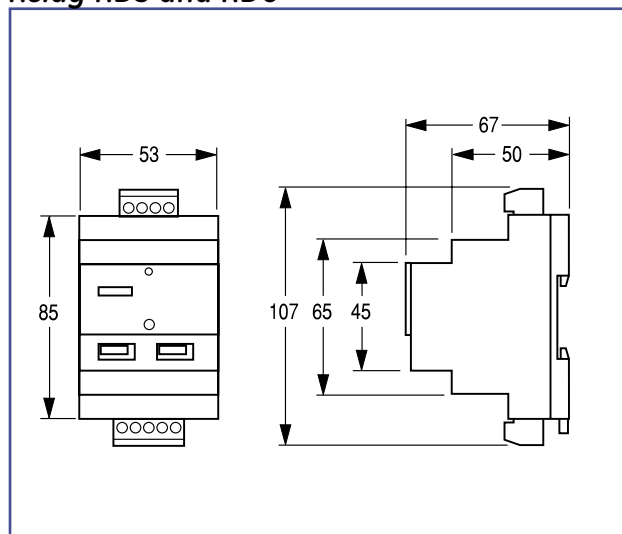
FK frame, external groundfault sensor

FK type

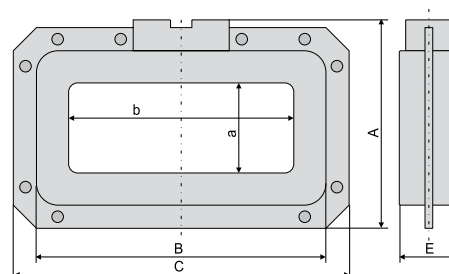


Dimensional Drawings

Relay RD5 and RD6

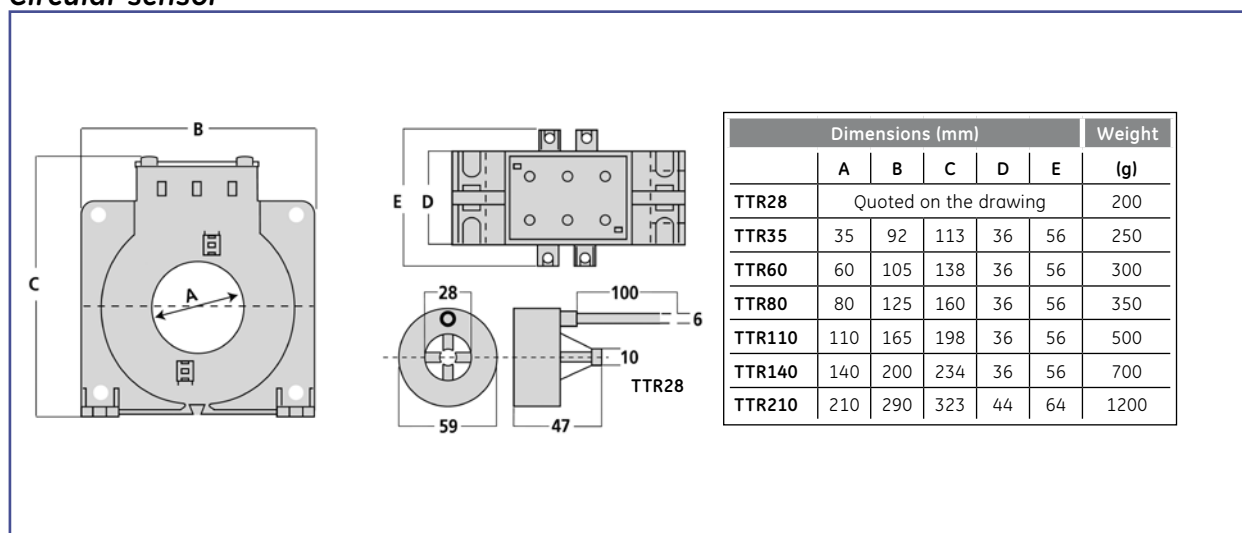


Rectangular sensor



Dimensions (mm)					
	a x b	A	B	C	E
BTR 175	70x175	162	225	261	46
BTR 305	115x305	226	360	402	55
BTR 350	130x350	271	415	460	55

Circular sensor



Dimensions (mm)						Weight
	A	B	C	D	E	(g)
TTR28	Quoted on the drawing					200
TTR35	35	92	113	36	56	250
TTR60	60	105	138	36	56	300
TTR80	80	125	160	36	56	350
TTR110	110	165	198	36	56	500
TTR140	140	200	234	36	56	700
TTR210	210	290	323	44	64	1200

- X.2 By reference number
- X.7 By catalogue number

The breaker	Intro
Order codes	A
Trip units	B
Components and accessories	C
Technical data	D
Application guide	E
Wiring diagrams	F
Dimensions	G
Numerical Index	X



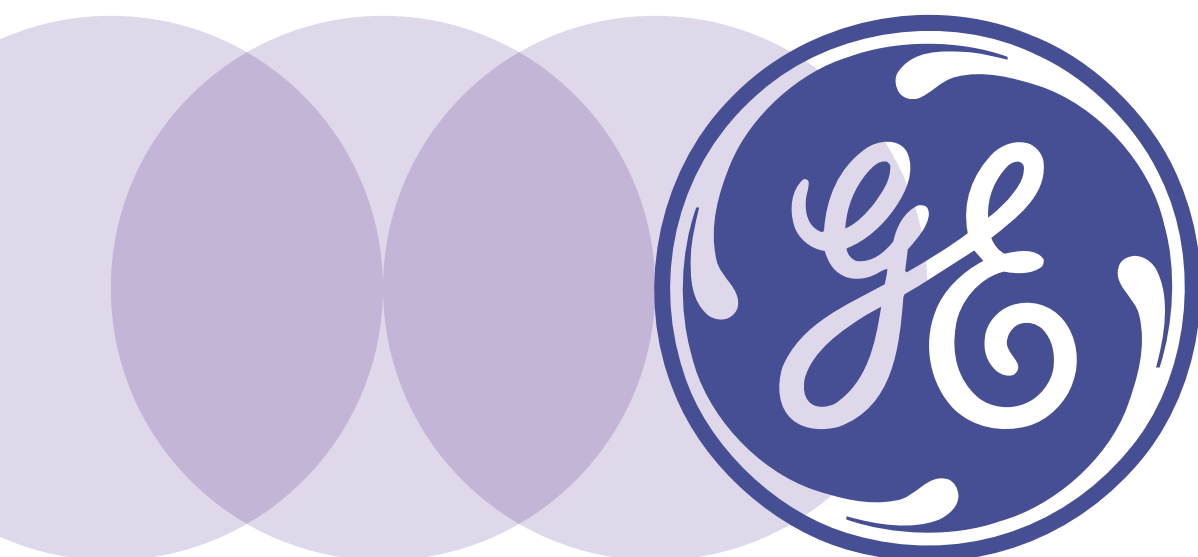
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430000			430101	FDN36TD020ED	A.6	430482	FDH46TG100GD	A.7	430846	FASHTF	A.9	431153	FGH406F400NF	A.51
430001	FDE36TC016EF	A.5	430102	FDN36TD025ED	A.6	430485	FDH46TG125GD	A.7	430847	FDN36TSD125GD	A.8	431156	FGH406F630NF	A.51
430002	FDE36TC020EF	A.5	430103	FDN36TD032ED	A.6	430498	FDL36MC080GD	A.7	430848	FDN36TSD160GD	A.8	431159	FEQDB4M/J/6	A.19
430003	FDE36TC025EF	A.5	430104	FDN36TD040ED	A.6	430501	FDL36MC100GD	A.7	430849	FASHTJ	A.9	431161	FEQDB4M/K/6	A.19
430004	FDE36TC032EF	A.5	430105	FDN36TD050ED	A.6	430504	FA1BR3	A.9	430850	FDH36TSD016ED	A.8	431165	FEH36TA080JF	A.13
430005	FDE36TC040EF	A.5	430106	FDN36TD063ED	A.6	430505	FA1BR4	A.9	430851	FDH36TSD020ED	A.8	431171	FEH36TA100JF	A.13
430006	FDE36TC050EF	A.5	430107	FDN36TG025ED	A.7	430506	FA1BR5	A.9	430852	FASHTN	A.9	431172	FGQDB3M/6	A.30
430007	FDE36TC063EF	A.5	430108	FDN36TG032ED	A.7	430507	FA1BR6	A.9	430853	FDH36TSD025ED	A.8	431177	FEH36TA125JF	A.13
430008	FDE46TC016EF	A.5	430109	FDN36TG040ED	A.7	430518	FDL36TD080GD	A.6	430854	FDH36TSD032ED	A.8	431181	FGQDB4M/6	A.30
430009	FDE46TC020EF	A.5	430110	FDN36TG050ED	A.7	430521	FDL36TD100GD	A.6	430855	FASHTU	A.9	431183	FEH36TA160JF	A.13
430010	FDE46TC025EF	A.5	430111	FDN36TG063ED	A.7	430524	FDL36TD125GD	A.6	430857	FDH36TSD040ED	A.8	431213	FEH406F160JF	A.48
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430012	FDE46TC040EF	A.5	430113	FDN436MC012ED	A.7	430540	FDL436MC100GD	A.7	430861	FAUVRD	A.9	431219	FEV36TSA125KF	A.18
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430060	FDH46TG040ED	A.7	430230	FDS46TD032ED	A.6	430805	FDY306D160GD	A.7	430971	FNDR4	A.9	431509	FEL406F250KF	A.49
430061	FDH46TG050ED	A.7	430232	FDS46TD040ED	A.6	430810	FY406D160GD	A.7	430986	FNDR	A.9	431545	FEL436TA080JF	A.13

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431802	FEN406F250KF	A.49	432269	FEH456TD250KF	A.16	432729	FETTG43K0160	A.49	433219	FETTD43K0160	A.49	433584	FDN456TD160GD	A.6
431838	FEN436TA080JF	A.13	432287	FEH46TD100JF	A.13	432732	FETTG43K0200	A.49	433222	FETTD43K0200	A.49	433587	FDN456TG160GD	A.7
431842	FEDFQ4	A.20	432296	FEH46TD125JF	A.13	432735	FETTG43K0250	A.49	433225	FETTD43K0250	A.49	433590	FDN46TD160GD	A.6
431844	FEN436TA100JF	A.13	432300	FEH46TD125KF	A.16	432741	FETTG45J0125	A.48	433231	FETTD45J0100	A.48	433593	FDN46TG160GD	A.7
431850	FEN436TA125JF	A.13	432303	FEH46TD160JF	A.13	432744	FETTG45J0160	A.48	433234	FETTD45J0125	A.48	433599	FDN66TD160GD	A.6
431856	FEN436TA160JF	A.13	432307	FEH46TD160KF	A.16	432747	FEL456TD125JF	A.13	433239	FETTD45J0160	A.48	433602	FDS36TD160GD	A.6
431870	FGGS0250	A.33	432311	FEH46TD200KF	A.16	432753	FETTG45K0160	A.49	433246	FDH13TF016EF	A.6	433604	FDS46TD160GD	A.6
431886	FEN456TA080JF	A.13	432316	FEH46TD250KF	A.16	432756	FETTG45K0200	A.49	433252	FETTD45K0125	A.49	433649	FDE36TE016ED	A.5
431892	FEN456TA100JF	A.13	432332	FEL36TD100JF	A.13	432759	FETTG45K0250	A.49	433255	FDH13TF020EF	A.6	433651	FDE36TE020ED	A.5
431898	FEN456TA125JF	A.13	432341	FEL36TD125JF	A.13	432774	FETTG4J0125	A.48	433257	FETTD45K0160	A.49	433653	FDE36TE025ED	A.5
431904	FEN456TA160JF	A.13	432344	FEL36TD125KF	A.16	432777	FETTG4J0160	A.48	433260	FETTD45K0200	A.49	433655	FDE36TE032ED	A.5
431949	FEN46TA080JF	A.13	432349	FEL36TD160JF	A.13	432780	FEL456TD125KF	A.16	433262	FDH13TF025EF	A.6	433657	FDE36TE040ED	A.5
431955	FEN46TA100JF	A.13	432353	FEL36TD160KF	A.16	432786	FETTG4K0160	A.49	433263	FETTD45K0250	A.49	433659	FDE36TE050ED	A.5
431960	FAUVRB	A.9	432357	FEL36TD200KF	A.16	432789	FETTG4K0200	A.49	433268	FDH13TF032EF	A.6	433661	FDE36TE063ED	A.5
431961	FEN46TA125JF	A.13	432361	FEL36TD250KF	A.16	432792	FETTG4K0250	A.49	433269	FETTD4J0100	A.48	433663	FDE36TE080GD	A.5
431965	FEH36TD160JF	A.13	432374	FEL436TD100JF	A.13	432796	FGDMP3	A.31	433272	FETTD4J0125	A.48	433665	FDE36TE100GD	A.5
431967	FEN46TA160JF	A.13	432391	FETTA43J0025	A.48	432799	FGDMP4	A.31	433274	FDH13TF040EF	A.6	433667	FDE36TE125GD	A.5
431980	FEH36TD160KF	A.16	432394	FETTA43J0032	A.48	432811	FGEMF8	A.30	433275	FETTD4J0160	A.48	433669	FDE36TE160GD	A.5
431981	FGBS53	A.32	432397	FETTA43J0040	A.48	432817	FGEMF8	A.30	433280	FDH13TF050EF	A.6	433697	FDE46TE016ED	A.5
431982	FGBS54	A.32	432400	FETTA43J0050	A.48	432820	FGEMFF	A.30	433284	FETTD4K0125	A.49	433699	FDE46TE020ED	A.5
431983	FGDFF3	A.31	432403	FETTA43J0063	A.48	432823	FGEMFH	A.30	433286	FDH13TF063EF	A.6	433701	FDE46TE025ED	A.5
431986	FGDFF4	A.31	432406	FETTA43J0080	A.48	432826	FGEMFJ	A.30	433287	FETTD4K0160	A.49	433703	FDE46TE032ED	A.5
431988	FEY306D160JF	A.14	432409	FETTA43J0100	A.48	432829	FGEMFN	A.30	433290	FETTD4K0200	A.49	433705	FDE46TE040ED	A.5
431991	FEY306D250KF	A.18	432412	FETTA43J0125	A.48	432834	FEL456TD160JF	A.13	433292	FDH13TF080GF	A.6	433707	FDE46TE050ED	A.5
431994	FEY406D160JF	A.14	432416	FEV36TA125KF	A.16	432836	FGFT	A.33	433293	FETTD4K0250	A.49	433709	FDE46TE063ED	A.5
431997	FEY406D250KF	A.18	432480	FETD30J0160	A.48	432838	FGGS0400	A.33	433296	FETTG3J0100	A.48	433711	FDE46TE080GD	A.5
432000	FABAM01	A.19	432483	FETD30K0250	A.49	432839	FGGS0630	A.33	433298	FDH13TF100GF	A.6	433713	FDE46TE100GD	A.5
432003	FABAM10	A.19	432486	FETD40J0160	A.48	432840	FGJB	A.33	433304	FDH13TF125GF	A.6	433715	FDE46TE125GD	A.5
432010	FDFF	A.11	432489	FETD40K0250	A.49	432843	FEL456TD160KF	A.16	433310	FDH13TF160GF	A.6	433717	FDE46TE160GD	A.5
432011	FE18PE	A.19	432501	FETMC3J0050	A.48	432846	FGJM3	A.33	433311	FETTG43J0100	A.48	433864	FDC35TF025EF	A.5
432012	FE18RE	A.19	432504	FETMC3J0100	A.48	432849	FGJM4	A.33	433316	FDN13TF016EF	A.6	433867	FDC35TF032EF	A.5
432017	FE1PF	A.22	432510	FETMC3J0160	A.48	432852	FGJP	A.33	433322	FDN13TF020EF	A.6	433870	FDC35TF040EF	A.5
432018	FEBE43	A.21	432513	FETMC3K0160	A.49	432855	FGJS3	A.33	433326	FETTG45J0100	A.48	433873	FDC35TF050EF	A.5
432019	FEBE44	A.21	432516	FETMC3K0250	A.49	432858	FGJS4	A.33	433328	FDN13TF025EF	A.6	433876	FDC35TF063EF	A.5
432020	FEBE93	A.21	432528	FETMC43J0050	A.48	432861	FGJW3	A.33	433332	FETTG4J0100	A.48	433879	FDC35TF080GF	A.5
432021	FEBE94	A.21	432531	FETMC43J0100	A.48	432864	FGJW4	A.33	433334	FDN13TF032EF	A.6	433882	FDC35TF100GF	A.5
432022	FEBEA3	A.21	432537	FETMC43J0160	A.48	432867	FGNFT	A.30	433340	FDN13TF040EF	A.6	433885	FDC35TF125GF	A.5
432023	FEBEA4	A.21	432538	FEWB3	A.20	432868	FEL456TD200KF	A.16	433346	FDN13TF050EF	A.6	433892	FGNRW	A.30
432024	FEBEH3	A.21	432540	FETMC43K0160	A.49	432871	FEL456TD250KF	A.16	433352	FDN13TF063EF	A.6	433899	FDC35TF160GF	A.5
432025	FEBEH4	A.21	432543	FETMC43K0250	A.49	432907	FEL46TD100JF	A.13	433357	FDBRCL2	A.10	433907	FDC35TE016ED	A.5
432026	FEBES3	A.21	432544	FEWB4	A.20	432908	FGUA3	A.33	433358	FDBRCS2	A.10	433911	FDC35TE020ED	A.5
432027	FEBES4	A.21	432546	FETTA3J0025	A.48	432909	FGUA4	A.33	433377	FBCI3	A.43	433914	FDC35TE025ED	A.5
432028	FEBRC3	A.21	432549	FETTA3J0032	A.48	432921	FEL46TD125JF	A.13	433400	FDTC1316	A.10	433918	FDC35TE032ED	A.5
432029	FEBRC4	A.21	432550	FGWB3	A.31	432924	FEL46TD125KF	A.16	433401	FDTC1416	A.10	433924	FDC35TE125GD	A.5
432032	FEBS3	A.21	432552	FETTA3J0040	A.48	432927	FEL46TD160JF	A.13	433412	FGTCA230B	A.32	433925	FDC35TE160GD	A.5
432033	FEBS4	A.21	432555	FETTA3J0050	A.48	432930	FEL46TD160KF	A.16	433413	FGTCA240B	A.32	433926	FDC45TF016EF	A.5
432034	FEDDF3	A.20	432556	FGWB4	A.31	432933	FEL46TD200KF	A.16	433415	FN18RY1	A.39	433928	FDC45TF020EF	A.5
432037	FEDDF4	A.20	432558	FETTA3J0063	A.48	432936	FEL46TD250KF	A.16	433416	FN1I2F	A.45	433930	FDC45TF025EF	A.5
432040	FEDFF3	A.20	432561	FETTA3J0080	A.48	432945	FEN36TD100JF	A.13	433417	FN1PR	A.40	433932	FDC45TF032EF	A.5
432043	FEDFF4	A.20	432564	FETTA3J0100	A.48	432952	FDS36TD063ED	A.6	433419	FNGS0800	A.40	433934	FDC45TF040EF	A.5
432046	FEDMP3	A.20	432567	FETTA3J0125	A.48	432953	FEN36TD125JF	A.13	433420	FNBS3R	A.39	433936	FDC45TF050EF	A.5
432049	FEDMP4	A.20	432570	FETTA3J0160	A.48	432955	FDS36TD080GD	A.6	433421	FNGS1000	A.40	433938	FDC45TF063EF	A.5
432052	FEEMFD	A.19	432573	FEL436TD125JF	A.13	432958	FDS36TD100GD	A.6	433422	FNBS4R	A.39	433940	FDC45TF080GF	A.5
432055	FEEMFF	A.19	432576	FEL436TD125KF	A.16	432961	FDS36TD125GD	A.6	433423	FNBR3	A.39	433942	FDC45TF100GF	A.5
432058	FEEMFH	A.19	432580	FEWT	A.20	432962	FEN36TD125KF	A.16	433425	FNBR4	A.39	433944	FDC45TF125GF	A.5
432061	FEEMFJ	A.19	432582	FETTA43J0160	A.48	432964	FDS46TD063ED	A.6	433426	FNBRCS3	A.39	433946	FDC45TF160GF	A.5
432064	FEEMFN	A.19	432583	FEWM	A.20	432967	FDS46TD080GD	A.6	433427	FNBRCS4	A.39	433948	FDC45TE016ED	A.5
432067	FEFF3	A.22	432585	FEL436TD160JF	A.13	432970	FDS46TD100GD	A.6	433434	FNWS3WP	A.39	433949	FDC45TE020ED	A.5
432068	FEFF4	A.22	432586	FEWN	A.20	432971	FEN36TD160JF	A.13	433436	FNWS3AP	A.39	433950	FDC45TE025ED	A.5
432071	FEFT	A.22	432588	FEL436TD160KF	A.16	432973	FDS46TD125GD	A.6	433438	FNCA4327	A.39	433951	FDC45TE032ED	A.5
432073	FEJB	A.22	432589	FEWA2	A.20	432976	FEN36TD160KF	A.16	433439	FNCA4427	A.39	433952	FDC45TE040ED	A.5
432076	FEH36TD200KF	A.16	432592	FGWT	A.31	432979	FEN36TD200KF	A.16	433440	FNWS4AP	A.39	433953	FDC45TE050ED	A.5
432079	FEJL3	A.22	432595	FGWM	A.31	432982	FEN36TD250KF	A.16	433442	FNWS4WT	A.39	433954	FDC45TE063ED	A.5
432082	FEJL4	A.22	432598	FGWN	A.31	432994								

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434481	FGR45LKO250 / 7	A.26	434976	FEL36TA040JF	A.13	435214	FEN46TA025JF	A.13	435542	FKH436NM800PF	A.35	435944	FEL436TG100JF	A.13
434482	FGR45LLO400 / 7	A.26	434977	FGH456VA630NNF	A.28	435217	FEN46TA032JF	A.13	435543	FKL436NM800PF	A.35	435947	FEL436TG125JF	A.13
434483	FGN36KA350LLF	A.26	434979	FEL36TA050JF	A.13	435220	FEN46TA040JF	A.13	435545	FKL36NE100SQF	A.36	435950	FEL436TG160JF	A.13
434492	FGR45LLO250 / 7	A.28	434982	FEL36TA063JF	A.13	435223	FEN46TA050JF	A.13	435546	FKL36NE125SSF	A.36	435953	FEL436TG160KF	A.16
434493	FGR45LLO400 / 7	A.28	434983	FGH46VA400LLF	A.26	435226	FEN46TA063JF	A.13	435547	FKL46NE100SQF	A.36	435956	FEL436TG200KF	A.16
434496	FGR45LLO400 / 7	A.28	434994	FEL436MC050JF	A.14	435229	FDE46TF020EF	A.5	435549	FKL46NE125SSF	A.36	435959	FEL436TG250KF	A.16
434502	FGR45LLO500 / 7	A.28	434997	FEL436MC100JF	A.14	435231	FDE46TF025EF	A.5	435550	FKN36NT100SF	A.36	435962	FEL456TG100JF	A.13
434510	FGN46KA350LLF	A.26	435003	FGH46VA630NNF	A.28	435238	FDE46TF032EF	A.5	435551	FKN36NT125SF	A.36	435965	FEL456TG125JF	A.13
434532	FGR45LLO630 / 7	A.28	435004	FEL436MC160JF	A.14	435240	FDE46TF040EF	A.5	435553	FKH36NT100SF	A.36	435968	FEL456TG160JF	A.13
434559	FGR45LLO160 / 7	A.26	435005	FKV36NT800PF	A.35	435242	FDE46TF050EF	A.5	435554	FKH36NT125SF	A.36	435971	FEL456TG160KF	A.16
434562	FGR45LLO250 / 7	A.26	435007	FEL436MC160KF	A.16	435244	FDE46TF063EF	A.5	435555	FKL36NT100SF	A.36	435974	FEL456TG200KF	A.16
434568	FGR45LLO250 / 7	A.26	435010	FEL436MC250KF	A.16	435246	FDE46TF080GF	A.5	435557	FKL36NT125SF	A.36	435977	FEL456TG250KF	A.16
434579	FGR45LLO250 / 7	A.26	435013	FEL436TA025JF	A.13	435248	FDE46TF100GF	A.5	435558	FKH36NM125SF	A.36	435992	FEL46TG100JF	A.13
434581	FGR45LLO400 / 7	A.28	435016	FEL436TA032JF	A.13	435250	FEN46TG100JF	A.13	435559	FKH36NM125SF	A.36	435995	FEL46TG125JF	A.13
434582	FGR45LLO350 / 7	A.26	435019	FEL436TA040JF	A.13	435253	FEN46TG125JF	A.13	435561	FKL36NM125SF	A.36	436002	FEL46TG160JF	A.13
434584	FGR45LLO400 / 7	A.26	435022	FEL436TA050JF	A.13	435256	FDE46TF125GF	A.5	435562	FKN436NT100SF	A.36	436005	FEL46TG160KF	A.16
434588	FGR45LLO250 / 7	A.28	435025	FEL436TA063JF	A.13	435258	FDE46TF160GF	A.5	435563	FKH436NT125SF	A.36	436008	FEL46TG200KF	A.16
434590	FGR45LLO400 / 7	A.28	435028	FKV36NT100SF	A.36	435259	FEN46TG160JF	A.13	435565	FKH436NT100SF	A.36	436011	FEL46TG250KF	A.16
434592	FGR45LLO250 / 7	A.28	435030	FKV36NT125SF	A.36	435262	FEN46TG160KF	A.16	435566	FKH436NT125SF	A.36	436014	FEN436TG100JF	A.13
434594	FGR45LLO400 / 7	A.28	435032	FKV36NE160TTF	A.37	435265	FEN46TG200KF	A.16	435567	FKL436NT100SF	A.36	436015	FEN436TG125JF	A.13
434596	FGR45LLO350 / 7	A.26	435035	FKV36NE125SSF	A.36	435268	FEN46TG250KF	A.16	435569	FKL436NT125SF	A.36	436016	FEN436TG160JF	A.13
434597	FGR45LLO500 / 7	A.28	435037	FEL456TA063JF	A.13	435273	FKY406DN100SF	A.37	435570	FKN436NM125SF	A.36	436017	FEL456TG160KF	A.16
434599	FGR45LLO250 / 7	A.26	435040	FKV36NE100SQF	A.36	435276	FKH36NE125SSF	A.36	435571	FKH436NM125SF	A.36	436018	FEN436TG200KF	A.16
434601	FGR45LLO350 / 7	A.26	435041	FKV36NE800PPF	A.35	435279	FKH36NE160TTF	A.37	435573	FKL436NM125SF	A.36	436019	FEN436TG250KF	A.16
434605	FGR43NN0400 / 7	A.28	435042	FKV46NE800PPF	A.35	435282	FKL46NE800PPF	A.35	435574	FN1BRV2	A.39	436020	FEN456TG100JF	A.13
434606	FGH36KA500NNF	A.28	435049	FEL46TA025JF	A.13	435285	FKH36NE800PPF	A.35	435575	FN1BRW1	A.39	436021	FEN456TG125JF	A.13
434607	FGR43NN0500 / 7	A.28	435052	FEL46TA032JF	A.13	435288	FKH36NE100SQF	A.36	435577	FN1BRW2	A.39	436022	FEN456TG160JF	A.13
434615	FGR43LKO250 / 7	A.26	435055	FEL46TA040JF	A.13	435294	FKH36NG125SSF	A.36	435578	FNFW	A.39	436023	FEN456TG160KF	A.16
434617	FGR43LLO400 / 7	A.26	435058	FEL46TA050JF	A.13	435297	FKH36NG160TTF	A.37	435579	FN1BPE	A.38	436024	FEN456TG200KF	A.16
434622	FGR43LLO630 / 7	A.28	435061	FEL46TA063JF	A.13	435300	FKN436NT800PF	A.35	435579	FN1BRE	A.38	436025	FEN456TG250KF	A.16
434624	FGR45LLO630 / 7	A.28	435064	FKV46NT800PF	A.35	435303	FKH36NG800PPF	A.35	435592	FN1BHT	A.38	436026	FEN456TG100JF	A.13
434633	FGH46KA500NNF	A.28	435065	FGL36VA400LLF	A.26	435306	FKH36NG100SQF	A.36	435593	FN1BHT	A.38	436027	FEN456TG125JF	A.13
434651	FGL36KA500NNF	A.28	435066	FKV46NE100SQF	A.36	435312	FKH36NS125SSF	A.36	435594	FN1BHT	A.38	436028	FEN456TG160JF	A.13
434735	FGNRE	A.30	435071	FGL36VA630NNF	A.28	435315	FKH36NS160TTF	A.37	435595	FN1BHT	A.38	436078	FETMC3J0080	A.48
434754	FEH36MC050JF	A.14	435077	FGL436VA400LLF	A.26	435318	FKH36NT800PF	A.35	435596	FN1BHT	A.38	436117	FDC35TE040ED	A.5
434757	FEH36MC100JF	A.14	435083	FKV46NE125SSF	A.36	435321	FKH36NS800PPF	A.35	435597	FN1BHT	A.38	436118	FDC35TE050ED	A.5
434763	FEH36MC160JF	A.14	435085	FEN36MC050JF	A.14	435324	FKH36NS100SQF	A.36	435598	FN1BHT	A.38	436133	FDC35TE063ED	A.5
434766	FEH36MC160KF	A.16	435086	FKV46NT100SF	A.36	435330	FKH46NE125SSF	A.36	435599	FN1BHT	A.38	436143	FDC35TE080GD	A.5
434769	FEH36MC250KF	A.16	435088	FEN36MC100JF	A.14	435333	FKH46NE160TTF	A.37	435700	FN1BHT	A.38	436144	FDC35TE100GD	A.5
434772	FEH36TA025JF	A.13	435089	FKV46NT125SF	A.36	435336	FKN36NT800PF	A.35	435701	FN1BHT	A.38	436145	FDC45TE080GD	A.5
434775	FEH36TA032JF	A.13	435091	FGL436VA630NNF	A.28	435339	FKH46NE800PPF	A.35	435702	FN1BHT	A.38	436146	FDC45TE100GD	A.5
434778	FEH36TA040JF	A.13	435092	FKV46NE160TTF	A.37	435342	FKH46NE100SQF	A.36	435706	FN1BHT	A.38	436147	FDC45TE125GD	A.5
434781	FEH36TA050JF	A.13	435094	FEN36MC160JF	A.14	435348	FKH46NG125SSF	A.36	435707	FN1BHT	A.38	436148	FDC45TE160GD	A.5
434782	FGL46KA500NNF	A.28	435095	FGL456VA400LLF	A.26	435351	FKH46NG160TTF	A.37	435708	FN1BHT	A.38	436150	FGH36KA250LKF	A.26
434784	FEH36TA063JF	A.13	435097	FEN36MC160KF	A.16	435354	FKH436NT800PF	A.35	435709	FN1BHT	A.38	436151	FGH36KA400LLF	A.26
434801	FKUE3	A.38	435100	FEN36MC250KF	A.16	435357	FKH46NG800PPF	A.35	435710	FN1BHT	A.38	436152	FGH36KA400NLF	A.28
434802	FKUE4	A.38	435103	FEN36TA025JF	A.13	435360	FKH46NG100SQF	A.36	435711	FN1BHT	A.38	436153	FGL46KA250LKF	A.26
434803	FKZD	A.40	435106	FEN36TA032JF	A.13	435366	FKH46NS125SSF	A.36	435712	FN1BHT	A.38	436154	FGL46KA400LLF	A.26
434804	FNJF	A.40	435107	FGTCA1327	A.32	435369	FKH46NS160TTF	A.37	435713	FN1BHT	A.38	436155	FGL46KA400NLF	A.28
434808	FEH36TG100JF	A.13	435109	FEN36TA040JF	A.13	435372	FKL36NT800PF	A.35	435714	FN1BHT	A.38	436156	FGN36KA400LLF	A.26
434811	FEH36TG125JF	A.13	435112	FEN36TA050JF	A.13	435375	FKH46NS800PPF	A.35	435715	FN1BHT	A.38	436157	FGN36KA400NLF	A.28
434817	FEH36TG160JF	A.13	435115	FEN36TA063JF	A.13	435378	FKH46NS100SQF	A.36	435716	FN1BHT	A.38	436158	FGN36KA630NNF	A.28
434820	FEH36TG160KF	A.16	435116	FGTCA1427	A.32	435381	FKY306DN100SF	A.37	435719	FN1BHT	A.38	436159	FGN46KA250LKF	A.26
434823	FEH36TG200KF	A.16	435118	FASHTH	A.9	435384	FKH36NE125SSF	A.36	435722	FN1BHT	A.38	436160	FGN46KA400LLF	A.26
434824	FGN36KA500NNF	A.28	435120	FAUVRH	A.9	435387	FKN36NE160TTF	A.37	435738	FN1BHT	A.38	436161	FGN46KA400NLF	A.28
434826	FEH36TG250KF	A.16	435122	FGL456VA630NNF	A.28	435390	FKL36NE800PPF	A.35	435745	FN1BHT	A.38	436166	FNTCA3327	A.39
434829	FDE36MC050JF	A.14	435127	FDE36TF016EF	A.5	435393	FKN36NE800PPF	A.35	435757	FN1BHT	A.38	436321	FNEMF/M	A.38
434832	FEH436MC100JF	A.14	435128	FGL46VA400LLF	A.26	435396	FKN36NE100SQF	A.36	435758	FN1BHT	A.38	436322	FNEMF/M	A.38
434838	FDE36MC160JF	A.14	435129	FDE36TF020EF	A.5	435402	FKN36NG125SSF	A.36	435759	FN1BHT	A.38	436323	FNEMF/M	A.38
434841	FEH436MC160KF	A.16	435130	FDE36TF025EF	A.5	435405	FKN36NG160TTF	A.37	435760	FN1BHT	A.38	436324	FNEMF/M	A.38
434844	FEH436MC250KF	A.16	435132	FDE36TF032EF	A.5	435408	FKN436NT630PF	A.35	435					

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436493	FENRD/5	A.19	437427	FEL37DD025JF	A.15	437554	FEH37DD125KF	A.17	437878	FETDN4250K	A.49	438677	FGTDN4400N	A.51
436494	FENRDV/5	A.19	437428	FEV37DD025JF	A.15	437555	FEL37DD125KF	A.17	437879	FETDD4250K	A.49	438678	FGTDD4400N	A.51
436495	FENRF/5	A.19	437429	FEN47DD025JF	A.15	437556	FEV37DD125KF	A.17	437881	FEFS0025	A.22	438680	FGTDA3630N	A.51
436496	FENRFV/5	A.19	437430	FEH47DD025JF	A.15	437557	FEN47DD125KF	A.17	437882	FEFS0063	A.22	438681	FGTDN3500N	A.51
436499	FENRX/5	A.44	437431	FEL47DD025JF	A.15	437558	FEH47DD125KF	A.17	437883	FEFS0125	A.22	438682	FGTDD3630N	A.51
436500	FENRY/5	A.19	437432	FEV47DD025JF	A.15	437559	FEL47DD125KF	A.17	437884	FEFS0160	A.22	438684	FGTDA4630N	A.51
436501	FENRVV/5	A.19	437441	FEN37DA063JF	A.14	437560	FEV47DD125KF	A.17	437885	FEFS0250	A.22	438685	FGTDN4500N	A.51
436502	FENRZ/5	A.19	437442	FEH37DA063JF	A.14	437569	FEN37DA160KF	A.17	438400	FGN37DA250LF	A.25	438686	FGTDD4630N	A.51
436503	FENRZV/5	A.19	437443	FEL37DA063JF	A.14	437570	FEH37DA160KF	A.17	438401	FGH37DA250LF	A.25			
436504	FGNRC/5	A.30	437444	FEV37DA063JF	A.14	437571	FEL37DA160KF	A.17	438402	FGL37DA250LF	A.25	456090	TTR28	A.39
436505	FGNRCV/5	A.30	437445	FEN37DN063JF	A.15	437572	FEV37DA160KF	A.17	438404	FGN37DN250LF	A.25	456091	TTR35	A.39
436506	FGNRD/5	A.30	437446	FEH37DN063JF	A.15	437573	FEN37DN160KF	A.17	438405	FGH37DN250LF	A.25	456092	TTR60	A.39
436507	FGNRDV/5	A.30	437447	FEL37DN063JF	A.15	437574	FEH37DN160KF	A.17	438406	FGL37DN250LF	A.25	456093	TTR80	A.39
436509	FGNRF/5	A.30	437448	FEV37DN063JF	A.15	437575	FEL37DN160KF	A.17	438408	FGN47DA250LF	A.25	456094	TTR110	A.39
436510	FGNRFV/5	A.30	437449	FEN47DA063JF	A.14	437576	FEV37DN160KF	A.17	438409	FGH47DA250LF	A.25	456095	TTR140	A.39
436512	FGNRX/5	A.44	437450	FEH47DA063JF	A.14	437577	FEN47DA160KF	A.17	438410	FGL47DA250LF	A.25	456096	TTR210	A.39
436513	FGNRY/5	A.30	437451	FEL47DA063JF	A.14	437578	FEH47DA160KF	A.17	438412	FGN47DN250LF	A.25	617000		
436514	FGNRYV/5	A.30	437452	FEV47DA063JF	A.14	437579	FEL47DA160KF	A.17	438413	FGH47DN250LF	A.25	617947	FDKE	A.11
436515	FGNRZ/5	A.30	437453	FEN47DN063JF	A.15	437580	FEV47DA160KF	A.17	438414	FGL47DN250LF	A.25	704000		
436516	FGNRZV/5	A.30	437454	FEH47DN063JF	A.15	437581	FEN47DN160KF	A.17	438416	FGN37DD250LF	A.25	704154	BTR 175	A.39
436517	FNNRC/5	A.38	437455	FEL47DN063JF	A.15	437582	FEH47DN160KF	A.17	438417	FGH37DD250LF	A.25	704155	BTR 305	A.39
436518	FNNRCV/5	A.38	437456	FEV47DN063JF	A.15	437583	FEL47DN160KF	A.17	438418	FGL37DD250LF	A.25	704156	BTR 350	A.39
436519	FNNRD/5	A.38	437457	FEN37DD063JF	A.15	437584	FEV47DN160KF	A.17	438420	FGN47DD250LF	A.25	704169	RD5 220	A.39
436520	FNNRDV/5	A.38	437458	FEH37DD063JF	A.15	437585	FEN37DD160KF	A.17	438421	FGH47DD250LF	A.25	704175	RD5 110	A.39
436522	FNNRF/5	A.38	437459	FEL37DD063JF	A.15	437586	FEH37DD160KF	A.17	438422	FGL47DD250LF	A.25	704176	RD5 380	A.39
436524	FNNRFV/5	A.38	437460	FEV37DD063JF	A.15	437587	FEL37DD160KF	A.17	438432	FGN37DA400LF	A.25	704177	RD6 220	A.39
436526	FNNRX/	A.44	437461	FEN47DD063JF	A.15	437588	FEV37DD160KF	A.17	438433	FGH37DA400LF	A.25	704178	RD6 110	A.39
436527	FNNRV/5	A.38	437462	FEH47DD063JF	A.15	437589	FEN47DD160KF	A.17	438434	FGL37DA400LF	A.25	704179	RD6 380	A.39
436528	FNNRVV/5	A.38	437463	FEL47DD063JF	A.15	437590	FEH47DD160KF	A.17	438436	FGN37DN400LF	A.25	872000		
436530	FNNRZ/5	A.38	437464	FEV47DD063JF	A.15	437591	FEL47DD160KF	A.17	438437	FGH37DN400LF	A.25	872224	RD1D 220	A.39
436531	FNNRZV/5	A.38	437473	FEN37DA125JF	A.14	437592	FEV47DD160KF	A.17	438438	FGL37DN400LF	A.25	872225	RD1D 110	A.39
436582	FDE36TSC016EF	A.8	437474	FEH37DA125JF	A.14	437601	FEN37DA250KF	A.17	438440	FGN47DA400LF	A.25	872226	RD1D 380	A.39
436583	FDE36TSC020EF	A.8	437475	FEL37DA125JF	A.14	437602	FEH37DA250KF	A.17	438441	FGH47DA400LF	A.25	872227	RDFR	A.39
436584	FDE36TSC025EF	A.8	437476	FEV37DA125JF	A.14	437603	FEL37DA250KF	A.17	438442	FGN47DA400LF	A.25			
436588	FDE36TSC032EF	A.8	437477	FEN37DN125JF	A.15	437604	FEV37DA250KF	A.17	438444	FGN47DN400LF	A.25	880954	FETCA630A	A.21
436589	FDE36TSC040EF	A.8	437478	FEH37DN125JF	A.15	437605	FEN37DN250KF	A.17	438445	FGH47DN400LF	A.25	880955	FETCA640A	A.21
436591	FDE36TSC050EF	A.8	437479	FEL37DN125JF	A.15	437606	FEH37DN250KF	A.17	438446	FGL47DN400LF	A.25	883000		
436593	FDE36TSC063EF	A.8	437480	FEV37DN125JF	A.15	437607	FEL37DN250KF	A.17	438448	FGN37DD400LF	A.25	883970	FBF6	A.10
436594	FDE36TSC080GF	A.8	437481	FEN47DA125JF	A.14	437608	FEV37DN250KF	A.17	438449	FGH37DD400LF	A.25			
436595	FDE36TSC100GF	A.8	437482	FEH47DA125JF	A.14	437609	FEN47DA250KF	A.17	438450	FGL37DD400LF	A.25			
436596	FDE36TSC125GF	A.8	437483	FEL47DA125JF	A.14	437610	FEH47DA250KF	A.17	438452	FGN47DD400LF	A.25			
436600	FDE36TSC160GF	A.8	437484	FEV47DA125JF	A.14	437611	FEL47DA250KF	A.17	438453	FGH47DD400LF	A.25			
436651	FNTCA3427	A.39	437485	FEN47DN125JF	A.15	437612	FEV47DA250KF	A.17	438454	FGL47DD400LF	A.25			
436656	FGRL3LK0250/7	A.26	437486	FEH47DN125JF	A.15	437613	FEN47DN250KF	A.17	438464	FGN37DA400NF	A.27			
436720	FDKM1	A.11	437487	FEL47DN125JF	A.15	437614	FEH47DN250KF	A.17	438465	FGH37DA400NF	A.27			
436721	FGRL3LL0400/7	A.26	437488	FEV47DN125JF	A.15	437615	FEL47DN250KF	A.17	438466	FGL37DA400NF	A.27			
436722	FGRL3NN0630/7	A.28	437489	FEN37DD125JF	A.15	437616	FEV47DN250KF	A.17	438468	FGN37DN400NF	A.27			
436726	FGRL3NN0400/7	A.28	437490	FEH37DD125JF	A.15	437617	FEN37DD250KF	A.17	438469	FGH37DN400NF	A.27			
436738	FGRL3NN0500/7	A.28	437491	FEL37DD125JF	A.15	437618	FEH37DD250KF	A.17	438470	FGL37DN400NF	A.27			
436739	FGRL3NL0250/7	A.28	437492	FEV37DD125JF	A.15	437619	FEL37DD250KF	A.17	438472	FGN47DA400NF	A.27			
436746	FGRL3NL0400/7	A.28	437493	FEN47DD125JF	A.15	437620	FEV37DD250KF	A.17	438473	FGH47DA400NF	A.27			
436747	FGRL3LL0250/7	A.26	437494	FEH47DD125JF	A.15	437621	FEN47DD250KF	A.17	438474	FGL47DA400NF	A.27			
436748	FGRL3LL0350/7	A.26	437495	FEL47DD125JF	A.15	437622	FEH47DD250KF	A.17	438476	FGN47DN400NF	A.27			
436749	FGRL3LK0160/7	A.26	437496	FEV47DD125JF	A.15	437623	FEL47DD250KF	A.17	438477	FGH47DN400NF	A.27			
436754	FEH36MC200KF	A.16	437505	FEN37DA160JF	A.14	437624	FEV47DD250KF	A.17	438478	FGN47DN400NF	A.27			
436755	FEH436MC200KF	A.16	437506	FEH37DA160JF	A.14	437825	FETDA3025J	A.48	438480	FGN37DD400NF	A.27			
436756	FEL36MC200KF	A.16	437507	FEL37DA160JF	A.14	437826	FETDN3025J	A.48	438481	FGH37DD400NF	A.27			
436763	FEL436MC200KF	A.16	437508	FEV37DA160JF	A.14	437827	FETDD3025J	A.48	438482	FGL37DD400NF	A.27			
436764	FEN36MC200KF	A.16	437509	FEN37DN160JF	A.15	437829	FETDA4025J	A.48	438484	FGN47DD400NF	A.27			
436765	FEN436MC200KF	A.16	437510	FEH37DN160JF	A.15	437830	FETDN4025J	A.48	438485	FGH47DD400NF	A.27			
436778	FETMC3K0200	A.49	437511	FET37DN160JF	A.15	437831	FETDD4025J	A.48	438486	FGL47DD400NF	A.27			
436779	FETMC43K0200	A.49	437512	FEV37DN160JF	A.15	437833	FETDA3063J	A.48	438496	FGN37DA630NF	A.27			
436798	FEV36TA160KF	A.16	437513	FEN47DA160JF	A.14	437834	FETDN3063J	A.48	438497	FGH37DA630NF	A.27			
436817	FEV46TA160KF	A.16	437514	FEH47DA160JF	A.14	437835	FETDD3063J	A.48	438498	FGL37DA630NF	A.27			
436880	FKMF1P	A.38	437515	FEL47DA160JF	A.14	437837	FETDA4063J	A.48	438500	FG				



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BT...			FDC35TF016EF	433532	A.5	FDE46TC125GF	430305	A.5	FDH436TD032ED	430040	A.6	FDL46TD050ED	430093	A.6
BTR 175	704154	A.39	FDC35TF020EF	433553	A.5	FDE46TC160GF	433569	A.5	FDH436TD040ED	430041	A.6	FDL46TD063ED	430094	A.6
BTR 305	704155	A.39	FDC35TF025EF	433864	A.5	FDE46TE016ED	433697	A.5	FDH436TD050ED	430042	A.6	FDL46TD080GD	430591	A.6
BTR 350	704156	A.39	FDC35TF032EF	433867	A.5	FDE46TE020ED	433699	A.5	FDH436TD063ED	430043	A.6	FDL46TD100GD	430594	A.6
FA...			FDC35TF040EF	433870	A.5	FDE46TE025ED	433701	A.5	FDH436TD080GD	430396	A.6	FDL46TD125GD	430597	A.6
FA18PH	430813	A.9	FDC35TF050EF	433873	A.5	FDE46TE032ED	433703	A.5	FDH436TD100GD	430399	A.6	FDL46TD160GD	435854	A.6
FA18PWD	432616	A.20	FDC35TF063EF	433876	A.5	FDE46TE040ED	433705	A.5	FDH436TD125GD	430402	A.6	FDN13TF016EF	433316	A.6
FA1BR1	430088	A.9	FDC35TF080GF	433879	A.5	FDE46TE050ED	433707	A.5	FDH436TD160GD	435827	A.6	FDN13TF020EF	433322	A.6
FA1BR2	430089	A.9	FDC35TF100GF	433882	A.5	FDE46TE063ED	433709	A.5	FDH436TG025ED	430044	A.7	FDN13TF025EF	433328	A.6
FA1BR3	430504	A.9	FDC35TF125GF	433885	A.5	FDE46TE080GD	433711	A.5	FDH436TG032ED	430045	A.7	FDN13TF032EF	433334	A.6
FA1BR4	430505	A.9	FDC35TF160GF	433899	A.5	FDE46TE100GD	433713	A.5	FDH436TG040ED	430046	A.7	FDN13TF040EF	433340	A.6
FA1BR5	430506	A.9	FDC45TE016ED	433948	A.5	FDE46TE125GD	433715	A.5	FDH436TG050ED	430047	A.7	FDN13TF050EF	433346	A.6
FA1BR6	430507	A.9	FDC45TE020ED	433949	A.5	FDE46TE160GD	433717	A.5	FDH436TG063ED	430048	A.7	FDN13TF063EF	433352	A.6
FA1BRH	430668	A.9	FDC45TE025ED	433950	A.5	FDE46TF016EF	435207	A.5	FDH436TG080GD	430415	A.7	FDN13TF080GF	433519	A.6
FA1BRWD	432613	A.20	FDC45TE032ED	433951	A.5	FDE46TF020EF	435229	A.5	FDH436TG100GD	430418	A.7	FDN13TF100GF	433522	A.6
FABAM01	432000	A.19	FDC45TE040ED	433952	A.5	FDE46TF025EF	435231	A.5	FDH436TG125GD	430421	A.7	FDN13TF125GF	433525	A.6
FABAM10	432003	A.19	FDC45TE050ED	433953	A.5	FDE46TF032EF	435238	A.5	FDH436TG160GD	435830	A.7	FDN13TF160GF	433527	A.6
FABAT01	430815	A.9	FDC45TE063ED	433954	A.5	FDE46TF040EF	435240	A.5	FDH456TD063ED	430049	A.6	FDN36MC003ED	436409	A.7
FABAT10	430818	A.9	FDC45TE080GD	436145	A.5	FDE46TF050EF	435242	A.5	FDH456TD080GD	430426	A.6	FDN36MC007ED	430095	A.7
FAC	430821	A.11	FDC45TE100GD	436146	A.5	FDE46TF063EF	435244	A.5	FDH456TD100GD	430429	A.6	FDN36MC012ED	430096	A.7
FAPF8	430823	A.10	FDC45TE125GD	436147	A.5	FDE46TF080GF	435246	A.5	FDH456TD125GD	430432	A.6	FDN36MC020ED	430097	A.7
FAPFM	430824	A.10	FDC45TE160GD	436148	A.5	FDE46TF100GF	435248	A.5	FDH456TD160GD	435833	A.6	FDN36MC030ED	430098	A.7
FAPIP	430825	A.10	FDC45TF016EF	433926	A.5	FDE46TF125GF	435256	A.5	FDH456TG063ED	430050	A.7	FDN36MC050ED	430099	A.7
FAPM8	430826	A.10	FDC45TF020EF	433928	A.5	FDE46TF160GF	435258	A.5	FDH456TG080GD	430437	A.7	FDN36MC080GD	430610	A.7
FAPPS	430827	A.10	FDC45TF025EF	433930	A.5	FDEMFM8	430920	A.9	FDH456TG100GD	430440	A.7	FDN36MC100GD	430613	A.7
FAR	433500	A.33	FDC45TF032EF	433932	A.5	FDEMF	430929	A.9	FDH456TG125GD	430443	A.7	FDN36TS0016ED	430833	A.8
FAS01L	430828	A.9	FDC45TF040EF	433934	A.5	FDEMFMH	430932	A.9	FDH456TG160GD	435836	A.7	FDN36TS0020ED	430835	A.8
FAS01R	430831	A.9	FDC45TF050EF	433936	A.5	FDEMFMJ	430935	A.9	FDH46TD016ED	430051	A.6	FDN36TS0025ED	430836	A.8
FAS10L	430834	A.9	FDC45TF063EF	433938	A.5	FDEMFMN	430938	A.9	FDH46TD020ED	430052	A.6	FDN36TS0032ED	430838	A.8
FAS10R	430837	A.9	FDC45TF080GF	433940	A.5	FDPE	432010	A.11	FDH46TD025ED	430053	A.6	FDN36TS0040ED	430839	A.8
FAS30W	432607	A.20	FDC45TF100GF	433942	A.5	FDFF3	430941	A.11	FDH46TD032ED	430054	A.6	FDN36TS0050ED	430841	A.8
FAS33W	432610	A.20	FDC45TF125GF	433944	A.5	FDFF4	430942	A.11	FDH46TD040ED	430055	A.6	FDN36TS0063ED	430842	A.8
FASHTB	430840	A.9	FDC45TF160GF	433946	A.5	FDFFH	430829	A.11	FDH46TD050ED	430056	A.6	FDN36TS0080GD	430844	A.8
FASHTD	430843	A.9	FDDDF3	430893	A.10	FDH13TF016EF	433246	A.6	FDH46TD063ED	430057	A.6	FDN36TS0100GD	430845	A.8
FASHTF	430846	A.9	FDDDF4	430896	A.10	FDH13TF020EF	433255	A.6	FDH46TD080GD	430460	A.6	FDN36TS0125GD	430847	A.8
FASHTH	435118	A.9	FDDFF3	430899	A.10	FDH13TF025EF	433262	A.6	FDH46TD100GD	430463	A.6	FDN36TS0160GD	430848	A.8
FASHTJ	430849	A.9	FDDFF4	430902	A.10	FDH13TF032EF	433268	A.6	FDH46TD125GD	430466	A.6	FDN36TD016ED	430100	A.6
FASHTN	430852	A.9	FDDFQ3	433489	A.10	FDH13TF040EF	433274	A.6	FDH46TD160GD	435839	A.6	FDN36TD020ED	430101	A.6
FASHTU	430855	A.9	FDDFQ4	433492	A.10	FDH13TF050EF	433280	A.6	FDH46TG025ED	430058	A.7	FDN36TD025ED	430102	A.6
FAUVDN	430858	A.9	FDDMP3	430905	A.10	FDH13TF063EF	433286	A.6	FDH46TG032ED	430059	A.7	FDN36TD032ED	430103	A.6
FAUVR8	436472	A.9	FDDMP4	430908	A.10	FDH13TF080GF	433292	A.6	FDH46TG040ED	430060	A.7	FDN36TD040ED	430104	A.6
FAUVRB	431960	A.9	FDE36TS0016EF	436582	A.8	FDH13TF100GF	433298	A.6	FDH46TG050ED	430061	A.7	FDN36TD050ED	430105	A.6
FAUVRD	430861	A.9	FDE36TS0020EF	436583	A.8	FDH13TF125GF	433304	A.6	FDH46TG063ED	430062	A.7	FDN36TD063ED	430106	A.6
FAUVRF	430864	A.9	FDE36TS0025EF	436584	A.8	FDH13TF160GF	433310	A.6	FDH46TG080GD	430479	A.7	FDN36TD080GD	430630	A.6
FAUVRH	435120	A.9	FDE36TS0032EF	436588	A.8	FDM36MC003ED	436396	A.7	FDH46TG100GD	430482	A.7	FDN36TD100GD	430633	A.6
FAUVRJ	430867	A.9	FDE36TS0040EF	436589	A.8	FDM36MC007ED	430015	A.7	FDH46TG125GD	430485	A.7	FDN36TD125GD	430636	A.6
FAUVRN	430870	A.9	FDE36TS0050EF	436591	A.8	FDM36MC012ED	430016	A.7	FDH46TG160GD	435842	A.7	FDN36TD160GD	433572	A.7
FAWE	432619	A.20	FDE36TS0063EF	436593	A.8	FDM36MC020ED	430017	A.7	FDJ8	430945	A.10	FDN36TG025ED	430107	A.7
FAZ	431406	A.33	FDE36TS0080GF	436594	A.8	FDM36MC030ED	430018	A.7	FDJK	430069	A.10	FDN36TG032ED	430108	A.7
FB...			FDE36TS0100GF	436595	A.8	FDM36MC050ED	430019	A.7	FDJL3	430951	A.10	FDN36TG040ED	430109	A.7
FBAD3	433443	A.43	FDE36TS0125GF	436596	A.8	FDM36MC080GD	430318	A.7	FDJL4	430954	A.10	FDN36TG050ED	430110	A.7
FBAD4	433446	A.43	FDE36TS0160GF	436600	A.8	FDM36MC100GD	430321	A.7	FDJP	430957	A.10	FDN36TG063ED	430111	A.7
FBAE3	433449	A.43	FDE36TC016EF	430001	A.5	FDM36TS0016ED	430850	A.8	FDJS3	430960	A.10	FDN36TG080GD	430649	A.7
FBAE4	433452	A.43	FDE36TC020EF	430002	A.5	FDM36TS0020ED	430851	A.8	FDJS4	430963	A.10	FDN36TG100GD	430652	A.7
FBB3E	433455	A.43	FDE36TC025EF	430003	A.5	FDM36TS0025ED	430853	A.8	FDKD3	430966	A.11	FDN36TG125GD	430655	A.7
FBB3S	433458	A.43	FDE36TC032EF	430004	A.5	FDM36TS0032ED	430854	A.8	FDKD4	430967	A.11	FDN36TG160GD	433575	A.7
FBB4E	433461	A.43	FDE36TC040EF	430005	A.5	FDM36TS0040ED	430857	A.8	FDKE	617947	A.11	FDN436MC003ED	436411	A.7
FBB4S	433464	A.43	FDE36TC050EF	430006	A.5	FDM36TS0050ED	430862	A.8	FDKM1	436720	A.11	FDN436MC007ED	430112	A.7
FBCI3	433377	A.43	FDE36TC063EF	430007	A.5	FDH36TS0063ED	430866	A.8	FDL36MC020ED	430065	A.7	FDN436MC012ED	430113	A.7
FBCL4	433444	A.43	FDE36TC080GF	430276	A.5	FDH36TS0080GD	430871	A.8	FDL36MC030ED	430066	A.7	FDN436MC020ED	430114	A.7
FBF6	883970	A.10	FDE36TC100GF	430279	A.5	FDH36TS0100GD	430874	A.8	FDL36MC050ED	430067	A.7	FDN436MC030ED	430115	A.7
FBTFL3L12	433456	A.43	FDE36TC125GF	430282	A.5	FDH36TS0125GD	430875	A.8	FDL36MC080GD	430498	A.7	FDN436MC050ED	430116	A.7
FBTFL4L12	433497	A.43	FDE36TC160GF	433566	A.5	FDH36TS0160GD	430881	A.8	FDL36MC100GD	430501	A.7	FDN436MC080GD	430668	A.7
FBTSL10L12	433474	A.43	FDE36TE016ED	433649	A.5	FDH36TD016ED	430020	A.6	FDL36TD025ED	430070	A.6	FDN436MC100GD	430671	A.7
FBTSL11L12	433468	A.43	FDE36TE020ED	433651	A.5	FDH36TD020ED	430021	A.6	FDL36TD032ED	430071	A.6	FDN436TD016ED	430117	A.6
FD...			FDE36TE025ED	433653	A.5	FDH36TD025ED	430022	A.6	FDL36TD040ED	430072	A.6	FDN436TD020ED	430118	A.6
FD18PE	430876	A.9	FDE36TE032ED	433655	A.5	FDH36TD032ED	430023	A.6	FDL36TD050ED	430073	A.6	FDN436TD025ED	430119	A.6
FD18RE	430877	A.9	FDE36TE040ED	433657	A.5	FDH36TD040ED	430024	A.6	FDL36TD063ED	430074	A.6	FDN436TD032ED	430120	A.6
FD1PF	430878	A.11	FDE36TE050ED	433659	A.5	FDH36TD050ED	430025	A.6	FDL36TD080GD	430518	A.6	FDN436TD040ED	430121	A.6
FD1PR	430879	A.11	FDE36TE063ED	433661	A.5	FDH36TD063ED	430026	A.6	FDL36TD100GD	430521	A.6	FDN436TD050ED	430122	A.6
FDBAM11	430880	A.9	FDE36TE080GD	433663	A.5	FDH36TD080GD	430338	A.6	FDL36TD125GD	430524	A.6	FDN436TD063ED	430123	A.6
FDBEA3	430883	A.10	FDE36TE100GD	433665	A.5	FDH36TD100GD	430341	A.6	FDL36TD160GD	435845	A.6	FDN436TD080GD	430688	A.6
FDBEA4	430884	A.10	FDE36TE125GD	433667	A.5	FDH36TD125GD	430344	A.6	FDL436MC020ED	430077	A.7	FDN436TD100GD	430691	A.6
FDBEH3	430885	A.10	FDE36TE160GD	433669	A.5	FDH36TD160GD	435821	A.6	FDL436MC030ED	430078	A.7	FDN436TD125GD	430694	A.6
FDBEH4	430886	A.10	FDE36TF016EF	435127	A.5	FDH36TG025ED	430027	A.7	FDL436MC050ED	430079	A.7	FDN436TD160GD	433578	A.6
FDBES3	430887	A.10	FDE36TF020EF	435129	A.5	FDH36TG032ED	430028	A.7	FDL436MC080GD	430537	A.7	FDN436TG025ED	430124	A.7
FDBES4	430888	A.10	FDE36TF025EF	435130	A.5	FDH36TG040ED	430029	A.7	FDL436MC100GD	430540	A.7	FDN436TG032ED	4301	

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FDN46TD016ED	430131	A.6	FDY306D160GD	430805	A.7	FEH37DD125KF	437554	A.17	FEH47DD160KF	437590	A.17	FEL436TD250KF	432621	A.16
FDN46TD020ED	430132	A.6	FDY406D063ED	430151	A.7	FEH37DD160JF	437522	A.15	FEH47DD250KF	437622	A.17	FEL436TG100JF	435944	A.13
FDN46TD025ED	430133	A.6	FDY406D0160GD	430810	A.7	FEH37DD160KF	437586	A.17	FEH47DN025JF	437422	A.15	FEL436TG125JF	435947	A.13
FDN46TD032ED	430134	A.6	FE			FEH37DD250KF	437618	A.17	FEH47DN063JF	437454	A.15	FEL436TG160JF	435950	A.13
FDN46TD040ED	430135	A.6	FE18PE	432011	A.19	FEH37DN025JF	437409	A.15	FEH47DN125JF	437486	A.15	FEL436TG160KF	435953	A.16
FDN46TD050ED	430136	A.6	FE18RE	432012	A.19	FEH37DN063JF	437446	A.15	FEH47DN125KF	437550	A.17	FEL436TG200KF	435956	A.16
FDN46TD063ED	430137	A.6	FE1I2	437001	A.45	FEH37DN125JF	437478	A.15	FEH47DN160JF	437518	A.15	FEL436TG250KF	435959	A.16
FDN46TD080GD	430752	A.6	FE1PF	432017	A.22	FEH37DN125KF	437542	A.17	FEH47DN160KF	437582	A.17	FEL456TA063JF	435037	A.13
FDN46TD100GD	430755	A.6	FEBE43	432018	A.21	FEH37DN160JF	437510	A.15	FEH47DN250KF	437614	A.17	FEL456TA080JF	431593	A.13
FDN46TD125GD	430758	A.6	FEBE44	432019	A.21	FEH37DN160KF	437574	A.17	FEJ8	432073	A.22	FEL456TA100JF	431599	A.13
FDN46TD160GD	433590	A.6	FEBE93	432020	A.21	FEH37DN250KF	437606	A.17	FEJL3	432079	A.22	FEL456TA125JF	431605	A.13
FDN46TG025ED	430138	A.7	FEBE94	432021	A.21	FEH406F160JF	431213	A.48	FEJL4	432082	A.22	FEL456TA160JF	431611	A.13
FDN46TG032ED	430139	A.7	FEBEA3	432022	A.21	FEH406F250KF	431216	A.49	FEJN3	436467	A.20	FEL456TD100JF	432699	A.13
FDN46TG040ED	430140	A.7	FEBEA4	432023	A.21	FEH436MC050JF	434829	A.14	FEJN4	436468	A.20	FEL456TD125JF	432747	A.13
FDN46TG050ED	430141	A.7	FEBEH3	432024	A.21	FEH436MC100JF	434832	A.14	FEJP	432085	A.22	FEL456TD125KF	432780	A.16
FDN46TG063ED	430142	A.7	FEBEH4	432025	A.21	FEH436MC125JF	436329	A.14	FEJS3	432088	A.22	FEL456TD160JF	432834	A.13
FDN46TG080GD	430771	A.7	FEBE53	432026	A.21	FEH436MC160JF	434838	A.14	FEJS4	432091	A.22	FEL456TD160KF	432843	A.16
FDN46TG100GD	430774	A.7	FEBE54	432027	A.21	FEH436MC160KF	434841	A.16	FEL306F160JF	431419	A.48	FEL456TD200KF	432868	A.16
FDN46TG125GD	430777	A.7	FEBR3	432028	A.21	FEH436MC200KF	436755	A.16	FEL306F250KF	431422	A.49	FEL456TD250KF	432871	A.16
FDN46TG160GD	433593	A.7	FEBR4	432029	A.21	FEH436MC250KF	434844	A.16	FEL36MC050JF	434952	A.14	FEL456TG100JF	435962	A.13
FDN66TD016ED	430143	A.6	FEBRCS3	432190	A.21	FEH436TA025JF	434847	A.13	FEL36MC080JF	435896	A.14	FEL456TG125JF	435965	A.13
FDN66TD020ED	430144	A.6	FEBRCS4	432191	A.21	FEH436TA032JF	434850	A.13	FEL36MC100JF	434955	A.14	FEL456TG160JF	435968	A.13
FDN66TD025ED	430145	A.6	FEBS3	432032	A.21	FEH436TA040JF	434853	A.13	FEL36MC125JF	436331	A.14	FEL456TG160KF	435971	A.16
FDN66TD032ED	430146	A.6	FEBS4	432033	A.21	FEH436TA050JF	434856	A.13	FEL36MC160JF	434961	A.14	FEL456TG200KF	435974	A.16
FDN66TD040ED	430147	A.6	FEDDF3	432034	A.20	FEH436TA063JF	434859	A.13	FEL36MC160KF	434964	A.16	FEL456TG250KF	435977	A.16
FDN66TD050ED	430148	A.6	FEDDF4	432037	A.20	FEH436TA080JF	431252	A.13	FEL36MC200KF	436756	A.16	FEL46TA025JF	435049	A.13
FDN66TD063ED	430149	A.6	FEDFF3	432040	A.20	FEH436TA100JF	431258	A.13	FEL36MC250KF	434967	A.16	FEL46TA032JF	435052	A.13
FDN66TD080GD	430794	A.6	FEDFF4	432043	A.20	FEH436TA125JF	431264	A.13	FEL36TA025JF	434970	A.13	FEL46TA040JF	435055	A.13
FDN66TD100GD	430797	A.6	FEDFQ3	430987	A.20	FEH436TA160JF	431270	A.13	FEL36TA032JF	434973	A.13	FEL46TA050JF	435058	A.13
FDN66TD125GD	430800	A.6	FEDFQ4	431842	A.20	FEH436TD100JF	432198	A.13	FEL36TA040JF	434976	A.13	FEL46TA063JF	435061	A.13
FDN66TD160GD	433599	A.6	FEDMP3	432046	A.20	FEH436TD125JF	432205	A.13	FEL36TA050JF	434979	A.13	FEL46TA080JF	431656	A.13
FDNR4	430971	A.9	FEDMP4	432049	A.20	FEH436TD125KF	432209	A.16	FEL36TA063JF	434982	A.13	FEL46TA100JF	431662	A.13
FDNRC/5	436474	A.9	FEEMF8	435812	A.19	FEH436TD160JF	432214	A.13	FEL36TA080JF	431458	A.13	FEL46TA125JF	431668	A.13
FDNRCV/5	436475	A.9	FEEMFD	432052	A.19	FEH436TD160KF	432218	A.16	FEL36TA100JF	431464	A.13	FEL46TA160JF	431674	A.13
FDNRD/5	436476	A.9	FEEMFF	432055	A.19	FEH436TD200KF	432223	A.16	FEL36TA125JF	431470	A.13	FEL46TD100JF	432907	A.13
FDNRDV/5	436477	A.9	FEEMFH	432058	A.19	FEH436TD250KF	432227	A.16	FEL36TA160JF	431476	A.13	FEL46TD125JF	432921	A.13
FDNRE	430986	A.9	FEEMFJ	432061	A.19	FEH436TG100JF	435902	A.13	FEL36TD100JF	432332	A.13	FEL46TD125KF	432924	A.16
FDNRF/5	436478	A.9	FEEMFN	432064	A.19	FEH436TG125JF	435903	A.13	FEL36TD125JF	432341	A.13	FEL46TD160JF	432927	A.13
FDNRV/5	436479	A.9	FEFE	430943	A.22	FEH436TG160JF	435904	A.13	FEL36TD125KF	432344	A.16	FEL46TD160KF	432930	A.16
FDNRV/5	436487	A.9	FEFF3	432067	A.22	FEH436TG160KF	435905	A.16	FEL36TD160JF	432349	A.13	FEL46TD200KF	432933	A.16
FDNRV/5	436488	A.9	FEFF4	432068	A.22	FEH436TG200KF	435906	A.16	FEL36TD160KF	432353	A.16	FEL46TD250KF	432936	A.16
FDNRZ/5	436489	A.9	FEFT	432071	A.22	FEH436TG250KF	435907	A.16	FEL36TD200KF	432357	A.16	FEL46TG100JF	435992	A.13
FDNRZV/5	436490	A.9	FEFS0025	437881	A.22	FEL456TA063JF	434871	A.13	FEL36TD250KF	432361	A.16	FEL46TG125JF	435995	A.13
FDOQB3H/6	431076	A.9	FEFS0063	437882	A.22	FEL456TA080JF	431300	A.13	FEL36TG100JF	435923	A.13	FEL46TG160JF	436002	A.13
FDOQB3M/6	431078	A.9	FEFS0125	437883	A.22	FEH456TA100JF	431306	A.13	FEL36TG125JF	435926	A.13	FEL46TG160KF	436005	A.16
FDOQB4H/6	431080	A.9	FEFS0160	437884	A.22	FEH456TA125JF	431312	A.13	FEL36TG160JF	435932	A.13	FEL46TG200KF	436008	A.16
FDOQB4M/6	431084	A.9	FEFS0250	437885	A.22	FEH456TA160JF	431318	A.13	FEL36TG160KF	435935	A.16	FEL46TG250KF	436011	A.16
FDOQI3M/6	431086	A.9	FEH306F160JF	431126	A.48	FEH456TD100JF	432242	A.13	FEL36TG200KF	435938	A.16	FEL47DA025JF	437419	A.14
FDOQI4M/6	431088	A.9	FEH306F250KF	431129	A.49	FEH456TD125JF	432250	A.13	FEL36TG250KF	435941	A.16	FEL47DA063JF	437451	A.14
FDOQD3H/6	431090	A.9	FEH36MC050JF	434754	A.14	FEH456TD125KF	432254	A.16	FEL37DA025JF	437402	A.14	FEL47DA125JF	437483	A.14
FDOQD3M/6	431095	A.9	FEH36MC080JF	435893	A.14	FEH456TD160JF	432259	A.13	FEL37DA063JF	437443	A.14	FEL47DA125KF	437547	A.17
FDOQD5H/6	431101	A.9	FEH36MC100JF	434757	A.14	FEH456TD160KF	432263	A.16	FEL37DA125JF	437475	A.14	FEL47DA160JF	437515	A.14
FDOQD5M/6	431103	A.9	FEH36MC125JF	436327	A.14	FEH456TD200KF	432266	A.16	FEL37DA125KF	437539	A.17	FEL47DA160KF	437579	A.17
FDS36TSD016ED	430546	A.8	FEH36MC160JF	434763	A.14	FEH456TD250KF	432269	A.16	FEL37DA160JF	437507	A.14	FEL47DA250KF	437611	A.17
FDS36TSD020ED	430577	A.8	FEH36MC160KF	434766	A.16	FEH456TG100JF	436026	A.13	FEL37DA160KF	437571	A.17	FEL47DD025JF	437431	A.15
FDS36TSD025ED	430578	A.8	FEH36MC200KF	436754	A.16	FEH456TG125JF	436027	A.13	FEL37DA250KF	437603	A.17	FEL47DD063JF	437463	A.15
FDS36TSD032ED	430579	A.8	FEH36MC250KF	434769	A.16	FEH456TG160JF	436028	A.13	FEL37DD025JF	437427	A.15	FEL47DD125JF	437495	A.15
FDS36TSD040ED	430580	A.8	FEH36TSD100KF	431235	A.18	FEH456TG160KF	435908	A.16	FEL37DD063JF	437459	A.15	FEL47DD125KF	437559	A.17
FDS36TSD050ED	430814	A.8	FEH36TSD125KF	431243	A.18	FEH456TG200KF	435909	A.16	FEL37DD125JF	437491	A.15	FEL47DD160JF	437527	A.15
FDS36TSD063ED	430816	A.8	FEH36TSD160KF	431244	A.18	FEH456TG250KF	435910	A.16	FEL37DD125KF	437555	A.17	FEL47DD160KF	437591	A.17
FDS36TSD080GD	430817	A.8	FEH36TSD200KF	431245	A.18	FEH46TA025JF	434883	A.13	FEL37DD160JF	437523	A.15	FEL47DD250KF	437623	A.17
FDS36TSD100GD	430819	A.8	FEH36TSD225KF	431247	A.18	FEH46TA032JF	434886	A.13	FEL37DD160KF	437587	A.17	FEL47DN025JF	437423	A.15
FDS36TSD125GD	430820	A.8	FEH36TA025JF	434772	A.13	FEH46TA040JF	434889	A.13	FEL37DD250KF	437619	A.17	FEL47DN063JF	437455	A.15
FDS36TSD160GD	430822	A.8	FEH36TA032JF	434775	A.13	FEH46TA050JF	434892	A.13	FEL37DN025JF	437412	A.15	FEL47DN125JF	437487	A.15
FDS36TD016ED	430161	A.6	FEH36TA040JF	434778	A.13	FEH46TA063JF	434895	A.13	FEL37DN063JF	437447	A.15	FEL47DN125KF	437551	A.17
FDS36TD020ED	430163	A.6	FEH36TA050JF	434781	A.13	FEH46TA080JF	431363	A.13	FEL37DN125JF	437479	A.15	FEL47DN160JF	437519	A.15
FDS36TD025ED	430165	A.6	FEH36TA063JF	434784	A.13	FEH46TA100JF	431369	A.13	FEL37DN125KF	437543	A.17	FEL47DN160KF	437583	A.17
FDS36TD032ED	430167	A.6	FEH36TA080JF	431165	A.13	FEH46TA125JF	431375	A.13	FEL37DN160JF	437511	A.15	FEL47DN250KF	437615	A.17
FDS36TD040ED	430169	A.6	FEH36TA100JF	431171	A.13	FEL46TA160JF	431381	A.13	FEL37DN160KF	437575	A.17	FEN306F160JF	431712	A.48
FDS36TD050ED	430178	A.6	FEH36TA125JF	431177	A.13	FEH46TD100JF	432287	A.13	FEL37DN250KF	437607	A.17	FEN306F250KF	431715	A.49
FDS36TD063ED	432952	A.6	FEH36TA160JF	431183	A.13	FEH46TD125JF	432296	A.13	FEL406F160JF	431506	A.48	FEN36MC050JF	435085	A.14
FDS36TD080GD	432955	A.6	FEH36TD100JF	431007	A.13	FEH46TD125KF	432300	A.16	FEL406F250KF	431509	A.49	FEN36MC080JF	435899	A.14

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FEN36TD125KF	432962	A.16	FEN46TD160KF	433076	A.16	FETDN3125K	437858	A.49	FETTG43J0160	432720	A.48	FGBEH3	431691	A.32
FEN36TD160JF	432971	A.13	FEN46TD200KF	433079	A.16	FETDN3160J	437850	A.48	FETTG43K0160	432729	A.49	FGBEH4	431695	A.32
FEN36TD160KF	432976	A.16	FEN46TD250KF	433082	A.16	FETDN3160K	437866	A.49	FETTG43K0200	432732	A.49	FGBES3	431696	A.32
FEN36TD200KF	432979	A.16	FEN46TG100JF	435250	A.13	FETDN3250K	437874	A.49	FETTG43K0250	432735	A.49	FGBES4	431697	A.32
FEN36TD250KF	432982	A.16	FEN46TG125JF	435253	A.13	FETDN4025J	437830	A.48	FETTG45J0100	433326	A.48	FGBR3C	431701	A.32
FEN36TG100JF	435139	A.13	FEN46TG160JF	435259	A.13	FETDN4063J	437838	A.48	FETTG45J0125	432741	A.48	FGBR4C	431702	A.32
FEN36TG125JF	435142	A.13	FEN46TG160KF	435262	A.16	FETDN4125J	437846	A.48	FETTG45J0160	432744	A.48	FGBRCS3	432193	A.32
FEN36TG160JF	435148	A.13	FEN46TG200KF	435265	A.16	FETDN4125K	437862	A.49	FETTG45K0160	432753	A.49	FGBRCS4	432194	A.32
FEN36TG160KF	435151	A.16	FEN46TG250KF	435268	A.16	FETDN4160	437854	A.48	FETTG45K0200	432756	A.49	FGBSS3	431981	A.32
FEN36TG200KF	435154	A.16	FEN47DA025JF	437416	A.14	FETDN4160K	437870	A.49	FETTG45K0250	432759	A.49	FGBSS4	431982	A.32
FEN36TG250KF	435157	A.16	FEN47DA063JF	437449	A.14	FETDN4250K	437878	A.49	FETTG4J0100	433332	A.48	FGDDF3	430944	A.31
FEN37DA025JF	437400	A.14	FEN47DA125JF	437481	A.14	FETMC3J0050	432501	A.48	FETTG4J0125	432774	A.48	FGDDF4	431064	A.31
FEN37DA063JF	437441	A.14	FEN47DA125KF	437545	A.17	FETMC3J0080	436078	A.48	FETTG4J0160	432777	A.48	FGDF3	431983	A.31
FEN37DA125JF	437473	A.14	FEN47DA160JF	437513	A.14	FETMC3J0100	432504	A.48	FETTG4K0160	432786	A.49	FGDF4	431986	A.31
FEN37DA125KF	437537	A.17	FEN47DA160KF	437577	A.17	FETMC3J0125	436358	A.48	FETTG4K0200	432789	A.49	FGDMP3	432796	A.31
FEN37DA160JF	437505	A.14	FEN47DA250KF	437609	A.17	FETMC3J0160	432510	A.48	FETTG4K0250	432792	A.49	FGDMP4	432799	A.31
FEN37DA160KF	437569	A.17	FEN47DD025JF	437429	A.15	FETMC3K0160	432513	A.49	FEUA3	432162	A.22	FGFMF8	432811	A.30
FEN37DA250KF	437601	A.17	FEN47DD063JF	437461	A.15	FETMC3K0200	436778	A.49	FEUA4	432163	A.22	FGFMFD	432817	A.30
FEN37DD025JF	437425	A.15	FEN47DD125JF	437493	A.15	FETMC3K0250	432516	A.49	FEUT	433540	A.22	FGEMFF	432820	A.30
FEN37DD125JF	437457	A.15	FEN47DD125KF	437557	A.17	FETMC43J0050	432528	A.48	FEV36T5A125KF	431219	A.18	FGEMFH	432823	A.30
FEN37DD125KF	437489	A.15	FEN47DD160JF	437525	A.15	FETMC43J0100	432531	A.48	FEV36T5A160KF	431220	A.18	FGEMFJ	432826	A.30
FEN37DD125KF	437553	A.17	FEN47DD160KF	437589	A.17	FETMC43J0125	436359	A.48	FEV36T5A200KF	431221	A.18	FGEMFN	432829	A.30
FEN37DD160JF	437521	A.15	FEN47DD250KF	437621	A.17	FETMC43J0160	432537	A.48	FEV36T5A225KF	431222	A.18	FGFE	430544	A.33
FEN37DD160KF	437585	A.17	FEN47DN025JF	437421	A.15	FETMC43K0160	432540	A.49	FEV36TA125KF	432416	A.16	FGFH	430545	A.33
FEN37DD250KF	437617	A.17	FEN47DN063JF	437453	A.15	FETMC43K0200	436779	A.49	FEV36TA160KF	432798	A.16	FGFT	432836	A.33
FEN37DN025JF	437406	A.15	FEN47DN125JF	437485	A.15	FETMC43K0250	432543	A.49	FEV36TA200KF	431058	A.16	FGGS0250	431870	A.33
FEN37DN063JF	437445	A.15	FEN47DN125KF	437549	A.17	FETTA3J0025	432546	A.48	FEV36TA250KF	431061	A.16	FGGS0400	432838	A.33
FEN37DN125JF	437477	A.15	FEN47DN160JF	437517	A.15	FETTA3J0032	432549	A.48	FEV37DA025JF	437405	A.14	FGGS0630	432839	A.33
FEN37DN125KF	437541	A.17	FEN47DN160KF	437581	A.17	FETTA3J0040	432552	A.48	FEV37DA063JF	437444	A.14	FGH306F250LF	434231	A.50
FEN37DN160JF	437509	A.15	FEN47DN250KF	437613	A.17	FETTA3J0050	432555	A.48	FEV37DA125JF	437476	A.14	FGH306FA00LF	431050	A.50
FEN37DN160KF	437573	A.17	FENFT	433531	A.19	FETTA3J0063	432558	A.48	FEV37DA125KF	437540	A.17	FGH306FA00NF	431067	A.51
FEN37DN250KF	437605	A.17	FENR4	432099	A.19	FETTA3J0080	432561	A.48	FEV37DA160JF	437508	A.14	FGH306F630NF	431073	A.51
FEN406F160JF	431799	A.48	FENRC/5	436491	A.19	FETTA3J0100	432564	A.48	FEV37DA160KF	437572	A.17	FGH36KA250LKF	436150	A.26
FEN406F250KF	431802	A.49	FENRCV/5	436492	A.19	FETTA3J0125	432567	A.48	FEV37DA250KF	437604	A.17	FGH36KA350LLF	434393	A.26
FEN436MC050JF	435160	A.14	FENRD/5	436493	A.19	FETTA3J0160	432570	A.48	FEV37DD025JF	437428	A.15	FGH36KA400LLF	436151	A.26
FEN436MC100JF	435163	A.14	FENRDV/5	436494	A.19	FETTA3J0025	432391	A.48	FEV37DD063JF	437460	A.15	FGH36KA400NLF	436152	A.28
FEN436MC125JF	436356	A.14	FENRF/5	436495	A.19	FETTA3J0032	432394	A.48	FEV37DD125JF	437492	A.15	FGH36KA500NNF	434606	A.28
FEN436MC160JF	435169	A.14	FENRFV/5	436496	A.19	FETTA3J0040	432397	A.48	FEV37DD125KF	437556	A.17	FGH36KA630NNF	434028	A.28
FEN436MC160KF	435172	A.16	FENRW	432120	A.19	FETTA3J0050	432400	A.48	FEV37DD160JF	437524	A.15	FGH36VA00LLF	434953	A.26
FEN436MC200KF	436765	A.16	FENRX/5	436499	A.44	FETTA3J0063	432403	A.48	FEV37DD160KF	437588	A.17	FGH36VA630NNF	434958	A.28
FEN436MC250KF	435175	A.16	FENRY/5	436500	A.19	FETTA3J0080	432406	A.48	FEV37DD250KF	437620	A.17	FGH37DA250LF	438401	A.25
FEN436TA025JF	435178	A.13	FENRYV/5	436501	A.19	FETTA3J0100	432409	A.48	FEV37DN025JF	437413	A.15	FGH37DA400LF	438433	A.25
FEN436TA032JF	435181	A.13	FENRZ/5	436502	A.19	FETTA3J0125	432412	A.48	FEV37DN063JF	437448	A.15	FGH37DA400NF	438465	A.27
FEN436TA040JF	435184	A.13	FENRZV/5	436503	A.19	FETTA3J0160	432582	A.48	FEV37DN125JF	437480	A.15	FGH37DA630NF	438497	A.27
FEN436TA050JF	435187	A.13	FEQDB3HJ/6	431118	A.19	FETTA45J0063	432603	A.48	FEV37DN125KF	437544	A.17	FGH37DD250LF	438417	A.25
FEN436TA063JF	435190	A.13	FEQDB3HK/6	431124	A.19	FETTA45J0080	432606	A.48	FEV37DN160JF	437512	A.15	FGH37DD400LF	438449	A.25
FEN436TA080JF	431838	A.13	FEQDB3MJ/6	431136	A.19	FETTA45J0100	432609	A.48	FEV37DN160KF	437576	A.17	FGH37DD400NF	438481	A.27
FEN436TA100JF	431844	A.13	FEQDB3MK/6	431139	A.19	FETTA45J0125	432612	A.48	FEV37DN250KF	437608	A.17	FGH37DD630NF	438513	A.27
FEN436TA125JF	431850	A.13	FEQDB4HJ/6	431145	A.19	FETTA45J0160	432615	A.48	FEV46TA125KF	431082	A.16	FGH37DN250LF	438405	A.25
FEN436TA160JF	431856	A.13	FEQDB4HK/6	431151	A.19	FETTA4J0025	432636	A.48	FEV46TA160KF	436817	A.16	FGH37DN400LF	438437	A.25
FEN436TD100JF	432994	A.13	FEQDB4MJ/6	431159	A.19	FETTA4J0032	432639	A.48	FEV46TA200KF	431094	A.16	FGH37DN400NF	438469	A.27
FEN436TD125JF	433001	A.13	FEQDB4MK/6	431161	A.19	FETTA4J0040	432642	A.48	FEV46TA250KF	431097	A.16	FGH37DN500NF	438501	A.27
FEN436TD125KF	433004	A.16	FETCA1316	432156	A.21	FETTA4J0050	432645	A.48	FEV47DA025JF	437420	A.14	FGH406F250LF	434234	A.50
FEN436TD160JF	433007	A.13	FETCA1320	432157	A.21	FETTA4J0063	432648	A.48	FEV47DA063JF	437452	A.14	FGH406FA00LF	431150	A.50
FEN436TD160KF	433010	A.16	FETCA1323	432160	A.21	FETTA4J0080	432651	A.48	FEV47DA125JF	437484	A.14	FGH406FA00NF	431153	A.51
FEN436TD200KF	433013	A.16	FETCA1416	432158	A.21	FETTA4J0100	432654	A.48	FEV47DA125KF	437548	A.17	FGH406F630NF	431156	A.51
FEN436TD250KF	433016	A.16	FETCA1420	432159	A.21	FETTA4J0125	432657	A.48	FEV47DA160JF	437516	A.14	FGH436VA400LLF	434960	A.26
FEN436TG100JF	436014	A.13	FETCA1423	432161	A.21	FETTA4J0160	432660	A.48	FEV47DA160KF	437580	A.17	FGH436VA630NNF	434965	A.26
FEN436TG125JF	436015	A.13	FETCA630A	880954	A.21	FETTD3J0100	433159	A.48	FEV47DA250KF	437612	A.17	FGH456VA400LLF	434971	A.26
FEN436TG160JF	436016	A.13	FETCA640A	880955	A.21	FETTD3J0125	433164	A.48	FEV47DD025JF	437432	A.15	FGH456VA630NNF	434977	A.28
FEN436TG160KF	436017	A.16	FETD30J0160	432480	A.48	FETTD3J0160	433168	A.48	FEV47DD063JF	437464	A.15	FGH46KA250LKF	434041	A.26
FEN436TG200KF	436018	A.16	FETD30K0250	432483										

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FGL36KA250LKF	434049	A.26	FGN47DD400NF	438484	A.27	FGTKA3N0500	434905	A.51	FKN36NM800PF	435537	A.35	FNNRCV/5	436518	A.38
FGL36KA350LLF	434438	A.26	FGN47DD630NF	438516	A.27	FGTKA3N0630	434204	A.51	FKN36NS100SQF	435432	A.36	FNNRD/5	436519	A.38
FGL36KA400LLF	434050	A.26	FGN47DN250LF	438412	A.25	FGTKAAL0250	434205	A.50	FKN36NS125SSF	435420	A.36	FNNRDV/5	436520	A.38
FGL36KA400NLF	434051	A.28	FGN47DN400LF	438444	A.25	FGTKAAL0350	434908	A.50	FKN36NS160TTF	435423	A.37	FNNRE	435738	A.38
FGL36KA500NNF	434651	A.28	FGN47DN400NF	438476	A.27	FGTKAAL0400	434261	A.50	FKN36NS800PPF	435429	A.35	FNNRF/5	436522	A.38
FGL36KA630NNF	434052	A.28	FGN47DN500NF	438508	A.27	FGTKAAN0400	434263	A.51	FKN36NT100SF	435550	A.36	FNNRFV/5	436524	A.38
FGL36VA400LLF	435065	A.26	FGNFT	432867	A.30	FGTKAAN0500	434911	A.51	FKN36NT125SF	435551	A.36	FNNRW	435745	A.38
FGL36VA630NNF	435071	A.28	FGNRC/5	436504	A.30	FGTKAAN0630	434265	A.51	FKN36NT630PF	435444	A.35	FNNRX/	436526	A.44
FGL37DA250LF	438402	A.25	FGNRCV/5	436505	A.30	FGUA3	432908	A.33	FKN36NT800PF	435336	A.35	FNNRX/5	436526	A.44
FGL37DA400LF	438434	A.25	FGNRD/5	436506	A.30	FGUA4	432909	A.33	FKN436NM125SF	435570	A.36	FNNRY/5	436527	A.38
FGL37DA400NF	438466	A.27	FGNRDV/5	436507	A.30	FGUT	433541	A.33	FKN436NM800PF	435541	A.35	FNNRYV/5	436528	A.38
FGL37DA630NF	438498	A.27	FGNRE	434735	A.30	FGWA2	432601	A.31	FKN436NT100SF	435562	A.36	FNNRZ/5	436530	A.38
FGL37DD250LF	438418	A.25	FGNRF/5	436509	A.30	FGWA3	432604	A.31	FKN436NT125SF	435563	A.36	FNNRZV/5	436531	A.38
FGL37DD400LF	438450	A.25	FGNRFV/5	436510	A.30	FGWB3	432550	A.31	FKN436NT630PF	435408	A.35	FNPFM	435758	A.39
FGL37DD400NF	438482	A.27	FGNRW	433892	A.30	FGWB4	432556	A.31	FKN436NT800PF	435300	A.35	FNS11L	435760	A.39
FGL37DD630NF	438514	A.27	FGNRX/5	436512	A.44	FGWM	432595	A.31	FKN46NE100SQF	435450	A.36	FNS11R	436401	A.38
FGL37DN250LF	438406	A.25	FGNRY/5	436513	A.30	FGWN	432598	A.31	FKN46NE125SSF	435438	A.36	FNSHT8	435692	A.38
FGL37DN400LF	438438	A.25	FGNRYV/5	436514	A.30	FGWT	432592	A.31	FKN46NE160TTF	435441	A.37	FNSHTD	435693	A.38
FGL37DN400NF	438470	A.27	FGNRZ/5	436515	A.30	FGY306D400LF	431659	A.26	FKN46NE800PPF	435447	A.35	FNSHTF	435694	A.38
FGL37DN500NF	438502	A.27	FGNRZV/5	436516	A.30	FGY306D630NF	431665	A.28	FKN46NG100SQF	435468	A.36	FNSHTJ	435695	A.38
FGL406F250LF	434242	A.50	FGQDB3M/6	431172	A.30	FGY406D400LF	431671	A.26	FKN46NG125SSF	435456	A.36	FNSHTN	435696	A.38
FGL406F400LF	431351	A.50	FGQDB4M/6	431181	A.30	FGY406D630NF	431687	A.28	FKN46NG160TTF	435459	A.37	FNTCA3327	436316	A.39
FGL406F400NF	431354	A.51	FGRL3LK0160/7	436749	A.26	FK...			FKN46NG800PPF	435465	A.35	FNTCA3427	436651	A.39
FGL406F630NF	431357	A.51	FGRL3LK0250/7	436656	A.26	FKF1S	436884	A.38	FKN46NS100SQF	435486	A.36	FNTCA4327	433438	A.39
FGL436VA400LLF	435077	A.26	FGRL3LL0250/7	436747	A.26	FKF2S	436885	A.38	FKN46NS125SSF	435474	A.36	FNTCA4427	433439	A.39
FGL436VA630NNF	435091	A.28	FGRL3LL0350/7	436748	A.26	FKF3S	436886	A.38	FKN46NS160TTF	435477	A.37	FNUA3	435762	A.40
FGL456VA400LLF	435095	A.26	FGRL3LL0400/7	436721	A.26	FKF6S	436887	A.38	FKN46NS800PPF	435483	A.35	FNUA4	435763	A.40
FGL456VA630NNF	435122	A.28	FGRL3NL0250/7	436739	A.28	FKH36NE100SQF	435288	A.36	FKUE3	434801	A.38	FNUT	435764	A.40
FGL46KA250LKF	436153	A.26	FGRL3NL0400/7	436746	A.28	FKH36NE125SSF	435276	A.36	FKUE4	434802	A.38	FNUVD6	435697	A.38
FGL46KA350LLF	434468	A.26	FGRL3NN0400/7	436726	A.28	FKH36NE160TTF	435279	A.37	FKV36NE100SQF	435040	A.36	FNUVR1	435698	A.38
FGL46KA400LLF	436154	A.26	FGRL3NN0500/7	436738	A.28	FKH36NE800PPF	435285	A.35	FKV36NE125SSF	435035	A.36	FNUVR6	435699	A.38
FGL46KA400NLF	436155	A.28	FGRL3NN0630/7	436722	A.28	FKH36NG100SQF	435306	A.36	FKV36NE160TTF	435032	A.37	FNUVR8	435700	A.38
FGL46KA500NNF	434782	A.28	FGRL43LK0160/7	434469	A.26	FKH36NG125SSF	435294	A.36	FKV36NE800PPF	435041	A.35	FNUVRD	435701	A.38
FGL46KA630NNF	434068	A.28	FGRL43LK0250/7	434615	A.26	FKH36NG160TTF	435297	A.37	FKV36NT100SF	435028	A.36	FNUVR	435702	A.38
FGL46VA400LLF	435128	A.26	FGRL43LL0250/7	434599	A.26	FKH36NG800PPF	435303	A.35	FKV36NT125SF	435030	A.36	FNUVRJ	437018	A.44
FGL46VA630NNF	435134	A.28	FGRL43LL0350/7	434601	A.26	FKH36NM125SF	435559	A.36	FKV36NT800PF	435005	A.35	FNWS3AP	433436	A.39
FGL47DA250LF	438410	A.25	FGRL43LL0400/7	434617	A.26	FKH36NM800PF	435538	A.35	FKV46NE100SQF	435066	A.36	FNWS3AT	435757	A.39
FGL47DA400LF	438442	A.25	FGRL43NL0250/7	434588	A.28	FKH36NS100SQF	435324	A.36	FKV46NE125SSF	435083	A.36	FNWS3WP	433434	A.39
FGL47DA400NF	438474	A.27	FGRL43NL0400/7	434590	A.28	FKH36NS125SSF	435312	A.36	FKV46NE160TTF	435092	A.37	FNWS3WT	436482	A.39
FGL47DA630NF	438506	A.27	FGRL43NN0400/7	434605	A.28	FKH36NS160TTF	435315	A.37	FKV46NE800PPF	435042	A.35	FNWS4AP	433440	A.39
FGL47DD250LF	438422	A.25	FGRL43NN0500/7	434607	A.28	FKH36NS800PPF	435321	A.35	FKV46NT100SF	435086	A.36	FNWS4AT	435759	A.39
FGL47DD400LF	438454	A.25	FGRL43NN0630/7	434622	A.28	FKH36NT100SF	435553	A.36	FKV46NT125SF	435089	A.36	FNWS4WP	436481	A.39
FGL47DD400NF	438486	A.27	FGRL45LK0160/7	434472	A.26	FKH36NT125SF	435554	A.36	FKV46NT800PF	435064	A.35	FNWS4WT	433442	A.39
FGL47DD630NF	438518	A.27	FGRL45LK0250/7	434481	A.26	FKH36NT630PF	435426	A.35	FKY306DN100SF	435381	A.37	RD...		
FGL47DN125LF	438414	A.25	FGRL45LL0250/7	434579	A.26	FKH36NT800PF	435318	A.35	FKY306DN125SF	435489	A.37	RD1D 110	872225	A.39
FGL47DN400LF	438446	A.25	FGRL45LL0350/7	434596	A.26	FKH436NM125SF	435571	A.36	FKY306DN160TF	435492	A.37	RD1D 220	872224	A.39
FGL47DN400NF	438478	A.27	FGRL45LL0400/7	434482	A.26	FKH436NM800PF	435542	A.35	FKY306DN800PF	435495	A.37	RD1D 380	872226	A.39
FGL47DN500NF	438510	A.27	FGRL45NL0250/7	434592	A.28	FKH436NT100SF	435565	A.36	FKY406DN100SF	435273	A.37	RD5 110	704175	A.39
FGN306F250LF	434247	A.50	FGRL45NL0400/7	434594	A.28	FKH436NT125SF	435566	A.36	FKY406DN125SF	435498	A.37	RD5 220	704169	A.39
FGN306F400LF	431473	A.50	FGRL45NN0400/7	434581	A.28	FKH436NT630PF	435462	A.35	FKY406DN160TF	435501	A.37	RD5 380	704176	A.39
FGN306F400NF	431488	A.51	FGRL45NN0500/7	434597	A.28	FKH436NT800PF	435534	A.35	FKY406DN800PF	435504	A.37	RD6 110	704178	A.39
FGN306F630NF	431491	A.51	FGRL45NN0630/7	434624	A.28	FKH46NE100SQF	435342	A.36	FKZD	434803	A.40	RD6 220	704177	A.39
FGN36KA250LKF	434073	A.26	FGRL4LK0160/7	434559	A.26	FKH46NE125SSF	435330	A.36	FN...			RD6 380	704179	A.39
FGN36KA350LLF	434483	A.26	FGRL4LK0250/7	434562	A.26	FKH46NE160TTF	435333	A.37	FN1BPE	435678	A.38	RDR	872227	A.39
FGN36KA400LLF	436156	A.26	FGRL4LL0250/7	434568	A.26	FKH46NE800PPF	435339	A.35	FN1BRE	435679	A.38	TT...		
FGN36KA400NLF	436157	A.28	FGRL4LL0350/7	434582	A.26	FKH46NG100SQF	435360	A.36	FN1BRW1	435575	A.39	TTR110	456094	A.39
FGN36KA500NNF	434824	A.28	FGRL4LL0400/7	434584	A.26	FKH46NG125SSF	435348	A.36	FN1BRW2	435577	A.39	TTR140	456095	A.39
FGN36KA630NNF	436158	A.28	FGRL4NL0250/7	434492	A.28	FKH46NG160TTF	435351	A.37	FN1BRY1	433415	A.39	TTR210	456096	A.39
FGN36VA400LLF	435140	A.26	FGRL4NL0400/7	434493	A.28	FKH46NG800PPF	435357	A.35	FN1BRY2	435574	A.39	TTR28	456090	A.39
FGN36VA630NNF	435146	A.28	FGRL4NN0400/7	434496	A.28	FKH46NS100SQF	435378	A.36	FN1I2F	433416	A.45	TTR35	456091	A.39
FGN37DA250LF	438400	A.25	FGRL4NN0500/7	434502	A.28	FKH46NS125SSF	435366	A.36	FN1I4F	437016	A.45	TTR60	456092	A.39
FGN37DA400LF	438432	A.25	FGRL4NN0630/7	434532	A.28	FKH46NS160TTF	435369	A.37	FN1PR	433417	A.40	TTR80	456093	A.39
FGN37DA400NF	438464	A.27	FGTCA1327	435107	A.32	FKH46NS800PPF	435							

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