

# CONTENTS

## Accessories

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# Circuit-breaker and fixed part accessories

The table below shows some functions which can be obtained by making a suitable selection of the accessories provided. Several of the functions listed may be needed at the same

time depending on the use of the circuit-breaker. See the related section for a detailed description of the individual accessories.

Function	Components
Remote control	<ul style="list-style-type: none"> <li>• Shunt opening release</li> <li>• Shunt closing release</li> <li>• Geared motor for automatic charging of closing springs</li> </ul>
Remote signalling or actuation of automatic functions depending on the state (open / closed) or isolated, or on the position (connected / isolated) of the circuit-breaker	<ul style="list-style-type: none"> <li>• Auxiliary contacts of circuit-breaker open / closed</li> <li>• Auxiliary contacts of circuit-breaker connected, isolated for test (for withdrawable circuit-breakers only)</li> <li>• Contact for electrical signalling of overcurrent trip units tripped</li> <li>• Contact for signalling undervoltage de-energised</li> <li>• Contact for signalling springs charged</li> </ul>
Remote opening for various needs, including: <ul style="list-style-type: none"> <li>– manual emergency operation</li> <li>– opening interlocked with operation of other switchgear or with plant automation requirements.</li> </ul> Examples <ul style="list-style-type: none"> <li>– circuit-breakers on L.V. side of transformers in parallel that must open automatically when the M.V. side device opens</li> <li>– automatic opening controlled by external relay (undervoltage, residual-current, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Shunt opening or undervoltage release</li> </ul>
Automatic opening of circuit-breaker due to undervoltage (as in the case, for example, of operation of asynchronous motors)	<ul style="list-style-type: none"> <li>• Instantaneous or time delay voltage release N.B. The time-delay device is recommended when unwarranted operation due to temporary voltage drops, is to be avoided (for functional or safety reasons).</li> <li>• Contact for signalling undervoltage energised</li> </ul>
Increase in degree of protection	<ul style="list-style-type: none"> <li>• IP54 protective cover for door</li> </ul>
Mechanical safety locks for maintenance or functional requirements for interlocking two or more circuit-breakers	<ul style="list-style-type: none"> <li>• Key lock in open position</li> <li>• Padlock device in open position</li> <li>• Key lock and padlock device in connected, isolated for test, isolated position</li> </ul>
Automatic switching of power supplies	<ul style="list-style-type: none"> <li>• Mechanical interlock between two or three circuit-breakers</li> </ul>

## Accessories supplied as standard

The following standard accessories are supplied depending on the circuit-breaker version:



Emax0450

### Fixed circuit-breakers:

- flange for switchboard compartment door (IP30)
- support for service releases
- four auxiliary contacts for electrical signalling of circuit-breaker open/closed (for circuit-breakers only)
- terminal box for connecting outgoing auxiliaries
- horizontal rear terminals
- lifting plate




Emax0448

### Withdrawable circuit-breakers:

- flange for switchboard compartment door
- support for service releases
- four auxiliary contacts for electrical signalling of circuit-breaker open/closed (for circuit-breakers only)
- sliding contacts for connecting outgoing auxiliaries
- horizontal rear terminals
- anti-insertion lock for circuit-breakers with different rated currents
- racking-out crank handle
- lifting plate
- device against racking-out with charged springs (Fail Safe)

# Circuit-breaker and fixed part accessories

Compatibility table for accessories and different versions

		E1 .. E6	
Accessories		Circuit-breaker	
			
Circuit-breaker version		Fixed	Withdrawable
1a) Shunt opening/closing release (YO/YC)		●	●
1b) SOR Test Unit		●	●
2a) Undervoltage release (YU)		●	●
2b) Time-delay device for undervoltage release (D)		●	●
3) Geared motor for automatic charging of closing springs (M)		●	●
4a) Mechanical signalling of overcurrent trip units tripped		●	●
4b) Electrical and mechanical signalling of overcurrent trip units tripped		●	●
5a) Electrical signalling of circuit-breaker open/closed <sup>(*)</sup>		●	●
5b) Electrical signalling of circuit-breaker connected/ isolated for test/isolated			●
5c) Contact signalling closing springs charged		●	●
5d) Contact signalling undervoltage release energised (C.aux YU)		●	●
6a) Current transformer for neutral conductor outside circuit-breaker		●	●
6b) Homopolar toroid for main power supply earthing conductor (star centre of the transformer)		●	●
7) Mechanical operation counter		●	●
8a) Lock in open position		●	●
8b) Circuit-breaker lock in connected/ isolated for test position / isolated			●
8c) Accessories for lock in isolated/ isolated for test position			●
8d) Accessorie for shutter padlock device			●
8e) Mechanical lock for compartment door		●	●
9a) Protection for opening and closing pushbuttons		●	●
9b) IP54 door protection		●	●
10) Circuit-breaker interlock		●	●

**CAPTION:**

- = Accessory on request on fixed or on moving part
- = accessory on request for fixed part
- = accessory on request for moving part

(\*) For automatic circuit-breakers four auxiliary contacts for electrical signalling of circuit-breaker open/closed is included in the supply as standard.

## Electrical accessories



Emax0369

### 1a) Shunt opening/closing release (YO/YC)

Allows remote control opening or closing of the switchgear depending on the installation position and connection of the releases in the support. The release can be used for either of these uses. Given the characteristics of the circuit-breaker operating mechanism, opening (with the circuit-breaker closed) is always possible, while closing is only possible when the closing springs are charged. The release can operate with direct current or alternating current.

This release provides instantaneous operation (\*), but can be powered permanently (\*\*).

When used as a permanently powered closing release, it is necessary to momentarily de-energise the closing release in order to close the circuit-breaker again after opening (in fact, the circuit-breaker operating mechanism has an anti-pumping device).

(\*) The minimum impulse current duration time in instantaneous service must be 100 ms.

(\*\*) If the opening release is permanently connected to the power supply, wait at least 30 ms before sending the command to the shunt closing release.

Power supply (Un):	24 V –
	30 V –
	48 V –
	60 V –
	110-120 V ~
	125-127 V ~
	220-240 V ~
	250 V –
	380-400 V ~
440-480 V ~	
Operating limits:	(YO): 70 ... 110 Un
	(YC): 85 ... 110 Un
Inrush power (Ps):	DC = 200 W
Inrush time $\leq 100$ ms	AC = 200 VA
Continuous power (Pc):	DC = 5 W
	AC = 5 VA
Opening time (YO):	(max) 60 ms
Closing time (YC):	(max) 80 ms

Reference figure in circuit diagrams:  
YO (4-5) - YC (2-3)



Emax0374

### 1b) SOR Test Unit

The control/monitoring SOR Test Unit allows continuity of the different versions of SACE Emax series of shunt opening releases to be checked.

Under particularly severe operating conditions or simply for remote control of the circuit-breaker, the shunt opening release as an accessory for the SACE Emax series of power circuit-breakers is widely used.

# Circuit-breaker and fixed part accessories

Maintenance of all functions of this accessory is a necessary condition to guarantee a high level of safety in the installation.

This brings about the need to have a device available which cyclically checks correct operation of the release, signalling any malfunctions.

The SACE SOR Test Unit allows continuity of the shunt opening release with a rated operating voltage between 24 V and 250 V (a.c. and d.c.) to be checked.

Checking of continuity is carried out cyclically with an interval of 20s between one test and the next.

The unit has visual signals by means of LEDs. The following information in particular is indicated:

- POWER ON: power supply present
- YO TESTING: version of the test
- TEST FAILED: signal following a failed test or lack of auxiliary power supply
- ALARM: signal following three failed tests.

Two relays with one change-over are also available on board the unit which allow remote signalling of the following two events:

- failure of a test - resetting takes place automatically when the alarm stops
- failure of three tests - resetting only takes place by means of the manual RESET from the front of the unit.

There is also a button for manual RESET on the front of the unit.

The main characteristics of the SACE SOR Test Unit are indicated below.

Auxiliary power supply	24 V ... 250 V $\simeq$
Maximum interrupted current	6 A
Maximum interrupted voltage	250V AC



Eimax0370

## 2a) Undervoltage release (YU)

The undervoltage release opens the circuit-breaker in the event of a significant drop in the power supply voltage or a power supply failure. It can be used for remote release (using normally-closed pushbuttons), for a lock on closing or for monitoring the voltage in the primary and secondary circuits. The power supply for the release is therefore branched on the supply side of the circuit-breaker or from an independent source. The circuit-breaker can only be closed with the release powered (the closing lock is obtained mechanically). The release can operate both with direct current and alternating current.

### Power supply (Un):

24 V –	125-127 V $\simeq$
30 V $\simeq$	220-240 V $\simeq$
48 V $\simeq$	250 V $\simeq$
60 V $\simeq$	380-400 V $\sim$
110-120 V $\simeq$	440-480 V $\sim$

The circuit-breaker is opened with release power supply voltages equal to 30-60% Un.

The circuit-breaker can be closed with a release power supply voltage equal to 85% Un.

Inrush power (Ps):	DC = 200 W
	AC = 200 VA
Continuous power (Pc)	DC = 5 W
	AC = 5 VA
Opening time (YU):	30 ms

It can be fitted with a contact for signalling the undervoltage release is energised (C.aux YU) (see accessory 5d)

Reference figure in circuit diagrams: YU (6)

**Note:** the use of an undervoltage release is not suitable when a Fail Safe device is present.



Emax0381

### 2b) Time-delay device for undervoltage release (D)

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

The time-delay device is designed to operate in conjunction with the undervoltage release with the same voltage as the time-delay device.

The characteristics of the time-delay device are as follows:

Power supply (D):	24-30 V
	48 V
	60 V
	110-127 V
	220-250 V
Adjustable opening time (YU+D):	0.5-1-1.5-2-3 s

Reference figure in circuit diagrams: YU+D **(7)**



Emax0382

### 3) Geared motor for automatic charging of closing springs (M)

Allows automatic charging of the circuit-breaker operating mechanism closing springs. The geared motor charges the closing springs again immediately after the circuit-breaker has closed.

The closing springs can, however, be charged manually (using the relative operating mechanism lever) in the event of a power supply failure or during maintenance work.

Power supply	24-30 V
	48-60 V
	100-130 V
	220-250 V
Operating limits:	85...110 Un
Inrush power (Ps):	DC = 500 W
	AC = 500 VA
Rated power (Pn):	DC = 200 W
	AC = 200 VA
Inrush time	0,2 s
Loading time:	4-5 s

It is always supplied with a limit contact and microswitch for signalling that the closing springs are charged (see accessory 5d).

Reference figure in circuit diagrams: M **(1)**

# Circuit-breaker and fixed part accessories

## 4) Mechanical and electrical signalling of undervoltage releases tripped

The following signals are available after the overcurrent trip unit has tripped:



### 4a) Mechanical signalling of overcurrent trip units tripped

Where the circuit-breaker is open following operation of the overcurrent trip units, this can be signalled visually on the operating mechanism, moving the release tripped pushbutton out. The circuit-breaker can only be closed again by resetting the pushbutton to its normal position.



### 4b) Electrical and mechanical signalling of overcurrent trip units tripped

Allows visual signalling on the operating mechanism (mechanical) and remote signalling (electrical using change-over contact) that the circuit-breaker is open following operation of the overcurrent trip units. The mechanical signalling pushbutton must be rearmed to reset the circuit-breaker.

The SACE PR112 trip unit is already supplied with an internal overcurrent signalling contact.

## 5) Auxiliary contacts

Auxiliary contacts, installed on the circuit-breaker are available, which enable the state of the circuit-breaker to be signalled.

Un	In max	t
125 Vdc	0.3 A	10 ms
250 Vdc	0.15 A	

Un	In max	cosφ
250 Vac	5 A	0.3

The versions available are as follows:

### 5a) Electrical signalling of circuit-breaker open/closed

It is possible to have electrical signalling of the state (open/closed) of the circuit-breaker using 4, 10 or 15 auxiliary contacts.

The auxiliary contacts have the following configurations:



- 10 open/closed contacts (5 normally open + 5 normally closed); not available when the SACE PR112 overcurrent trip unit is required.
- 15 additional open/closed contacts for installation outside the circuit-breaker. The basic configuration described above may be modified by the user for normally open or normally closed indication by repositioning the faston connector on the microswitch.

Reference figure in circuit diagrams: Q/1÷10 **(21-22)**





Emax0380

**5b) Electrical signalling of circuit-breaker connected/ isolated for test/isolated**

In addition to mechanical signalling of the circuit-breaker position, it is also possible to obtain electrical signalling using 5 or 10 auxiliary contacts which are installed on the fixed part.

Only available for withdrawable circuit-breakers - for installation on the fixed part.

The auxiliary contacts take on the following configurations:

- 5 contacts; set comprising 2 contacts for signalling connected, 2 contacts for signalling withdrawn and 1 contact for signalling test position (main pliers isolated, but sliding contacts inserted).
- 10 contacts; set comprising 4 contacts for signalling connected, 4 contacts for signalling withdrawn and 2 contacts for signalling test position (main pliers isolated, but sliding contacts inserted).

Reference figure in diagrams:

S75I **(31-32)**

S75T **(31-32)**

S75E **(31-32)**



Emax0389

**5c) Contact for signalling closing springs loaded**

Comprises a microswitch which allows remote indication of the state of the circuit-breaker operating mechanism closing springs. (Supplied as standard with spring-charging geared motor).

Reference figure in circuit diagrams S33 M/2 **(11)**



Emax0388

**5d) Contact signalling undervoltage release energised (C.aux YU)**

The undervoltage releases can be fitted with a contact (normally closed or open as preferred) for signalling undervoltage energised to provide remote signalling of the state of the undervoltage release.

Reference figure in circuit diagrams: **(12)**

# Circuit-breaker and fixed part accessories

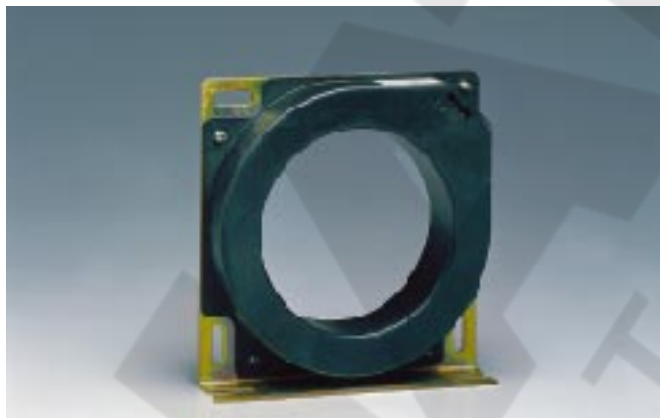


Emax0386

## 6a) Current transformer for the neutral conductor outside the circuit-breaker

Only for three-pole circuit-breakers. Allows protection of the neutral by means of connection to the overcurrent release. (Can be supplied on request).

Reference figure in circuit diagrams: TI/N-UI/N (51-52)



Emax0377

## 6b) Homopolar toroid for the main power supply grounding conductor (star centre of the transformer)

The range of SACE PR112 microprocessor-based electronic releases can be used combined with an external toroid located on the conductor which connects the star centre of the MV/LV transformer to earth (homopolar transformer).

In this case, the protection to earth is defined as Source Ground Return.

The homopolar transformer is proposed in four different versions in terms of rated current (but keeping the same overall dimensions in any case).

Rated current	100 A, 250 A, 400 A, 800 A
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Reference figure in circuit diagrams: TI/O (51-52)

## Mechanical accessories



Emax0406

## 7) Mechanical operation counter

Connected to the operating mechanism using a simple lever mechanism, it indicates the number of mechanical operations of the circuit-breaker. The indication is visible from outside on the front of the circuit-breaker.

## 8) Mechanical locks



Emax0416

## 8a) Lock in open position

Several different mechanisms are available which allow the circuit-breaker to be locked in the open position.

These devices can be controlled by:

- Key: a special circular lock with different keys (for a single circuit-breaker) or the same keys (for several circuit-breakers). In the latter case, up to four different key numbers are available.
- Padlocks: up to 3 padlocks (not supplied):  $\varnothing$  4 mm.
- Key with Kirk lock (arrangement only).



**8b) Circuit-breaker lock in connected-isolated for test - isolated**

This device can be controlled by a special circular lock with different keys (for a single circuit-breaker) or the same keys (for several circuit-breakers - up to four different key numbers available) and padlocks (up to 3 padlocks, not supplied - Ø 4 mm).

Only available for withdrawable circuit-breakers - for installation on the moving part.



**8d) Accessory for shutter padlock device**

Allow the shutters (installed on the fixed part) to be padlocked in their closed position.

Only available for withdrawable circuit-breakers - for installation on the fixed part.



**8c) Accessories for locking in isolated - isolated for test position**

In addition to the circuit-breaker lock in the connected - isolated for test - isolated position, allows the circuit-breaker to be locked only in the isolated or isolated for test positions.

Only available for withdrawable circuit-breakers - for installation on the moving part.



**8e) Mechanical lock for compartment door**

Stops the compartment door from being opened when the circuit-breaker is closed (and circuit-breaker connected for withdrawable circuit-breakers) and locks closing of the circuit-breaker when the compartment door is open.

**8f) Fail Safe device (against racking-out operations with springs charged)**

This prevents the moving part of the withdrawable circuit-breaker from being racked out of the fixed part when the closing springs are charged.

**Note:** the use of a Fail Safe device is not suitable when an undervoltage release is present.

# Circuit-breaker and fixed part accessories

## 9) Transparent protections



Emax0472

### 9a) Opening and closing pushbutton protection

These protections are fitted over the opening and closing pushbuttons, preventing the relative circuit-breaker operations unless a special tool is used.



Emax0407

### 9b) IP54 door protection (NEMA 3/3S/13)

This is a transparent plastic protective cover which completely protects the front panel of the circuit-breaker, and allows degree of protection IP54 to be achieved. Mounted on hinges, it is fitted with a key lock.



Emax0371

## 10) Interlock between circuit-breakers

This mechanism creates a mechanical interlock between two or three circuit-breakers (even different models and different versions - fixed / withdrawable) using a flexible cable. The circuit diagram for electrical switching using a relay (for installation by the customer) is supplied with the mechanical interlock. The circuit-breakers can be installed vertically or horizontally.

Four types of interlocks are available:

type A: between 2 circuit-breakers (power supply + emergency power supply)

type B: between 3 circuit-breakers (2 power supplies + emergency power supply)

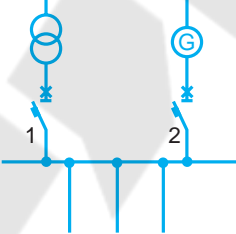
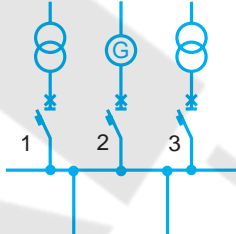
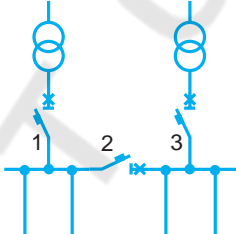
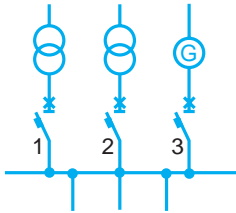
type C: between 3 circuit-breakers (2 power supplies + bus-tie)

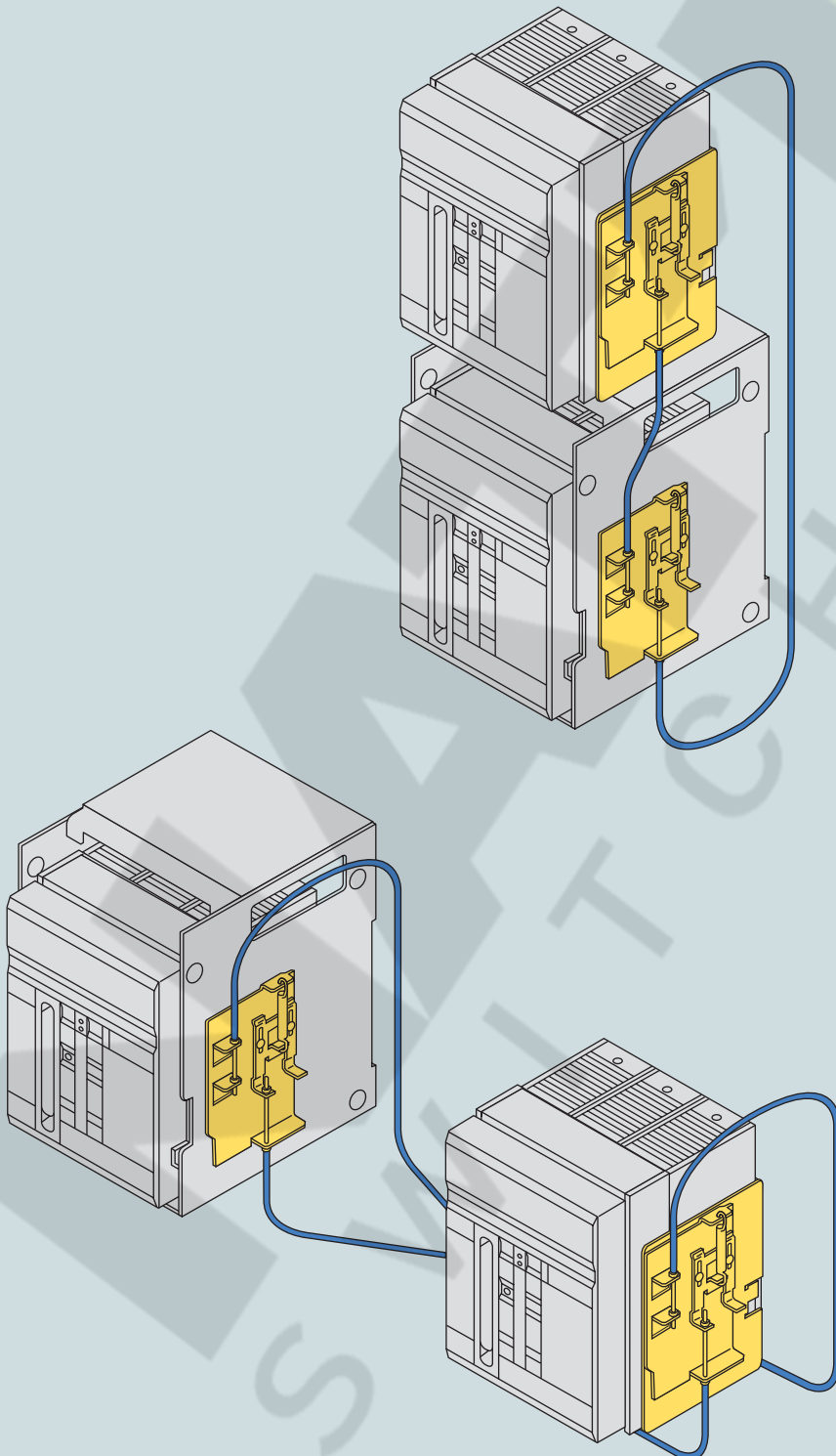
type D: between 3 circuit-breakers (3 power supplies / one single closed circuit-breaker)

**Note:** See the chapter on "Installation of the circuit-breaker" for information on the dimensions (fixed and withdrawable versions) and preparation (pages 81, 82).

## Interlocks

The mechanical interlocks possible are shown below linked to whether 2 or 3 circuit-breakers (any model in any version) are used in the switching system (also see chapter on "Accessories").

Type of interlock	Typical circuit	Interlocks possible																								
<p><b>Between two circuit-breakers</b></p> <p>One normal power supply and one emergency power supply</p> <p><b>Type A</b></p>	 <p>O = Circuit-breaker open I = Circuit-breaker closed</p>	<p>Circuit-breaker 1 can only be closed if 2 is open and vice versa</p> <table border="1" data-bbox="1422 619 1502 778"> <thead> <tr> <th>1</th> <th>2</th> </tr> </thead> <tbody> <tr> <td>O</td> <td>O</td> </tr> <tr> <td>I</td> <td>O</td> </tr> <tr> <td>O</td> <td>I</td> </tr> <tr> <td>I</td> <td>I</td> </tr> </tbody> </table>	1	2	O	O	I	O	O	I	I	I														
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<p><b>Between three circuit-breakers</b></p> <p>Two normal power supplies and one emergency power supply</p> <p><b>Type B</b></p>	 <p>O = Circuit-breaker open I = Circuit-breaker closed</p>	<p>Circuit-breakers 1 and 3 can only be closed if 2 is open. Circuit-breaker 2 can only be closed when 1 and 3 are open.</p> <table border="1" data-bbox="1377 963 1502 1198"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>O</td> <td>O</td> <td>O</td> </tr> <tr> <td>I</td> <td>O</td> <td>O</td> </tr> <tr> <td>O</td> <td>O</td> <td>I</td> </tr> <tr> <td>I</td> <td>O</td> <td>I</td> </tr> <tr> <td>O</td> <td>I</td> <td>O</td> </tr> </tbody> </table>	1	2	3	O	O	O	I	O	O	O	O	I	I	O	I	O	I	O						
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<p><b>Between three circuit-breakers</b></p> <p>The two half-busbars can be powered by a single transformer (bus-tie closed) or by both at the same time (bus-tie open)</p> <p><b>Type C</b></p>	 <p>O = Circuit-breaker open I = Circuit-breaker closed</p>	<p>One or two circuit-breakers out of three can be closed at the same time.</p> <table border="1" data-bbox="1377 1298 1502 1617"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>O</td> <td>O</td> <td>O</td> </tr> <tr> <td>I</td> <td>O</td> <td>O</td> </tr> <tr> <td>O</td> <td>I</td> <td>O</td> </tr> <tr> <td>O</td> <td>O</td> <td>I</td> </tr> <tr> <td>O</td> <td>I</td> <td>I</td> </tr> <tr> <td>I</td> <td>I</td> <td>O</td> </tr> <tr> <td>I</td> <td>O</td> <td>I</td> </tr> </tbody> </table>	1	2	3	O	O	O	I	O	O	O	I	O	O	O	I	O	I	I	I	I	O	I	O	I
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<p><b>Between three circuit-breakers</b></p> <p>Three power supplies (generators or transformers) on the same busbar, so operation in parallel is not allowed</p> <p><b>Type D</b></p>	 <p>O = Circuit-breaker open I = Circuit-breaker closed</p>	<p>Only one of three circuit-breakers can be closed.</p> <table border="1" data-bbox="1377 1727 1502 1919"> <thead> <tr> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>O</td> <td>O</td> <td>O</td> </tr> <tr> <td>I</td> <td>O</td> <td>O</td> </tr> <tr> <td>O</td> <td>I</td> <td>O</td> </tr> <tr> <td>O</td> <td>O</td> <td>I</td> </tr> </tbody> </table>	1	2	3	O	O	O	I	O	O	O	I	O	O	O	I									
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The emergency power supply is usually installed to take over from the normal power supply in two cases:

- to power health and safety services (e.g. hospital installations);
- to power parts of installations which are essential for requirements other than safety (e.g. continuous cycle industrial plants).

The range of accessories for SACE Emax circuit-breakers includes solutions for a wide variety of different plant engineering requirements.

Where devices for protection against overcurrents and direct and indirect contacts and the provisions aiming to improve reliability and safety of emergency circuits are concerned, see the relative standards.

Switching from the normal to the emergency power supply can be carried out manually (locally or by remote control) or automatically.

To this end, the circuit-breakers used for switching must be fitted with the accessories required to allow electric remote control and provide the electrical and mechanical interlocks required by the switching logic.

These include:

- the shunt opening release
- the shunt closing release
- the motor operator
- the auxiliary contacts.

The switching function can be automated using a suitable electronically-controlled relay circuit, to be installed by the customer (circuit diagram supplied by ABB SACE L.V.).

The mechanical interlocks between two or three circuit-breakers are created using cables which are suitable both for horizontally and vertically installed circuit-breakers.

## Spare parts

### Spare parts

- Front metal shields and escutcheon plate
- Opening solenoid for SACE PR111 - PR112 overcurrent trip unit
- Arcing chamber
- Closing springs
- Plier isolating contact for fixed part of withdrawable circuit-breaker
- Sliding grounding contact (for withdrawable version)
- Shutters for fixed part
- Complete pole
- Control device
- Cables for connecting trip units and current transformers to each other
- Transparent guard for trip units
- SACE PR110/B power supply unit.



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