TECHNICAL CATALOGUE

Formula Air

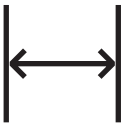
New low voltage air circuit-breakers



Formula Air
Consultation guide



Chapter 1
Main characteristics
Overview of the Formula Air family, distinctive features of the series and product conformity.



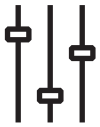
Chapter 2
The ranges
Electrical characteristics of automatic circuit-breakers.



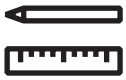
Chapter 3
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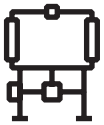
Chapter 4
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Chapter 5
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Simplicity and safety, up to 50kA

Protecting your electrical installation has never been easier thanks to Formula Air. This is the new line of low-voltage automatic circuit-breakers.
Easy to order, use and install, the Formula Air series offers all of the standard performance levels, quality and reliability you would expect from ABB technology.

Formula Air is an ideal solution for main installation requirements, from distribution switchboards to onboard compartments. This comprehensive range offers the most suitable solution for each specific set of requirements. Easy to use Formula Air products are also easy to order.







The performance levels you need

The automatic circuit-breakers are available three sizes up to 4000A, with short-circuit performance levels up to 50kA. They are equipped with the new Ek 1 and Ek 2 trip units, which guarantee maximum flexibility because they are interchangeable and common all the three frames.

Current capacity		
F4		2500 - 4000
F2	1600 - 2000	
FA	630 - 1600	

Ek 1. Enables rapid and accurate setting of the protections with the use of dip switches. This is the most appropriate solution for common applications.

Ek 2. Enables simple and intuitive navigation thanks to the graphical user interface of the LCD screen.

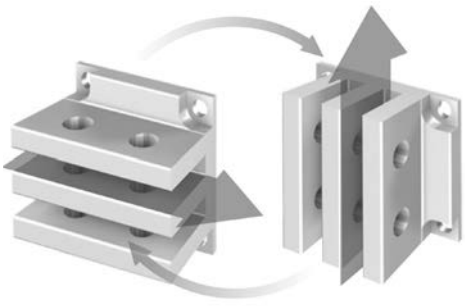
Simplicity and safety, up to 50kA

The simplicity you are looking for

The installation of Formula Air and its accessories is simple, quick and safe. The accessories, pre-cabled and common to all the three frames, allow for rapid mounting and a significant reduction in warehouse stock.
The innovative design guarantees flexibility in the installation of the circuit-breaker and permits last-minute changes.
It is actually possible to change, on site, the orientation of the rear terminals from horizontal to vertical or vice versa. If you need a switchboard with more compact dimensions, front terminals are available.

The safety you would expect

The supervision of the electrical installation is essential. For this reason, Formula Air allows you to directly monitor the main electrical parameters from the front of the circuit-breaker. The Ek 2 trip unit features a large screen that displays clear and complete information. Formula Air also ensures the safety of maintenance personnel. When removing the main cover of the breaker, the only accessible section is the area meant for accessories; this ensures segregation from the operating mechanism.
The quality of Formula Air is guaranteed by ABB, a leader in the development of low-voltage circuit-breakers, with decades of international experience in the sector. Moreover, ABB's global network offers prompt and efficient support. For your installations, choose the quality, reliability and experience of ABB.





Formula Air automatic circuit-breakers

Common data		
Rated service voltage Ue	[V]	440
Rated insulation voltage Ui	[V]	1000
Rated impulse withstand voltage Uimp	[kV]	12
Frequency	[Hz]	50 - 60
Number of poles		3- 4
Version		Fixed - Withdrawable
Operating temperature		-25°C....+70°C
Storage temperature		-40°C....+70°C



Formula Air			**FA1**		**FA2**	**FA4**
Performance levels			B	C	C	C
Max rated uninterrupted current at 40°C - Iu		[A]	630	630	1600	2500
		[A]	800	800	2000	3200
		[A]	1000	1000		4000
		[A]	1250	1250		
		[A]	1600	1600		
Neutral pole current-carrying capacity for 4 poles breakers		[%Iu]	100	100	100	100
Rated ultimate breaking capacity under short circuit - Icu	@400-415V	[kA]	42	50	50	50
	@440V	[kA]	42	50	50	50
Rated service breaking capacity under short-circuit - Ics		[%Icu]	100	100	100	100
Rated short time withstand current - Icw	(1s) @440V	[kA]	42	50	50	50
	(3s)	[kA]	24	24	25	25
Rated making capacity under short-circuit (peak value) - Icm	440 V	[kA]	88	105	105	105
Utilization category (according to IEC 60947-2)			B	B	B	B
Operating times		[ms]	40	40	40	40
Dimensions	H - Fixed/Withdrawable	[mm]		296/363.5	371/425	371/425
	D - Fixed/Withdrawable	[mm]		183/271	270/383	270/383
	W - Fixed 3p/4p	[mm]		210/280	276/317	384/510
	W - Withdrawable 3p/4p	[mm]		278/348	317/407	425/551
Weights (CB with trip unit and current sensor)	Fixed 3p/4p			14/16	41/53	56/70
	Withdrawable 3p/4p (fixed part included)			38/43	54/99	110/136

Formula AIR			**FA1**			**FA2**	**FA4**	**FA4**	
Mechanical life with regular ordinary maintenance		[Iu]	≤ 1000	1250	1600	≤ 2000	2500	3200	4000
		[No. cycles x 1000]	15	15	15	15	15	15	15
Frequency		[Oper./Hour]	60	60	60	60	60	60	60
Electrical life with regular ordinary maintenance	440 V	[No. cycles x 1000]	6	6	6	6	5	5	4
Frequency		[Cycles/Hour]	30	30	30	30	20	20	20

Formula Air switch-disconnector

Switch-disconnectors, identified with the abbreviation “/MS”, are devices that satisfy the isolating specifications provided by the IEC 60947-3 Standard. The switch-disconnectors are derived from the corresponding automatic circuit-breakers, and they have the same dimensions and accessory options. This version differs from the automatic circuit-breakers only because of the absence of protection trip units.

The device, when in the open position, guarantees an isolating distance between the main contacts of the circuit-breaker that is sufficient to ensure that the installation downstream is not live.
Furthermore the switch-disconnectors, if used with an external protection relay with maximum delay of 500ms, enable a breaking capacity at a maximum rated operating voltage (Ue) equal to the value of rated short-time withstand current (Icw) for one second.

Common data		
Rated service voltage Ue	[V]	440
Rated insulation voltage Ui	[V]	1000
Rated impulse withstand voltage Uimp	[kV]	12
Frequency	[Hz]	50 - 60
Number of poles		3- 4
Version		Fixed - Withdrawable
Operating temperature		-25°C....+70°C
Storage temperature		-40°C....+70°C



Formula Air			**FA1**	**FA2**	**FA4**
Performance levels			N/MS	C/MS	C/MS
Max rated uninterrupted current at 40°C - Iu		[A]	630	1600	2500
		[A]	800	2000	3200
		[A]	1000		4000
		[A]	1250		
		[A]	1600		
Neutral pole current-carrying capacity for 4 poles breakers		[%Iu]	100	100	100
Rated making capacity under short-circuit (peak value) - Icm	440 V	[kA]	105	105	105
Rated short time withstand current - Icw	(1s) @440V	[kA]	50	50	50
	(3s)	[kA]	30	25	25
Category			AC23	AC23	AC23
Dimensions	H - Fixed/Withdrawable	[mm]	296/363.5	371/425	371/425
	D - Fixed/Withdrawable	[mm]	183/271	270/383	270/383
	W - Fixed 3p/4p	[mm]	210/280	276/317	384/510
	W - Withdrawable 3p/4p	[mm]	278/348	317/407	425/551

Formula AIR			**FA1**		**FA2**	**FA4**	**FA4**	
Mechanical life with regular ordinary maintenance		[Iu]	≤ 1000	1600	≤ 2000	2500	≤ 3200	≤ 4000
		[No. cycles x 1000]	15	15	15	15	15	15
Frequency		[Oper./Hour]	60	60	60	60	60	60
Electrical life with regular ordinary maintenance	440 V	[No. cycles x 1000]	6	6	6	6	5	4
Frequency		[Cycles/Hour]	30	30	30	20	20	20

Introduction

Formula Air automatic circuit-breakers are equipped with the new trip units for protection and measurements. All Formula Air circuit-breakers are equipped with protection trip units that are interchangeable from the front with just a few, simple operations by the customer.

The range offers two different types of protection trip unit, according to the different types of requirements.
The table below shows the family offering:

	Protection of Current	Measurement of Current
Ek 1	●	-
Ek 2	●	●

All protection trip units of the Formula Air family are self-powered by current that pass through the circuit-breaker.
They guarantee excellent reliability due to a system of self monitor of internal connections.
The interchangeability of the trip units enables personalization of the functions available, even during commissioning or when the circuit-breaker has already been installed.

In particular, Ek consists of:

- **Protection trip unit,** available with different interfaces and versions that range from basic to more complete.

- **Interchangeable rating plug** enables all protection thresholds to be adjusted according to the rated current, increasing flexibility for the customer. It is useful in installations that are prepared for future development or in cases in which the power supplied may be limited temporarily.

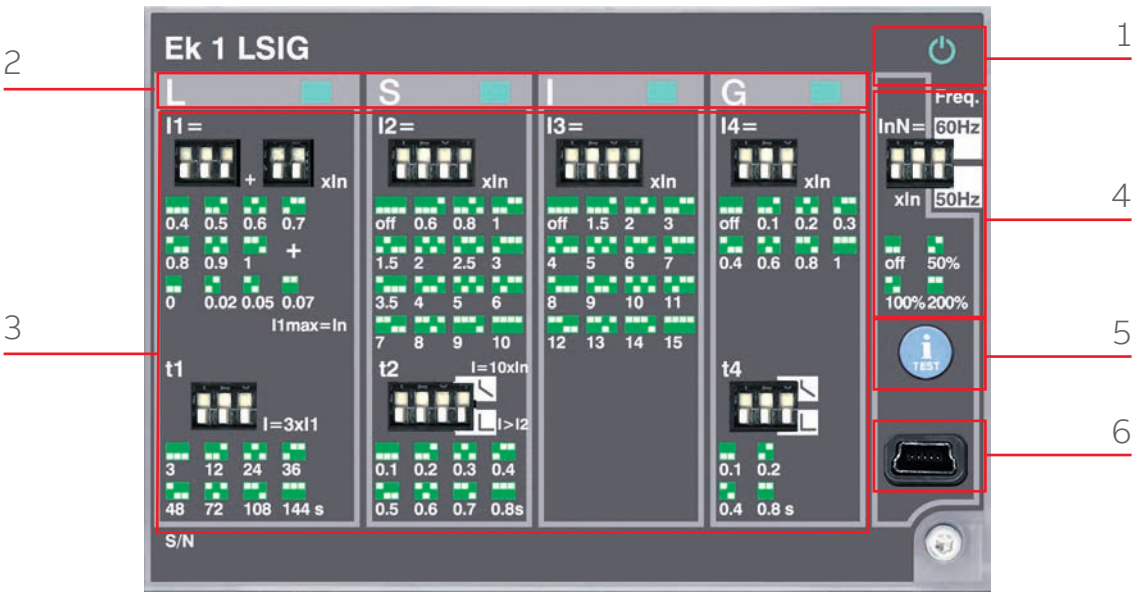


Protection trip units
Ek 1

Ek 1 is the new protection trip unit of the Formula Air family for all applications in which high accuracy and reliable protection against overcurrent are required. Ek 1 offers a complete set of standard protection functions. Dedicated LEDs allow the fault that caused tripping to be determined.

Characteristics
The unit is available in the following versions:
- Ek 1 LI
- Ek 1 LSIG

Key:
1. Power-on LED for signalling correct operation (watchdog)
2. LEDs for alarm signalling of L, S, I and G protection functions and diagnostics
3. Dip switches for setting the protection functions
4. Dip switches for setting the network frequency and neutral protection device
5. Pushbutton for test and for indicating the cause of tripping
6. Test and programming connector



Protection trip units
Ek 1

Protection functions
Ek 1 offers overcurrent protection functions and, in the event of tripping, controls the opening of the circuit-breaker, preventing it from closing again unless it has been reset by the operator (lockout device – code ANSI 86).

- Overload (L - ANSI 49)
- Time-delayed overcurrent (S - ANSI 51 & 50TD)
- Thermal memory
- Instantaneous overcurrent (I - ANSI 50)
- Earth Fault (G - ANSI 51N & 50NTD)
- Neutral protection

Measurements
The Ek 1 unit measures phase and neutral current with great accuracy: 1.5% including the current transformers in the 0.2 ... 1.2 In range.
Ek 1 also records the characteristics of the circuit-breaker, to enable a rapid analysis in the event of maintenance. All values stored can be displayed on a PC, through the free software Ekip Connect.
- Maximum and average current values per phase;
- Date, time, fault current per phase and type of protection tripped over the last 20 trips;
- Date, time and type of operation of the last 100 events (for example: opening/closing of circuit-breaker, pre-alarms, editing settings);
- Number of mechanical and electric operations of the circuit-breaker;
- Total operating time;
- Contact wear;
- Date and time of the last maintenance carried out, in addition to the estimate of the next maintenance required;
- Circuit-breaker identifying data: type, serial number, firmware version, name of the device as assigned by the user.

Watchdog
All the protection trip units of the Formula Air family ensure high reliability owing to an electronic circuit that periodically monitor the continuity of the internal connections, such as trip coil, rating plug and each current sensor (Ansi 74). In the event of a malfunction, the LEDs indicate the corresponding alarm to enable the fault to be identified rapidly.

User interface
Ek 1 offers a great variety of thresholds and trip times, the protections can be set by dip-switches. Up to 5 LEDs are also available (depending on the version) to indicate correct operation or alarms. The interface always enables the status of the installation to be identified clearly and quickly: correct operation (green LED), overcurrent pre-alarms or alarms, presence of selfcontrol functions alarms, maintenance interval expired, indication of tripped protection after a fault. The protection tripped indication is activated by pressing the iTest key, and operates without the need of an external power supply because a battery is installed inside the unit.

Test function
The test port on the front of the protection trip unit can be used to run the circuit-breaker tests by connecting one of the following devices:
- Ekip TT to run the trip test, the LEDs test and check absence of alarms detected by the watchdog function;
- Ekip T&P to permit not only the trip test and LEDs test but also to run the test of the individual protection functions and save the relative report;
- ITest key that is pressed to run the battery test when the circuit-breaker is disconnected.

Supply
The Ek 1 protection trip unit does not require an external supply for the protection functions or for the alarm indication functions because it is self-supplied by the current sensors installed on the circuit-breaker. A three-phase 100A current suffices to activate the LED indications.
The Ek Supply module enables an auxiliary supply to be easily connected and is able to receive both a direct current supply and an alternating current (110-240V AC/DC) to activate additional functions such as:
- G protection at values below 100A or below 0.2 In;
- recording the number of operations.

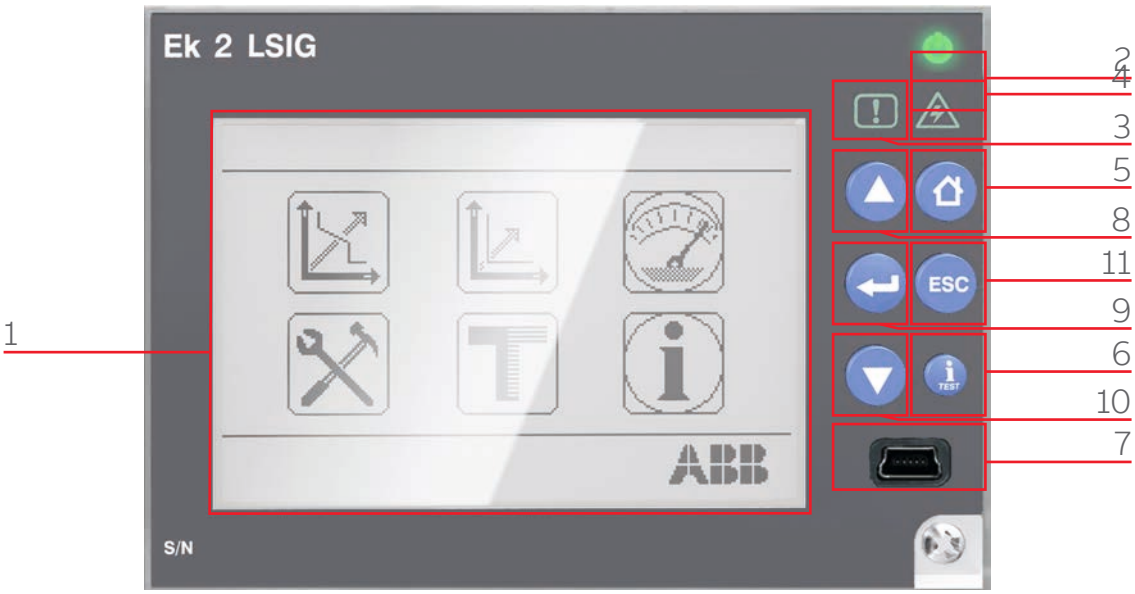
The trip unit can also be supplied by means of a galvanically isolated 24V DC auxiliary voltage.

Protection trip units
Ek 2

Ek 2 is the new protection trip unit for Formula Air that provides a complete series of protections and high accuracy measurements of current parameters.
The simple and intuitive interface enables the operator to access all the information and settings rapidly and easily by minimizing installation and commissioning time.

Characteristics
The unit is available in the following versions:
- Ek 2 LSIG

Key:
1. Wide LCD display
2. Power-on LED to indicate correct operation (watchdog)
3. Pre-alarm LED
4. Alarm LED
5. Home pushbutton to return to home page
6. Pushbutton for test and indicating cause of trip
7. Test and program-ming connector
8. Up pushbutton
9. Enter pushbutton
10. Down pushbutton
11. ESC pushbutton



Protection functions
Ek 2 protection trip unit enables all the protection functions to be set with a few simple steps directly from the wide display using pushbottons. If the circuit breaker is tripped it must be reset manually or electrically by the operator (lockout relay – code ANSI 86).
- Overload (L - ANSI 49)
- Time-delayed overcurrent (S - ANSI 51 & 50TD)
- Thermal memory
- Instantaneous overcurrent (I - ANSI 50)
- Closing on short-circuit (MCR)
- Earth Fault (G-ANSI 51N & 50NTD)
- Instantaneous Earth Fault (G-ANSI 50N)
- Neutral protection
- Start-up function
- Current unbalance (IU – ANSI 46)
- Zone selectivity for S and G protection (ANSI 68)
- Current thresholds

Measurements
Measurements and meters
Bar graphs that show the currents of the three phases and of neutral (with 1,5% accuracy in the 0.2 to 1.2 In range) on a 0-125% In scale in addition to the numeric value of the most loaded phase can be selected as the default page. The bar graphs are yellow in the event of a pre-alarm and red in the event of an overload to enable an irregular condition to be identified immediately.

Protection trip units
Ek 2

Where applicable, the measurement of the earth fault current is shown on a dedicated page. The ammeter can operate both in self-supplied mode and with auxiliary voltage. In the latter case, the display always has back lighting and the ammeter is also active at currents below 100A.

Data logger
Ek 2 is always supplied with the exclusive Data Logger (register) function that stores with high sampling frequency the instantaneous values of all the measurements in two memory buffer registers. The data can be easily downloaded by the Ekip Connect unit and transferred to any personal computer. This enables the current waveforms to be analyzed for rapid fault analysis. The function continuously stores and stops recording, with a selectable delay, whenever the event set by the user occurs (e.g. trip or alarm). In this manner, it is possible to analyze the complete evolution of the fault: from the start to its complete elimination.

Information on trip and opening data
If a trip occurs, Ek 2 stores all the information that is required for rapid identification and elimination of the causes:
- Protection tripped
- Opening data (current)

Time-stamping (data, time and consecutive opening number)
If the iTest key is pressed, the trip unit displays all these data directly on the display.
No auxiliary supply is required. The information is also available to the user with the circuit-breaker open or without current flow, due to the battery installed inside the unit.

Maintenance indicators
A complete set of information about the circuit-breaker and its operation is available for effective fault analysis and preventive scheduling of maintenance. All the information can be seen from the display in particular:
- Date, time, fault current by phase and type of protection tripped over the last 20 trips;
- Date, time and type of operation of the last 100 events (example: opening/closing of circuit-breaker, pre-alarms, editing of settings, ect.);
- Number of operations of the circuit-breaker: divided into mechanical operations (no current), electrical operations (with current) and protection function (trip);
- Contact wear estimated in function of the number and type of openings;
- Total operating time of the circuit-breaker with circulating current;
- Date and time of the last maintenance session, scheduling of the next maintenance session;
- Circuit-breaker identifying data: type, serial number, firmware version, device name assigned by the user.

All the information can be viewed directly from the display and from a PC using the front port of the trip unit.



Watchdog
All of the trip units in the Formula Air family ensure high reliability because of an electronic circuit that periodically controls continuity of the internal connections, such as trip coil, rating plug and each current sensor (Ansi 74). In the event of an alarm, a message is shown on the display, and if it is set during the installation phase, the trip unit can command the opening of the circuit- breaker. If a protection function intervenes, Ek 2 always checks that the circuit-breaker has been opened by auxiliary contacts that indicate the position of the main contacts. Otherwise, Ek 2 indicates an alarm (ANSI BF code - Breaker Failure) to be used to command the opening of the circuit-breaker located upstream. Ek 2 also contains self-protection that preserves the correct operation of the unit against abnormal temperatures (T) inside the protection trip unit.
The user disposes of the following indications:
- “Warning” LED for temperature below -20 °C or above +70 °C, at which the trip unit operates correctly with the display switched off
- “Alarm” LED for temperature outside the operating range, at which the trip unit commands the opening of the circuit-breaker (if set during the configuration phase).

Protection trip units
Ek 2

User interface
All operations with Ek 2 are simple and intuitive thanks to the wide LCD display. For example, all the main information is listed on one page, thus enabling the state of the installation to be identified rapidly: maximum current. In addition, the use of Ek 2 is further simplified by the possibility of scrolling through the menu and reading the alarms. The home pushbutton enables you to return, at any moment, to the main page and the iTest key enables the information to be viewed after a circuit-breaker trip and test.
As in the previous generation of trip units, a password system is used to manage “Read” or “Edit” modes. The default password, 00001, can be edited by the user. The protection parameters (curve and trip thresholds) are settable in “Edit” mode whereas it is always possible to consult the information in “Read” mode.

On the front of the trip unit there are also two LEDs: a pre-alarm LED (square yellow LED) and an alarm LED (red triangular LED); a message on the display always accompanies the flashing of the LEDs for clear identification of the type of event. The list of all the alarms active at that moment can be viewed by simply pushing the iTest button.
Ek 2 is also supplied with a front port that permits a temporary connection to devices for test, supply or communication (for example Ekip T&P).

Test function
For circuit-breaker testing it is possible to use the test port and the iTest key positioned on the front of the protection trip unit.
The available functions are:
- trip test, test of the display and of the LEDs and check of absence of alarms detected by the watchdog function using Ekip TT;
- test of the single protection functions and saving of the report, in addition to the trip test and test of the display, using Ekip T&P;
- test of the battery with the circuit-breaker switched off by pressing the iTest key.

Supply
The Ek 2 protection trip unit is self-supplied by the current sensors and does not require an external supply for the basic protection functions or for the alarm indication functions. All protection settings are stored in a non-volatile memory that maintains the information, even without a power supply. To activate the indication functions the ammeter and



the display, a 100A three-phase current suffices. An auxiliary supply can easily be connected. The Ek Supply module can be connected to supplies of both direct current and alternating current to activate additional functions such as:
- using the unit with circuit-breaker open;
- recording the number of operations;
- G protection with values below 100A or below 0.2 In;
- MCR protection functions.

The Ek Supply module allows the cartridge modules to be used in the terminal box area. Otherwise, the trip unit can be supplied by means of a galvanically isolated 24V DC auxiliary voltage.

The Ek 2 protection trip unit is also supplied with a battery that enables the cause of the fault to be indicated after a trip, without a time limit. In addition, the battery enables date and time to be updated, thus ensuring the chronology of the events. When Ek 2 is operating, it uses an internal control circuit to indicate automatically that the battery is flat. On the other hand, when the unit is switched off the battery test can be run by simply pressing the iTest key.



Technical characteristics
Protection functions

ABB Code	ANSI/IEEE C37.2 Code	Function	Threshold
L	49	Overload protection	I1 = 0.4 - 0.42 - 0.45 - 0.47 - 0.5 - 0.52 - 0.55 - 0.57 - 0.6 - 0.62 - 0.65 - 0.67 - 0.7 - 0.72 - 0.75 - 0.77 - 0.8 - 0.82 - 0.85 - 0.87 - 0.9 - 0.92 - 0.95 - 0.97 - 1 x In
		Thermal memory	
		Tolerance	tripping between 1.05 and 1.2 x I1
S	50TD	Short-circuit selective protection	I2 = 0.6 - 0.8 - 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4 - 5 - 6 - 7 - 8 - 9 - 10 x In
		Tolerance	± 7% If ≤ 6 x In ± 10% If > 6 x In
	51	Short-circuit selective protection	I2 = 0.6 - 0.8 - 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4 - 5 - 6 - 7 - 8 - 9 - 10 x In
		Thermal memory	
		Tolerance	± 7% If ≤ 6 x In ± 10% If > 6 x In
I	50	Short-circuit instantaneous protection	I3= 1.5 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 - 13 - 14 - 15 x In
		Tolerance	± 10%
G	50N TD	Earth fault protection	I4(1) = 0.1 - 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 1 x In
		Tolerance	± 7%
	51N	Earth fault protection	I4(1) = 0.1 - 0.2 - 0.3 - 0.4 - 0.6 - 0.8 - 1 x In
		Tolerance	± 7%

(1) G protection below 100A or below 0.2 In available with auxiliary supply
(2) The minimum trip time is 1s, regardless of the type of curve set (self-protection)

The tollerances above apply to trip units already powered by the main circuit with current flowing in at least two-phases or an auxiliary power supply.
In all other cases the following tollerance values apply

ABB Code	Trip threshold	Trip time
L	Trip between 1.05 and 1.2 x I1	± 20%
S	± 10%	± 20%
I	± 15%	≤ 60ms
G	± 15%	± 20%



Trip time	Excludibility	Pre Alarm	Trip curve	Ek 1
with I = 3 I1, t1 = 3 - 12 - 24 - 36 - 48 - 72 - 108 - 144 s (2)	No	50 ... 90 I1 Step 1%	t = k / I²	●
	Yes			●
± 10% If ≤ 6 x In ± 20% If > 6 x In				
t2 = 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8s	Yes	No	t = k	●
The best between: ± 10% or ± 40 ms				
with I = 10 In, t2 = 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8s	Yes	No	t = k / I²	●
	Yes	No		
± 15% If ≤ 6 x In ± 20% If > 6 x In				
Instantaneous	Yes	No	t = k	●
≤ 30 ms				
t4 = 0.1 - 0.2 - 0.4 - 0.8s	Yes	50...90% I4 Step 1%	t = k	●
The best between: ± 10% or ± 40 ms				
t4 = 0.1 - 0.2 - 0.4 - 0.8s	Yes	50...90% I4 Step 1%	t = k / I²	●
± 15%				

Technical characteristics
Protection functions

ABB Code	ANSI Code	Function	Thereshold	Threshold step	Tripping time	Time Step
L	49	Overload Protection	I1 = 0.4…1 x In	0.001 x In	with I = 3 I1, t1 = 3...144 s	1s
		Thermal Memory				
		Tolerance	tripping between 1.05 and 1.2 x I1		± 10% I ≤ 6 x In ± 20% I > 6 x In	
S	50TD	Time-delayed overcurrent protection	I2 = 0.6...10 x In	0.1 x In	t2 = 0.05...0.8s	0.01s
		Start up	Activation: 0.6…10 x In	0.1 x In	Range: 0.1…30s	0.01s
		Tolerance	± 7% I ≤ 6 x In ± 10% I > 6 x In		The best between: ± 10% or ± 40 ms	
	51	Time-delayed overcurrent protection	I2 = 0.6...10 x In	0.1 x In	with I = 10 In, t2 = 0.05...0.8s	0.01s
		Thermal Memory				
		Tolerance	± 7% I ≤ 6 x In ± 10% I > 6 x In		± 15% I ≤ 6 x In ± 20% I > 6 x In	
I	50	Istantaneous overcurrent protection	I3= 1.5...15 x In	0.1 x In	Instantaneous	-
		Start up	Activation: 1.5…15 x In	0.1 x In	Range: 0.1…30s	0.01s
		Tolerance	± 10%		≤ 30 ms	
MCR		Closing on short-circuit protection	I3= 1.5...15 x In	0.1 x In	With I>I3 Istantaneous Monitor time range: 40..500ms	0.01s
		Tolerance	± 10%		≤ 30 ms	
G	50N/50N TD	Earth fault protection	I4(1) = Inst, 0.1...1 x In	0.001 x In	with I > I4, t4 = 0.1…1s	0.05s
		Start up	Activation: 0.2…1 x In	0.2 x In	range: 0.1…30s	0.01s
		Tolerance	± 7%		The best between: ± 10% or ± 40 ms or 50ms with t4=Istantaneous	
	51N	Earth fault protection	I4(1) = 0.1...1 x In	0.01 x In	with I = 4 In, t4 = 0.1…1s	0.05s
		Tolerance	± 7%		± 15%	
IU	46	Current unbalance protection	I6 = 2…90% In unbalance	1%In	t6 = 0.5…60s	0.5s
		Tolerance	± 10%		The best between: ± 10% or ± 40 ms (for t<5s) ±100ms (for t≥5s)	

ABB Code	Trip threshold	Trip time
L	Trip between 1.05 and 1.2 x I1	± 20%
S	± 10%	± 20%
I	± 15%	≤ 60ms
G	± 15%	± 20%
Other protection	± 15%	± 20%



Excludibility	Excludibility trip	Pre-allarm	Trip curve	Ek 2
no	no	50...90% I1	t = k / I^2	●
yes				●
yes	yes	no	t = k	●
yes				●
yes	yes	no	t = k / I^2	●
yes				●
yes	no	no	t = k	●
yes				●
yes	no	no	t = k	●
yes	yes	50...90% I4 Step 1%	t = k	●
yes				●
yes	yes	50...90% I4 Step 1%	t = k / I^2	●
yes	yes	no	t = k	●

Technical characteristics
Measurement functions

Instantaneous measurements		**Parameters**
Currents (RMS)	[A]	L1, L2, L3, Ne
Earth fault current (RMS)	[A]	Ig
Record of values: of the parameter for each interval with time-stamping		**Parameters**
Current: minimum and maximum	[A]	I Min, I Max
Data logger: record of high sampling rate parameters		**Parameters**
Currents	[A]	L1, L2, L3, Ne, Ig
Sampling rate	[Hz]	1200-9600
Maximum recording duration	[s]	18
Recording stop delay	[s]	0-10s
Number of registers	[no]	2 independent
Information on trip and opening data: after a fault without auxiliary supply		**Parameters**
Type of protection tripped		eg. L, S, I, G
Fault values per phase	[A]	eg. I1, I2, I3, neutral
Time-stamping		Date, time and progressive number
Maintenance indicators		**Parameters**
Information on last 20 trips		Type of protection, fault values and time-stamping
Information on last 100 events		Type of event, time-stamping
Number of mechanical operations (1)	[no]	Can be associated to alarm
Total number of trips	[no]	
Total operating time	[h]	
Wear of contacts	[%]	Prealarm >80%; Alarm = 100%
Date of maintenance operations performed		Last
Indication of maintenance operation needed		
Circuit-breaker I.D.		Type of circuit-breaker, assigned device name, serial number
Self-diagnosis		**Parameters**
Check of continuity of internal connnections		Alarm due to disconnection: rating plug, sensors, trip coil
Failure of circuit-breaker to open (ANSI 50BF)		Alarm following non-tripping of protection functions
Temperature (T)		Prealarm and alarm for abnormal temperature

(1) with auxiliary supply present

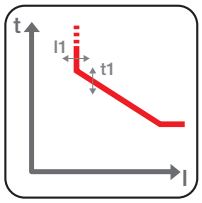




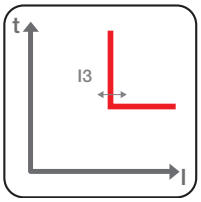
		Ek 1	Ek 2
Accuracy			
1.5%		●	●
2%		●	●
Window	**Intervals**		
Fixed synchronizable by remote	Duration: 5…120min Number of intervals: 24	●	●
		–	●
		–	●
		–	●
		–	●
		–	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
		●	●
Note: Opening of circuit-breaker can be set in the event of alarm		●	●
		●	●
		●	●

Key: ● available – not available

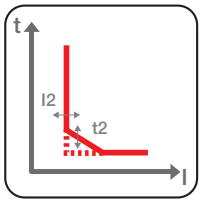
Description of protection functions
Ek 1



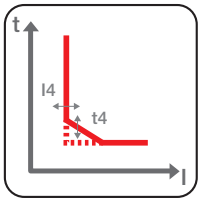
Overload (L - ANSI 49): available with 25 current thresholds and 8 curves, it provides effective protection of all systems. A pre-alarm warning is also available on reaching 90% of the threshold set.



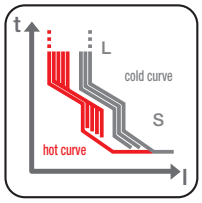
Instantaneous overcurrent (I - ANSI 50): with tripping curve without intentional delay, it offers 15 tripping thresholds and can be excluded by setting the dip switch combination to “OFF”.



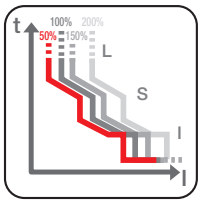
Time-delayed overcurrent (S - ANSI 51 & 50TD): with constant tripping time (t = k), or with constant specific let-through energy (t = k/I²), it provides 15 current thresholds and 8 curves, for fine adjustment. The function can be excluded by setting the dip switch combination to “OFF”.



Earth fault (G - ANSI 51N & 50NTD): with tripping time independent of current (t = k) or constant specific let-through energy (t = k/I²). The function can be excluded by setting the dip switch combination to “OFF”.

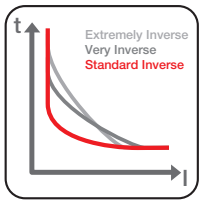


Thermal memory: for L and S protection functions, this is used to protect components, such as transformers, from overheating following an overload. The function, which can be enabled by the Ekip Connect software, adjusts the protection tripping time according to the length of time that has elapsed since the first overload, taking into account the amount of heat generated.

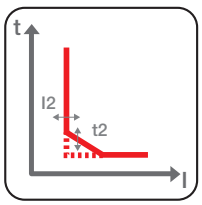


Neutral protection: available at 50%, 100% or 200% of the phase currents, or disabled, it is applied to the overcurrent protections L, S and I.

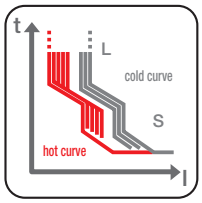
Description of protection functions
Ek 2



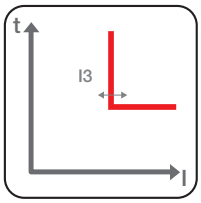
Overload (L - ANSI 49): with inverse long-time delay trip of the type t = k/I². Thresholds and tripping time can be fine tuned directly from the display with a very high precision. A pre-alarm threshold can be set, before the protection causes a trip. The settable pre-alarm indicates the set threshold is reached before the protection is tripped.



Time-delayed overcurrent (S - ANSI 51 & 50TD): with constant trip time (t = k), or constant specific letthrough energy (t = k/I²).

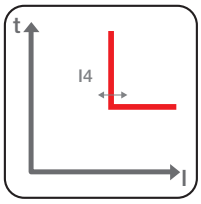


Thermal memory: for protections L and S it is used to protect the components, such as transformers, against overheating following overloads. The protection adjusts the trip time of the protection according to how much time has elapsed after the first overload, taking account of the overheating caused.

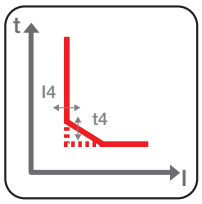


Instantaneous overcurrent (I - ANSI 50): with trip curve without intentional delay.

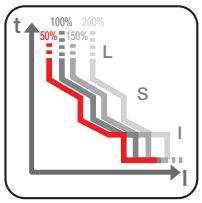
Closing on short-circuit (MCR): the protection uses the same algorithm of the protection I, limiting operation to a settable time window from the closing of the circuit-breaker. The protection can be disabled, also alternatively to protection I. The function is active with an auxiliary supply.



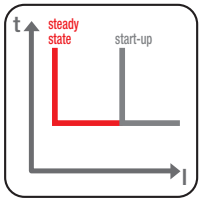
Instantaneous Earth Fault (G-ANSI 50N): with trip curve without instantaneous delay.



Earth fault (G - ANSI 51N & 50NTD): with trip time independent of the current (t = k) or with constant specific let-through energy (t = k/I²). A pre-alarm indication is also available when 90% of the threshold is reached to activate corrective measures before the protection is tripped. The function also enables the trip to be excluded so that only the alarm is indicated, for use in installations where continuity of service is an essential requirement.

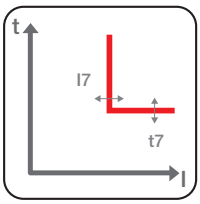


Neutral protection: available at 50%, 100%, 150% or 200% of the phase currents, or disabled, it is applied to the overcurrent protections L, S and I.



Start-up function: enables protections S, I and G to operate with higher trip thresholds during the starting phase, avoiding untimely trips due to high inrush currents of certain loads (motors, transformers, lamps). The starting phase lasts 100 ms to 30 s and is recognized automatically by the trip unit:

- at the closing of the circuit-breaker with a self-supplied trip unit;
- when the peak value of the maximum current exceeds the set threshold (0.1…10 x In) with an externally supplied trip unit; a new start-up is possible after the current falls below the threshold.



Current unbalance (IU – ANSI 46): with constant trip time (t = k), protects from an unbalance between the currents of the single phases protected by the circuit-breaker.

Current thresholds: this function enables the realization of four independent thresholds to be indicated in order to enable corrective action implementation before the overload L protection trips the circuit-breaker.

Standard supply

The new Formula Air circuit-breakers have been designed to optimize the installation and commissioning of accessories.

Thanks to its innovative design, this new family allows to install electrical and mechanical accessories in a simple and time efficient way. At the same time, the operating mechanism area remains segregated and protected, providing safety for operators.

Fixed circuit-breakers and fixed parts of withdrawable circuit-breakers are provided with a functional terminal box for the auxiliary connection. The terminals can be wired first and then installed on the circuit-breaker terminal box, thereby facilitating cable connection for the operator.

The fixed versions of Formula Air automatic circuit-breakers are always supplied as standard with the following accessories:
- IP30 protection for switchgear door
- adjustable rear terminals mounted in HR – HR configuration
- front terminals for FA1 circuit-breaker
- four standard open/closed auxiliary contacts - AUX 4Q 400V
- four terminals for auxiliary connections
- mechanical signalling of the tripping of the protection trip unit - TU Reset

The withdrawable versions of automatic circuit-breakers are always supplied as standard with the following accessories:
- closed circuit-breaker racked-out mechanism lock
- lever for racking in and racking out
- anti-insertion lock
- four standard open/closed auxiliary contacts - AUX 4Q 400V
- four terminals for auxiliary connections
- mechanical signalling of the tripping of the protection trip unit - TU Reset

The fixed parts feature:
- IP30 protection for switchgear door
- anti-insertion lock
- standard shutter lock – SL
- adjustable rear terminals, mounted in HR – HR configuration.

Accessories for circuit-breakers

Contacts



Fig. 01-A



Fig. 01-B

Open / closed auxiliary contacts - AUX (Fig. 01A/B)

Formula Air circuit-breakers can be equipped with auxiliary contacts that signal the open or closed status of the circuit-breaker. The first block of four standard contacts is always provided with the automatic circuit-breakers. The switching contacts are available in the following configurations:

Open / closed auxiliary contacts (AUX 4Q)	**FA1**	**FA2 - FA4**
4 auxiliary contacts	●	●
Open / closed supplementary auxiliary contacts (AUX 6Q)		
6 auxiliary contacts	-	●
Open / closed external supplementary auxiliary contacts (AUX 15Q)		
15 auxiliary contacts	●	●
Maximum number of open / closed auxiliary contacts that can be installed	19	25

			Standard contact
Type			changeover contacts
Minimum load			100mA @ 24V
Breaking capacity			
DC	125V		0.3A @ 10ms
	250V		0.15A @ 10ms
AC	250V		5A @ cosφ 1
			5A @ cosφ 0.7
			5A @ cosφ 0.3
	400V		3A @ cosφ 1
			2A @ cosφ 0.7
			1A @ cosφ 0.3

Electrical diagram reference: figure 1, 81, 91

AUX 15Q is an alternative to the mechanical interlock (MI) and the DLP lock if mounted on the right side.



Fig. 02-B

Auxiliary position contacts - AUP (Fig. 02)

When the circuit-breaker is a withdrawable version, the position of the mobile part can be signalled electrically by accessorizing the fixed part with one of the following signalling contact units:

Auxiliary position contacts (AUP)	**FA1**	**FA2 - FA4**
5 auxiliary contacts	-	●
5 supplementary auxiliary contacts	-	●
6 auxiliary contacts	●	-
Maximum number of auxiliary position contacts that can be installed	6	10

			Standard contact
Type			changeover contacts
Minimum load			100mA @ 24V
Breaking capacity			
DC	125V		0.3A @ 10ms
	250V		0.15A @ 10ms
AC	250V		5A @ cosφ 1
			5A @ cosφ 0.7
			5A @ cosφ 0.3
	400V		3A @ cosφ 1
			2A @ cosφ 0.7
			1A @ cosφ 0.3

Electrical diagram reference: figure 96, 97

Accessories for circuit-breakers



Fig. 03

Ready to close signalling contact - RTC (Fig. 03)
The ready to close signalling contact – RTC – indicates that the circuit-breaker is ready to receive the closing command. The circuit-breaker is ready to close when the following conditions have been met:
- circuit-breaker open
- springs loaded
- no opening command or locks on the opening command
- circuit-breaker reset following tripping of Ek protection trip unit.

		Standard contact
Type		Switching
Minimum load		100mA @ 24V
Breaking capacity		
DC	250V	0.5A @ 0ms / 0.2A 10ms
AC	250V	3A @ cosφ 0.7

Electrical diagram reference: figure 71



Fig. 04

Mechanical signalling of the tripping of protection trip unit - TU Reset (Fig. 04)
The automatic circuit-breakers are always equipped with a mechanical device that signals the tripping status of the protection trip units. After the Ek trip unit has tripped due to an electrical fault, the signalling device clearly indicates the tripping status on the front of the circuit-breaker. The circuit-breaker can be reset only after the signalling pushbutton has been restored to its normal operating position. The device conforms to the Ansi 86T standard.



Fig. 05

Contact signalling tripping of protection trip unit S51 (Fig. 05)
The contact signals the opening of the circuit-breaker after the Ek protection trip unit has tripped. The circuit-breaker can only be closed after the “TU Reset” tripped trip unit mechanical signalling pushbutton has been restored to its normal operating position.

Electrical diagram reference: figure 11

Contact signalling loaded springs – S33 M/2
This contact is always supplied with a geared motor; it remotely signals the spring status of the circuit-breaker operating mechanism.

		Standard contact
Type		changeover contacts
Minimum load		100mA @ 24V
Breaking capacity		
DC	125V	0.3A @ 10ms
	250V	0.15A @ 10ms
AC	250V	5A @ cosφ 1
		5A @ cosφ 0.7
		5A @ cosφ 0.3
	400V	3A @ cosφ 1
		2A @ cosφ 0.7
		1A @ cosφ 0.3

Electrical diagram reference: figure 12



Fig. 06

Coils and motor

Opening and closing release- YO/YC (Fig. 6)

The opening and closing releases enable the circuit-breaker to be controlled remotely. Opening is always possible, while closing is available only when the closing springs of the operating mechanism are loaded and the circuit-breakers is ready to close. The releases operate by means of minimum impulse current duration time of 100 ms. Furthermore, they can operate in permanent service. In this case, if opening command is given by means of the opening release, the circuit-breaker can be closed by de-energizing the opening release and, after a time of at least 30 ms, by controlling the closing.

Electrical diagram reference: figure 75, 77

Undervoltage release – YU

The undervoltage release opens the circuit-breaker with trip unit power supply voltages of 35-70% Un. The circuit-breaker can be closed with a trip unit power supply voltage of 85-110% Un. It can be used for safe remote tripping, for blocking closing or to control the voltage in the primary and secondary circuits. The power supply for the release is therefore obtained on the supply side of the circuit-breaker or from an independent source. Circuit-breaker closing is permitted only when the release is powered.

Electrical diagram reference: figure 73

General characteristics		
Power supply (Un)	AC	DC
110V...120V	●	●
220V...240V	●	●
Operating limits (IEC60947-2 standards)	YO: 70%...110% Un - YC: 85%...110% Un	
Inrush power (Ps)	300VA	300W
Continuous power (Pc)	3.5VA	3.5W
Opening time (YO)		
FA1	35 ms	
FA2-4	35 ms	
Opening time (YU)		
FA1	30 ms	50 ms
FA2-4	50 ms	70 ms
Closing time (YC)	50 ms	70 ms

Accessories for circuit-breakers

Time-delay device for undervoltage release (UVD)

The undervoltage release can be combined with an electronic time-delay device for the circuit-breaker, allowing for delayed external tripping with adjustable preset times. Use of the delayed undervoltage trip unit is recommended to prevent tripping when the power supply network for the trip unit is subject to brief voltage drops or power supply failures. Circuit-breaker closing is inhibited when it is not powered. The time-delay device must be used with an undervoltage release with the same voltage.

General characteristics		
Power supply (UVD)	AC	DC
110-127V	●	●
220-250V	●	●
Adjustable opening time (YU + D):	0.5-1-1.5-2-3 s	

—

Electrical diagram reference: figure 74



—

Fig. 08

Motor – M (Fig. 08)

The motor automatically loads the closing springs of the circuit-breaker. The device, which can be installed from the front, automatically reloads the springs of the operating device when they are unloaded and power is present. In the event no power is present, the springs can be manually loaded by a dedicated lever on the operating device. The motor is always supplied with the limit switch contact S33 M/2 which signals the status of the springs.

General characteristics			
Power supply (Un)		AC	DC
	100V...130V	●	●
	220V...250V	●	●
Operating limits (IEC60947-2 standards)		85%...110% Un	
Inrush power (Ps)		300VA FA1	300W FA1
		500VA FA2-4	500W FA2-4
Inrush time		200ms	
Continuous power (Pc)		100VA FA1	100W FA1
		150VA FA2-4	150W FA2-4
Charging time	FA1	8 sec	
	FA2-4	7 sec	

—

Electrical diagram reference: figure 13

Locks



Fig. 9

Key lock in open position - KLC (Fig. 9)
Due to these safety devices, the Formula Air circuit-breaker can be locked in the open position. The lock can also be used during maintenance activities when the shield of the accessories area is removed. The device is available with lock with different keys – KLC-D (for only one circuit-breaker) or with the same keys – KLC-S (for several circuit-breakers). Four different key numbers are available for the KLC-S.



Fig. 10

Padlocks - PLC (Fig. 10)
These padlock options allow the circuit-breaker to be kept open by acting directly on the mechanical operating device (opening pushbutton). Three different padlock versions are available:
- Locking device with plastic structure for up to a maximum of three padlocks of 4 mm
- Locking device with metal structure for up to a maximum of two padlocks of 8 mm
- Locking device with metal structure for one padlock of 7 mm or for padlock holders

The padlocks must be supplied by the customer. This device is an alternative to the PBC..



Fig. 11

Key lock in racked-in / test / racked-out position - KLP (Fig. 11)
This device enables the mobile part to be locked in one of the three positions: racked-in, test and racked-out. This device can be supplied with locks with different keys – KLP-D or with the same keys – KLP-S. Moreover, it is possible to allow locking only when in the racked-out position with a supplementary accessory.



Fig. 12

Padlock in racked-in / test / racked-out position - PLP (Fig. 12)
This device can hold up to three padlocks of 8 mm in diameter. The structure housing the padlocks can also be used in combination with the 2 lock KLP keylock option. Furthermore, it enables the lock of the moving part in the racked-out position only by means of the supplementary lock in racked-out position.

Shutter lock – SL
When the mobile part is in the test position, the shutters of the fixed part close, maintaining the insulation distance and physically segregating the live parts of the of the cradle from the internal breaker compartment of the cradle. Using two dedicated mechanisms, the upper and lower shutters can be locked independently of one another.
The shutter lock is always supplied with the fixed part of the Formula Air circuit-breakers and locks the shutters, using a maximum of three padlocks of 4 mm, 6 mm or 8 mm.



Fig. 13

Lock for racking-out mechanism with circuit-breaker in closed position (Fig. 13)
All Formula Air withdrawable circuit-breakers are always supplied with a lock that prevents the mobile part from being racked in and racked out when the circuit-breaker is in the closed position.
To rack in the mobile part, the circuit-breaker must be in the open position.

Lock for racking in / racking out the mobile part when the door is open - DLR
This accessory, which is mounted on the fixed part, prevents the mobile part from being racked in or out when the switchgear door is open.

Accessories for circuit-breakers



Fig. 14

Lock to prevent door opening when the circuit-breaker is in racked-in / test position - DLP (Fig. 14)
This safety device prevents the switchgear door from being opened when the mobile part of the withdrawable version of the circuit-breaker is in the racked-in or test position.
The circuit-breaker can only be racked in when the door is open, which is then closed.
This accessory can be installed on either the right-hand or left-hand side of the fixed part. It is available for FA2 and FA4.
If mounted on the right side, it is an alternative to the mechanical interlock, the AUX 15Q or the DLC.



Fig. 15

Lock to prevent door opening when the circuit-breaker is in the closed position - DLC (Fig. 15)
This prevents the compartment door from being opened when the circuit-breaker is in the closed position (and with the circuit-breaker racked in for withdrawable circuit-breakers).
It also blocks the circuit breaker from closing when the compartment door is open. For FA1 DLC is an alternative to the mechanical interlock and the AUX 15Q. For FA2 and FA4.
DLC direct door is compatible with all mechanical interlocks and the AUX 15Q. DLC cable door is compatible with mechanical interlock type A and the AUX 15Q.

Anti-insertion lock
The withdrawable circuit-breakers are equipped with special locks that allow the mobile part to be inserted only into the corresponding fixed part.



Fig. 16

Mechanical operation counter - MOC (Fig. 16)
The number of mechanical operations is often one of the elements that determines the frequency of ordinary maintenance operations on circuit-breakers. With this mechanical operation counter, which is always visible on the front of the circuit-breaker, the user knows how many mechanical operations the device has performed.



Fig. 17

Protection device for opening and closing pushbuttons - PBC (Fig. 17)
This accessory is applied to the safety cover of the circuit-breaker and is available in two versions:
- Pushbutton protection device, which blocks operations on both the opening and closing pushbuttons unless the special key is used.
- Padlockable pushbutton protection device, which makes it possible to block either or both pushbuttons and lock the covers in place. It does not trip the breaker as a standard "Padlock device" would.
- PBC is an alternative to PLC padlocks.



Fig. 18

IP30 Protection (Fig. 18)
Supplied with every circuit-breaker, the cover frame is installed on the door of the switchgear to achieve IP30 degree of protection on the front part of the circuit-breaker.



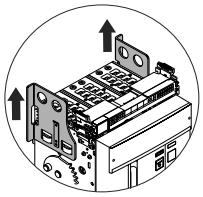
—
Fig. 19

IP54 Protection (Fig. 19)
This transparent cover completely protects the front of the circuit-breaker, enabling an IP54 degree of protection to be achieved. This accessory is provided with double key lock (same or different keys).



—
Fig. 21

Separators - PB (Fig. 21)
These protection devices increase the insulation distance between adjacent phases.



Lifting plates
Plates for raising fixed circuit-breakers and mobile parts. Provided as standard supply for FA2 and FA4.

Terminals

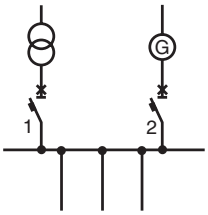
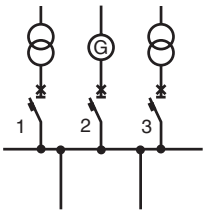
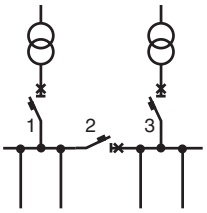
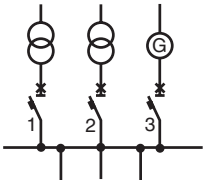
The integration of the circuit-breaker in the electrical system is simplified because of the connection terminals of the circuit-breakers.
The silver-plated copper terminals are designed to assist installation of connecting bars according to the change in the rated capacity of the circuit-breaker. Each terminal has been created to the standard width of busbar for that amperage and is equipped with one, two or three terminal stabs for easy connection to multiple bus runs that may be required for the application. For particular installation requirements, the circuit-breakers can be equipped with different combinations of terminals for the upper and lower part.

Type	Abbreviation	FA1	FA2	FA4
Rear adjustable terminal	HR/VR	F,W	F,W	F,W
Front terminal	F	F		

Accessories for circuit-breakers

Mechanical interlocks

These interlock systems enable various opening and closing configurations to be obtained between two or three circuit-breakers.
Four types of interlock configuration are available:

Types of interlock	Possible application	Logic	Circuit-breakers
Type A			
Excludes the possibility of having two circuit-breakers in the closed position at the same time.	Main line power supply and emergency power supply. 	1 2 O O I O O I	Available between circuit-breakers of different sizes and with any fixed / withdrawable version
Type B			
Permits a pair of circuit-breakers to be closed if the third is open. The latter can only be closed when the pair is open.	Two power supplies from transformers and one emergency power supply. 	1 2 3 O O O I O O O O I I O I O I O	Available between FA2 and FA4 circuit-breakers, fixed or withdrawable version
Type C			
Permits two out of three circuit-breakers to be closed at the same time.	Two half-busbars can be powered by a single transformer (bus-tie closed) or by both at the same time (bus-tie open). 	1 2 3 O O O I O O O I O O O I O I I I I O I O I	Available between FA2 and FA4 circuit-breakers, fixed or withdrawable version
Type D			
Permits one out of three interlocked circuit-breakers to be closed.	Three power supplies on the same busbar that must not operate in parallel. 	1 2 3 O O O I O O O I O O O I	Available between FA2 and FA4 circuit-breakers, fixed or withdrawable version

The mechanical interlocks offer multiple solutions for installation that simplify their integration into the switchgear. The interlocks can be mounted:

- vertically **VR**
- horizontally **HR**
- mixed **L**

Different types of interlocks can be supplied according to the maximum distance between two interlocked breakers:

Configuration	Type A	Type B, C, D*
Horizontal	2750mm	1600mm
Vertical	1000mm	1000mm

* not available for FA1

For B, C and D types, the maximum distance between the two furthest breakers is 3200mm for horizontal configurations and 2000mm for vertical configurations (it is possible to make the mechanical interlock among three circuit-breakers disposed in “L position” by using the cables of three horizontal circuit-breakers interlock. Make sure the distance between the horizontal and vertical circuit-breakers respects the minimum and maximum values). All cables can be cut to guarantee easy installation in switchboards. Mechanical interlocks are not compatible with AUX 15Q, the lock for preventing door opening when the circuit breaker is in the closed position (DLC) or when the circuit breaker is in the racked in or test position (DLP), if mounted on the right side.

Accessories for Ek trip units

Modules



Fig. 22

Ek Supply (Fig. 22)

Ek Supply 110-240V AC/DC allows to supply all Ek trip units using the auxiliary power available in the switchgear. The module is mounted in the terminal box and can be installed at any time.

Electrical diagram reference: figure 31, 32

Supply	Ek Supply
Nominal voltage	110-240V AC/DC
Voltage range	105-265V AC/DC
Rated power (including modules)	10W max.
Inrush current	~10A for 5ms



Fig. 23

Rating Plug (Fig. 23)

The rating plugs are field interchangeable from the front on all trip units and enable the protection thresholds to be adjusted according to the actual rated current of the system.
This function is particularly advantageous in installations that may require future expansion or in cases in which the power supplied needs to be limited temporarily (e.g. mobile Gen Set).

Circuit-breaker	Rating plugs available
FA1	630-800-1000-1250-1600
FA2	630-800-1000-1250-1600-2000
FA4	630-800-1000-1250-1600-2000-2500-3200-4000



Fig. 24

Current sensor for neutral conductor outside the circuit-breaker (Fig. 24)

This is only for three-pole circuit-breakers; it enables protection of the neutral conductor to be achieved through connection to the Ek trip unit. It is supplied on request.

Electrical diagram reference: figure 27

Accessories for Ek trip units



—
Fig. 25

Testing and programming unit

Ekip TT testing and power supply unit (Fig. 25)
Ekip TT is a device that allows you to verify that the circuit-breaker trip mechanism is functioning correctly (trip test).
It also allows a trip unit not provided with auxiliary power supply to be supplied with power so that the last protection device tripped can be displayed directly on the screen or by the lighting up of corresponding LEDs.
The device can be connected to the front test connector of any Ek trip unit of Formula Air.



—
Fig. 26

Ekip T&P testing kit (Fig. 26)
Ekip T&P is a kit that includes different components for programming and testing the electronic protection trip units. The kit includes:

- Ekip T&P unit;
- Ekip TT unit;
- adaptors for Emax, Emax 2 and Tmax trip units;
- USB cable to connect the T&P unit to the Ek trip units;
- installation CD for Ekip Connect and Ekip T&P interface software.

The Ekip T&P unit is easily connects from your PC (via USB) to the trip unit (via mini USB) with the cable provided.
The Ekip connect software is available free of charge on the ABB website. It is compatible with different operating systems of personal PCs (Windows XP, Windows 7, Windows Vista).
Ekip T&P unit connects the PC (via USB) with the trip unit (via mini USB). The software allows all system parameters and protection thresholds to be set rapidly in the trip units thanks to the easy and intuitive navigation pages. It is also possible to consult and download the records of events, alarms and the tripping information, thereby facilitating the identification and understanding of anomalies. Ekip connect also enables the electronic protection trip units to be tested for correct operation during the stages of commissioning and system maintenance.
As a result of advanced graphical interfaces, the user can simply select the test to perform: from simple current and voltage signals to more complex wave forms.

Installation circuit-breaker

The new Formula Air family maintains the characteristics of strength and reliability that have always distinguished the tradition of ABB air circuit-breakers.

Safety is guaranteed thanks to the double insulation of the live parts and total segregation of the phases. Furthermore, the new functional design of the Formula Air circuit- breakers has been developed with the purpose of improving installation operations and use of the devices and accessories; making them simple, intuitive and safe.

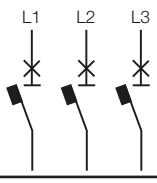
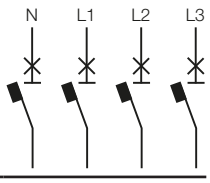
Distinctive characteristics		Benefits
Simplicity of use and safety	- Ek protection trip units are interchangeable from front of circuit breaker	Reduced times during the stages of: - installation - wiring - configuration - commissioning - maintenance Increased level of safety
	- Rapid configuration of the Ek trip units	
	- Electrical plug-in accessories can be installed from the front of circuit breaker	
	- New push-in terminal box allows rapid auxiliary connections	
	- Horizontal or vertical rear connections can be modified on-site by turning 90°	
	- Accessorizing logic common to the entire family of circuit-breakers	
	- Accessory cabinet and terminal box are stamped with accessory codes for easy identification	
	- Accessories area is separated functionally from the safety area	
	- Mechanical safety locks in open position are active when the shield is removed	
	- Guided racking in and out of the mobile part	

Versions

The Formula Air circuit-breakers are available in both fixed and withdrawable versions. The withdrawable version is recommended in applications in which service continuity is a fundamental requirement. Replacement of the moving part with a new device does not require any intervention on power connections or on auxiliary connections, thus permitting reset in the shortest time possible. The fixed version, which is connected directly to power system through the circuit-breaker terminals, is recommended in applications in which the need for space means that compact products are required without compromising the performance and possibility of fitting accessories.

Poles

Formula Air circuit-breakers are available in three-pole and four-pole versions and can be used in all types of distribution systems. Furthermore, with the possibility of connecting the external current sensor, three-pole circuit-breakers can be used efficiently even in systems in which the neutral conductor cannot be isolated.
All frames are always provided with full-size neutral pole with rated uninterrupted current-carrying capacity identical to the phase poles.

Circuit-breaker	Three-pole	Four-pole
FA1 FA2 FA4		

Terminals

The integration of the circuit-breaker in the electrical system is simplified because of the connection terminals of the circuitbreakers.
The terminals are designed to assist installation of connecting bars according to the change in the rated capacity of the circuit-breaker. Each terminal has been created to the standard width of busbar for that amperage and is equipped with one or three terminal stabs for easy connection to multiple bus runs that may be required for the application.

For particular installation requirements, the circuit-breakers can be equipped with different combinations of terminals for the upper and lower part. FA1 (withdrawbale version), FA2 and FA4 circuit-breakers are equipped with rear adjustable terminals. The adjustable terminals are supplied as standard in the HR – HR configuration.
FA1 fixed circuit-breakers are equipped with front terminals, in order to guarantee the maximum compactness. In case of particular installation requirements, the circuit-breakers can be equipped with different combinations of terminals for the upper and lower part.

Installation circuit-breaker

Degree of protection

The Formula AIR circuit-breakers guarantee the following degrees of protection:

- IP20 for circuit-breakers in fixed or withdrawable versions, excluding the terminals.
- IP30 for the front parts of the circuit-breaker when installed in switchgear with IP30 flange mounted on the door.
- IP54 for circuit-breakers equipped with optional IP54 transparent flange fixed on the door in front of the switchgear.

Power losses

To guarantee the performance of the electrical switchgear in terms of rated uninterrupted current-carrying capacity, the design of the electrical switchgear must take into consideration the power losses by the apparatus and by live parts installed.
These power losses are measured according to IEC60947 product standard, the values given in the table refer to total power for three and four pole circuit-breakers with balanced loads with a current flow equal to rated uninterrupted current "Iu" at 50/60Hz.

Circuit-breaker type		**Iu**	**630A**	**800A**	**1000A**	**1250A**	**1600A**	**2000A**	**2500A**	**3200A**	**4000A**
Fixed CBs	FA1 B/C	[W]	31	50	78	122	201	-	-	-	-
	FA2 C	[W]		-	-	-	161	240	-	-	-
	FA4 C	[W]		-	-	-	-	-	272	430	565
Withdrawable CBs	FA1 B/C	[W]	62	100	156	244	400	-	-	-	-
	FA2 C	[W]		-	-	-	378	465	-	-	-
	FA4 C	[W]		-	-	-	-	-	590	750	900

Temperature derating

Under certain installation conditions, the circuit-breakers can operate at higher temperatures than the reference temperature of 40°C. In this case the current-carrying capacity of the circuit-breaker may be lower than the rated current-carrying capacity at the reference temperature: therefore the derating coefficients shown in the table must be applied. Percentage values refer to withdrawable and fixed circuit breaker. If not specified, all data refer to a copper cross section according to IEC60947.

FA1

Temperature	**FA1 630**		**FA1 800**		**FA1 1000**		**FA1 1250**		**FA1 1600**	
[°C]	**%**	**[A]**	**%**	**[A]**	**%**	**[A]**	**%**	**[A]**	**%**	**[A]**
≤ 40	100	630	100	800	100	1000	100	1250	100	1600
45	100	630	100	800	100	1000	100	1250	100	1600
50	100	630	100	800	100	1000	100	1250	100	1600
55	100	630	100	800	100	1000	100	1250	100	1600
60	100	630	100	800	100	1000	100	1250	100	1600
65	100	630	100	800	100	1000	100	1250	100	1600
70	100	630	100	800	100	1000	100*	1250	87.5	1400

* Performance achievable increasing busbars cross section

FA2

Temperature	**FA2 1600**		**FA2 2000**	
[°C]	**%**	**[A]**	**%**	**[A]**
≤ 40	100	1600	100	2000
45	100	1600	100	2000
50	100	1600	100	2000
55	100	1600	100	2000
60	100	1600	95	1900
65	100	1600	91	1820
70	98	1568	87	1740

FA4

Temperature	**FA4 2500**		**FA4 3200**		**FA4 4000**	
[°C]	**%**	**[A]**	**%**	**[A]**	**%**	**[A]**
≤ 40	100	2500	100	3200	100	4000
45	100	2500	100	3200	100	4000
50	100	2500	100	3200	97	3880
55	100	2500	100	3200	93	3720
60	100	2500	95	3040	89	3560
65	100	2500	93	2976	86	3440
70	100	2500	89	2848	83	3320

Installation environment

Formula Air circuit-breakers have been designed and tested in accordance with major international Standards to manage with maximum reliability the electrical plant. The installation requirements prescribed by the international Standards are listed below.

In addition, ABB provides instructions for the use of circuit-breakers in nonstandard environments, as for example personalized maintenance program or installation solutions aimed at increasing performances and extending the lifecycle of the circuit-breaker.

Temperature

Formula Air circuit-breakers can operate in the following environmental conditions:

	Temperature (°C)		
	Operating	**Active Display**	**Storage**
Formula Air with Ek 1	-25°C ... +70°C	-	-40°C ... +70°C
Formula Air with Ek 2	-25°C ... +70°C	-25°C ... +70°C	-40°C ... +70°C

Environmental conditions

The devices can be installed in industrial environments with pollution level 3, IEC60947. Formula Air circuit-breakers also comply with:

- IEC60721-3-6 class 6C3
- IEC60721-3-3 class 3C2

Altitude

Formula Air air circuit-breakers do not undergo changes in rated performance up to 2000 metres.

Electromagnetic compatibility

The use of specific devices in industrial installations may cause electromagnetic interference in the electrical system. Formula Air circuit- breakers have been developed and tested for electromagnetic compatibility in accordance with IEC 60947-2, Appendices J and F.

Installation in switchgear

Position

All Formula Air circuit-breakers can be floor mounted in a vertical position inside the switchgear compartment. It is not allowed to mount any circuit-breaker in horizontal position.

Power supply

The Formula Air circuit-breakers can be supplied, indifferently, from either the upper or lower terminals.

Insulation distances and connection

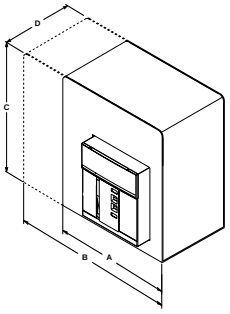
The circuit-breakers can be connected to the main power system using the most common configurations and dimensions of copper bars. Installation of live parts must ensure:

- **Minimum insulation distances between the phases**

Rated insulation voltage Ui	Minimum distance [mm]
1000V	14mm in accordance with IEC 61439;

- **Insulation distance of installation cubicle**

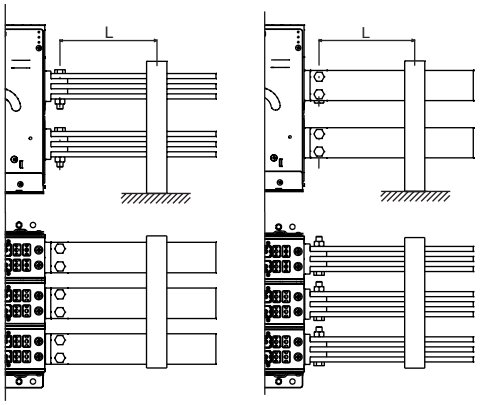
	A	B	C	D
FA1 fixed	250	322	382,5	130
FA1 Withdrawable	280	350	440	252
FA2 - FA4 fixed	500	600	500	221
FA2 - FA4 withdrawable	500	600	500	355



- **Anchorage plates**

The electrodynamic force released during a short-circuit can cause high levels of mechanical stress to the devices and structures of the switchgear. To minimize this, fastening plates must be positioned near the circuit-breaker terminals. The table below indicates the distance for positioning the first anchor plate according to the type of circuit-breaker type and the short-circuit capacity:

Frame	Icu	L
FA1	50 kA	20 cm
FA2C - FA4C	50 kA	40 cm



- **Tightening torques**

The following table indicates the values required for connecting the circuit-breaker terminal and the connecting bars.

Type	FA1	FA2	FA4
Rear adjustable terminal	40 Nm	70 Nm	70 Nm
Horizontal rear spread terminal	-	70 Nm	70 Nm
Vertical rear spread terminal	-	70 Nm	70 Nm
Front terminal	40 Nm	70 Nm	70 Nm

- **Segregation plates and separator plates**

The rear part of the circuit-breaker has been designed with specific slots in which insulating walls can be housed to facilitate segregation of live parts. In addition, phase separators are available as optional accessories.

Earthing connection

To achieve continuity and equal potential of earthing between the Formula Air circuitbreaker and the protection citcuit of the switchboard, customers can connect the Formula Air fixed circuit-breaker or the fixed part of the withdrawable circuit-breaker to the protective circuit by means of a cable with suitable cross-sectional area to fulfil the requirements of clause 10.5.2 fo the Standard IEC 61439-1.

Busbar types

The circuit-breakers, via the terminals, can be connected to the main distribution system by busbars of different types: copper, silver-plated copper and tinned aluminium when the main distribution system is made of aluminium. The circuit-breakers can also be connected indirectly by cable-carrying bars.

Performance in switchgear

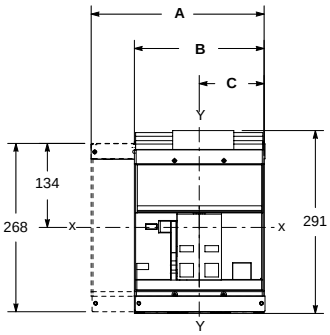
The many types of switchgear that can be created and the installation and environmental conditions can considerably influence the performance of the circuit-breaker.

General conditions:
- Switchgear degree of protection: IP31
- Switchgear dimension: 2200x800x900 (HxWxD)
- Segregation form 3
- Ambient temperature Ta (IEC61439-1): 35°C
- Withdrawable circuit-breakers
- Maximum withstand temperature for the terminal: 115°C.

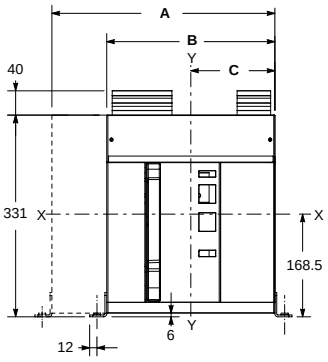
The tables should be used solely as a general guideline for selecting products. Due to the extensive variety of switchgear construction shapes and conditions that can affect the behavior of the apparatus, the solution used must always be verified.

Fixed circuit-breaker

FA1

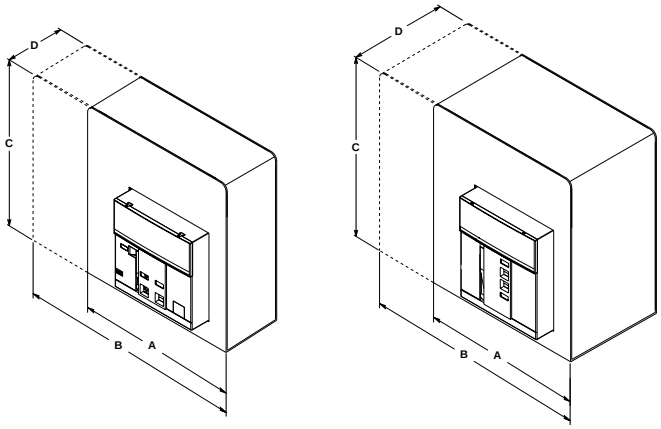


FA2 - FA4



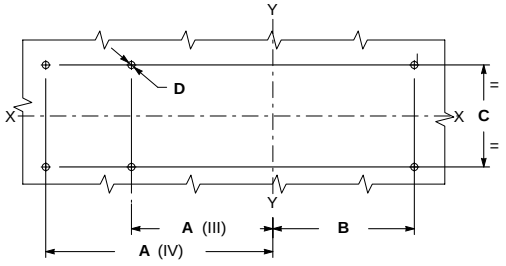
[mm]	A 4p	B 3p	C 3p	4p
FA1	284	214	107	107
FA2	366	276	138	138
FA4	510	384	192	192

Dimensions of the compartment



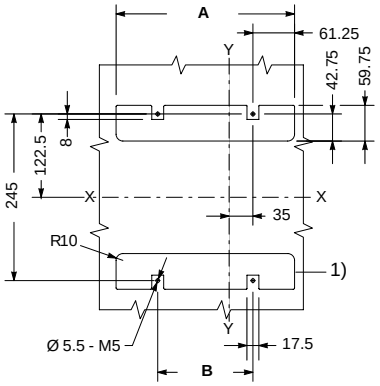
	A	B	C	D
FA1 fixed	250	322	382.5	130
FA2 FA4 fixed	500	600	500	221

Floor fixing

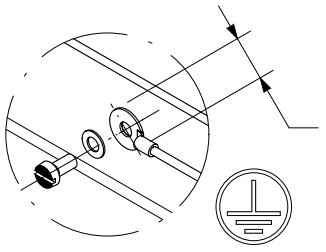


[mm]	A 3p	A 4p	B 3p	B 4p	C	D
FA1	117	187	117	117	80	5.5
FA2	154	244	154	154	150	10.5
FA4	208	334	208	208	150	10.5

Wall fixing (only for FA1)



Earthing device FA2 - FA4



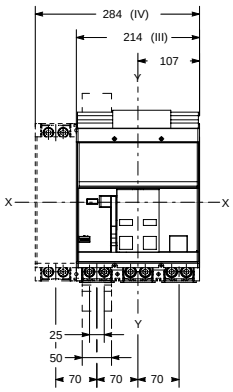
Ø 10 MAX
M5x8 screws supplied
Tightening torque 3Nm

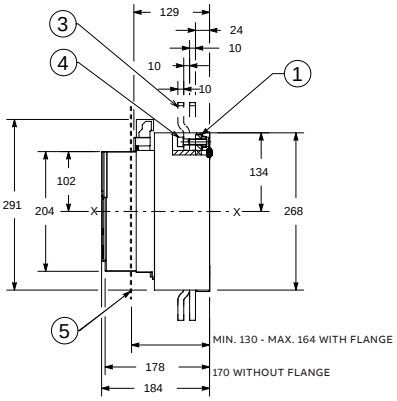
[mm]	3 p	4 p
A	192.5	262.5
B	70	140

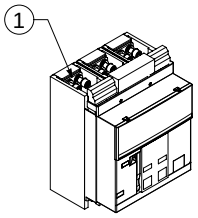
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1) for fixing with rear terminals

Fixed circuit-breaker - FA1

Front terminals – F

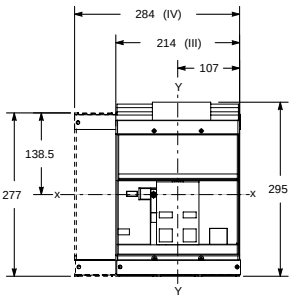


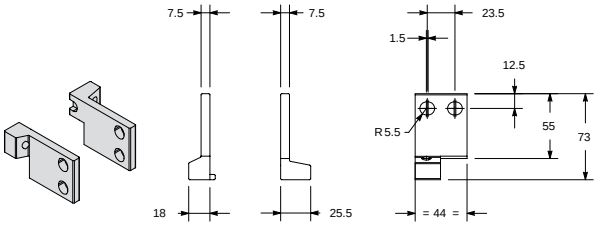




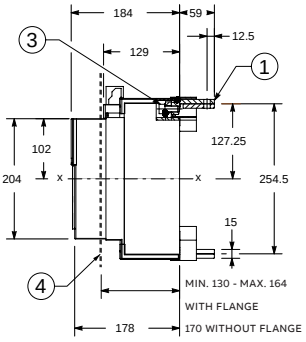
—
Key
1 Front terminals for flat connection
3 To be supplied by the customer
4 Tightening torque 18Nm
5 Door position - Ref. page 7/2

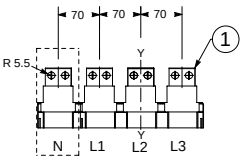
Orientable rear terminals - HR/VR

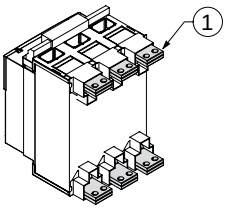




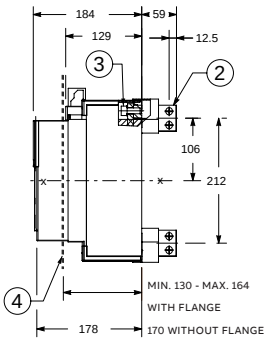
Terminals HR

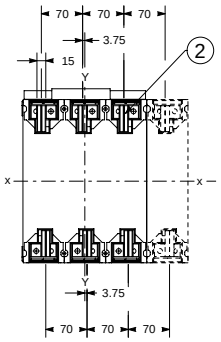


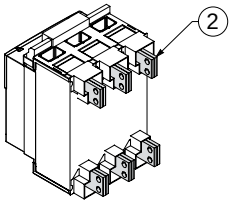




Terminals VR



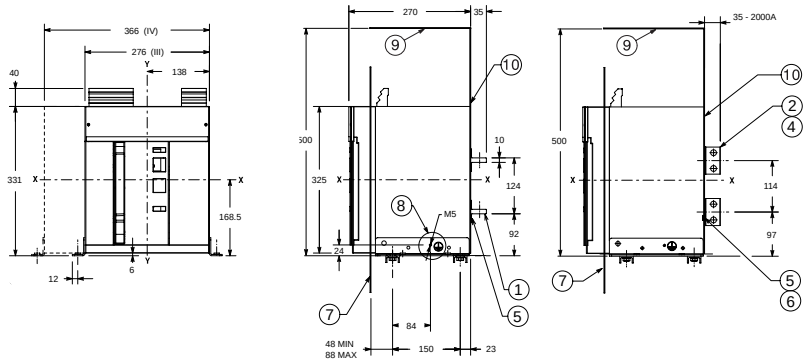


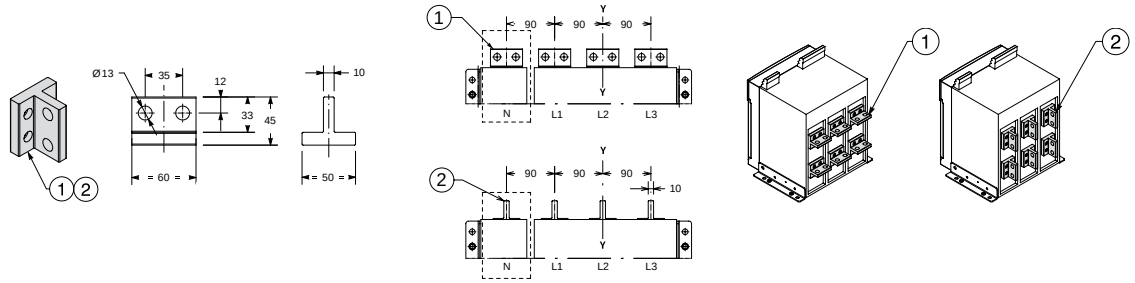


—
Key
1 Horizontal orientable terminals HR
2 Vertical orientable terminals VR
3 Tightening torque 20Nm
4 Door position - Ref. page 7/2

Fixed circuit-breaker - FA2

Orientable rear terminals - HR/VR





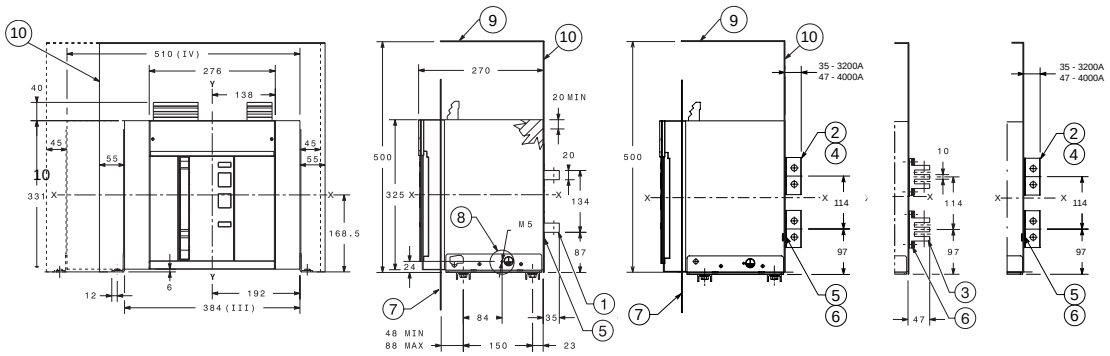
Key

1 Horizontal terminals 2000A
2 Vertical terminals 2000A
5 Tightening torque 2000A 8.6Nm
7 Door position - Ref. page 7/2
8 Earthing device - Ref. page 7/3
9 Metallic sheet
10 Insulating sheet or insulated metallic sheet

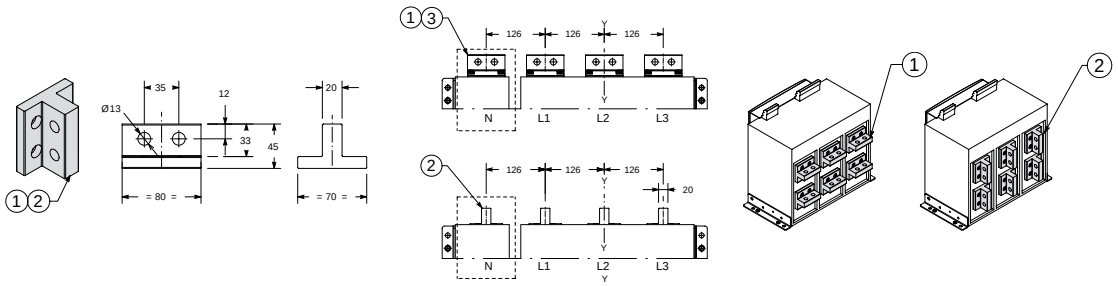
Fixed circuit-breaker - FA4

Orientable rear terminals - HR/VR

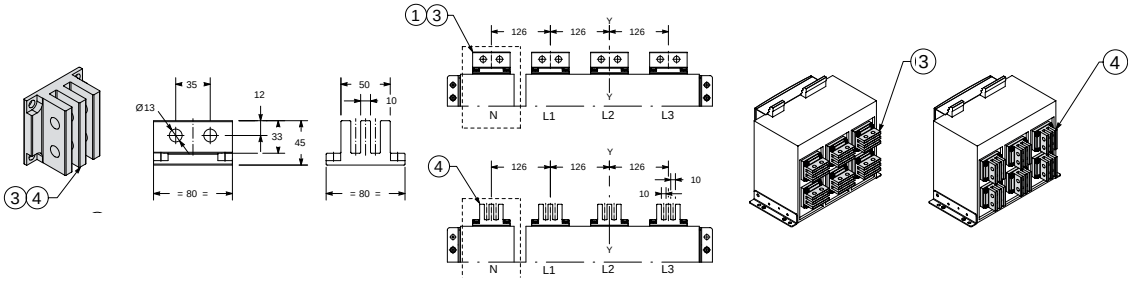
FA4 3200A **FA4 4000A**



3200A



4000A

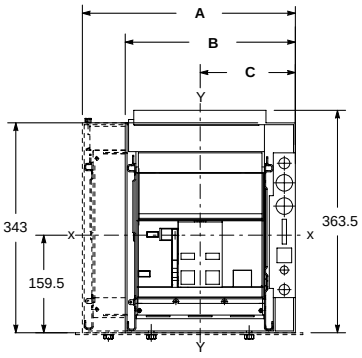


Key

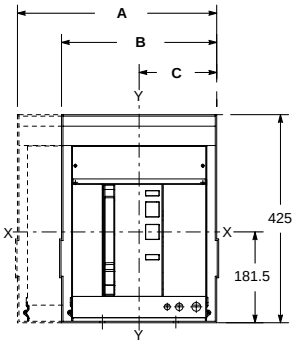
1 Horizontal terminals 3200A
2 Vertical terminals 3200A
3 Horizontal terminals 4000A
4 Vertical terminals 4000A
5 Tightening torque 3200A 20Nm
6 Tightening torque 4000A 20Nm
7 Door position - Ref. page 7/2
8 Earthing device - Ref. page 7/3
9 Metallic sheet
10 Insulating sheet or insulated metallic sheet

Withdrawable circuit-breaker

FA1



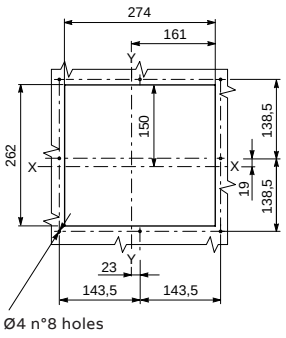
FA2 - FA4



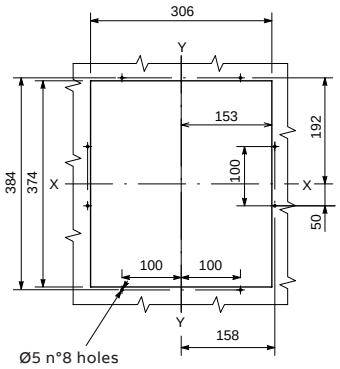
[mm]	A 4p	B 3p	C 3p	4p
FA1	348	278	155.5	155.5
FA2	407	317	158.5	158.5
FA4	551	425	212.5	212.5

Compartment door drilling

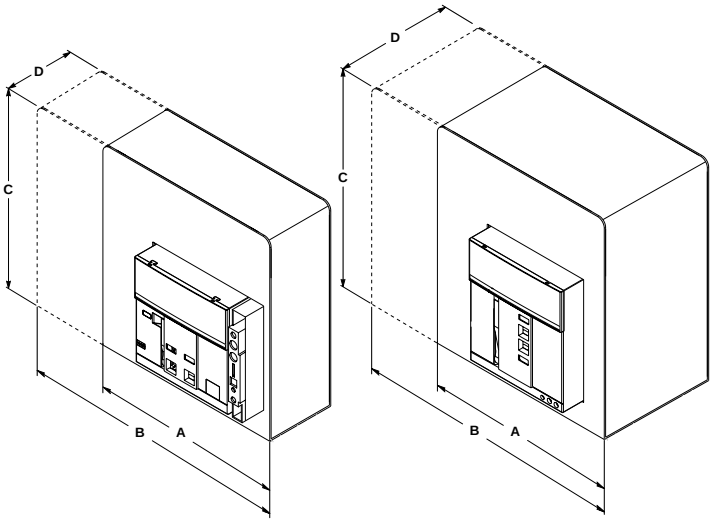
FA1



FA2 - FA4

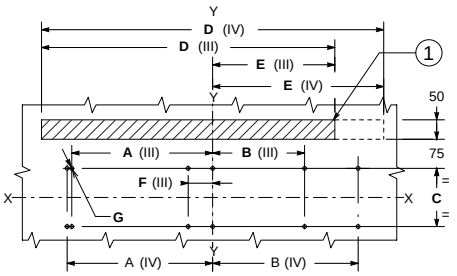


Dimensions of the compartment

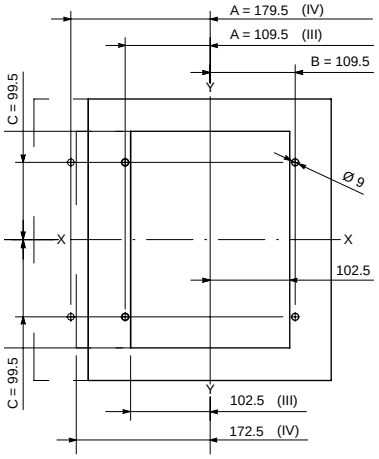


	A	B	C	D
FA1 Withdrawable	250	322	382.5	130
FA2 FA4 Withdrawable	500	600	500	221

Floor fixing



Wall fixing (only for FA1)



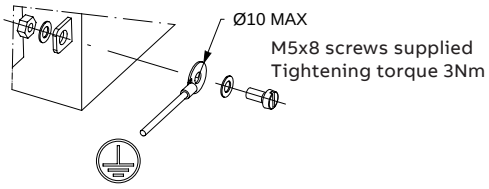
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Key

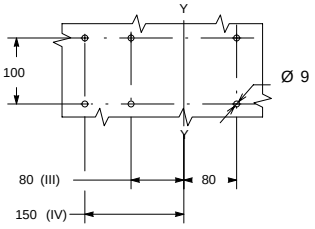
1 Ventilation drilling on the switchgear

	A		B		C	D		E		F	G
[mm]	3p	4p	3p	4p		3p	4p	3p	4p		
FA1	80	150	80	80	100	-	-	-	-	-	9
FA2	75	175	75	75	150	270	360	135	135	-	10
FA4	100	225	100	100	150	378	504	189	189	-	10

Earthing device FA2 - FA4

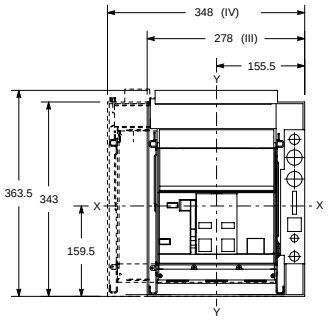


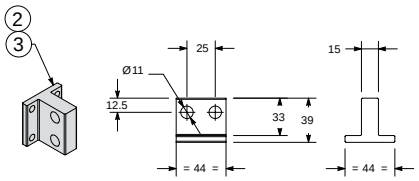
Fixing on support sheet (only for FA1)



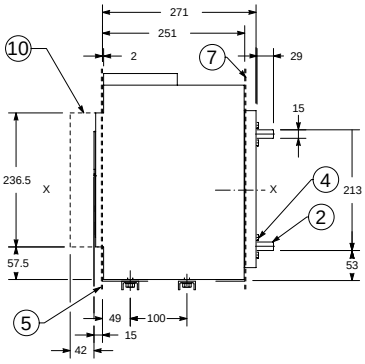
Withdrawable circuit-breaker - FA1

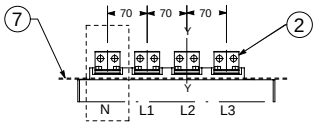
Rear orientable terminals - HR/VR

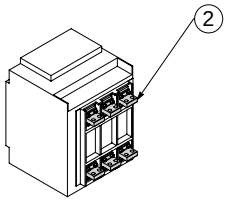




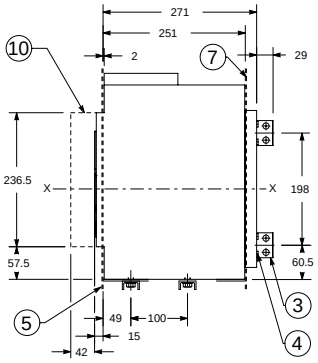
Terminals HR

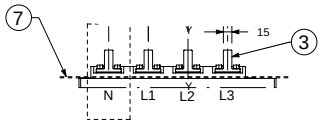


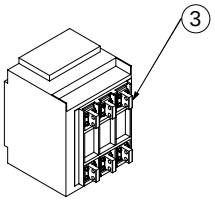




Terminals VR



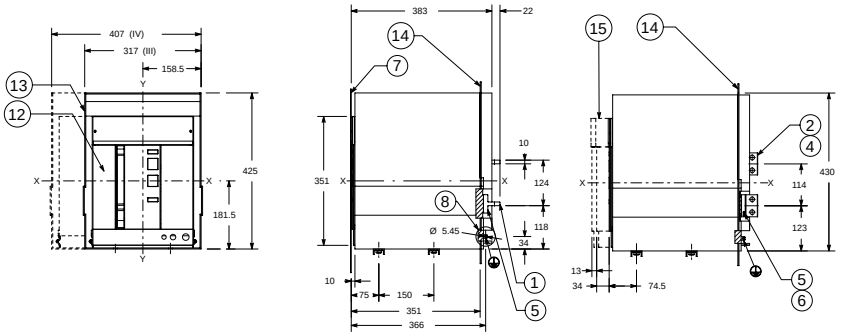


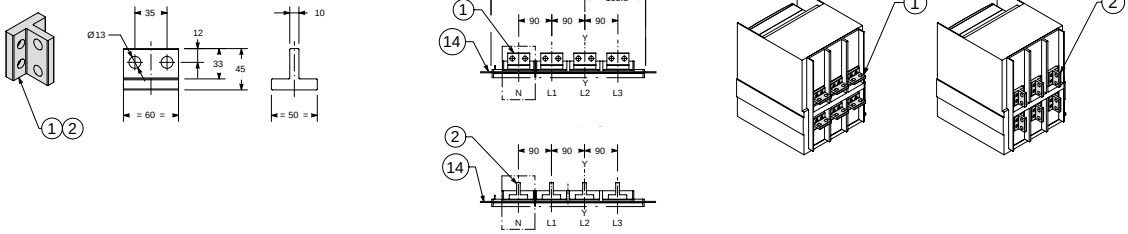


Key
2 Horizontal rear terminals
3 Vertical rear terminals
4 Tightening torque 12 Nm
5 Door position - Ref. page 7/20
7 Rear segregation for rear terminals
10 Sectioning run

Withdrawable circuit-breaker - FA2

Rear orientable terminals - HR/VR





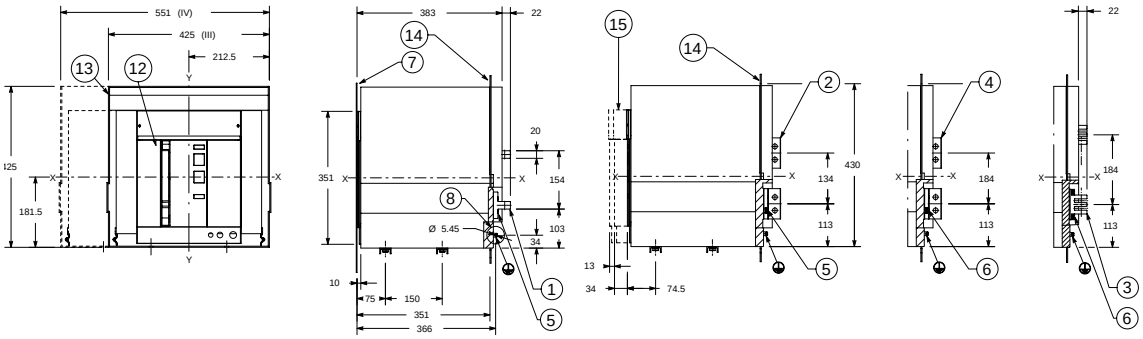
Key

1 Horizontal terminals 2000A
2 Vertical terminals 2000A
5 Tightening torque 2000A 8.6Nm
7 Door position - Ref. page 7/20
8 Earthing device
12 Mobile part
13 Fixed part
14 Segregation (where envisaged)
15 Distance from connected for testing to isolated

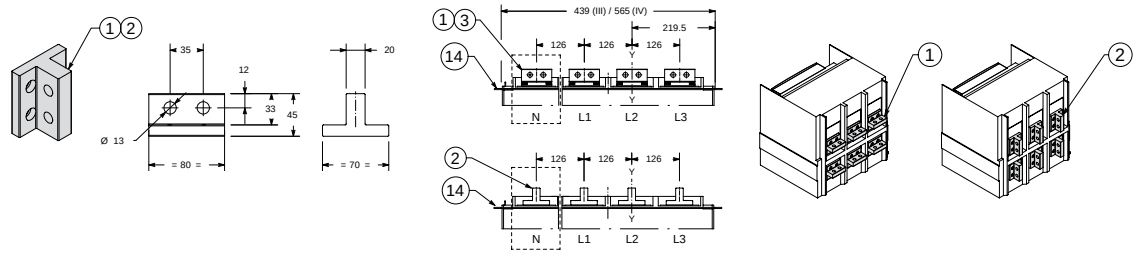
Withdrawable circuit-breaker - FA4

Rear orientable terminals - HR/VR

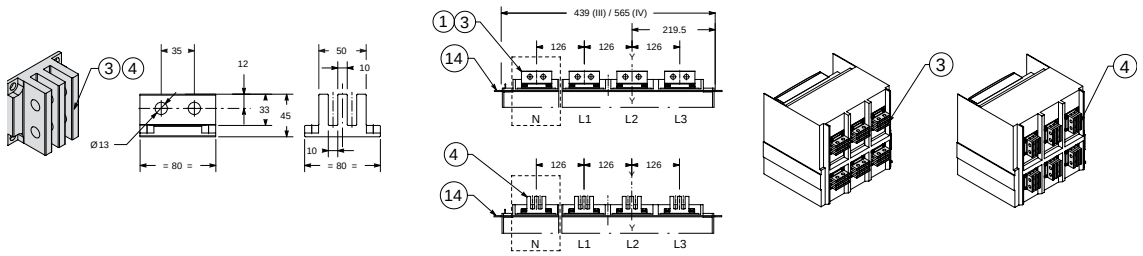
FA4 3200A **FA4 4000A**



3200A



4000A



—

Key

1 Horizontal terminals 3200A
2 Vertical terminals 3200A
3 Horizontal terminals 4000A
4 Vertical terminals 4000A
5 Tightening torque 3200A 20Nm
6 Tightening torque 4000A 20Nm
7 Door position - Ref. page 7/20
8 Earthing device
12 Mobile part
13 Fixed part
14 Segregation (where envisaged)
15 Distance from connected for testing to isolated

Reading information

Operating state shown
The diagram is shown in the following conditions:
- withdrawable version circuit-breaker, open and racked-in
- circuits de-energized
- releases not tripped
- motor operator mechanism with springs. discharged

Key

*	= See the note indicated by the letter
A1	= Applications located on the mobile part of the circuit-breaker
A3	= Applications located on the fixed part of the circuit-breaker
A4	= Indicative devices and connections for control and signalling, outside the circuit-breaker
D	= Electronic time-lag device of YU undervoltage coil, outside the circuit-breaker
F1	= Time-delayed trip fuse
K51	= Electronic overcurrent protection trip unit of the types: Ek 1 and Ek 2
K51/SUPPLY	= Auxiliary supply module (110-240VAC/DC)
M	= Motor for loading closing springs
Q	= Circuit-breaker
Q/1...Q/25	= Auxiliary open/closed contacts of circuit-breaker
Q/26...Q/27	= Auxiliary open/close contacts used internally by the trip unit
RTC	= Contact for signalling circuit-breaker is ready to close
S33M/1...2	= Limit contacts of spring loading motor
S51	= Trip signalling contact
S75E/1...4(*)	= Contacts for signalling circuit-breaker in racked-out position (provided only with withdrawable version)
S75I/1...4(*)	= Contacts for signalling circuit-breaker in racked-in position (provided only with withdrawable version)
S75T/1...2(*)	= Contact for signalling circuit-breaker in test position (provided only with withdrawable version)
SC	= Pushbutton or contact for closing the circuit-breaker
SO	= Pushbutton or contact for immediate opening of the circuit-breaker
SO1	= Pushbutton or contact for opening the circuit-breaker with time-delayed trip
TI/L1-L2-L3	= Current transformer phase L1-L2-L3
TI/N	= Current transformer on neutral
TU1...TU2	= Insulation voltage transformer (outside circuit-breaker)
Uaux	= Auxiliary supply voltage
UI/L1-L2-L3	= Current sensor phase L1-L2-L3
UI/N	= Current sensor on neutral
W2	= Serial interface with internal bus (local bus)
X	= Delivery connector for auxiliary circuits for withdrawable version of circuit-breaker
XB1...XB7	= Connectors for circuit-breaker applications
XF	= Delivery terminal board for position contacts of withdrawable version of circuit-breaker
XK1...XK3	= Connectors for auxiliary circuits of the Ek protection trip unit
XV	= Delivery terminal board for auxiliary circuits of fixed version circuit-breaker
YC	= Closing coil
YO	= Opening coil
YO1	= Opening coil for overcurrent
YU	= Undervoltage coil

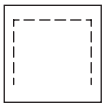
Reading information

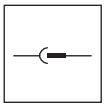
Notes

A) Local bus function is required the presence of auxiliary power supply (refer to diagram figures 31 - 32).
C) Always supplied with motor for loading closing springs in Fig. 13.
D) Make the correction using the ABB cable supplied. There must be no break in the cable. Use of other cable or extensions using intermediate terminal boxes is not allowed. With a three-pole circuit-breaker, poles Ne+ and Ne- of connector X (or XV) are short-circuited unless the external neutral is present: enable short-circuit if connection is absent.
E) The auxiliary voltage Uaux enables activation of all the functions of the Ek electronic protection trip units. Since an earth insulated Uaux was requested, it is necessary to use "galvanically separated convectors" which comply with the standards IEC 60950 (UL 1950) or equivalent.
F) Use cables type BELDEN 3105A or equivalent with maximum lenght 15m.
G) Use cables type BELDEN 3079A or equivalent.
H) Use cables type BELDEN 3084A or equivalent.

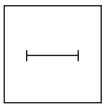
Reading information

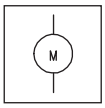
Graphical symbols for electrical diagrams (617 IEC standards)


Screen, shield (it may be drawn in any convenient shape)

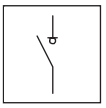

Plug and socket (male and female)

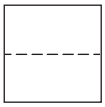

Circuit breaker disconnector with automatic release

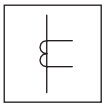

Delay

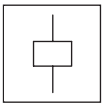


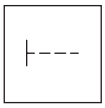
Motor (general symbol)

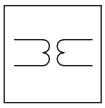

Switch disconnector (on-load isolating switch)

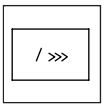

Mechanical connection (link)


Current transformer

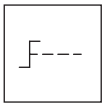

Operating device (general symbol)

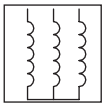

Manually operated control (general case)

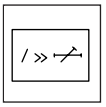

Voltage transformer



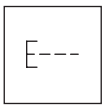
Instantaneous overcurrent or rate-of-rise relay

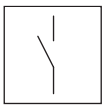

Operated by turning

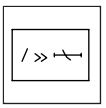

Winding of three-phase transformer, connection star



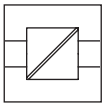
Overcurrent relay with adjustable short time-lag charateristic

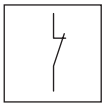

Operated by pushing

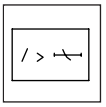

Make contact



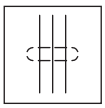
Overcurrent relay with inverse short time-lag charateristic

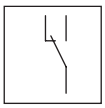

Converter with galvanic separator

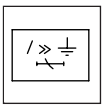

Break contact



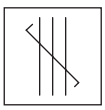
Overcurrent relay with inverse long time-lag charateristic


Conductors on a screened cable, three conductors shown

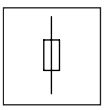

Change-over break before make contact

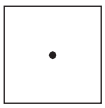


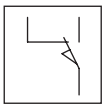
Earth fault overcurrent relay with inverse short time-lag charateristic

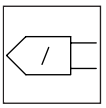

Twisted conductors, three conductors shown


Position switch (limit switch), break contact

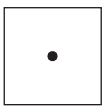

Fuse (general symbol)


Connection of conductors


Position switch (limit switch), change-over break before make contact

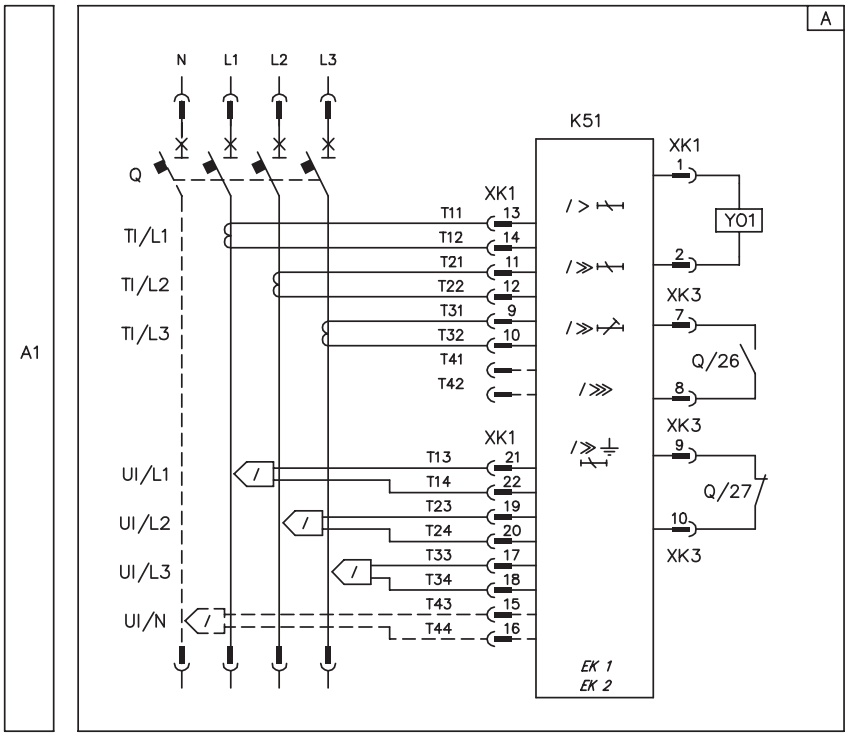


Current sensing element

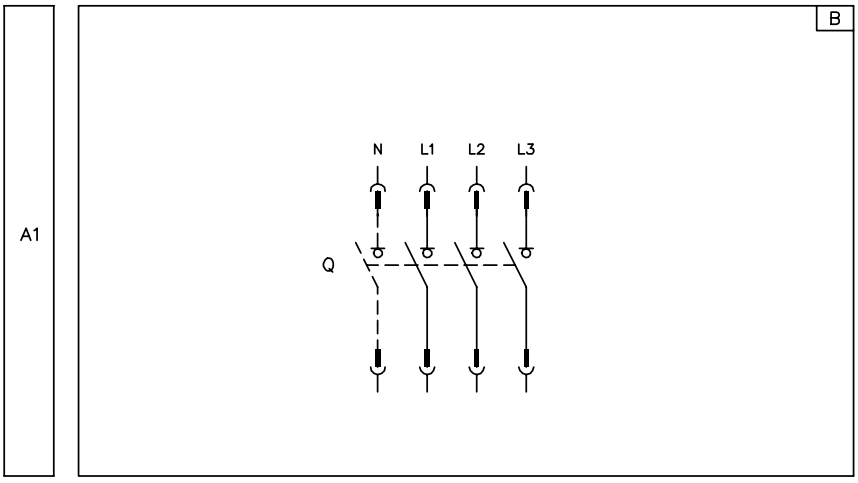

Terminal

Circuit-breakers

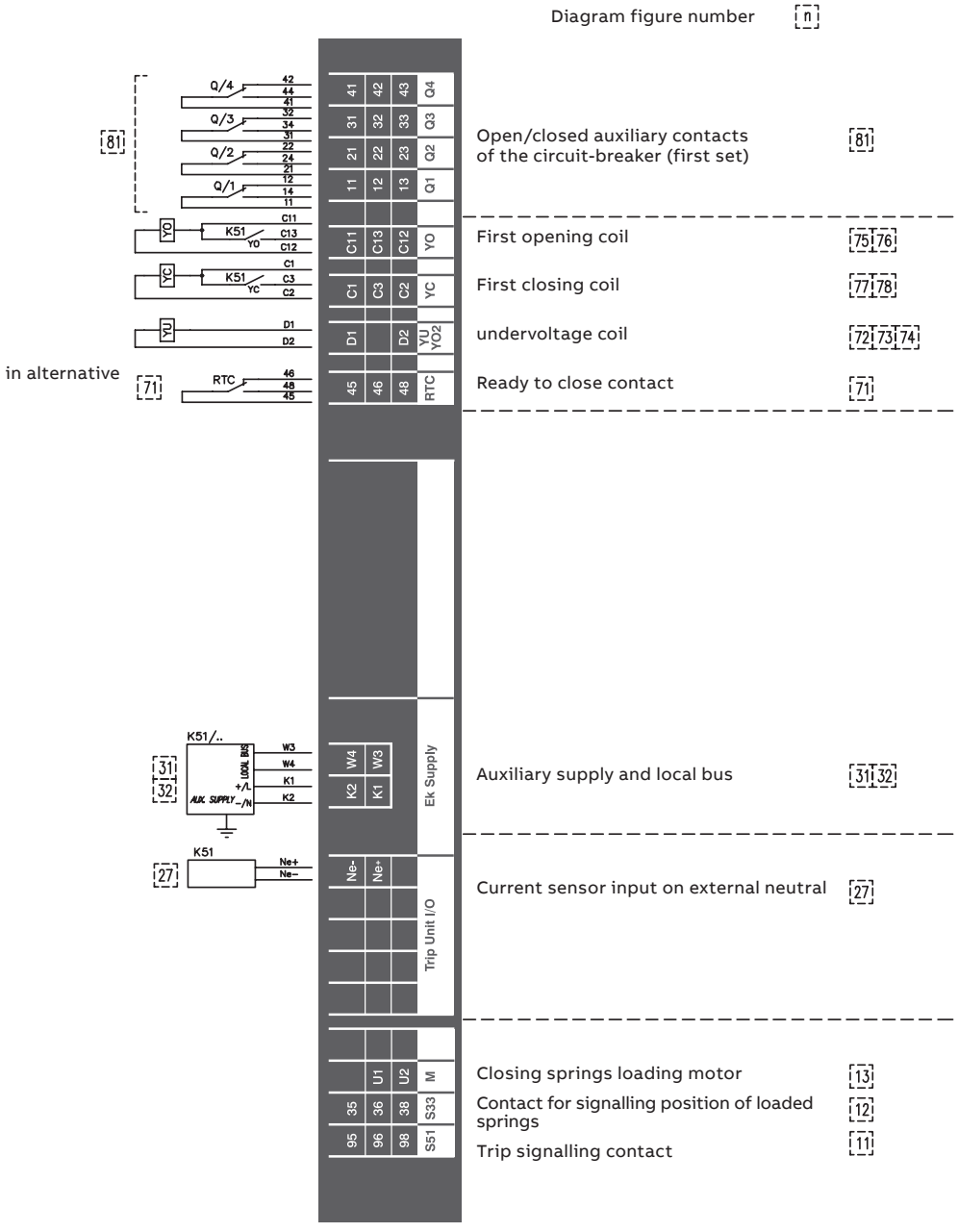
3-pole or 4-pole circuit breaker



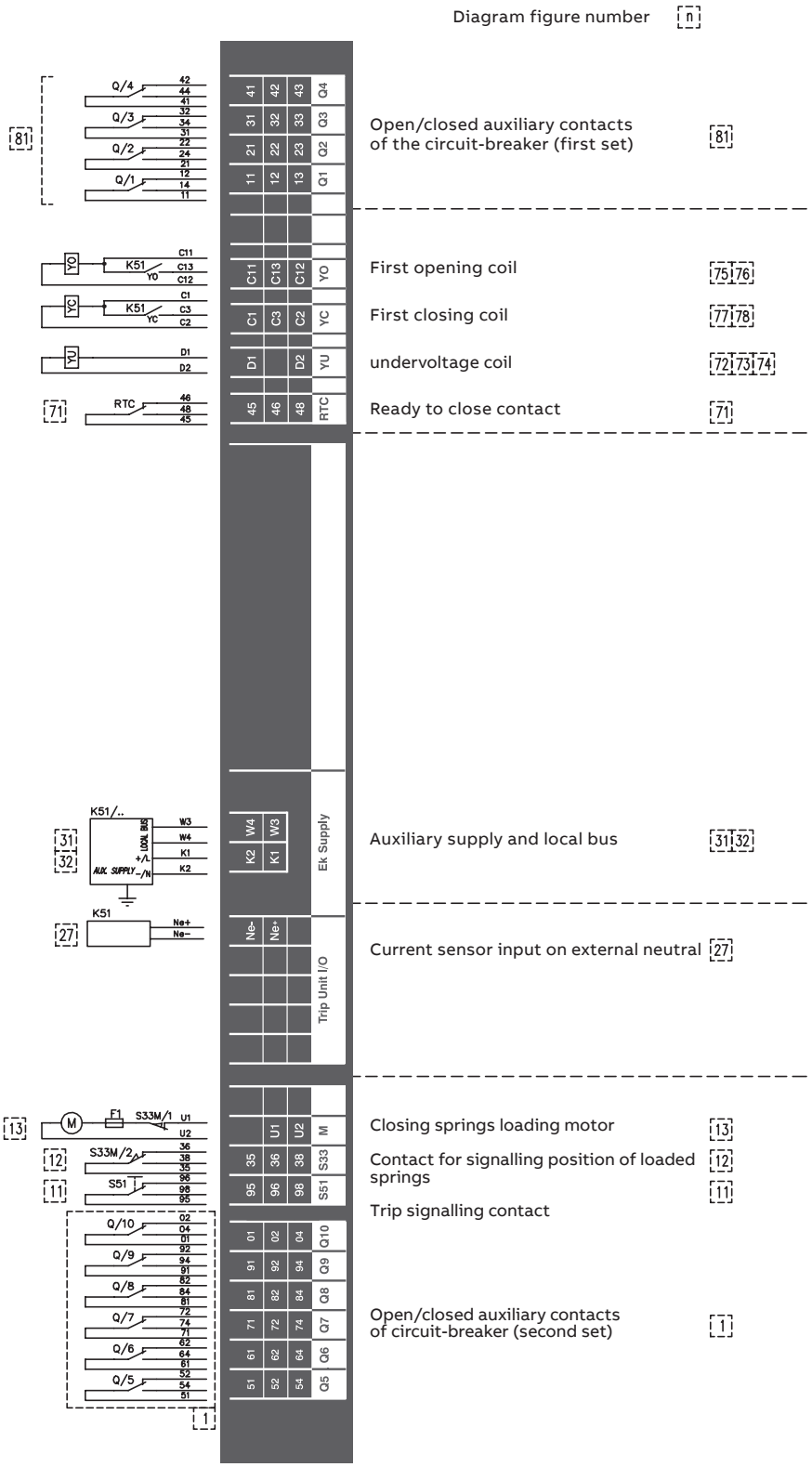
3-pole or 4-pole switch-disconnector



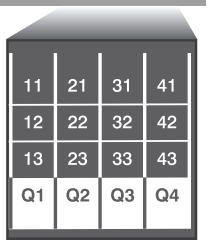
Terminal box



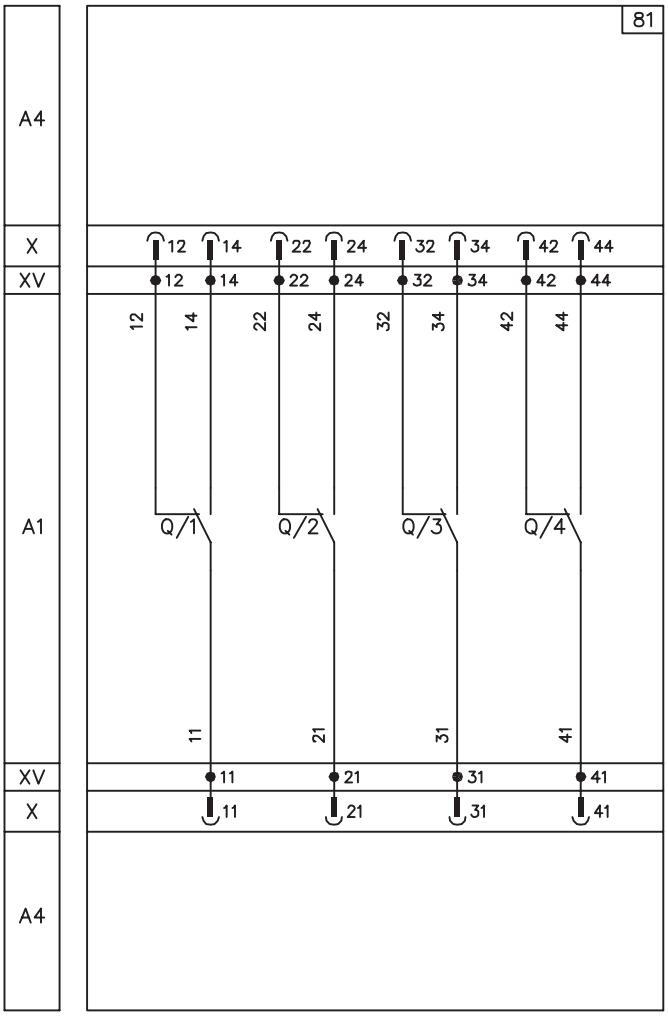
Electrical accessories



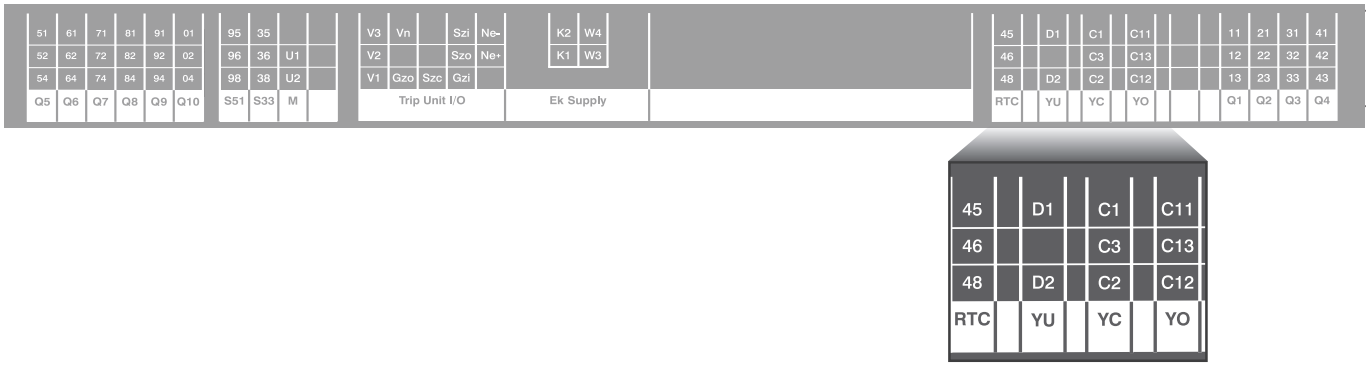




81) Open/closed auxiliary contacts of circuit breaker (first set)

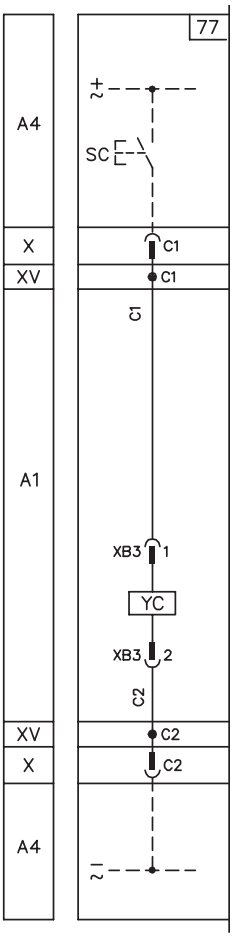


Electrical accessories

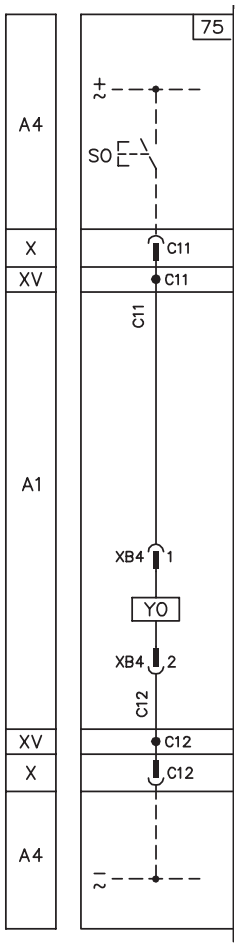


77) First closing coil - YC

75) First opening coil - YO

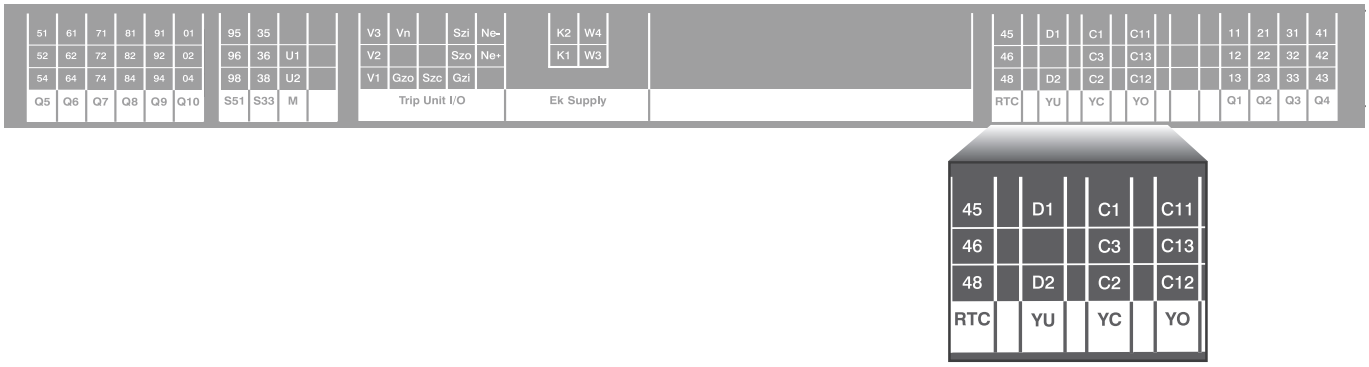


77 (YC)



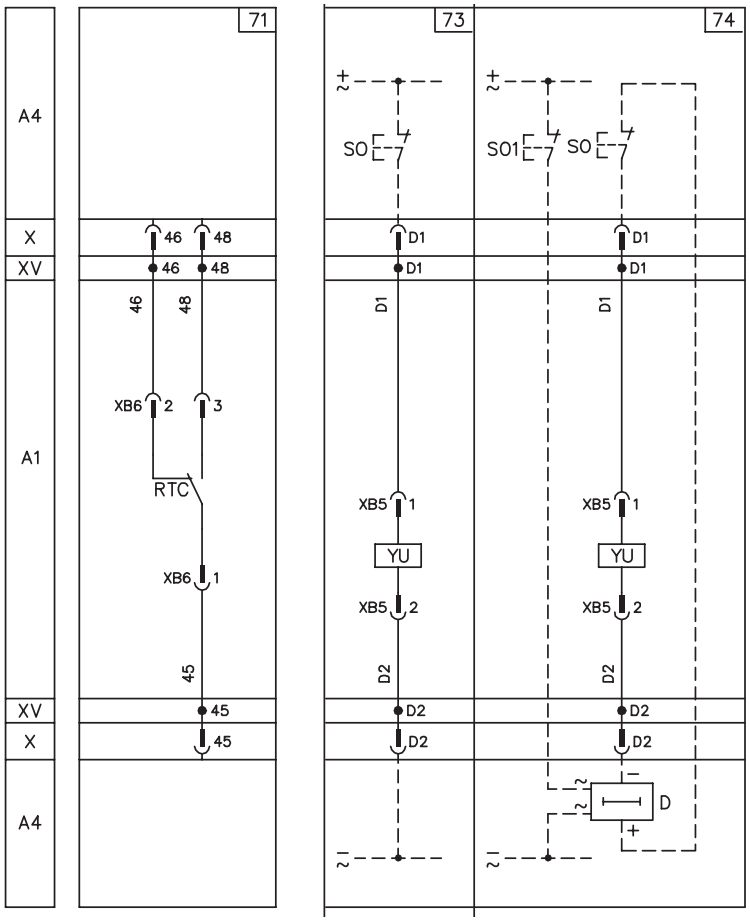
75 (Y0)

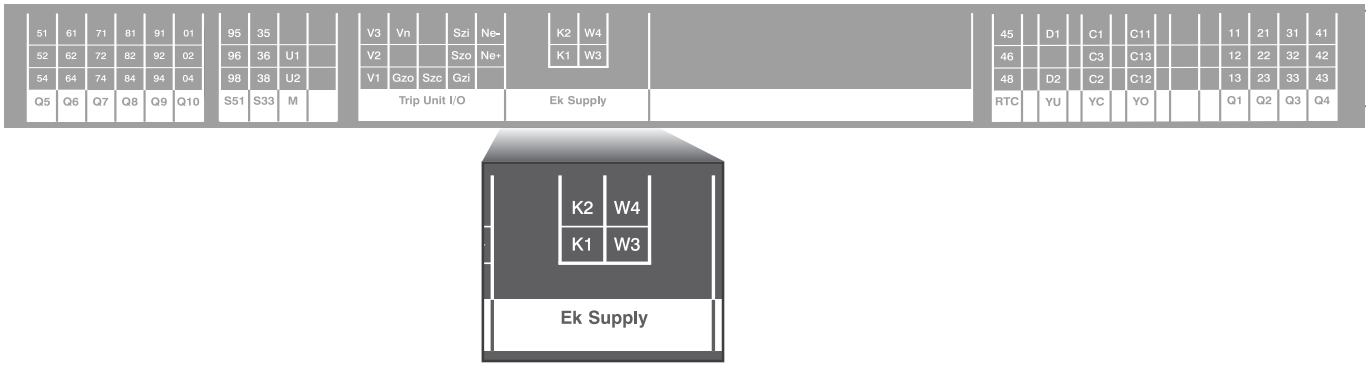
Electrical accessories



71) Ready to close contact - RTC
73) Undervoltage coil - YU
74) Undervoltage coil with external time-lag device - YU, D

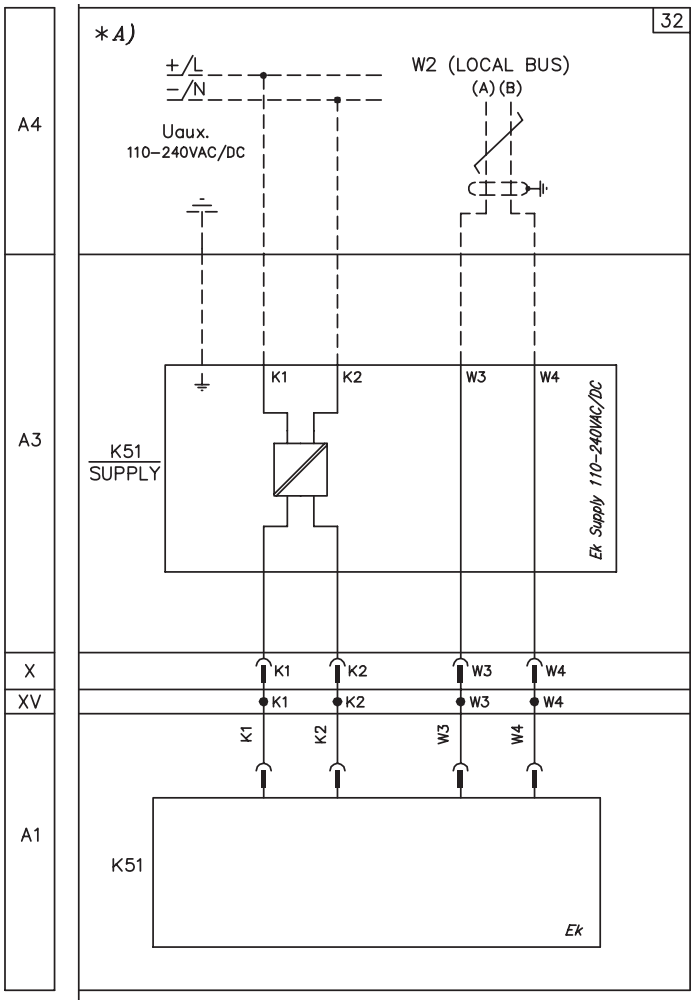
—
73 (YU) -
74 (YU, D) as an
alternative to each other



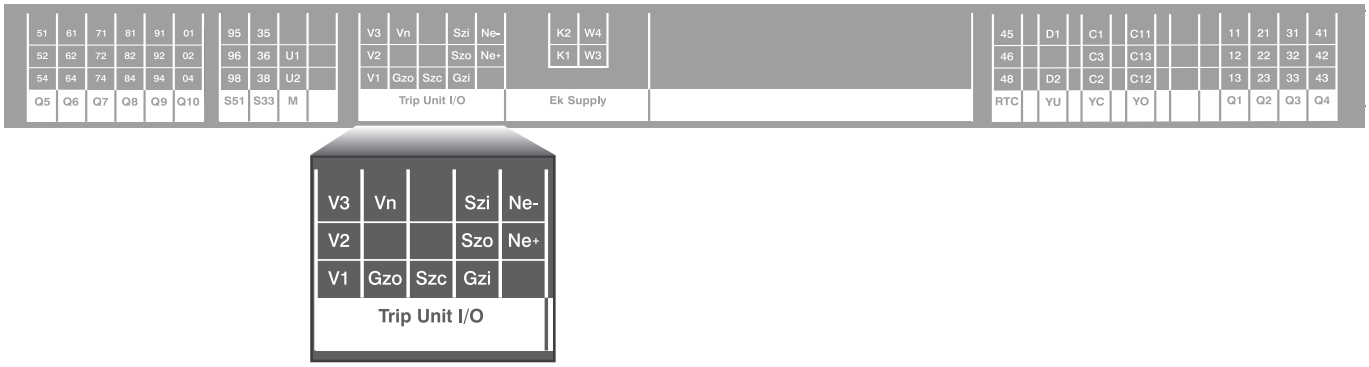


32) Auxiliary supply through module 110-240V AC/DC and local bus

—
As an alternative to figure 31

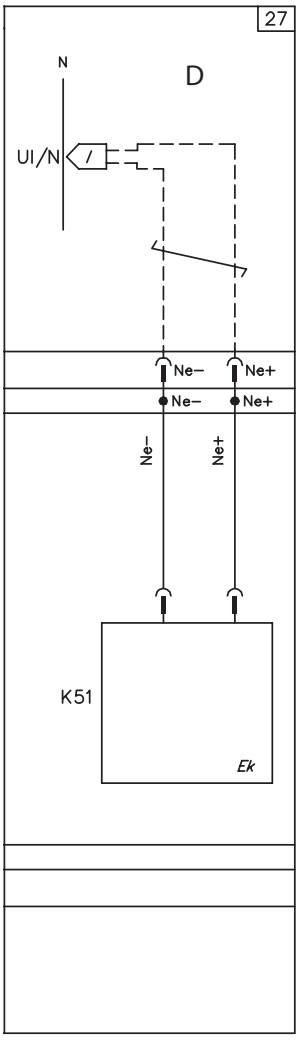


Electrical accessories



27) Current sensor input on external neutral (only for 3-pole circuit breaker)

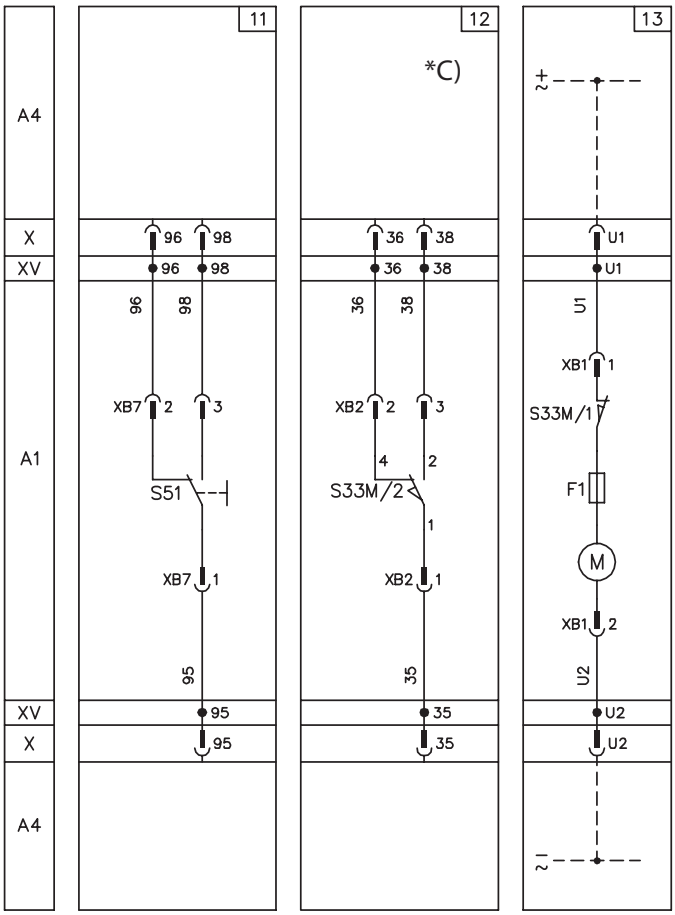
—
As an alternative
to figure 20-21



Electrical accessories



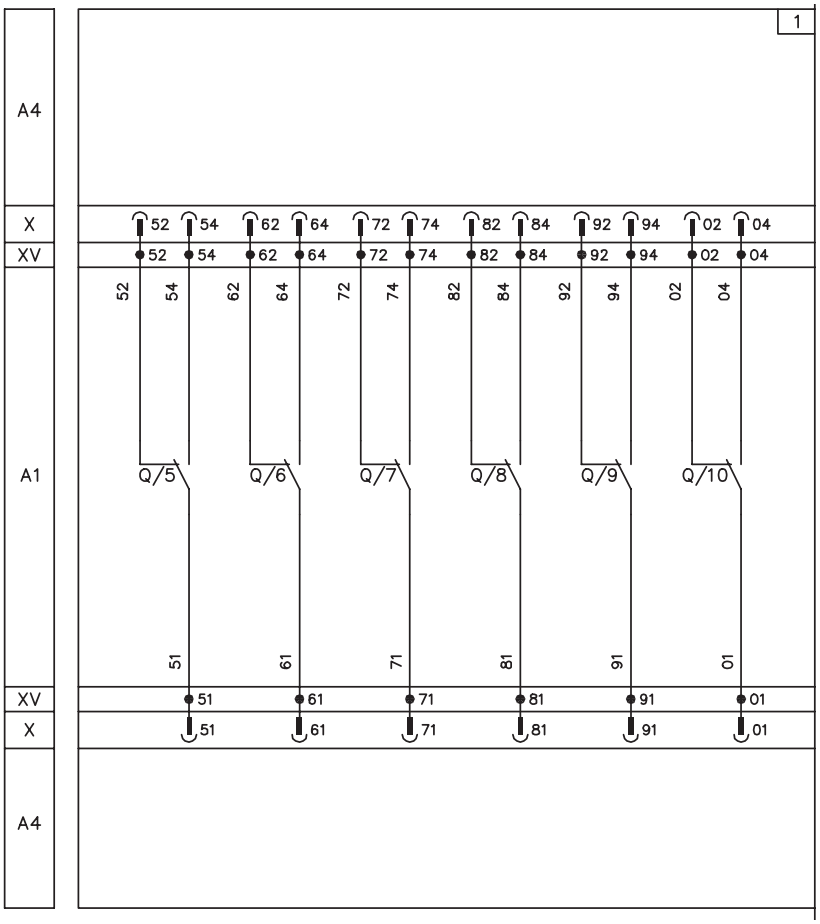
11) Trip signalling contact - S51
12) Contact for signalling position of loaded springs - S33
13) Motor for loading closing springs - M





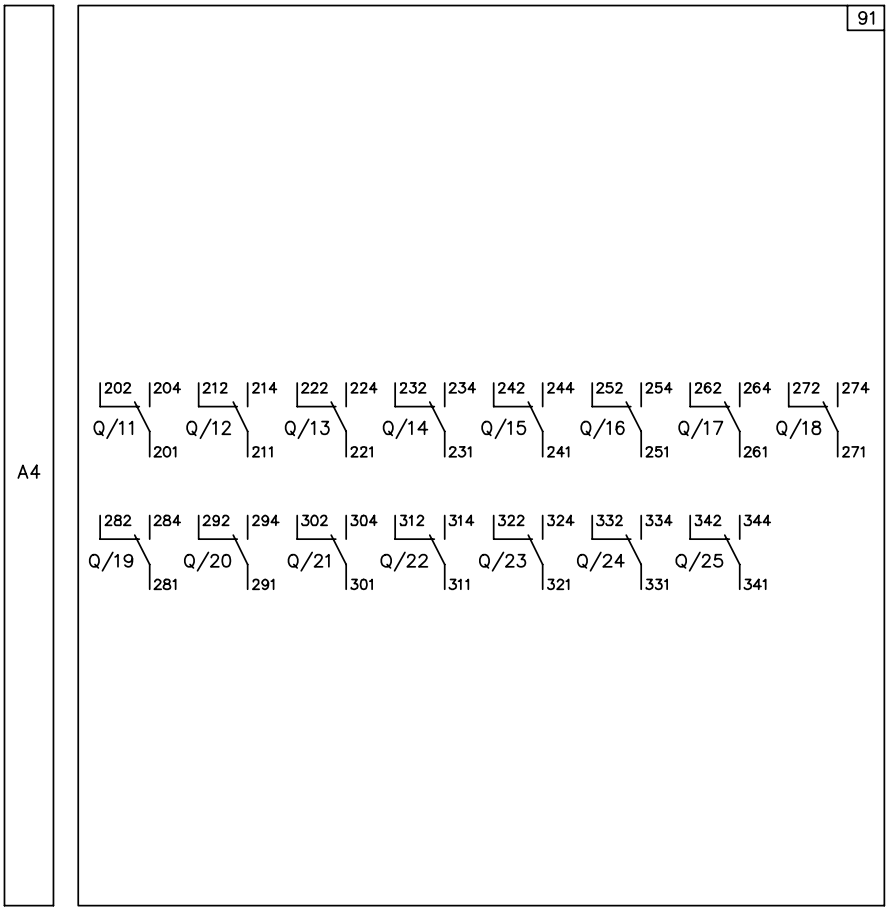
1) Supplementary open/closed auxiliary contacts of the circuit breaker (second set)

—
Only for circuit breakers



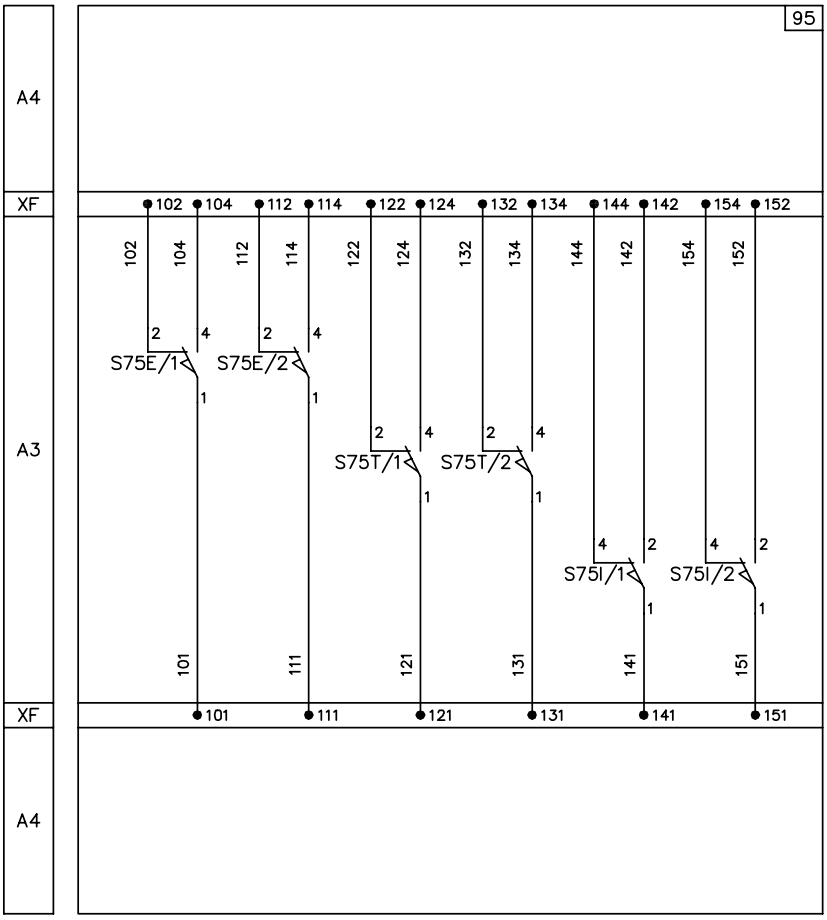
Electrical accessories

91) Supplementary open/closed auxiliary contacts outside the circuit breaker



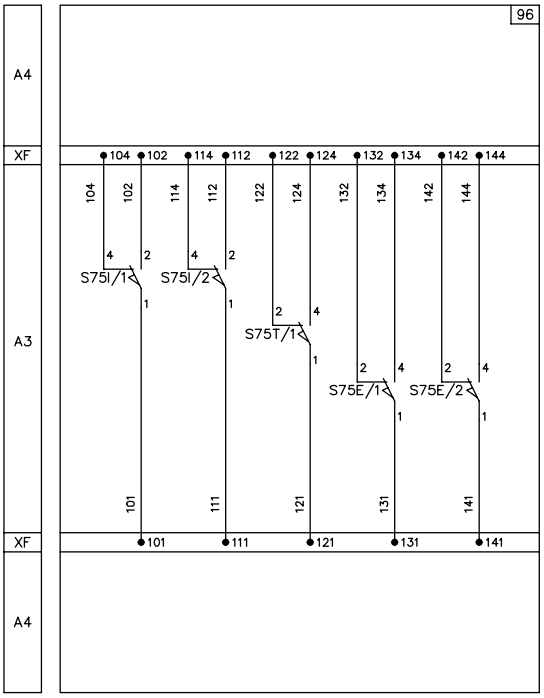
95) Contacts for signalling of circuit breaker in racked-in, test, racked-out position

—
Only for circuit breakers FA1 in withdrawable version



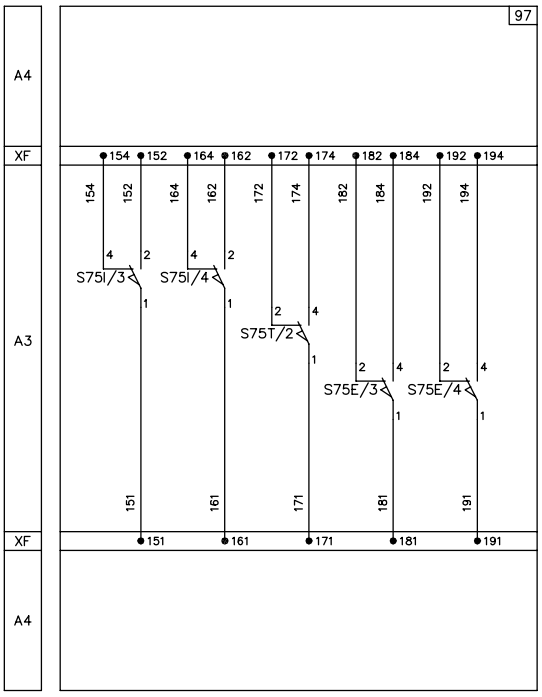
Electrical accessories

—
Only for circuit breakers FA2 - FA4 in with-drawable version



—
Only for circuit breakers FA2 - FA4 in with-drawable version

97) Contacts for signalling of circuit breaker in racked-in, test, racked-out position (second set)



General informations

Abbreviations used for the description of the product

Versions and terminals

F	Fixed circuit-breaker
W	Withdrawable circuit-breaker
MP	Mobile part of withdrawable circuit-breaker
FP	Fixed part of withdrawable circuit-breaker

Iu	Rated uninterrupted current
In	Rated current of the rating plug
Icu	Rated ultimate short-circuit breaking capacity
Icw	Rated short-time withstand current

/MS	Switch-disconnector

HR VR	Rear orientable terminals
F	Front terminals

Protection trip units and functions

Ek 1	Protection trip unit for power distribution
Ek 2	Measurement and protection trip unit for power distribution

L	Overload protection
S	Protection against selective short circuit
I	Protection against instantaneous short circuit
G	Earth fault protection

Instructions for ordering
Ordering examples

Standard version Formula AIR series circuit-breakers are identified by means of commercial codes that can be accessorized. Please note that, for automatic circuit breakers, the breaking unit must be ordered together with a trip unit (Ek 1 or Ek 2), as shown in the examples below.
Step 1: [mandatory] select the breaking part of the automatic circuit-breaker
Step 2: [mandatory] select the trip unit type and version
Step 3: [optional] select mechanical and/or electrical accessories for the circuit-breaker

For fixed parts:
Step 1: select the fixed part
Step 2: [optional] select mechanical and/or electrical accessories for the fixed part

Ordering examples

- **Terminal kit codes** (other than standard supply) for fixed circuit-breaker or for fixed part of withdrawable circuit-breaker. The codes refer to 3 or 4 pieces (for mounting on top or bottom terminals). To convert a complete circuit-breaker, 1 kit for upper terminals and 1 kit for lower terminals must be specified in the order.

Example no. 1

FA2C 3 poles fixed with vertica rear terminals (VR)	
1SDA080383R1	FA2C 2000 3p FHR
1SDA080517R1	Ek 2 LSIG
1SDA080611R1	Kit VR Up FA2 Iu=2000 3pcs INST
1SDA080613R1	Kit VR Low FA2 Iu=2000 3pcs INST

Example no. 2

FA1 4 poles fixed breaker with front (F) terminals (standard supply)	
1SDA085437R1	FA1C 1600 4p F F FAIC
1SDA080515R1	Ek 1 LSIG

Example no. 3

FA4C 4 poles fixed with upper vertical rear terminals (VR) and lower horizontal terminals (HR)	
1SDA080407R1	FA4C 4000 4p FHR
1SDA080517R1	Ek 2 LSIG
1SDA080620R1	Kit VR Up FA4 Iu=4000 4pcs INST

- **Rating Plug for lower values than rated current.** Rating plug installed on the circuit-breaker enables to obtain lower current values than rated current.

Example no. 4

FA4C 3200A 3 poles fixed In=2500A	
1SDA080390R1	FA4C 3200 3p FHR
1SDA080609R1	Rating Plug 2500 FA4 INST

- **Ordering for Ek modules.**

Example no. 5

FA2C 3 poles fixed with modules: Ek Supply	
1SDA080382R1	FA2C 1600 3p FHR
1SDA080517R1	Ek 2 LSIG
1SDA080584R1	Ek Supply 110-240VAC/DC

- **Ordering for electrical accessories.** All the accessories and auxiliary contacts are available. In particular, up to 3 coils can be ordered.

Example no. 6

FA4C 3 poles withdrawable with accessories: opening release, closing release, undervoltage release and motor for automatic charging of the springs	
1SDA080421R1	FA4C 2500 3p WMP
1SDA080517R1	Ek 2 LSIG
1SDA080519R1	YO FA2-FA4 220-240 Vac/dc
1SDA080521R1	YC FA2-FA4 220-240 Vac/dc
1SDA080523R1	YU FA2-FA4 220-240 Vac/dc
1SDA080525R1	M FA2-FA4 220-250 Vac/dc

- **Ordering for locks.**

Example no. 7

FA2C 4 poles withdrawable with key lock in open position (KLC) and padlock in racked-in / test / racked-out position (PLP)	
1SDA080431R1	FA2C 2000 4p WMP FAC
1SDA080513R1	Ek 1 LI
1SDA080541R1	KLC-D Key lock open FA2-FA4
1SDA080557R1	PLP Position padlock D=4/6/8mmFA2-FA4

- **Ordering for mechanical Interlocks.**
  Interlocks have several strategy configuration, suitable for fixed circuit-breakers and withdrawable circuit-breakers. Each configuration requires different groups:
  - **Cables**, select one kit for strategy A / B / C / D. The cables must be ordered on fixed circuit-breaker or fixed part of withdrawable circuit-breaker.
  - **Lever**, required only for FA2 and FA4. The lever must be mounted on fixed circuit-breaker or on mobile part of withdrawable circuit-breaker.
  - **Support**, select one kit for each fixed circuit-breaker or fixed part of withdrawable ciruit-breaker. This support is mounted on the external right side of the circuit-breaker or fixed part.

Example no. 8

Interlock between two fixed circuit-breakers: FA1 and FA2	
FA1 fixed circuit-breakers	**FA2 fixed circuit-breakers**
Cables [Group 1]: 1 item	Lever [Group 2]: 1 item
Support [Group 3]: 1 item	Support [Group 3]: 1 item

Example no. 9

Interlock between three fixed circuit-breakers: two FA2 and one FA4		
FA2 fixed circuit-breakers	**FA2 fixed circuit-breakers**	**FA4 fixed circuit-breakers**
Cables [Group 1]: 1 item	Lever [Group 2]: 1 item	Lever [Group 2]: 1 item
Lever [Group 2]: 1 item	Support [Group 3]: 1 item	Support [Group 3]: 1 item
Support [Group 3]: 1 item		

Example no. 10

Interlock between two withdrawable circuit-breakers: FA2 and FA4	
FA2 mobile part	**FA4 mobile part**
Lever [Group 2]: 1 item	Lever [Group 2]: 1 item
+	**+**
FA2 fixed Part	**FA4 fixed Part**
Cables [Group 1]: 1 item	Support [Group 3]: 1 item
Support [Group 3]: 1 item	

Example no. 11

Interlock between three withdrawable circuit-breakers: two FA2 and one FA4		
FA2 mobile part	**FA2 mobile part**	**FA4 mobile part**
Lever [Group 2]: 1 item	Lever [Group 2]: 1 item	Lever [Group 2]: 1 item
+	**+**	**+**
FA2 fixed Part	**FA2 fixed Part**	**FA4 fixed Part**
Cables [Group 1]: 1 item	Support [Group 3]: 1 item	Support [Group 3]: 1 item
Support [Group 3]: 1 item		

Automatic circuit-breakers

Fixed version





Formula AIR FA1 Front terminals (F), FA2-4 adjustable rear terminals (HR)

Size	Iu	Icu (440 V)	Icw 1s (440V)	Type	3 Poles Code	4 Poles Code
FA1B	630	42	42	FA1B 630	1SDA085459R1	1SDA085464R1
	800	42	42	FA1B 800	1SDA085460R1	1SDA085465R1
	1000	42	42	FA1B 1000	1SDA085461R1	1SDA085466R1
	1250	42	42	FA1B 1250	1SDA085462R1	1SDA085467R1
	1600	42	42	FA1B 1600	1SDA085463R1	1SDA085468R1
FA1C	630	50	50	FA1C 630	1SDA085419R1	1SDA085429R1
	800	50	50	FA1C 800	1SDA085421R1	1SDA085431R1
	1000	50	50	FA1C 1000	1SDA085423R1	1SDA085433R1
	1250	50	50	FA1C 1250	1SDA085425R1	1SDA085435R1
	1600	50	50	FA1C 1600	1SDA085427R1	1SDA085437R1
FA2C	1600	50	50	FA2C 1600	1SDA080382R1	1SDA080398R1
	2000	50	50	FA2C 2000	1SDA080383R1	1SDA080399R1
FA4C	2500	50	50	FA4C 2500	1SDA080389R1	1SDA080405R1
	3200	50	50	FA4C 3200	1SDA080390R1	1SDA080406R1
	4000	50	50	FA4C 4000	1SDA080391R1	1SDA080407R1

To be ordered together with an microprocessor trip unit reported below

Withdrawable version





Formula AIR FA1 - FA4, mobile part of withdrawable breaking unit (MP)

Size	Iu	Icu (440 V)	Icw 1s (440V)	Type	3 Poles Code	4 Poles Code
FA1B	630	42	42	FA1B 630	1SDA085469R1	1SDA085474R1
	800	42	42	FA1B 800	1SDA085470R1	1SDA085475R1
	1000	42	42	FA1B 1000	1SDA085471R1	1SDA085476R1
	1250	42	42	FA1B 1250	1SDA085472R1	1SDA085477R1
	1600	42	42	FA1B 1600	1SDA085473R1	1SDA085478R1
FA1C	630	50	50	FA1C 630	1SDA085439R1	1SDA085449R1
	800	50	50	FA1C 800	1SDA085441R1	1SDA085451R1
	1000	50	50	FA1C 1000	1SDA085443R1	1SDA085453R1
	1250	50	50	FA1C 1250	1SDA085445R1	1SDA085455R1
	1600	50	50	FA1C 1600	1SDA085447R1	1SDA085457R1
FA2C	1600	50	50	FA2C 1600	1SDA080414R1	1SDA080430R1
	2000	50	50	FA2C 2000	1SDA080415R1	1SDA080431R1
FA4C	2500	50	50	FA4C 2500	1SDA080421R1	1SDA080437R1
	3200	50	50	FA4C 3200	1SDA080422R1	1SDA080438R1
	4000	50	50	FA4C 4000	1SDA080423R1	1SDA080439R1

To be ordered together with an microprocessor trip unit reported below




Ek microprocessor trip units

Size	Type	Code
FA1-FA4	Ek 1 LI	1SDA080513R1
FA1-FA4	Ek 1 LSIG	1SDA080515R1
FA1-FA4	Ek 2 LSIG	1SDA080517R1
FA1-FA4	Trip Unit Battery*	1SDA080583R1

* Spare part. All trip units are already equipped with a battery.

Switch-disconnectors

Fixed version





Formula AIR FA1/MS Front terminals (F), FA2-4/MS adjustable rear terminals (HR)

Size	Iu	Icw 1s (440V)	Type	3 Poles	4 Poles
				Code	Code
FA1N	630	50	FA1N/MS 630	1SDA085480R1	1SDA085490R1
	800	50	FA1N/MS 800	1SDA085482R1	1SDA085492R1
	1000	50	FA1N/MS 1000	1SDA085484R1	1SDA085494R1
	1250	50	FA1N/MS 1250	1SDA085486R1	1SDA085496R1
	1600	50	FA1N/MS 1600	1SDA085488R1	1SDA085498R1
FA2C	1600	50	FA2C/MS 1600	1SDA080446R1	1SDA080462R1
	2000	50	FA2C/MS 2000	1SDA080447R1	1SDA080463R1
FA4C	2500	50	FA4C/MS 2500	1SDA080453R1	1SDA080469R1
	3200	50	FA4C/MS 3200	1SDA080454R1	1SDA080470R1
	4000	50	FA4C/MS 4000	1SDA080455R1	1SDA080471R1

Withdrawable version





Formula AIR FA1/MS-FA4/MS, mobile part of withdrawable breaking unit (MP)

Size	Iu	Icw 1s (440V)	Type	3 Poles	4 Poles
				Code	Code
FA1N	630	50	FA1N/MS 630	1SDA085500R1	1SDA085510R1
	800	50	FA1N/MS 800	1SDA085502R1	1SDA085512R1
	1000	50	FA1N/MS 1000	1SDA085504R1	1SDA085514R1
	1250	50	FA1N/MS 1250	1SDA085506R1	1SDA085516R1
	1600	50	FA1N/MS 1600	1SDA085508R1	1SDA085518R1
FA2C	1600	50	FA2C/MS 1600	1SDA080478R1	1SDA080494R1
	2000	50	FA2C/MS 2000	1SDA080479R1	1SDA080495R1
FA4C	2500	50	FA4C/MS 2500	1SDA080485R1	1SDA080501R1
	3200	50	FA4C/MS 3200	1SDA080486R1	1SDA080502R1
	4000	50	FA4C/MS 4000	1SDA080487R1	1SDA080503R1

Fixed parts




Size	Iu max	Type of terminal	Type	3 Poles	4 Poles
				Code	Code
FA1	1600	HR-HR	FA1 W FP Iu=1600 HR HR	1SDA085127R1	1SDA085128R1
FA2	2000	HR - HR	FA2 W FP Iu=2000 HR HR	1SDA080507R1	1SDA080508R1
FA4	3200	HR - HR	FA4 W FP Iu=3200 HR HR	1SDA080509R1	1SDA080510R1
FA4	4000	HR - HR	FA4 W FP Iu=4000 HR HR	1SDA080511R1	1SDA080512R1

Automatic circuit-breakers
Configured codes

Configured code for 3 Pole moving part with trip unit





Current	Frame	Icw	3 Pole Drawout - WMP		
			Ek 1 LI	Ek 1 LSIG	Ek 2 LSIG
630A	FA1B	42kA	1SDX194771R1	1SDX194769R1	1SDX194770R1
800A	FA1B	42kA	1SDX194767R1	1SDX194766R1	1SDX194768R1
1000A	FA1B	42kA	1SDX196744R1	1SDX196745R1	1SDX196746R1
1250A	FA1B	42kA	1SDX204724R1	1SDX204725R1	1SDX204726R1
1600A	FA1B	42kA	1SDX204730R1	1SDX204731R1	1SDX204732R1
630A	FA1C	50kA	1SDX204736R1	1SDX204737R1	1SDX204738R1
800A	FA1C	50kA	1SDX022998R1	1SDX012156R1	1SDX012213R1
1000A	FA1C	50kA	1SDX012119R1	1SDX012157R1	1SDX012214R1
1250A	FA1C	50kA	1SDX012120R1	1SDX012158R1	1SDX012215R1
1600A	FA1C	50kA	1SDX012121R1	1SDX012159R1	1SDX012216R1
1600A	FA2C	50kA	1SDX012126R1	1SDX012164R1	1SDX012221R1
2000A	FA2C	50kA	1SDX012127R1	1SDX012165R1	1SDX012222R1
2500A	FA4C	50kA	1SDX012130R1	1SDX012189R1	1SDX012225R1
3200A	FA4C	50kA	1SDX012131R1	1SDX012190R1	1SDX012226R1
4000A	FA4C	50kA	1SDX012132R1	1SDX012191R1	1SDX012227R1

Configured code for 4 Pole moving part with trip unit





Current	Frame	Icw	4 Pole Drawout - WMP		
			Ek 1 LI	Ek 1 LSIG	Ek 2 LSIG
630A	FA1B	42kA	1SDX205255R1	1SDX205256R1	1SDX205257R1
800A	FA1B	42kA	1SDX194764R1	1SDX194763R1	1SDX194765R1
1000A	FA1B	42kA	1SDX205264R1	1SDX205265R1	1SDX205266R1
1250A	FA1B	42kA	1SDX205270R1	1SDX205271R1	1SDX205272R1
1600A	FA1B	42kA	1SDX205276R1	1SDX205277R1	1SDX205278R1
630A	FA1C	50kA	1SDX205282R1	1SDX205283R1	1SDX205284R1
800A	FA1C	50kA	1SDX012231R1	1SDX012269R1	1SDX012307R1
1000A	FA1C	50kA	1SDX012232R1	1SDX012270R1	1SDX012308R1
1250A	FA1C	50kA	1SDX012235R1	1SDX012273R1	1SDX012309R1
1600A	FA1C	50kA	1SDX012236R1	1SDX012274R1	1SDX012310R1
1600A	FA2C	50kA	1SDX012241R1	1SDX012279R1	1SDX012315R1
2000A	FA2C	50kA	1SDX012242R1	1SDX012280R1	1SDX012316R1
2500A	FA4C	50kA	1SDX012245R1	1SDX012283R1	1SDX012319R1
3200A	FA4C	50kA	1SDX012246R1	1SDX012284R1	1SDX012320R1
4000A	FA4C	50kA	1SDX012247R1	1SDX012285R1	1SDX012321R1

Note:
Above codes for Drawout version includes breaking part & trip unit
The configured codes does not include fixed part.

Automatic circuit-breakers
Configured codes

Configured code for 3 Pole fixed type with trip unit





Current	Frame	Icw	3 Pole Fixed - F F/FHR		
			Ek 1 LI	Ek 1 LSIG	Ek 2 LSIG
630A	FA1B	42kA	1SDX260777R1	1SDX260778R1	1SDX260779R1
800A	FA1B	42kA	1SDX234540R1	1SDX235807R1	1SDX260805R1
1000A	FA1B	42kA	1SDX260193R1	1SDX260811R1	1SDX260812R1
1250A	FA1B	42kA	1SDX260194R1	1SDX260820R1	1SDX260821R1
1600A	FA1B	42kA	1SDX260825R1	1SDX260826R1	1SDX260827R1
630A	FA1C	50kA	1SDX260831R1	1SDX260832R1	1SDX260833R1
800A	FA1C	50kA	1SDX259376R1	1SDX251130R1	1SDX260837R1
1000A	FA1C	50kA	1SDX260841R1	1SDX192557R1	1SDX260842R1
1250A	FA1C	50kA	1SDX259377R1	1SDX257921R1	1SDX260846R1
1600A	FA1C	50kA	1SDX194909R1	1SDX260849R1	1SDX266646R1
1600A	FA2C	50kA	1SDX117747R1	1SDX117748R1	1SDX266649R1
2000A	FA2C	50kA	1SDX117766R1	1SDX117768R1	1SDX266652R1
2500A	FA4C	50kA	1SDX117769R1	1SDX117771R1	1SDX266658R1
3200A	FA4C	50kA	1SDX117773R1	1SDX117774R1	1SDX266662R1
4000A	FA4C	50kA	1SDX117776R1	1SDX117779R1	1SDX266666R1

Configured code for 4 Pole fixed type with trip unit





Current	Frame	Icw	4 Pole Fixed - F F/FHR		
			Ek 1 LI	Ek 1 LSIG	Ek 2 LSIG
630A	FA1B	42kA	1SDX266908R1	1SDX266909R1	1SDX266910R1
800A	FA1B	42kA	1SDX266915R1	1SDX266916R1	1SDX266917R1
1000A	FA1B	42kA	1SDX266921R1	1SDX226083R1	1SDX266922R1
1250A	FA1B	42kA	1SDX266926R1	1SDX260195R1	1SDX266927R1
1600A	FA1B	42kA	1SDX266931R1	1SDX266932R1	1SDX266933R1
630A	FA1C	50kA	1SDX266940R1	1SDX266941R1	1SDX266942R1
800A	FA1C	50kA	1SDX233063R1	1SDX266946R1	1SDX266947R1
1000A	FA1C	50kA	1SDX232374R1	1SDX226084R1	1SDX266953R1
1250A	FA1C	50kA	1SDX266956R1	1SDX256633R1	1SDX266957R1
1600A	FA1C	50kA	1SDX235972R1	1SDX266960R1	1SDX266961R1
1600A	FA2C	50kA	1SDX232375R1	1SDX256634R1	1SDX266963R1
2000A	FA2C	50kA	1SDX266966R1	1SDX207733R1	1SDX266967R1
2500A	FA4C	50kA	1SDX266969R1	1SDX266970R1	1SDX266971R1
3200A	FA4C	50kA	1SDX266974R1	1SDX266976R1	1SDX266977R1
4000A	FA4C	50kA	1SDX266980R1	1SDX287106R1	1SDX287113R1

Note: Above codes for fixed version ACB includes breaking part & trip unit

Accessories
Electrical accessories



First and second opening release - YO

Size	Type	Code
FA1-FA4	YO FA 110-120 VAC/DC	1SDA080518R1
FA1-FA4	YO FA 220-240 VAC/DC	1SDA080519R1

Closing release - YC

Size	Type	Code
FA1-FA4	YC FA 220-240 VAC/DC	1SDA080521R1
FA1-FA4	YC FA 110-120 VAC/DC	1SDA080520R1

Undervoltage release - YU

Size	Type	Code
FA1-FA4	YU FA 110-120 VAC/DC	1SDA080522R1
FA1 -FA4	YU FA 220-240 VAC/DC	1SDA080523R1



Motor - M

Size	Type	Code
FA1	M FA1 100-130 VAC/DC	1SDA085085R1
FA1	M FA1 220-250 VAC/DC	1SDA085086R1
FA2-FA4	M FA2/FA4 100-130 VAC/DC	1SDA080524R1
FA2-FA4	M FA2/FA4 220-250 VAC/DC	1SDA080525R1



Current sensor for neutral conductor outside the circuit-breaker

Size	Type	Code
FA1-FA2	Ext CS N FA2* 2000A	1SDA080526R1
FA4	Ext CS N FA4* 2500A-3200A	1SDA080527R1
FA4	Ext CS FA4* 4000A	1SDA080528R1

* only as loose part



Open/closed auxiliary contacts - AUX

Size	Type	Code
FA1	AUX 4Q 400V FA1*	1SDA085089R1
FA1	AUX 15Q 400V FA1**	1SDA085090R1
FA2-FA4	AUX 4Q 400VAC FA2/FA4*	1SDA080531R1
FA2-FA4	AUX 6Q 400VAC FA2/FA4	1SDA080532R1
FA2-FA4	AUX 15Q 400VAC F INS FA2/FA4**	1SDA080533R1

* standard supply with automatic circuit breakers
** not compatible with mechanical locks on compartment doors or mechanical interlocks



Auxiliary position contacts - AUP

Size	Type	Code
FA1	AUP 6 contacts 400VAC FA1	1SDA085091R1
FA2-FA4	AUP 5 400VAC SX FA2/FA4	1SDA080534R1
FA2-FA4	AUP 5 400VAC DX FA2/FA4	1SDA080535R1



Ready to close signalling contact - RTC

Size	Type	Code
FA1	RTC 250VAC FA1	1SDA085092R1
FA2-FA4	RTC 250VAC FA2/FA4	1SDA080536R1



Contact signalling tripping of Ek protection trip unit - S51

Size	Type	Code
FA1	S51 250V FA1	1SDA085093R1
FA2-FA4	S51 250V FA2/FA4	1SDA080538R1

Terminals for auxiliary connection

Size	Type	Code
FA1-FA4	Terminals terminal box FA	1SDA080539R1

Accessories
Mechanical accessories



Mechanical operation counter - MOC

Size	Type	Code
FA1	MOC FA1	1SDA085094R1
FA2-FA4	MOC FA2/FA4	1SDA080540R1



Key lock in open position - KLC

Size	Type	Code
FA1	KLC-D Key lock open FA1	1SDA085095R1
FA1	KLC-S Key lock open N.20005 FA1	1SDA085096R1
FA1	KLC-S Key lock open N.20006 FA1	1SDA085097R1
FA2-FA4	KLC-D Key lock open FA2/FA4	1SDA080541R1
FA2-FA4	KLC-S N.20005 FA2/FA4	1SDA080542R1
FA2-FA4	KLC-S N.20006 FA2/FA4	1SDA080543R1



Padlocks in open position - PLC

Size	Type	Code
FA1	PLC FA1/HF1.2 D=8mm	1SDA085103R1
FA2-FA4	PLC FA2/FA4/HF2.2/HF4.2 D=8mm	1SDA080549R1

Key lock in racked-in / test / racked-out position- KLP

Size	Type	Code
FA1	KLP-D Pos. lock FA1/HF1.2 1key	1SDA085104R1
FA1	KLP-S Pos. lock N.20005 FA1/HF1.2 1key	1SDA085105R1
FA1	KLP-S Pos. lock N.20006 FA1/HF1.2 1key	1SDA085106R1
FA2-FA4	KLP-D Pos. lock FA2/FA4/HF2.2/HF4.2 1Key	1SDA080550R1
FA2-FA4	KLP-S N.20005 FA2/FA4/HF2.2/HF4.2 1Key	1SDA080551R1
FA2-FA4	KLP-S N.20006 FA2/FA4/HF2.2/HF4.2 1Key	1SDA080552R1



Accessory for supplementary lock in racked-out position

Size	Type	Code
FA1	Suppl. lock rack. out FA1	1SDA085110R1
FA2-FA4	Suppl. lock rack. out FA2/FA4	1SDA080556R1



Padlock in racked-in / test / racked-out position - PLP

Size	Type	Code
FA1	PLP D=4/6/8mm FA1	1SDA085111R1
FA2-FA4	PLP D=4/6/8mm FA2/FA4	1SDA080557R1

Floor fixing plate - F

Size	Type	Code
FA1	Floor fixing plate for fixed ACB FA1	1SDA085168R1



Protection device for opening and closing pushbuttons - PBC

Size	Type	Code
FA1	PBC FA1/HF1.2	1SDA085112R1
FA1	PBC D=8mm FA1/HF1.2	1SDA085115R1
FA2-FA4	PBC FA2/FA4/HF2.2/HF4.2	1SDA080558R1
FA2-FA4	PBC D=8mm FA2/FA4/HF2.2/HF4.2	1SDA080561R1



Lock for racking in / racking out the mobile part when the door is open - DLR

Size	Type	Code
FA2-FA4	DLR FA2/FA4/HF2.2/HF4.2*	1SDA080562R1

* Only as loose part



Lock to prevent door opening when the circuit-breaker is in racked-in / test position

Size	Type	Code
FA2-FA4	DLP FA2/FA4/HF2.2/HF4.2*	1SDA080563R1

* Only as loose part

Lock to prevent door opening when circuit-breaker is in closed position - DLC

Size	Type	Code
FA1	DLC Interlock direct door for fixed to wall FA1	1SDA085171R1
FA1	DLC Interlock direct door for fixed part withdrawable FA1	1SDA085173R1
FA1	DLC Interlock cable door for fixed to wall FA1	1SDA085174R1
FA1	DLC Interlock cable door for fixed part withdrawable FA1	1SDA085176R1
FA2-FA4	DLC cable FA2/FA4*	1SDA080564R1
FA2-FA4	DLC direct FA2/FA4*	1SDA080565R1

* To be ordered with lever for interlock [group 2] and support for interlock [1SDA080581R1]



Phase Barriers - PB

Size	Type	Code
FA1	PB H=100mm 4pz FA1/HF1.2 F 3P	1SDA085120R1
FA1	PB H=100mm 6pz FA1/HF1.2 F 4P	1SDA085121R1
FA1	PB 2pz FA1/HF1.2 W FP 3P	1SDA085169R1
FA1	PB 3pz FA1/HF1.2 W FP 4P	1SDA085170R1
FA2-FA4	PB 2pz FA2/FA4/HF2.2/HF4.2 F 3P	1SDA080571R1
FA2-FA4	PB 3pz FA2/FA4/HF2.2/HF4.2 F 4P	1SDA080572R1
FA2-FA4	PB 2pz FA2/FA4/HF2.2/HF4.2 W FP 3P	1SDA080573R1
FA2-FA4	PB 3pz FA2/FA4/HF2.2/HF4.2 W FP 4P	1SDA080574R1

Circuit-breaker flange

Size	Type	Code
FA1	IP54 Flange FA1/HF1.2	1SDA085118R1
FA2-FA4	IP54 Flange FA2/FA4	1SDA080568R1
FA2-FA4	IP54 Flange 20005 FA2/FA4	1SDA080569R1
FA2-FA4	Sealable TU cover FA2/FA4	1SDA080570R1

Accessories
Mechanical interlocks and Modules

Cables for mechanical interlock [Group 1]

Size	Type	Code
FA1-FA4	Cable interlock A - HR FA	1SDA080575R1
FA1-FA4	Cable interlock B,C,D HR FA2/FA4	1SDA080576R1
FA1-FA4	Cable interlock A - VR FA	1SDA080577R1
FA1-FA4	Cable interlock B,C,D VR FA2/FA4	1SDA080578R1

Only one type of cable for each interlock. The cable must be ordered on the fixed circuit-breaker or on the fixed part of withdrawable circuit-breaker

Lever for mechanical interlock of fixed circuit-breaker or mobile part [Group 2]

Size	Type	Code
FA2	Lever interlock FA2	1SDA080579R1
FA4	Lever interlock FA4	1SDA080580R1

The lever for mechanical interlock is not required for FA1

Support for mechanical interlock of fixed circuit-breaker or fixed part [Group 3]

Size	Type	Code
FA1	Support F Type A FA1 fl. mounted	1SDA085124R1
FA1	Support F Type A FA1 mounted	1SDA085125R1
FA1	Support FP Type A FA1	1SDA085126R1
FA2-FA4	Support F/FP A, B, D FA2/FA4	1SDA080581R1
FA2-FA4	Support F/FP Type C FA2/FA4	1SDA080582R1



Power supply module

Size	Type	Code
FA1-FA4	Ek SUPPLY 110-240VAC/DC FA	1SDA080584R1

Trip Test Unit

Size	Type	Code
FA1-FA4	Ekip TT - Formula AIR	1SDA080974R1



Rating plugs

Size	Type	Code (loose supply)	Code (installed)
FA1-FA4	Rating Plug 630 FA	1SDA080594R1	1SDA080603R1
FA1-FA4	Rating Plug 800 FA	1SDA080595R1	1SDA080604R1
FA1-FA4	Rating Plug 1000 FA	1SDA080596R1	1SDA080605R1
FA1-FA4	Rating Plug 1250 FA	1SDA080597R1	1SDA080606R1
FA1-FA4	Rating Plug 1600 FA	1SDA080598R1	1SDA080607R1
FA2	Rating Plug 2000 FA	1SDA080599R1	1SDA080608R1
FA4	Rating Plug 2500 FA	1SDA080600R1	1SDA080609R1
FA4	Rating Plug 3200 FA	1SDA080601R1	1SDA080610R1
FA4	Rating Plug 4000 FA	1SDA080602R1	-

Accessories
Terminals

Kit for terminals - installed for fixed circuit breaker

Size	Version	Iu max	Type	3 Poles	4 Poles
				Code	Code
FA2	F	2000	Kit VR Upper	1SDA080611R1	1SDA080612R1
FA2	F	2000	Kit VR Lower	1SDA080613R1	1SDA080614R1
FA4	F	3200	Kit VR Upper	1SDA080615R1	1SDA080616R1
FA4	F	3200	Kit VR Lower	1SDA080617R1	1SDA080618R1
FA4	F	4000	Kit VR Upper	1SDA080619R1	1SDA080620R1
FA4	F	4000	Kit VR Lower	1SDA080621R1	1SDA080622R1

Kit for terminals - installed for fixed part of withdrawable circuit breaker

Size	Version	Iu max	Type	3 Poles	4 Poles
				Code	Code
FA1	W	1600	Kit VR Upper	1SDA085129R1	1SDA085130R1
FA1	W	1600	Kit VR Lower	1SDA085131R1	1SDA085132R1
FA2	W	2000	Kit VR Upper	1SDA080639R1	1SDA080640R1
FA2	W	2000	Kit VR Lower	1SDA080641R1	1SDA080642R1
FA4	W	3200	Kit VR Upper	1SDA080643R1	1SDA080644R1
FA4	W	3200	Kit VR Lower	1SDA080645R1	1SDA080646R1
FA4	W	4000	Kit VR Upper	1SDA080647R1	1SDA080648R1
FA4	W	4000	Kit VR Lower	1SDA080649R1	1SDA080650R1

Kit for terminals - loose supply for fixed circuit breaker

Size	Version	Iu max	Type	3 Poles	4 Poles
				Code	Code
FA1	F	1600	Kit Adjustable HR/VR	1SDA085145R1	1SDA085146R1
FA1	F	1600	Kit F	1SDA085135R1	1SDA085136R1
FA2	F	2000	Kit Adjustable HR/VR	1SDA080651R1	1SDA080652R1
FA4	F	3200	Kit Adjustable HR/VR	1SDA080653R1	1SDA080654R1
FA4	F	4000	Kit Adjustable HR/VR	1SDA080655R1	1SDA080656R1

Kit for terminals - loose supply for fixed part of withdrawable circuit breaker

Size	Version	Iu max	Type	3 Poles	4 Poles
				Code	Code
FA1	W	1600	Kit Adjustable HR/VR	1SDA085133R1	1SDA085134R1
FA2	W	2000	Kit Adjustable HR/VR	1SDA080651R1	1SDA080652R1
FA4	W	3200	Kit Adjustable HR/VR	1SDA080653R1	1SDA080654R1
FA4	W	4000	Kit Adjustable HR/VR	1SDA080655R1	1SDA080656R1

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