



Application Guide

ABB MaxSB Low Voltage Switchboard

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Product Description

The MaxSB has been utilized in the following markets:

- Oil and gas
- Utility and co-generation
- Pharmaceutical
- Generator Manufacturers
- Food and beverage
- Critical power and data centers
- Mining and materials
- Steel mill
- Waste water
- Power generation
- Aerospace

System Overview

The MaxSB low voltage switchboard is designed, constructed, and tested to provide superior power distribution, protection, and power monitoring and control. MaxSB is designed to maximize the functionality of the World Class Emax power circuit breakers and the Tmax molded case circuit breakers. It follows the vision of ABB products in providing customers with advanced solutions to meet the needs associated with the mechanical, electrical and thermal stress of today's manufacturing environment.

The MaxSB Low Voltage Deadfront Switchboard offers many advantages that include:

- Modular frame design arrangements for flexibility
- Optional vertical barriers for between sections
- Optional breaker compartment barriers for increased personnel protection
- Maintenance Switch Option
- Standard connections to a full range of ABB products
- Optional Modbus Communications
- Optional REA Relay Arc Flash System

The basic design:

- Standard UL 891
 - Modular frame arrangements
 - Efficient and flexible designs
 - Operational reliability
 - Enclosure Type: NEMA-1
-
- MaxSB is available with the following ratings:
 - 600VAC max
 - 5000A max horizontal bus
 - 3000A max vertical bus in group mounted sections
 - 50/60 Hz
 - 2200VAC RMS Dielectric
 - 50kA at 600Vac and 100kA at 480Vac Symmetrical Short Circuit withstand rating

Standards

The MaxSB is designed, tested, and constructed in accordance with the following industry standards:

- UL 891 – Switchboards
- CSA No. 244-05 – Canadian Standards Association
- ANCE NMX-J-1182/2-ANCE-2006 – Association of Standardization and Certification
- Seismic Qualification to IBC-2006 in accordance with ICC-ES-AC156
- IEEE-STD-693-2005 – Seismic Qualification

The MaxSB breakers are designed, tested and constructed in accordance with the one or more of the following standards:

- ANSI C37.13 – Low Voltage AC Power Circuit Breakers Used in Enclosures
- ANSI C37.16 – Preferred Ratings, Related Requirements, and Application for Low Voltage Power Circuit Breakers and AC Power Circuit Protectors
- ANSI C37.17 – Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers
- UL1066 – Low Voltage AC and DC Power Circuit Breakers Used in Enclosures
- UL489 – Standard for Molded Case Circuit Breakers and Circuit Breaker Enclosures
- CSA 22.2 – Canadian Standard Association



Product Description

Ratings

Description	Value
Rated test voltage (maximum)	254VAC, 508VAC, 635VAC
Rated voltage for 3 phase 3 and 4 wire at 60 Hz	208VAC, 240VAC, 480VAC, 600VAC
Rated voltage for 3 phase 3 and 4 wire at 50 Hz	208VAC, 240VAC, 480VAC, 600VAC
Frequency	50/60 Hz, +/-2%
4 wire neutral special considerations at 60 Hz	208/120, 480/277, 600/347
Neutral	100% rated
Rated horizontal bus continuous current	1600A, 2500A, 3000A, 4000A, 5000A
Distribution bus (vertical bus)	800A, 1500A, 2250A (Group mounted), 1000 – 5000A (Emax)
Ground bus	4000A (single group mounted), up to 5000A max in others
Short circuit current at 480VAC	65kA, 100kA
Short circuit current at 600VAC	50kA
Max peak short circuit current	149.5 kA, 230 kA
Service entrance requirements	Yes (Optional)

Ambient Conditions

Requirements	Unit	Value
Temperature range during operation	°C	25 to +40
For ambient temperature of 50°C ABB self certification letter to be provided		
Temperature range for transport and storage	°C	-40 to +70
Maximum bus temperature	°C	65 over 40
Place of operation		Indoor

Overall System Derating

ANSI Switchboard Altitude Correction Factors

Altitude (m)	Altitude (ft)	Voltage	Current
2000	6600	1.00	1.00
3000	9900	0.87	0.98
4000	13200	0.72	0.93
5000	16500	0.58	0.90

Notes:

- The voltage values above are indicative of the Tmax circuit breakers. The Emax circuit breakers and enclosures will have a higher value. To obtain the system derating, the lowest rated device must be used.
- Intermediate values may be obtained by interpolation.
- For devices used in switchboard assemblies, standards covering the specific devices should be used to determine the specific altitude correction factors.
- 1000m is approximately 3300 ft.
- As the altitude increases, the atmospheric properties alter in terms of composition, dielectric capacity, cooling power and pressure. Therefore, the breaker undergoes derating as well.

Product Description

Emax Breaker Loss

Circuit Breaker	Iu [A]	Fixed 3 Pole [W]	Withdrawable 3 Pole [W]
E3N-A/S-A/H-A/V-A	800	25	37
	1200	44	83
	1600	85	150
	2000	120	225
	2500	205	350
E4S-A/H-A/V-A	3000	207	374
	3200	230	422
	3600	292	535
E6H-A/V-A	4000	265	445
	5000	415	700

Tmax Breaker Loss

Please reference the Tmax Technical Catalog
1SDC210025D0201.

Emax Breaker Temperature Derating

The continuous current rating of Emax circuit breakers and Tmax molded case breakers are based on their use in an enclosure at 40°C ambient temperature and 105°C maximum breaker temperature for Class A insulation. Continuous current ratings of Emax circuit breakers and Tmax molded case breakers must be derated for ambient temperatures above 40°C (Trip unit ambient is limited to 70°C).

Emax Temperature Derating Chart

Ambient temperature	Derating Factor
40	1.00
45	0.95
50	0.89
55	0.84
60	0.77
65	0.71
70	0.63

For Tmax breaker temperature derating please refer to the Tmax Technical Manual 1SDC210025D0201.

Technical Data

Structure

The MaxSB switchboard assembly consists of one or more enclosed vertical sections. The ends are designed to allow installation of future sections. The main vertical sections shall consist of a single mounted Emax power breaker with an option for an instrument compartment on the top. Feeder sections with power breakers shall consist of two individually enclosed Emax power breakers. Group mounted sections shall be used for mounting multiple Tmax molded case breakers with accessories. The structure has the capability of being bolted together to form a single assembly.

Standard finish

The standard finish color is RAL7035 light gray. The standard paint process is a UL approved electrostatic textured powder coat paint system utilizing polyester powder coat paint. The paint goes through a five stage wash system. The completed finish has a minimum thickness of 2 mils.

Frame

The basic elements of the frames are made of the Turati ArTu-K enclosure with additional channels for support. The frontal crosspiece, posterior crosspiece, and lateral crosspiece that make up the top and bottom frame, and the frame column uprights are zinc coated steel with a thickness of 1.5 mm. The frame is reinforced with 12 gauge thickness galvanized steel supports throughout. The corner joints are carried out by means of an aluminum three way joint. A 12 gauge galvanized bottom base is attached to the bottom of each crosspiece frame. Hex head tap tite screws are used to connect all cross-pieces, upright columns and joints. Lifting eyes are provided as standard on the roof of the enclosure to allow lifting by the use of a crane.

Available Dimensions

The available widths for main sections are: 28.3" (720 mm), 37" (940 mm), and 44" (1120 mm). The available widths for tie sections are: 28.3" (720 mm), 37" (940 mm), and 44" (1120 mm). The available widths for Emax feeder sections are: 28.3" (720 mm), and 44" (1120 mm). The available width for group mounted sections is: 37" (940 mm). The available widths for incoming pull sections are: 28.3" (720 mm), 37" (940 mm), 44" (1120 mm). The standard height is: 92" (2340 mm).

The available section depths are: 15" (385 mm), 33" (840 mm), and 41" (1040 mm).



Technical Data

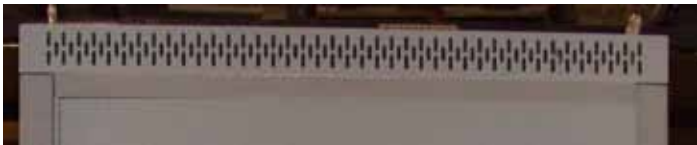
Shipping design

Removable wood shipping base or pallet is provided per shipping split and anchored at four points. The switchboard maximum shipping split is 78" (1990 mm).

Doors and covers

Side panels and rear panels shall consist of a 1-piece design 1.5mm (.059") thickness steel secured by M6 screws. Side panels and rear panels are provided in standard finish paint.

The MaxSB is provided with a single piece top cover for depths up to 41" (1040 mm) with slots along the side to allow for heat rise. The top panel is made of 14 gauge thickness steel.

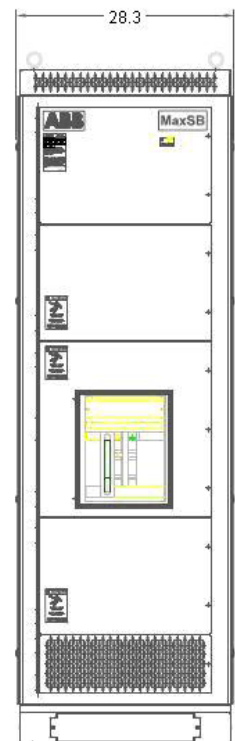
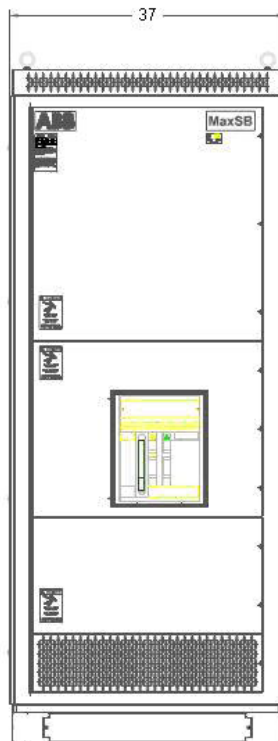
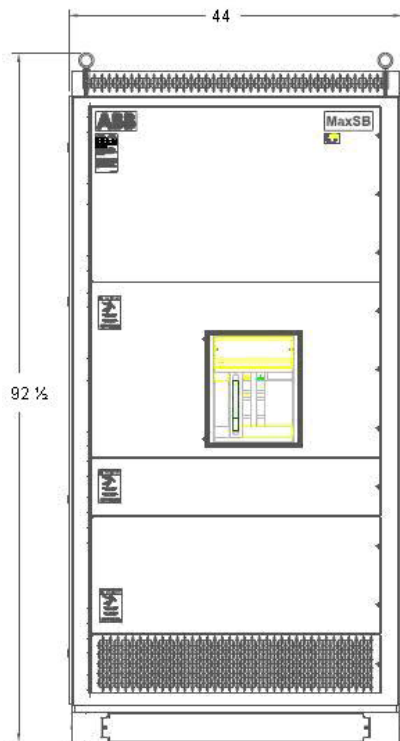
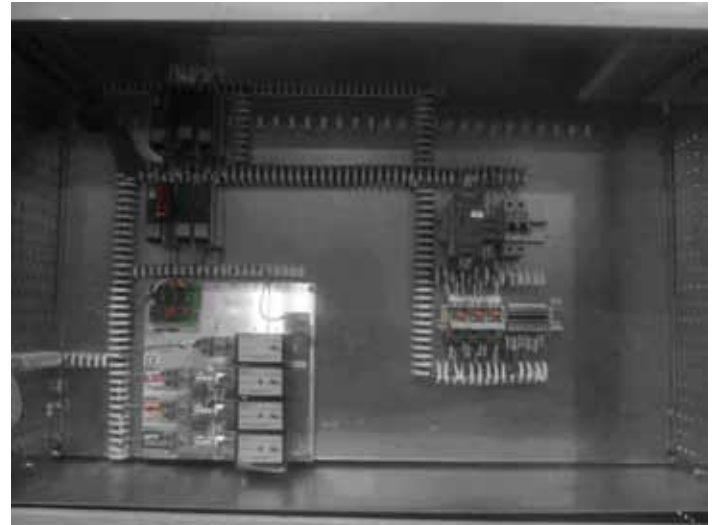


Circuit breaker and equipment compartment doors are provided with a separate hinged door design and of 16 gauge thickness. All doors are secured by screws as a standard.

Barriers

Instrument mounting panels are used for mounting electrical equipment and as barriers to isolate electrical components from the main bus when accessing through the front. Optional glastic or steel barriers are available between each section to segregate each section completely.

When service entrance is required, the MaxSB will incorporate all appropriate service entrance barriers.



Technical Data

Nameplates

MaxSB nameplates meet all standards listed in UL 891. Precautionary labels meet ANSI Z52.4. Standard nameplates for devices are white background with black lettering phenolic screwed on type. Other optional nameplates are available upon request. The main system nameplate is stainless steel screwed on type with self tapping screws with engraved lettering.

The following information is available on switchboard assembly nameplates:

- Manufacturer's name and address
- Manufacturer's type designations
- Manufacturer's identification reference
- Rated maximum voltage (where applicable)
- Rated power frequency (where applicable)
- Rated continuous current (main bus)
- Rated short-circuit withstand current
- Date of manufacture

Instruction manual number

Enclosure

The MaxSB switchboard enclosure is NEMA 1 rated. The enclosures are deadfront, metal-enclosed structures. All front doors, side panels, and rear panels are painted using electrostatic powder type paint. The frame is not painted.

Standard Features:

- RAL7035 paint color
- Barriers between main breaker compartment and bus for service entrance applications
- Ground bus
- Removable, steel top plates
- Lifting eyes

Available Options:

- Strip heaters and thermostats
- Padlock provisions on main breaker
- Optional paint colors
- Metering
- REA Arc Flash Relay (Group mounted only)
- Maintenance Switch on Emax breakers
- Mimic Bus
- Nameplate



Technical Data

Bus Bar System

The bus bar system is installed in the rear section of the switchboard and includes the main horizontal bus bar system, neutral bus when required, and vertical bus bars for feeder breaker sections.

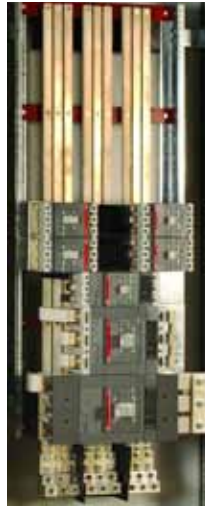
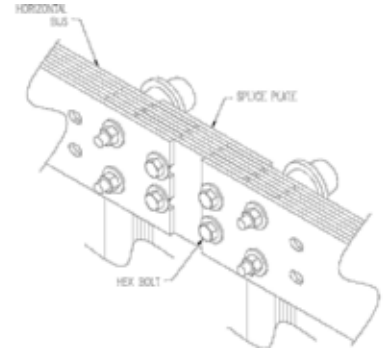
The **main horizontal bus** is arranged with phases A, B, C and neutral from top to bottom for top located bus and N, A, B, C for bottom located bus. The main bus can be mounted in the top, bottom, or middle of the section depending on the application. The bus bars are connected to the adjacent section at each end by means of shipping splices secured by grade 5 hardware. The size of the bus bar, number of bars per phase, and number and size of bolts depend upon the current rating of the bus. All bus designs are based on UL and ANSI 37.20.1 standard temperature rise of 65°C above maximum ambient air temperature of 40°C. All bus is supported by polyester standoff insulators on steel brackets.

Main bus amperages include: 1600A, 2500A, 3000A, 4000A, and 5000A with a bus bracing at 100kA. Non-insulated silver plated copper bussing is standard; optional tin plating copper is available.

All main horizontal bus construction is based on single section shipping splits.

The **vertical bus bars** run A, B, and C phase from the left to right when viewed from the front. The vertical bus riser is rated up to 2250A in the single group mounted sections with molded case breakers, or up to 3000 amps when fed from the main horizontal bus. The bus bracing is rated for 100kA. The vertical bus bar is silver plated as standard; optional tin plating is available on request. Breakers are connected by means of copper bus straps. The vertical bus mounting slots allow the breakers to mount in any location along the bus.

The **ground bus** for the single group mounted section is rated as follows: 1 bar of 1/4" x 2", rated at 4000A. For other sections the ground bus is 1 bar of 1/4" x 4" copper rated up to 5000A. As a standard, ABB offers a silver plated copper ground bus with an optional tin plating option. A 600kcmil – 2 AWG mechanical ground lug with NEMA 2 hole mounting pattern is installed on the ground bus in each section of the lineup. As an option, ABB may accommodate other mechanical lug sizes. Some limitations may apply.



Technical Data

Incoming Connections

ABB offers several options for incoming connections including: cable, bus duct, and close couple connections to transformers. For cable incoming requirements ABB can accommodate top or bottom lugs for amperages of 1600A, 2500A, 3000A, 4000A, and 5000A applications. ABB provides mechanical lugs as standard with an option for compression lugs. For bus duct connections, ABB requires a certified construction drawing at the approval stage in order to match bus riser to it. The actual bus flange must be provided to the factory at the release to manufacturing stage in order to ship with the equipment. In close coupling applications ABB offers a standard connection to ABB dry type transformers for all available bus amperages. Connection to oil filled ABB transformers requires a transition section with a minimum width of 28.3" section. For all non ABB transformer connections, ABB will need to provide a customized design transition section. All certified construction drawings of the existing transformer need to be provided at the time of the quotation request.

Incoming Auxiliary Sections Information

Ampacity (A)	Width	Depth (Fixed breakers in line up)	Depth (Drawout breakers in line up)
800-2500	28.3" (720 mm)	33" (840 mm)	41" (1040 mm)
3000-3200	37" (940 mm)	33" (840 mm)	41" (1040 mm)
4000-5000	44"(1120 mm)	33" (840 mm)	41" (1040 mm)

Wiring

Wiring for power circuit breakers is done on terminal strips located above or below the breaker. All additional wiring is done in an instrument compartment.

As a standard, all control wiring is a minimum #14 AWG gray SIS. Control wiring will be terminated by means of wire ferrules, ring terminals, or fork terminals. Potential transformers are provided with either #14 AWG SIS wire or optional #12 AWG SIS wire. Current transformer wire is either #14 AWG SIS wire or optional #10 AWG SIS wire. Control wire for a control power transformer up to 1kVA is #14 AWG SIS. For higher rated control power transformers, the appropriate wire size is used.

Control wires are ran through openings covered with a grommet or other type of insulating material to prevent wire damage.

Wire markers are not provided as a standard. Optional heat shrinkable wire markers can be provided.

Instrument compartments are available for mounting additional devices such as, but not limited to: voltage transformers, control power transformers, metering, and supervisory devices. Internal compartments are also available for mounting terminal blocks for customer and internal wiring. Breaker devices such as indicating lights, control switches, and specified meters are either mounted in the main breaker compartment door or in an instrument compartment.

Spare terminal points can be located in front of the board in an instrument compartment or in the breaker compartment. Number of spare terminal points may impact overall equipment layout and dimensions.

Instrumentation/Metering

Voltage Transformer – External Metering and Relaying

The MaxSB can provide voltage transformers when requested as an option. The voltage transformers are mounted in either an instrument compartment at the top or in a control compartment at the bottom of the section. The electrical characteristics of ABB's standard potential transformer consist of the following:

Insulation Class is 600 volt dielectric, 10 kV full wave BIL. Accuracy Class is 0.6W and 1.2 X burdens at 60 Hz. Thermal ratings are 150 VA at 30°C ambient and 100 VA at 55°C ambient. Primary and secondary fuses are mounted separately in an instrument compartment. Terminals are brass studs No. 10-32 with one lockwasher, flatwasher, and regular nut. Approximate weight is 7.75 lbs.

Voltage Ratio	Turns Ratio	Rec. Primary Fuse Rating
120:120	120:120	4.0
240:120	240:120	2.0
277:120	277:120	2.0
288:120	288:120	1.5
480:120	480:120	1.0
600:1	600:1	0.75

Control Power Transformer

The ABB MaxSB can be supplied with an optional control power transformer in order to provide 120VAC control power. The 120VAC control power transformer shall be sized accordingly for the load requirement of the breakers and other equipment. The MaxSB can also accommodate a 125VDC external source for the instruments and breakers as optional. The control power transformer shall be mounted in either an available instrument compartment or control compartment. The control power transformer shall have the same insulation class as the voltage transformers.

Primary and secondary fuses are mounted either separately in an instrument compartment or on board fuse clips mounted on the transformer. ABB control power transformers are available with the following ratings: 750VA, 1 kVA and 3 kVA. For control power transformers above 3 kVA, please consult factory.

Instrumentation/Metering

Current Transformers

Current transformers utilized in MaxSB are mounted either on the line side or the load side of the main breaker. The electrical characteristics of ABB's standard current transformers consist of the following:

600Volts, 10 kV BIL Frequency 50-400Hz

Ratio	ANSI METERING CLASS AT 60HZ					SECONDARY WINDING RESISTANCE (OHMS @ 75°C)
	BO.1	BO.2	BO.5	BO.9	B1.8	
400:5	0.6	0.6	1.2	1.2		0.095
500:5	0.3	0.3	0.6	1.2	2.4	0.178
600:5	0.3	0.3	0.6	0.6	1.2	0.190
750:5	0.3	0.3	0.3	0.6	1.2	0.211
800:5	0.3	0.3	0.3	0.6	0.6	0.256
1000:5	0.3	0.3	0.3	0.3	0.6	0.368
1200:5	0.3	0.3	0.3	0.3	0.6	0.262
1500:5	0.3	0.3	0.3	0.6	0.6	0.328
1600:5	0.3	0.3	0.3	0.6	0.6	0.410
2000:5	0.3	0.3	0.3	0.3	0.6	0.347
3000:5	0.3	0.3	0.3	0.3	0.6	0.625
3200:5	0.3	0.3	0.3	0.3	0.6	0.536
4000:5	0.3	0.3	0.3	0.3	0.6	0.834
5000:5	0.3	0.3	0.3	0.3	0.6	0.872

Zero Sequence Current Transformers and Ground Fault Relays

Zero sequence current transformers can be offered as an option for sections with Emax breakers. The accuracy of the standard zero sequence CTs shall be a minimum of C50. Along with the zero sequence CT, an optional ABB Ground Fault Relay is available. If another ground fault relay is customer specified, the factory will need to be contacted. The minimum depth of the switchboard shall be 41" (1040 mm) when this option is selected.

Metering

The MaxSB switchboard allows for mounting a variety of metering options. The standard meter is the Electro Industries Shark 100 Multifunction Meter.

Basic Features Summary

- Meets ANSI C12.20
- 0.2% Class Revenue Certifiable Energy and Demand Metering
- Multifunction Measurement
- Power quality measurements (%THD and Alarm limits)
- 3 Line .56 inch LED display
- % of Load Bar for Analog Meter Perception
- Standard RS485 (Modbus and DNP 3.0)
- Ethernet communication as optional
- IrDA Port for PDA Read
- Ultra Compact
- Fits both ANSI and DIN Cutouts

Other Multifunction Meters are available upon request. Please contact the ABB factory for other types of meters.

Analog switchboard meters, such as ammeters, voltmeters, watt-hour, power factor, etc. are also available. As a standard, ABB will supply Crompton Series 77 for these types of devices. All metering devices are protected by means of ABB miniature breakers.



Technical Data

TVSS

The MaxSB can provide devices as an option to help protect AC electrical circuits from the effect of lightning-induced currents, substation switching transients, and internally generated transients resulting from inductive or capacitive load switching known as TVSS.

Features

- UL 1449 Third Edition Listed, cUL, UL 1283 R/C
- UL 1449-3 Type 2 SPD
- UL 1449-3 tested SCCR: 200kA
- UL 1449-3 Voltage Protection Ratings (VPRs):
 - 208Y/120V: as low as 500V
 - 480Y/277V: as low as 900V
- 200kAIR rated fusing
- Less than 1 nanosecond response time
- Repetitive Impulse: 5,000 hits
- AC Sinewave Tracking Filter with EMI/RFI Filtering up to -50dB from 10kHz to 100MHz
- Designed, Manufactured & Tested consistent with:
 - ANSI/IEEE C62.41.1-2002, C62.41.2-2002, and C62.45-2002
 - NEMA LS-1
 - NEC Article 285
- High Energy Parallel Design for Category C3 & C-High applications
- Individually Fused Suppression Modes
- Large-Block utility grade 34mm square MOVs
- Replaceable Phase Module Construction
- Thermal Sensitivity in Each Mode
- Busbar Construction
- Solid State Bidirectional Operation
- Busbar connection

Breaker Control Switch

Electrically operated breakers can be provided with breaker control switches when required. The standard offering is the Electroswitch Series 20 breaker control switch. Optional nameplates with LEDs are available. Please see Layout section at the end of the document for restrictions.

Selector Switches

ABB can provide selector switches as an option. Selector switches are used for Auto/Manual transfer schemes or Local/Remote selection. An ABB type cam switch is used as a standard. Optional switches can be provided upon request.

Test Switches and Plugs

As an option, the ABB MaxSB switchboard will allow the installation of the ABB FT-1 or FT-14 test switch or test plugs. The test switch may be utilized for current and potential transformer testing. The make-before-break current short circuit feature allows quick and safe isolation for equipment from current transformer circuits. All Flexitest Switches meet or exceed all requirements of ANSI/IEEE Standard C37.90 and are UL, CUL and CSA listed. All Flexitest Switches are rated at 600 volts and 30 amps. As a standard, ABB offers the black cover test switch. The clear cover is available as an option.

Space Heaters, Thermostats, and Humidistat

One space heater per section mounted on the bottom frame piece is available as an option. Heaters are rated for 240VAC, 250W but are operated at 120VAC. The space heaters are enclosed in a metal protective housing. The thermostat utilized with space heaters has an operating range of 10 to 100 degrees Fahrenheit. The contact is a SPST design rated at 15 amps operating at 120/240VAC. A humidistat control is also available as an option.

1



2



3



4



5



6



1. TVSS | 2. Breaker Control Switch | 3. Selector Switch | 4. Test Switches and Plugs | 5. & 6. Space Heaters, Thermostats, and Humidistats

Section Types

Emax Main Sections

The MaxSB provides main sections up to 5000A using fixed or drawout type Emax power circuit breakers (UL1066). Each circuit breaker is located behind a hinged door secured by screws.

There are three available frame sizes that may be used in the MaxSB: E3, E4, and E6

The Emax power circuit breaker is available in various levels of interrupting ratings (AIR) as listed below.

Amperage (A)	Frame Size	Dimensions		Line/Load Lug Information	
		Width	Depth	Quantity (per phase)	Size (kcmil) Mechanical
800	E3	28.3" (720mm)	33" (840 mm)	2	#2-600
1200				3	
1600				4	
2000				5	
2500				6	
3000	E4	37" (940 mm)	33" (840 mm)	8	
3200				8	
4000	E6	44" (1120 mm)	41" (1040 mm)	10	
5000				12	

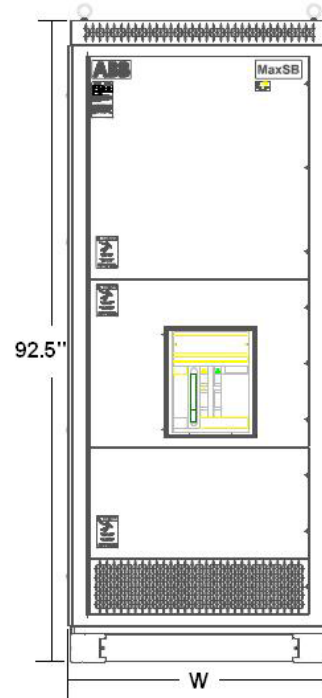


Table 1: Emax Power Circuit Breaker Interrupting Rating

Frame Size	Circuit Breaker Model	Rated Short Time		
		240V [kA]	480V [kA]	600V [kA]
2000, 2500	E3 N-A	65	50	50
800,1200, 1600, 2000, 2500	E3 S-A	85	65	65
800,1200, 1600, 2000, 2500	E3 H-A	85	85	85
800,1200, 1600, 2000, 2500	E3 V-A	125	125	100
3200	E4 S-A	85	65	65
3200	E4 H-A	100	85	85
3200	E4 V-A	100	100	100
3200	E4 L-A	150	150	100
4000	E6 H-A	125	85	85
4000	E6 V-A	125	125	100
4000	E6 L-A	150	150	100
5000	E6 H-A	125	85	85
5000	E6 V-A	125	125	100
5000	E6 L-A	150	150	100

Available Accessories

- Additional auxiliary contacts—up to 15
- TOC contacts – up to 10
- Spring charging motor
- Shunt trip
- Undervoltage release
- Unervoltage contact
- Key interlock
- Padlock attachment
- Communications – Modbus standard
- Mechanical counter
- Transparent breaker cover
- Bell Alarm
- Bell Alarm reset
- Button guard
- Shutter padlock
- Position key lock
- Shutter position indicator
- Kirk Key accessory
- PR010/T portable test kit
- Circuit breaker lift truck

Section Types

Stacked Feeder Sections

The MaxSB can provide stacked feeder sections up to 2000A using fixed or drawout type Emax power circuit breakers (UL1066). Each circuit breaker is located behind a hinged door secured by screws.

The MaxSB utilizes only the E3 frame size.

The Emax power circuit breaker is available in various levels of interrupting ratings (AIR) as listed below.

Amperage (A)	Frame Size	Dimensions		Line/Load Lug Information	
		Width	Depth	Quantity (per phase)	Size (kcmil) Mechanical
800	E3	28.3"	33"	2	#2-600
1200		(720mm)	(840 mm)	3	
1600				4	
2000				5	

Stacked Emax Power Circuit Breaker Interrupting Rating

Frame Size	Circuit Breaker Model	Rated Short Time		
		240V [kA]	480V [kA]	600V [kA]
800, 1200, 1600, 2000, 2500	E3 N-A	65	50	50
800,1200, 1600, 2000, 2500	E3 S-A	85	65	65
800,1200, 1600, 2000, 2500	E3 H-A	85	85	85
800,1200, 1600, 2000, 2500	E3 V-A	125	125	100



Available Accessories

- Additional auxiliary contacts—up to 15
- TOC contacts – up to 10
- Spring charging motor
- Shunt trip
- Undervoltage release
- Unvoltage contact
- Key interlock
- Padlock attachment
- Communications – Modbus standard
- Mechanical counter
- Transparent breaker cover
- Bell Alarm
- Bell Alarm reset
- Button guard
- Shutter padlock
- Position key lock
- Shutter position indicator
- Kirk Key accessor
- PR010/T portable test kit
- Circuit breaker lift truck

Section Types

Group Mounted Sections

The MaxSB provides group mounted sections up to 3000A using Tmax molded case breakers (UL489). Each group mounted section is provided with a full height hinged door. The breakers are attached to the vertical bus with bus straps and can be arranged within the vertical bus at different locations.

There are eight available frame sizes that may be used in the MaxSB: T1, T2, T3, Ts3, T4, T5, T6, and T7

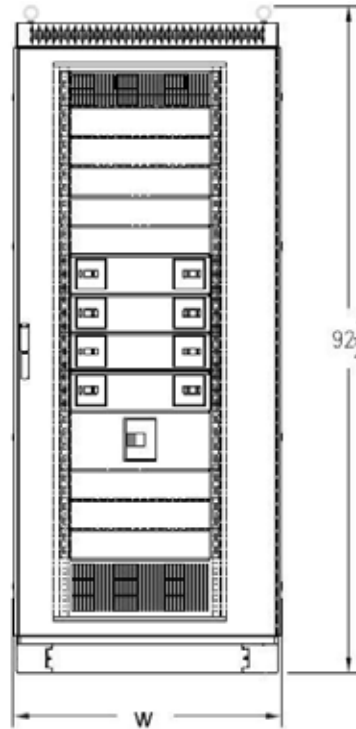
The Tmax molded case breakers are available in various levels of interrupting ratings (AIR) as listed below.

Group Mounted Sections

Amperage (A)	Dimensions		Line/Load Lug Information	
	Width	Depth	MLO Quantity (per phase)	Size (kcmil) Mechanical
800	37"	15"	2	#4-600
1500	(940 mm)	(385 mm)	4	
2250			6	
2500	33" (840 mm)		6	
3000			8	

Incoming Pull Sections

Amperage (A)	Dimensions		Line/Load Lug Information	
	Width	Depth	MLO Quantity (per phase)	Size (kcmil) Mechanical
2500	28.3" (720mm)	33" (840 mm)	6	#2-600
3000	37" (940 mm)		8	



Available Accessories

- Auxiliary contacts
- Shunt trip
- Undervoltage release
- Padlock provision
- Bell Alarm

Emax Breaker

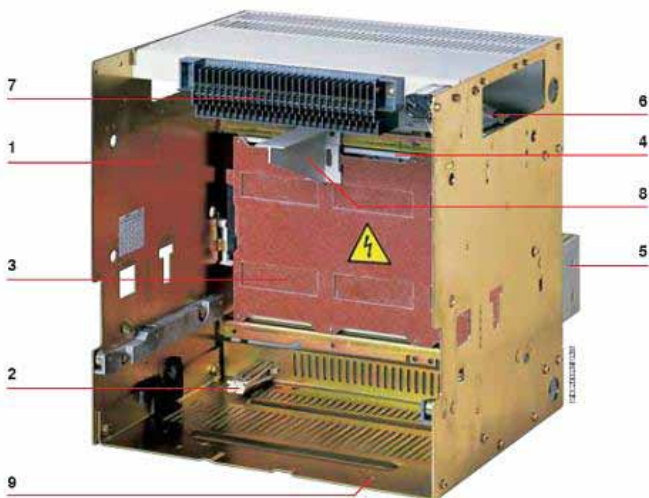
Construction Characteristics

The Emax power circuit breaker offers a series of operating and signaling parts to minimize the risk of operational errors:



Caption	Description
1	Trademark and size of circuit
2	PR121, PR122 or PR123 Trip units
3	Pushbutton for manual opening
4	Pushbutton for manual closing
5	Lever to manually charge closing springs
6	Label with electrical characteristics
7	Mechanical device to signal circuit breaker open "O" and closed "I"
8	Signal for springs charged or discharged
9	Mechanical indication of trip
10	Key lock in open position
11	Key lock and padlock in racked-in/racked-out position (for drawout version only)
12	Racking-in/racking out device (for draw out version only)
13	Terminal box (for fixed version only)
14	Sliding contacts (fro draw out version only)
15	Circuit breaker position indicator: connected/isolated for test/racked-out (for draw out version only)

Cradle Details



Caption	Description
1	Sheet steel supporting structure
2	Single Grounding contacts mounted on the left for E1, E2, and E3 double grounding contacts for E4 and E6
3	Safety shutters
4	Terminal support base
5	Terminals
6	Contacts signaling that the circuit breaker is connected, isolated for test, racked-out
7	Sliding contacts
8	Padlock device for safety shutters (on request)
9	Fixing points (4 for E1, E2, E3, and 6 for E4, E6)

Emax Breaker

Rating Plugs

Emax Circuit Breaker Rating Plugs for Electronic Trip Units

Type of circuit breaker	Rated Current I _n	Ln [A] 400	600	800	1000	1200	1600	2000	2500	3000	3200	3600	4000	5000
E3N-A	2000	X	X	X	X	X	X	X						
	2500	X	X	X	X	X	X	X	X					
E3S-A	800	X	X	X										
	1200	X	X	X	X	X								
	1600	X	X	X	X	X	X							
	2000	X	X	X	X	X	X	X						
E3H-A	800	X	X	X										
	1200	X	X	X	X	X								
	1600	X	X	X	X	X	X							
	2000	X	X	X	X	X	X	X						
E3V-A	800	X	X	X										
	1200	X	X	X	X	X								
	1600	X	X	X	X	X	X							
	2000	X	X	X	X	X	X	X						
E4S-A	3200			X	X	X	X	X	X	X	X			
E4H-A	3200			X	X	X	X	X	X	X	X			
E4V-A	3200			X	X	X	X	X	X	X	X			
E4L-A	3200			X	X	X	X	X	X	X	X			
E6H-A	4000			X	X	X	X	X	X	X	X	X	X	
E6V-A	4000			X	X	X	X	X	X	X	X	X	X	
E6H-A	5000			X	X	X	X	X	X	X	X	X	X	
E6V-A	5000			X	X	X	X	X	X	X	X	X	X	

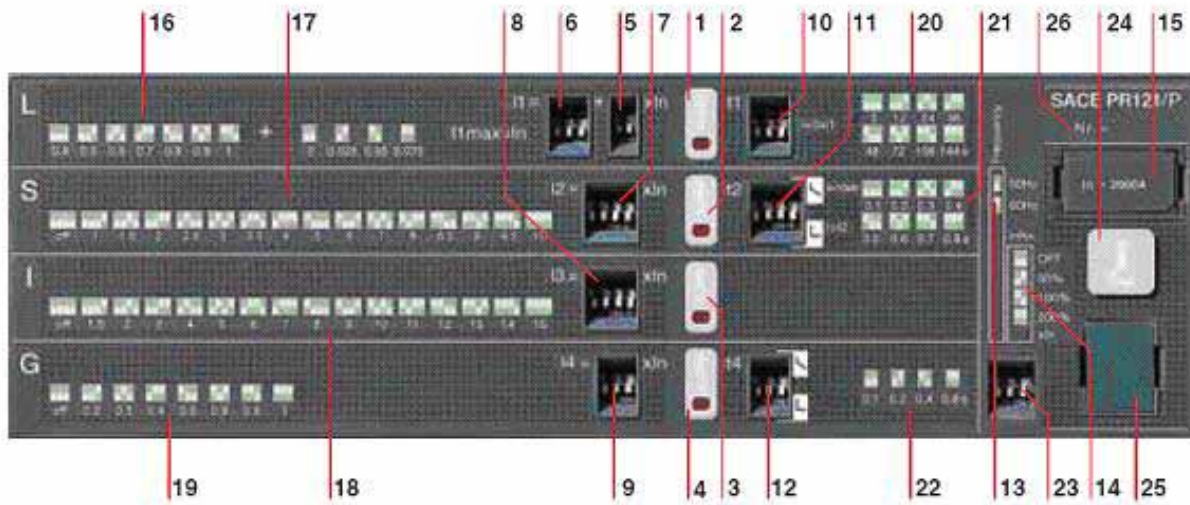
Emax Breaker

Trip Units

The Emax breaker offers three types of trip units: PR121, PR122, and PR123. Each of them provides its own distinct set of characteristics and features.

The PR121/P is the new basic and complete release for the Emax circuit breaker series. The complete range of protection functions together with the wide combination of thresholds and trip times offered make it suitable for protecting a wide range of alternating current installation. In addition to protection

functions the unit is provided with multifunction LED indicators. Furthermore, PR121/P allows connection to external devices enhancing its advanced characteristics like remote signaling and monitoring, or remote supervision display. For trip curves and additional information on the trip unit please reference the Emax Technical Catalog 1SDC20008D0201.



Legend

- | | |
|--|---|
| <ul style="list-style-type: none"> 1 LED signaling Alarm for protection Function L 2 LED signaling Alarm for protection function S 3 LED signaling Alarm for protection function I 4 LED signalling Alarm for protection function I1 5 DIP switches for fine setting current threshold I1 6 DIP switches for main setting current threshold I1 7 DIP switches for setting current threshold I2 8 DIP switches for setting current threshold I3 9 DIP switches for setting current threshold I4 10 DIP switches for setting trip timet1 (type of curve) 11 DIP switches for setting trip timet2 (type of curve) 12 DIP switches for setting trip timet4 (type of curve) 13 Indication of the DIP switch position for network frequency 14 Indication of the DIP switch position for Neutral protection setting 15 Rating plug 16 Indication of the DIP switch positions for the various current thresholds values I1 17 Indication of the DIP switch positions for the various current threshold values I2 | <ul style="list-style-type: none"> 18 Indication of the DIP switch positions for the various current threshold values I3 19 Indication of the DIP switch positions for the various current threshold values I4 20 Indication of DIP switch positions for the various time settings t1 21 Indication of DIP switch positions for the various time settings t2 22 Indication of DIP switch positions for the various time settings t4 23 DIP switch for setting network frequency and neutral protection setting 24 Trip cause indication and trip test pushbutton 25 Test connector for connecting or testing the release through an external device (PR030/B battery unit, BT030 wireless communication unit and SACE PR010/T unit) 26 Serial number of protection release |
|--|---|

Emax Breaker

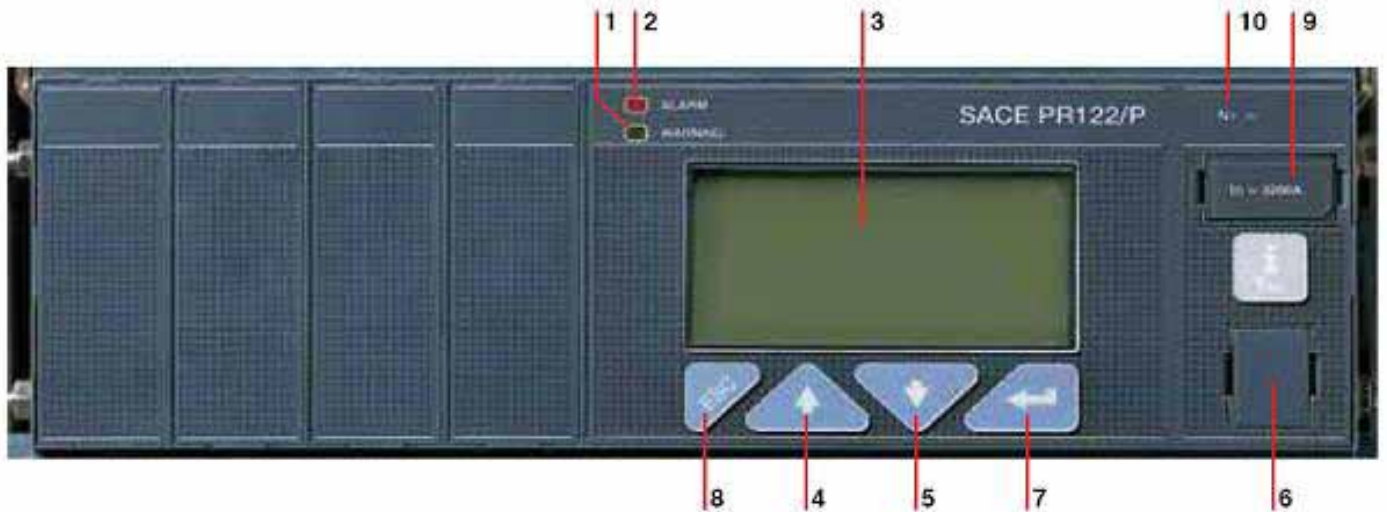
The **PR122** release is a sophisticated and flexible protection system based on a state-of-the-art microprocessor and DSP technology. Fitted with the optional internal PR120/D-M dialogue unit, PR122/P turns into an intelligent protection, measurement and communication device, based on the Modbus protocol.

The new PR122/P is the result of ABB SACE's experience in designing protection releases. The exhaustive range of settings makes this protection unit ideal for general use in any type of installation, from distribution to the protection of motors, transformers, drives and generators. Access to information and programming using a keyboard and graphic liquid crystal display is extremely simple and intuitive. The interface is now common to PR122/P and PR123/P in order to give to the user maximum ease of use.

An integrated ammeter and many other additional features are provided over and above the protection functions. These additional functions can be further increased with addition on board of the dialogue, signaling, measurement, and wireless communication units.

Functions S and G can operate with a time delay independent of the current ($t = k$) or with an inverse time delay (constant specific let-through energy: $I^2 t = k$), as required. Protection against earth faults can also be obtained by connecting the PR122 release to an external toroid located on the conductor that connects the transformer star centre to earth (homopolar toroid).

All the thresholds and trip curve delays of the protection functions are stored in special memories which retain the information even when no power is supplied. For trip curves and additional information on the trip unit please reference the Emax Technical Catalog 1SDC20008D0201.



Legend

- | | | | |
|---|---|----|--|
| 1 | LED Warning indicator | 7 | ENTER button to confirm data or change pages |
| 2 | Alarm LED | 8 | Button to exit submenus or cancel operations (ESC) |
| 3 | Rear-lit graphic display | 9 | Rating plug |
| 4 | Cursor UP button | 10 | Serial number of protection release |
| 5 | Cursor DOWN button | | |
| 6 | Test connector for connecting or testing the release by means of an external device (PR030/B battery unit, BT030 wireless communication unit and SACE PR010/T unit) | | |

Emax Breaker

The **PR123** protection release completes the range of releases available for the Emax family of circuit breakers. It is a high-performance and extraordinarily versatile release, capable of offering a complete set of functions for protection, measurement, signaling, data storage and control of the circuit breaker, and it represents the benchmark in low voltage protection units for circuit breakers.

The front interface of the unit, common to PR122/P, is extremely simple thanks to the aid of the liquid crystal graphics display. It can show diagrams, bar graphs, measurements and sine curves for the various electrical values.

PR123 integrates all the features offered by PR122/P plus a series of evolute functionalities. As with PR122, it can be integrated with the additional features provided by internal modules and external accessories. For trip curves and additional information on the trip unit please reference the Emax Technical Catalog 1SDC20008D0201.



Legend

- | | | | |
|---|---|----|--|
| 1 | LED Warning indicator | 7 | ENTER button to confirm data or change pages |
| 2 | Alarm LED | 8 | Button to exit submenus or cancel operations (ESC) |
| 3 | Rear-lit graphic display | 9 | Rating plug |
| 4 | Cursor UP button | 10 | Serial number of protection release |
| 5 | Cursor DOWN button | 11 | PowerLED |
| 6 | Test connector for connecting or testing the release by means of an external device (PR030/B battery unit, BT030 wireless communication unit and SACE PR010/T unit) | 12 | Voltage-uptake switch-disconnector |

Emax Breaker

Features		PR121	PR122	PR123
Protection functions				
L	Protection against overload with inverse long time-delay trip	■	■	■
S	Selective protection against short circuit inverse or definite short time-delay trip	■	■	■
S	Second selective protection against short circuit inverse or definite short time-delay trip			■
I	Protection against instantaneous short circuit with adjustable trip current threshold	■	■	■
G	Protection against ground fault	residual	■	■
		source ground return		■
D	Protection against directional short circuit with adjustable time-delay			■
U	Protection against phase unbalance		■	■
OT	Protection against overtemperature (check)		■	■
UV	Undervoltage protection		opt. ⁽¹⁾	■
OV	Overvoltage protection		opt. ⁽¹⁾	■
RV	Residual voltage protection		opt. ⁽¹⁾	■
RP	Reverse active power protection		opt. ⁽¹⁾	■
M	Thermal memory for functions L and S		■	■
UF	Underfrequency protection		opt. ⁽¹⁾	■
OF	Overfrequency protection		opt. ⁽¹⁾	■
Measurements				
	Currents (phases, neutral, ground fault)		■	■
	Voltage (phase-phase, phase-neutral, residual)		opt. ⁽¹⁾	■
	Power (active, reactive, apparent)		opt. ⁽¹⁾	■
	Power factor		opt. ⁽¹⁾	■
	Frequency and peak factor		opt. ⁽¹⁾	■
	Energy (active, reactive, apparent, meter)		opt. ⁽¹⁾	■
	Harmonics analysis (display of wave forms and harmonics module)			■
Event marking and maintenance data				
	Event marking with the instant it occurred	opt. ⁽²⁾	■	■
	Chronological event storage	opt. ⁽²⁾	■	■
	Electrical operations counter and contact wear		■	■
Communication with supervision system and centralised control (IEC only)				
	Remote setting of the protection functions parameter, unit configuration, communication		opt. ⁽³⁾	opt. ⁽³⁾
	Transmission of measurements, states and alarms from circuit breaker to system		opt. ⁽³⁾	opt. ⁽³⁾
	Transmission of events and maintenance data from circuit breaker to system		opt. ⁽³⁾	opt. ⁽³⁾
Watchdog				
	Alarm and trip for release overtemperature		■	■
	Check of trip status	■	■	■
Interface with the user				
	Presetting by means of dip switches	■		
	Presetting by means of keys and LCD viewer		■	■
	Alarm signals for functions L, S, I and G	■	■	■
	Alarm signal of one of the following protections: undervoltage, overvoltage, residual voltage, reverse power, phase unbalance, overtemperature		opt. ⁽¹⁾	■
	Complete management of pre-alarms and alarms for all the self-control protection functions		■	■
	Enabling password for use with consultation in "READ" mode or consultation and setting in "EDIT" mode		■	■
Load control				
	Load connection and disconnection according to the current passing through the circuit breaker		■	■
Zone discrimination				
	Can be activated for protection functions S, G and (PR123 only) D		■	■

Emax Breaker

Trip Unit Modules

PR122 and PR123 can be enriched with additional internal modules, increasing the capacity of the trip unit and making these units highly versatile.

Electrical signaling contacts: PR120/K Module

This unit, internally connected to PR122/P and PR123/P, allows the remote signaling of alarms and trips of the circuit breaker. Four independent power relays provided on the PR120/K module enable electrical signaling of the following:

- timing for protections L, S, G (and UV, OV, RV, RP, D, U, OF, UF where applicable);
- protections L, S, I, G, OT, (and UV, OV, RV, RP, D, U, OF, UF where applicable) tripped and other events;
- in addition, by using an external device (PR010/T, BT030, PR120/D-BT), the contacts can be freely configured in association with any possible event or alarm.

PR120/K can also be used as actuator for the Load control function.

In addition, the unit can be provided with a digital input signal, enabling the following functions:

- activation of alternative set of parameter (PR123/P only);
- external trip command
- trip reset of the trip unit
- reset of PR120/K power relays

When the digital input is required the power relays have a common connection.

This latest kind of connection must be specified in the order when required together with the circuit breaker. When PR120/K is ordered as loose accessory both of the configurations are possible.

The auxiliary 24V DC power supply is needed for the unit (shown by a green Power LED). Four yellow LEDs show the status of each output relay.

The use of Voltage Transformers is mandatory for rated voltages higher than 690V.



Type	Monostable STDP
Maximum switching power (resistive load)	100W / 1250 VA
Maximum switching voltage	130 V DC / 250 V AC
Maximum switching current	5A
Breaking capacity (resistive load)	
@ 30V DC	3.3A
@ 250V AC	5A
Contact/coil insulation	200 V eff (1 min @ 50 Hz)

Emax Breaker

PR120/V Measurement Module

This optional internal module, installed in PR122 (standard in PR123), allows the release to measure the phase and neutral voltages and to process them in order to achieve a series of features, in terms of protection and measurement.

PR120/V does not normally require any external connection or Voltage Transformer, since it is connected internally to the lower terminals of Emax Circuit Breakers. When necessary, the connection of voltage pick-ups can be moved to any other points (i.e. upper terminals), by using the alternative connection located in the terminal box. The module is provided with a sealable switch-disconnector for the dielectric test. PR120/V is able to energize the PR122 while line voltage input is above 85V. The use of Voltage Transformers is mandatory for rated voltages higher than 690V. Voltage transformers shall have burdens equal to 10VA and accuracy class 0.5 or better.

Additional Protections with PR120/V:

- UnderVoltage (UV) protection
- Overvoltage (OV) protection
- Residual voltage (RV) protection
- Reverse power (RP) protection
- Underfrequency (UF) protection
- Overfrequency (OF) protection
- Phase sequence (alarm only)

All the above indicated protections can be excluded, although it is possible to leave only the alarm active when required. With the circuit breaker closed, these protections also operate when the release is self-supplied. With the circuit breaker open, they operate when the auxiliary power supply (24V DC or PR120/V) is present: in this case the release will indicate the “ALARM” status.

Voltage protections UV, OV, RV

With the PR120/V module, the PR122/P release is able to provide the undervoltage and overvoltage protection (UV, OV) and the residual voltage protection (RV). The residual voltage protection RV identifies interruptions of the neutral (or of the earthing conductor in systems with earthed neutral) and faults that shift the star center in systems with insulated neutral (e.g. large earth faults). The star center shift is calculated as a vectorial sum of the phase voltages.



Reverse power protection RP

Reverse power protection is especially suitable for protecting large machines such as motors and generators. The PR122 with the PR120/V module can analyze the direction of the active power and open the circuit breaker if the direction is opposite to that of normal operation. The reverse power threshold and the trip time are adjustable.

Frequency protections UF, OF

The frequency protections detect the variation of network frequency above adjustable thresholds, generating an alarm or opening the circuit breaker. It is a protection typically needed in an isolated network, i.e. powered by a genset.

Emax Breaker

PR120/D-M Communication Module

PR 120/D-M communication module is the solution for connecting Emax to a Modbus network, allowing the remote supervision and control of the circuit breaker.

It is suitable for PR122/P and PR123/P trip units. As for PR120/V this module can be added at any time to the protection trip unit and its presence is automatically recognized. When ordered separately from the circuit breakers it is supplied complete of all the accessories needed for its installation, such as pre-cabled auxiliary switches and cables for signaling the circuit breaker status (springs, position inserted).

It is provided with three LEDs on the front side:

- Power LED
- Rx/TX LEDs

PR030/B power supply unit

This accessory, always supplied with the PR122 and PR123 range of trip units, makes it possible to read and configure the parameters of the unit whatever the status of the circuit breaker (open-closed, in test isolated or racked-in position, with/without auxiliary power supply).

PR030/B is also needed for reading trip data if the trip occurred more than 48 hours earlier and the trip unit was no longer powered.

An internal electronic circuit supplies the unit for approximately 3 consecutive hours for the sole purpose of reading and configuring data.

In relation to the amount of use, battery life decreases if the PR030/B accessory is also used to perform the Trip test & Auto Test.



PR021/K signaling unit

The PR021/K signaling unit can convert the digital signals supplied by the PR121, PR122, and PR123 trip unit into electrical signals, via normally open electrical contacts (potential free). The unit is connected to the protection trip unit by means of a dedicated serial line through which all of the information about the activation status of the protection functions flows. The corresponding power contacts are closed based on this information.

The following signals/contacts are available:

- overload pre-alarm L (the alarm signal remains active throughout the overload until the trip unit is tripped)
- timing and tripping of any protections (the trip signals of the protections remain active during the timing phase, and after the trip unit has tripped)
- protection I tripped
- timing and over-temperature threshold exceeded ($T > 185\text{ °F}$ / 85 °C)
- two load control contacts (connection and disconnection of a load, or disconnection of two loads)
- trip unit tripped
- dialogue fault on a serial line (connecting the protection and signaling units)
- phase unbalance

Setting a dip-switch allows up to seven signal contacts to be freely configured in PR122-PR123 including: direction protection D tripped, under- and overvoltage UV, OV tripped, reverse power RP tripped, and others.

Emax Breaker

Two contacts available on the PR021/K unit (load control) can pilot a circuit breaker shunt trip and closing coil. These contacts allow various applications, including load control, alarms, signals and electrical locks.

Pressing the Reset pushbutton resets the status of all signals. The unit also contains ten LEDs to visually signal the following information:

- “Power ON”: auxiliary power supply present
- “TX (Int Bus)”: flashing synchronized with dialogue with the Internal Bus
- Eight LEDs associated with the signaling contacts.

The following table lists the characteristics of the signaling contacts available in the PR021/K unit.

Auxiliary power supply	24 V DC +/-20%
Maximum ripple	5%
Rated power @ 24V	4.4W

Type	Monostable STDP
Maximum switching power (resistive load)	100W / 1250 VA
Maximum switching voltage	130 V DC / 250 V AC
Maximum switching current	5A
Breaking capacity (resistive load)	
@ 30V DC	3.3A
@ 250V AC	5A
Contact/coil insulation	200 V eff (1 min @ 50 Hz)

Tmax Breakers

The MaxSB uses the following molded case breakers in group mounted sections. The series of Tmax molded case circuit breakers comply with UL 489 and CSA C22.2 No. 5 Standards. They are divided into different basic sizes, with an application range from 15 A to 1200 A and breaking capacities up to 150 kA at 480 VAC.

For protection of alternating current networks, the following are available:

- T1B 1p, T1, T2, T3, Ts3 and T4 circuit breakers equipped with TMF thermal magnetic trip units with fixed thermal and magnetic threshold ($I_3 = 10 \times I_n$)
- T4 (up to 50 A) circuit breaker equipped with TMD thermal magnetic trip units with adjustable thermal threshold ($I_1 = 0.7 \dots 1 \times I_n$) and fixed magnetic threshold ($I_3 = 10 \times I_n$);
- T4, T5 and T6 circuit breakers with TMA thermal magnetic trip units with adjustable thermal threshold ($I_1 = 0.7 \dots 1 \times I_n$) and adjustable magnetic threshold ($I_3 = 5 \dots 10 \times I_n$);
- T2 with PR221DS electronic trip unit;
- T4, T5 and T6 with PR221DS, PR222DS/P and PR222DS/PD-A electronic trip units;
- the T7 circuit breaker, which completes the Tmax family up to 1200 A, fitted with PR231/P, PR232/P, PR331/P and PR332/P electronic trip units. The T7 circuit breaker is available in the two versions: with a manual operating mechanism or a motorized stored energy operating mechanism.

The field of application in alternating current of the Tmax series varies from 1 A to 1200 A with voltages up to 600 V. The Tmax T1, T2, T3, Ts3, T4, T5 and T6 circuit breakers equipped with TMF, TMD and TMA thermal magnetic trip units can also be used in direct current plants, with a range of applications from 15 A to 800 A and a minimum operating voltage of 24 V DC, according to the appropriate connection diagrams.

The three-pole T2, T3 and Ts3 circuit breakers can also be fitted with MA adjustable magnetic only trip units, both for applications in alternating current and in direct current, in particular for motor protection.

For all the circuit breakers in the series, fitted with thermal magnetic and electronic trip units, the single phase trip current is defined

For additional information on the trip unit curves and accessories please see the Tmax Technical Catalog 1SDC210025D0201.



Tmax Breakers

Tmax Interrupting Ratings

Type	Frame Size		Interrupting ratings [kA rms]			
			240 VAC	480 VAC	600Y/347 VAC	600 VAC
Tmax T1	100	N	50 ⁽¹⁾	22 ⁽¹⁾	10	
Tmax T2	100	S	65	35		
		H	150	65		
Tmax T3	225	N	50	25	10	
		S	65	35	10	
Tmax Ts3	150	N	65	25		14
		H	100	50		14
		L	150	85 ⁽²⁾		25
Tmax Ts3	225	N	65	25		
		H	100	50		
		L	150	65		
Tmax T4	250	N	65	25		18
		S	100	35		25
		H	150	65		35
		L	200	100		65
		V	200	150		100
Tmax T5	400	N	65	25		18
		S	100	35		25
		H	150	65		35
		L	200	100		65
		V	200	150		100
Tmax T6	800	N	65	35		20
		S	100	50		25
		H	200	65		35
		L	200	100		42
Tmax T7	1000-1200	S	65	50		25
		H	100	65		50
		L	150	100		65

(1) In 15 A => 35kA @ 240 V AC - 14 kA @ 480Y/277 V AC

(2) In from 15 A up to 30 A => 65 kA @ 480 V AC

Tmax Breakers

Tmax Breaker Trip Units

PR221DS – Tmax T2, T4, T5 and T6

The PR221DS trip unit, available for T2, T4, T5 and T6, provides protection functions against overload L and short-circuit S/I (version PR221DS-LS/I): with this version you can choose whether to have inverse time-delay S or instantaneous I protection against short-circuit by moving the dedicated dip-switch. Alternatively, the version with only the protection function against instantaneous short-circuit I is available (version PR221DS-I).

There is a single adjustment for the phases and the neutral. The neutral is adjustable from 50 - 100% of the phases for Tmax T2 $I_n = 160 \text{ A}$ ($T2 I_n < 160 \text{ A}$, $N = 100\%$), whereas for T4, T5 and T6 it is possible to select the protection threshold OFF, 50%

or 100% directly from the front of the trip unit by means of the specific dip switch.

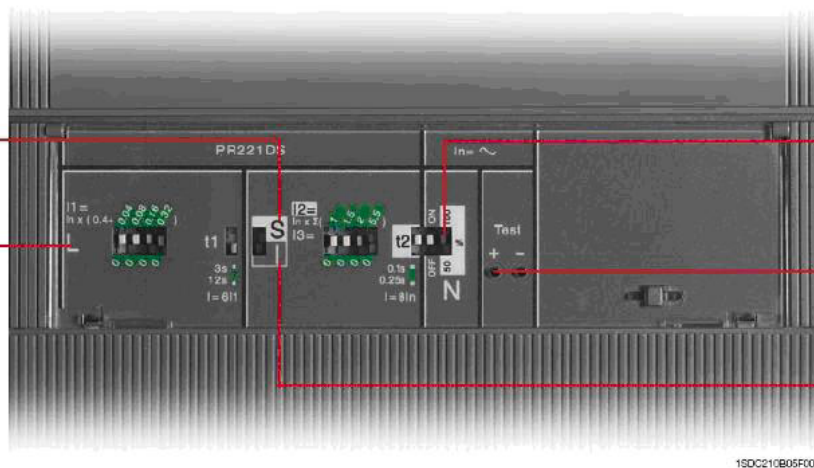
The trip coil is always supplied with the PR221DS trip unit for Tmax T2 and is housed in the right-hand slot of the circuit breaker. Dedicated auxiliary contacts are available for T2 with electronic trip units.

For Tmax T4, T5 and T6, the opening solenoid is housed internally and therefore, by not using the right hand slot of the circuit breaker, all the auxiliary contacts available can be used.

PR221DS-LS/I

Protection S
Against short-circuit with delayed trip

Protection L
Against overload









Dip-switch for neutral setting (only for T4, T5 and T6)

Socket for TT1 test unit

Protection I
Against short-circuit with instantaneous trip

1SDC210B05F0001

PR221DS - Protection functions and settings

Protection functions	Trip threshold	Trip curves ⁽¹⁾
 L Against overload with long inverse time delay trip and trip characteristic according to an inverse time curve ($I^2t = \text{constant}$) CANNOT BE EXCLUDED	 $I_1 = 0.40 - 0.44 - 0.48 - 0.52 - 0.56 - 0.60 - 0.64 - 0.68 - 0.72 - 0.76 - 0.80 - 0.84 - 0.88 - 0.92 - 0.96 - 1 \times I_n$ Release between $1.1 \dots 1.3 \times I_1$ (IEC 60947-2 and UL 489)	at $6 \times I_1$ $t_1 = 3\text{s}$ Tolerance: $\pm 10\%$ up to $6 \times I_n$ $\pm 20\%$ above $6 \times I_n$
 S Against short-circuit with inverse short time delay trip and trip characteristic with inverse time ($I^2t = \text{constant}$) (selectable as an alternative to protection function I)	 $I_2 = 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4.5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 8.5 - 9 - 10 \times I_n^{(2)}$ Tolerance: $\pm 10\%$ (T4-T5) $\pm 10\%$ up to $2 \times I_n$ (T2) $\pm 20\%$ above $2 \times I_n$ (T2)	at $6 \times I_1$ $t_1 = 6\text{s}$ only for T2 Tolerance: $\pm 10\%$ up to $6 \times I_n$ $\pm 20\%$ above $6 \times I_n$
 I Against short-circuit with instantaneous trip (selectable as an alternative to protection function S)	 $I_3 = 1 - 1.5 - 2 - 2.5 - 3 - 3.5 - 4.5 - 5.5 - 6.5 - 7 - 7.5 - 8 - 8.5 - 9 - 10 \times I_n^{(2)}$ Tolerance: $\pm 10\%$ (T4-T5) $\pm 20\%$ (T2)	at $6 \times I_1$ $t_1 = 12\text{s}$ only for T4, T5 Tolerance: $\pm 10\%$ up to $6 \times I_n$ (T4-T5) $\pm 20\%$ above $6 \times I_n$ (T4-T5) $\pm 20\%$ (T2)
	instantaneous	

⁽¹⁾ These tolerances hold in the following conditions:
 - self-powered relay at full power and/or auxiliary supply;
 - two or three-phase power supply.

In conditions other than those considered, the following tolerances hold:

	Trip time
S	$\pm 20\%$
I	$\leq 40\text{ms}$

⁽²⁾ For T5 $I_n = 600 \text{ A} \Rightarrow I_2 \text{ max} = 9.5 \times I_n$
⁽³⁾ For T5 $I_n = 600 \text{ A} \Rightarrow I_3 \text{ max} = 9.5 \times I_n$

Tmax Breakers

PR222DS/P – Tmax T4, T5 and T6

The PR222DS/P trip unit, available for T4, T5 and T6, has protection functions against overload L, delayed S and instantaneous I short-circuit (version PR222DS/P-LSI). Alternatively, in addition to the functions L, S, I, it also has protection against ground fault G (version PR222DS/P-LSIG).

Setting of the PR222DS trip unit can be carried out either by means of dip switches on the front of the circuit breaker or electronically, using the PR010/T programming and control unit or the BT030 wireless communication unit.

There is a single setting for the phases and neutral to decide whether to set the threshold of the protection functions to OFF, to 50% or to 100% of the phases by means of two dedicated dip switches.

Furthermore, on the front of the PR222DS/P (or PR222DS/PD-A) trip units, signaling of pre-alarm and alarm of protection L is available. The pre-alarm threshold value, signaled by the red LED fixed, is equal to $0.9 \times I_n$. It is also possible to remotely transmit the alarm of protection L by simply connecting connector X3 to the dedicated contact.

PR222DS/P

Protection S

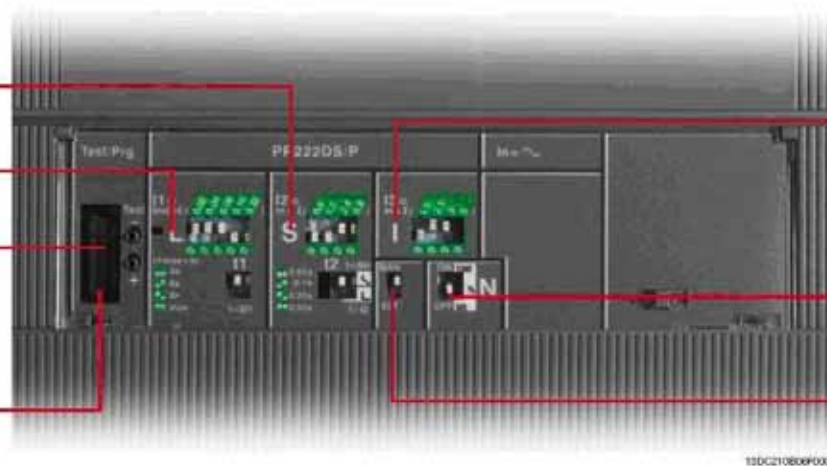
Against short-circuit with delayed trip

Protection L

Against overload

Socket for TT1 test unit

Socket for connection of PR010/T test unit and BT030 wireless communication unit



130C210800F0001

Tmax Breakers

Thermal Magnetic Trip Units

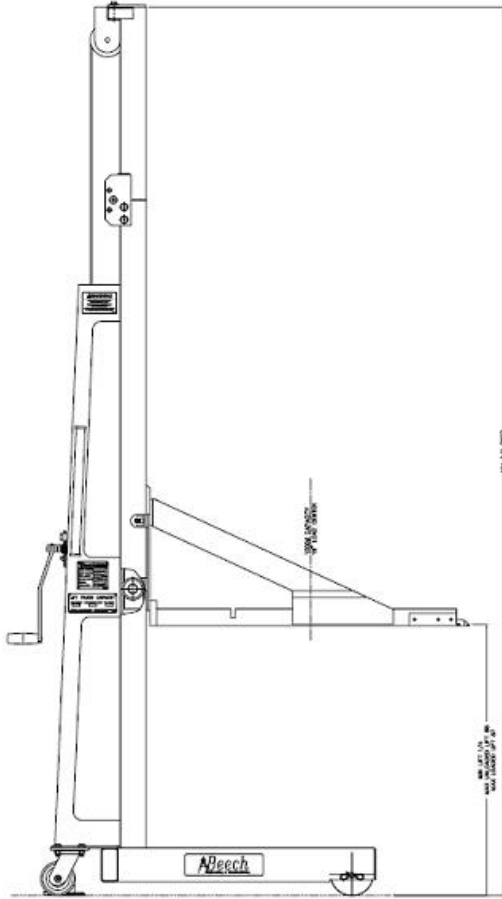
The Tmax T1 1p, T1, T2, T3, Ts3, T4, T5 and T6 circuit breakers can be fitted with thermal magnetic trip units and are used in protection of alternating and direct current networks with a range of use from 15 A to 800 A. They allow the protection against overload with a thermal device (with fixed threshold for T1 1p, T1, T2, T3, Ts3, T4 and adjustable threshold for T4, T5 and T6) using the bimetal technique, and protection against short-circuit with a magnetic device (with fixed threshold for T1, T2, T3, Ts3 and T4 up to 50 A and adjustable threshold for T4, T5 and T6).

In [A]	15	20	25	30	35	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	600	800	
Neutral [A]	15	20	25	30	35	40	50	60	70	80	90	100	125	150	175	200	225	250	300	400	600	800	
T1 (I _t =I _n)	X	X	X	X		X	X	X	X	X	X	X											
T2 (I _t =I _n)	X	X	X	X	X	X	X	X	X	X	X	X											
T3 (I _t =I _n)								X	X	X	X	X	X	X	X	X	X						
Ts3 (I _t =I _n)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
T4 (I _t =I _n)	X	X																					
T4 (I _t =0.7...1.0 x I _n)				X		X	X			X		X	X	X		X		X					
T5 400 (I _t =0.7...1.0 x I _n)																			X	X			
T6 (I _t =0.7...1.0 x I _n)																						X	X
T1																							
I ₃ [A]	1000	1000	1000	1000		1000	1500	1500	1500	1500	1500	1500											
Neutral [A]	1000	1000	1000	1000		1000	1500	1500	1500	1500	1500	1500											
T2, T3																							
I ₃ [A]	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250						
Neutral [A]	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250						
Ts3																							
I ₃ [A]	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250						
Neutral [A]	500	500	500	500	500	500	500	600	700	800	900	1000	1250	1500	1750	2000	2250						
T4, T5																							
I ₃ [A]	500	500		500		500	500			400	500	625	750		1000	1250	1500	1500	2000	2000	3000	4000	
Neutral [A]	500	500		500		500	500			400	500	625	750		1000	1250	1500	1500	2000	2000	3000	4000	
T6																							
I ₃ = 5...10 x I _n [A]																						3000	4000
																						6000	8000
Neutral [A] - 100%																						3000	4000
																						6000	8000
Neutral [A] - 50%																						1500	2000
																						3000	4000

Features and Options

Lift Truck

Another available option would be a circuit breaker lift truck which can be used to lift and/or lower the Emax circuit breaker in front of the switchboard for ease of the removal or installation of the circuit breakers.



Features and Options

Configuration Test Unit

As an option ABB can provide a portable test unit for the Emax circuit breaker trip units. The PR010/T unit is an instrument capable of performing the functions of secondary injection testing, programming, and reading parameters for the trip units equipping Emax low voltage air circuit breakers. In particular, the test function involves the following units:

- PR121P (all versions)
- PR122P (all versions)
- PR123P (all versions)

whereas the parameter programming and reading functions regard the range of PR122 and PR123 trip units.

All of the functions mentioned can be carried out “on board” by connecting the SACE PR010/T unit to the front multi-pin connector on the various protection units. Special interfacing cables supplied with the unit must be used for this connection. The human-machine interface takes the form of a touchpad and multi-line alphanumeric display.

The unit also has two LEDs to indicate, respectively:

- POWER-ON and STAND BY
- battery charge state

Two different types of test are available: automatic (for PR121, PR122, and PR123) and manual.

By connection to a PC (using the floppy-disc supplied by ABB), it is also possible to upgrade the software of the PR010/T unit and adapt the test unit to the development of new products.

It is also possible to store the most important results in the unit itself, and to send a report to the personal computer with following information:

- type of protection tested
- threshold selected
- curve selected
- phase tested
- test current
- estimated trip time
- measured trip time
- test results

At least 5 complete tests can be stored in memory. The report downloaded onto a PC allows creation of an archive of tests carried out on the installation.

In automatic mode, the PR010/T unit is capable of testing the following with the PR122 range:

- protection functions L, S, I
- G protection function with internal transformer,
- G protection function with toroid on the transformer star centre
- Monitoring of correct microprocessor operation

The unit can also test the following protections of the PR122 equipped with the PR120/V:

- Over voltage protection function OV
- Under voltage protection function UV
- Residual voltage protection function RV
- Phase unbalance protection function U

The standard version of the PR010/T unit includes:

- PR010/T test unit complete with rechargeable batteries
- TT1 test unit
- 100-240VAC/12VDC external power supply with cord
- Cables to connect the unit and a PC (RS232 serial)
- User manual and compact disc containing application software



Arc Flash Safety Features

Maintenance Switch

Description

The maintenance switch on Emax breakers is used to manually change the circuit breaker's Instantaneous protection settings to a pre-programmed set of values by means of a door mounted switch.

Application

The maintenance switch concept is used when the customer requires a faster tripping time when personnel are working in or around the switchboard. The circuit breaker stores preset values (Value A = "Normal" and Value B = "Maintenance") with regards to the instantaneous settings. These values are determined by the customer and programmed into the circuit breaker trip unit. "Normal" values are specified for regular operation of the switchboard, "Maintenance" values are specified for when work is being performed on the switchboard. The values can be easily changed by means of the maintenance switch located on the circuit breaker compartment door.



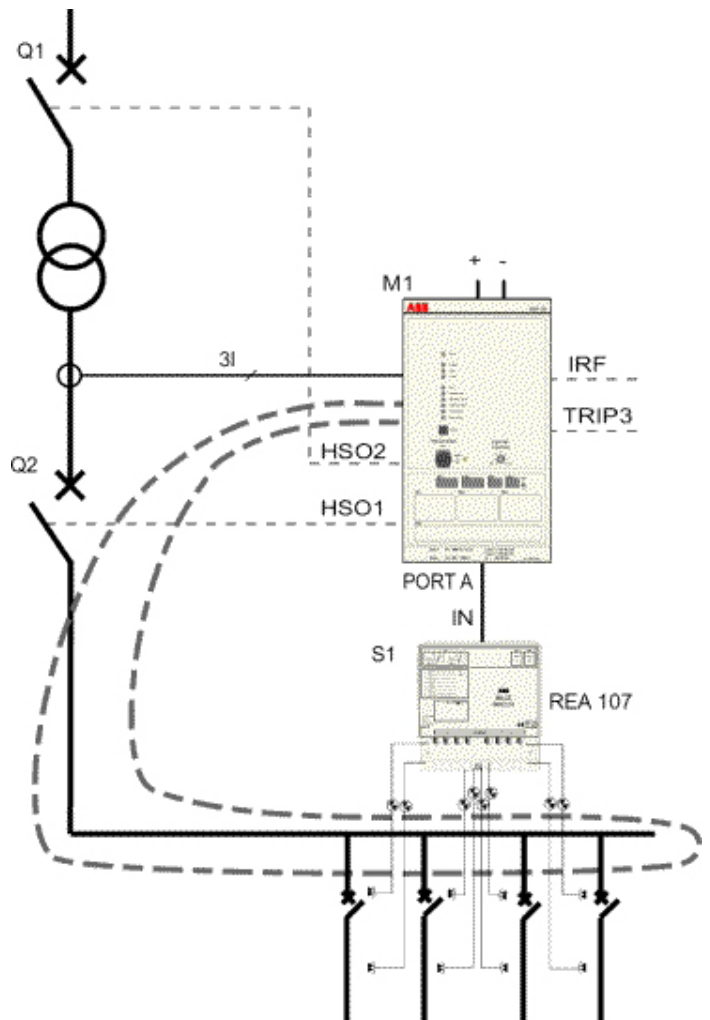
REA Relay System

Description

The REA arc protection relay minimizes material damage to switchboard, enables quick restoration of the power distribution and guarantees improved personnel safety. The REA detects an arc anywhere in the bus compartment and cable compartment utilizing long-fiber sensor system. Total reaction time is less than 2.5ms plus Emax breaker opening time.

Application

The REA relay system concept is used when the customer requires protection on the equipment against an arc. The REA system uses a fiber optic cable wired through the bus compartment and cable compartment in order to detect an arc flash. It then feeds signal to an REA relay which verifies current change on the incoming main bus by the use of CT's. If a change is detected by the relay along with a signal from the fiber optic cable the relay will then send a signal to the main breaker in the corresponding bus to trip, therefore opening the corresponding bus. Total reaction time is equal to the reaction time of the relay which is 2.5ms plus the Emax breaker opening time.



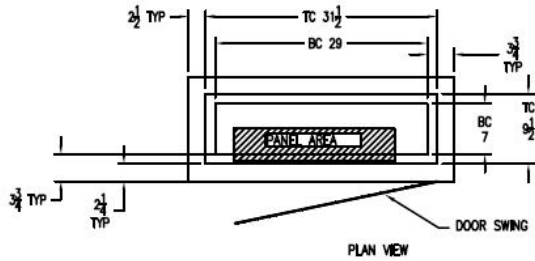
Conduit Layouts

Conduit Layouts

These drawings are valid for all mains, feeders, and group mounted sections based on depth and width.

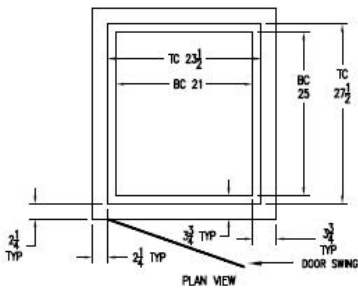
Floor Plans

15" (385 mm) Deep Section

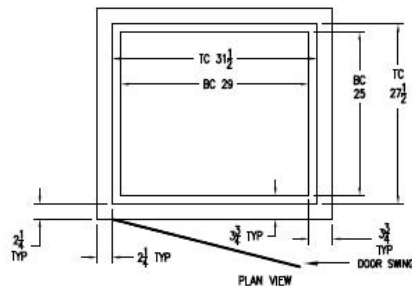


37" (940 mm)

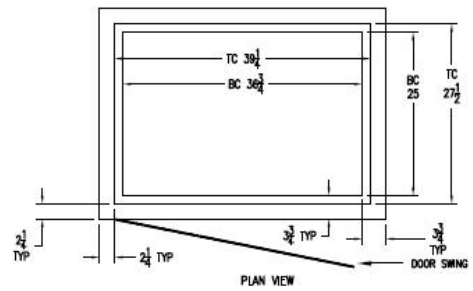
33" (840 mm) Deep Section



28.3" (720 mm)

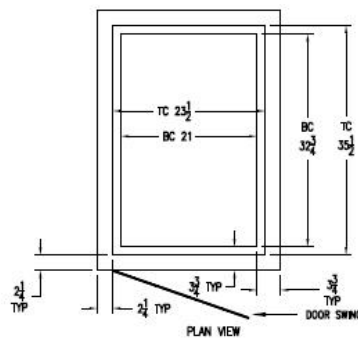


37" (940 mm)

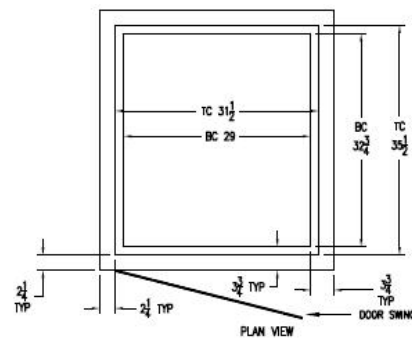


44" (1120 mm)

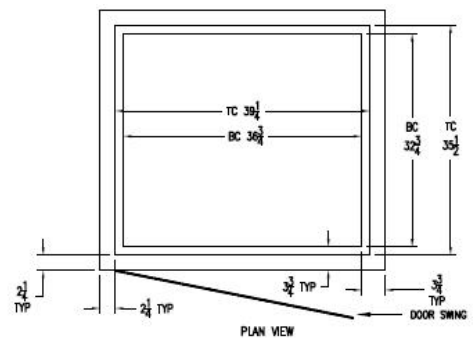
41" (1040 mm) Deep Section



28.3" (720 mm)



37" (940 mm)



44" (1120 mm)

Notes

Notes

Notes

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