MasterPact™ NT and NW Universal Power Circuit Breakers Certified to ABS-NVR (American Bureau of Shipping—Naval Vessel Rules)

Class 0613

Catalog

0613CT0601
R12/19

www.se.com

Legal Information

Table of Contents

General Information

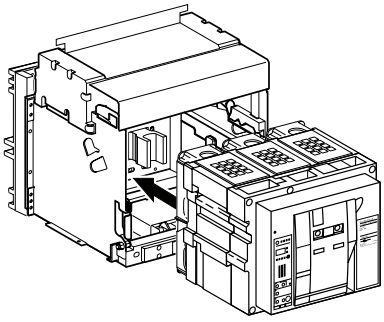
Introduction

800–1600 A MasterPact NT Drawout Circuit Breaker

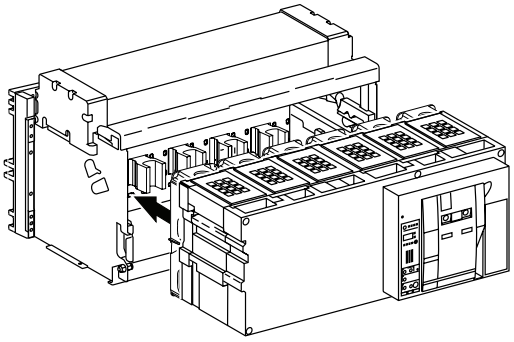
The MasterPact™ NT/NW Universal Power Circuit Breaker is designed and tested to meet IEC 609472 and 60947-3 Standards and Certified to ABS-NVR® (American Bureau of Shipping–Navel Vessel Rules). These circuit breakers are specifically designed and tested for shipboard use to protect electrical systems from damage caused by overloads, short circuits and equipment ground faults. All MasterPact circuit breakers are designed to open and close a circuit manually, and to open the circuit automatically at a predetermined overcurrent setting. MasterPact circuit breakers can also:

- Enhance coordination by their adjustability.
- Provide integral ground-fault protection for equipment.
- Provide high interrupting ratings and withstand ratings.
- Provide communications.
- Provide power monitoring.
- Provide protective relaying functions.
- Provide zone-selective interlocking (ZSI) which can reduce damage in the event of a fault.

Figure 1 - MasterPact NW Drawout Circuit Breakers



800–3200 A MasterPact NW Drawout Circuit Breaker



4000–6300 A MasterPact NW Drawout Circuit Breaker

Codes and Standards

MasterPact circuit breakers are manufactured and tested in accordance with the following standards:

Circuit Breaker	IEC® Extreme Atmospheric Conditions
IEC 60947-2 IEC 60947-3 ABS-NVR	IEC 68-2-1: Dry cold at –55°C IEC 68-2-2: Dry heat at +85°C IEC 68-2-30: Damp heat (temp. +55°C, rel. humidity 95%) IEC 68-2-52 Level 2: Salt mist

MasterPact circuit breakers are available in Square D™ or Schneider Electric™ brands.

Features and Benefits

High Ampere Interrupting Rating (AIR)

MasterPact NW circuit breakers have an interrupting rating of 150 kA at 440 Vac without fuses.

High Short-Time Current Rating

MasterPact NW circuit breakers have exceptional short-time ratings—up to 100 kA.

100% Rated Circuit Breaker

MasterPact circuit breakers are designed for continuous operation at 100% of their current rating.

Reverse Fed Circuit Breaker

MasterPact circuit breakers can be fed either from the top of the circuit breaker or from the bottom.

Two-Step Stored Energy Mechanism

MasterPact circuit breakers are operated via a stored-energy mechanism which can be charged manually or by a motor. The closing time is less than five cycles. Closing and opening operations can be initiated by remote control or by push buttons on the circuit breaker front cover. An O–C–O cycle is possible without recharging.

Drawout or Fixed Mount, 3-Pole (3P) or 4-Pole (4P) Construction

MasterPact circuit breakers are available in drawout or fixed mounts, with either three-pole or four-pole construction.

Field-installable Trip Units, Sensor Plugs and Accessories

Trip units, sensor plugs and most accessories are field installable with only the aid of a screwdriver and without adjusting the circuit breaker. The uniform design of the circuit breaker line allows most accessories to be common for the whole line.

Reinforced Insulation

Two insulation barriers separate the circuit breaker front from the current path.

Isolation Function by Positive Indication of Contact Status

The mechanical indicator is truly representative of the status of all the main contacts.

Segregated Compartment

Once the accessory cover has been removed to provide access to the accessory compartment, the main contacts remain fully isolated. Furthermore, interphase partitioning allows full insulation between each pole even if the accessory cover has been removed.

Front Connection of Secondary Circuits

All accessory terminals (ring terminals are available as an option) are located on a connecting block which is accessible from the front in the connected, test and disconnected positions. This is particularly useful for field inspection and modification.

Anti-Pumping Feature

All MasterPact NT and NW circuit breakers are designed with an anti-pumping feature that causes an opening order to always takes priority over a closing order. Specifically, if opening and closing orders occur simultaneously, the charged mechanism discharges without any movement of the main contacts keeping the circuit breaker in the open (OFF) position.

In the event that opening and closing orders are simultaneously maintained, the standard mechanism provides an anti-pumping function which continues to keep the main contacts in the open position.

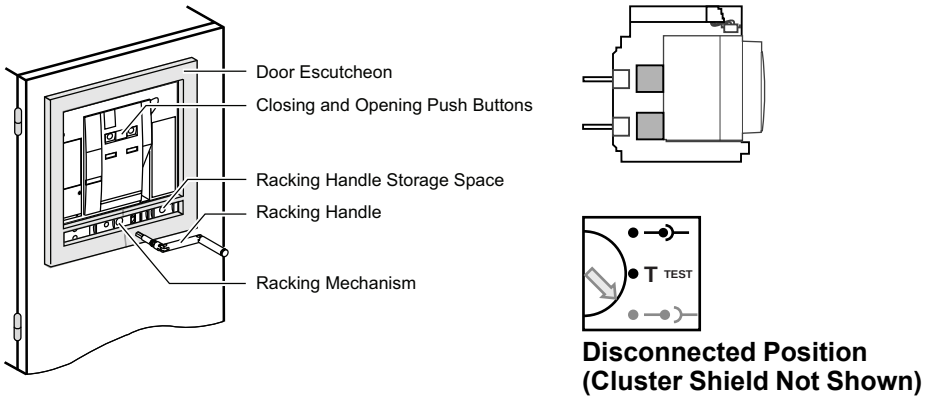
In addition, after fault tripping or opening the circuit breaker intentionally (using the manual or electrical controls and with the closing coil continuously energized) the circuit breaker cannot be closed until the power supply to the closing coil is discontinued and then reactivated.

NOTE: When the automatic reset after fault trip (RAR) option is installed, the automatic control system must take into account the information supplied by the circuit breaker before issuing a new closing order or before blocking the circuit breaker in the open position. The information is on the type of fault, e.g. overload, short-circuit or ground fault.

Disconnection Through the Front Door

The racking handle and racking mechanism are accessible through the front door cutout. Disconnecting the circuit breaker is possible without opening the door and exposing live parts.

Figure 2 - Racking Handle and Mechanism

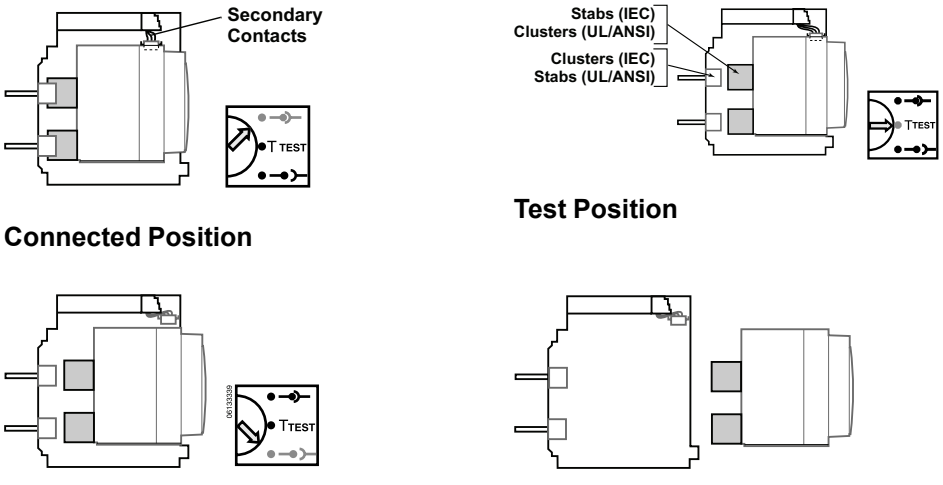


Disconnected Position (Cluster Shield Not Shown)

Drawout Mechanism

The drawout assembly mechanism allows the circuit breaker to be racked in four positions (connected, test, disconnected, or withdrawn), as shown in the figure below.

Figure 3 - Racking Positions (Cluster Shield Not Shown)



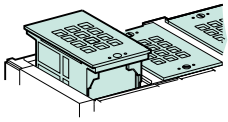
Connected Position

Test Position

Disconnected Position

Withdrawn Position

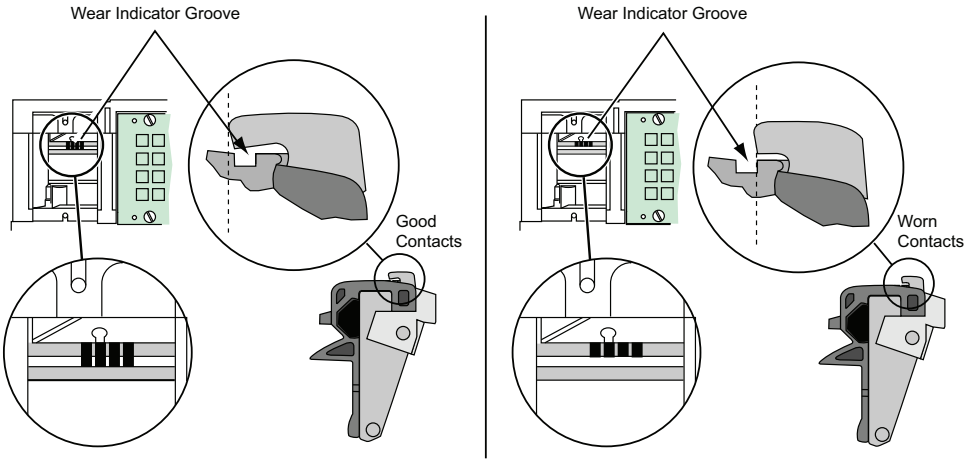
Arc Chamber



Reduced Maintenance

Under normal operating conditions, the circuit breaker does not require maintenance. However, if maintenance or inspection is necessary, the arc chambers are removable to allow visual inspection of the contacts and wear indicator groove (see *Contact Wear Indicators, page 12* for how wear is indicated). The operation counter can also indicate when inspections and possible maintenance should be done.

Figure 4 - Contact Wear Indicators



Operating Conditions

MasterPact circuit breakers can operate under the following temperature conditions:

The electrical and mechanical characteristics are stipulated for an ambient temperature between -13°F (25°C) and 158°F (70°C). Mechanical closing of the circuit breaker (by pushbutton) is possible down to -31°F (-35°C).

It is recommended that the equipment be cooled or heated to the proper operating temperature and kept free of excessive vibration and dust. Operation at temperatures above 122°F (50°C) may require derating or overbussing the circuit breaker. See the appropriate instruction bulletin and *Temperature Correction Factors, page 16* for additional information.

MasterPact circuit breakers have been tested to meet ABS-NVR Standards.

MasterPact circuit breakers meet IEC 68-2-6 Standards for vibration.

- 2 to 13.2 Hz and amplitude 0.039 in. (1 mm)
- 13.2 to 100 Hz constant acceleration 0.024 oz. (0.7 g.)

The materials used in MasterPact NT and NW circuit breakers will not support the growth of fungus and mold.

MasterPact circuit breakers have been tested to the following:

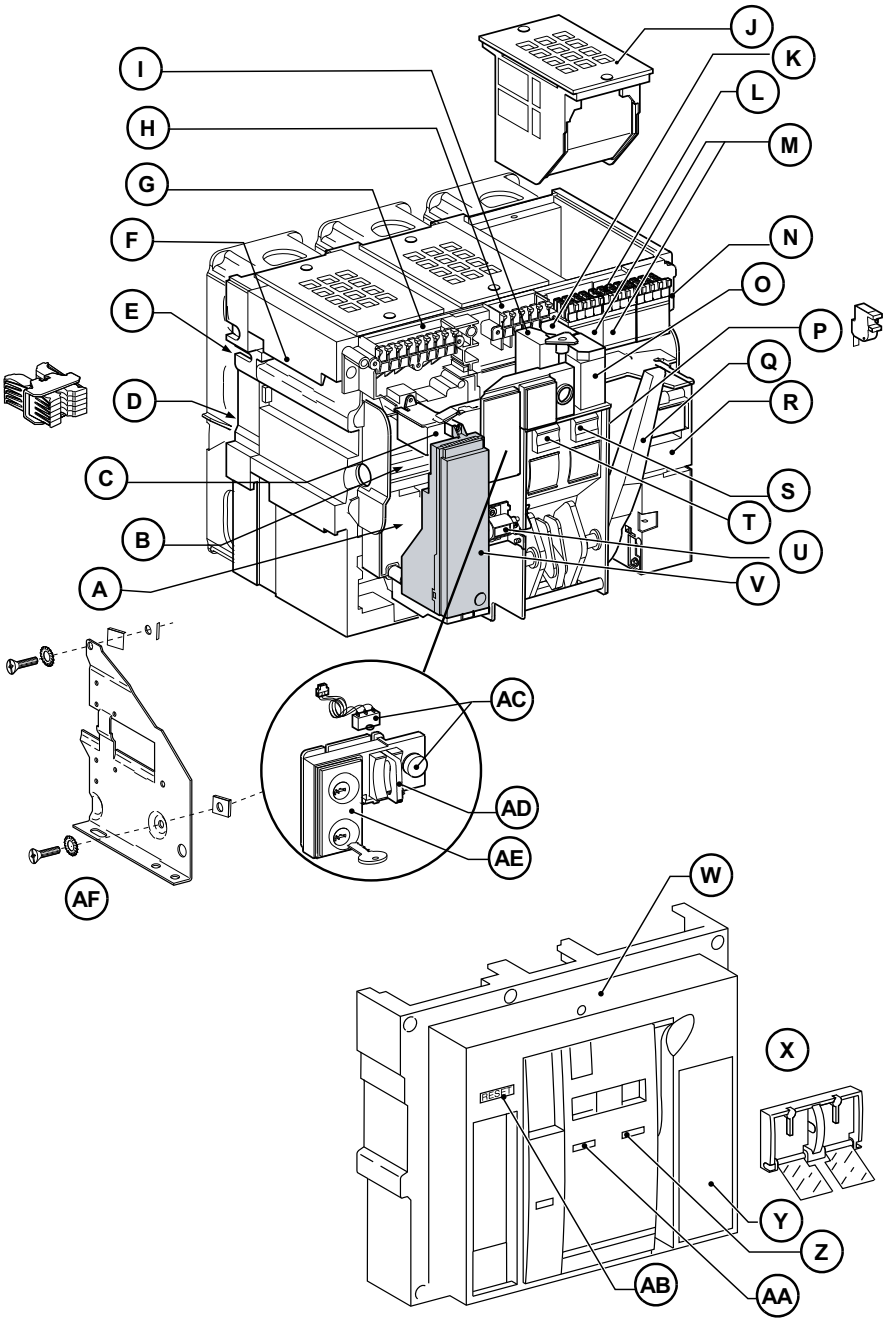
- IEC 68-2-30 - Damp heat (temperature +55°C and relative humidity of 95%)
- IEC 68-2-52 level 2 - salt mist

Storage Temperature

Circuit breakers with trip units without LCD displays may be stored in the original packaging at temperatures between -40°F (-40°C) and 185°F (85°C). For circuit breakers with trip units with LCD displays, this range is -13°F (-25°C) to 185°F (85°C).

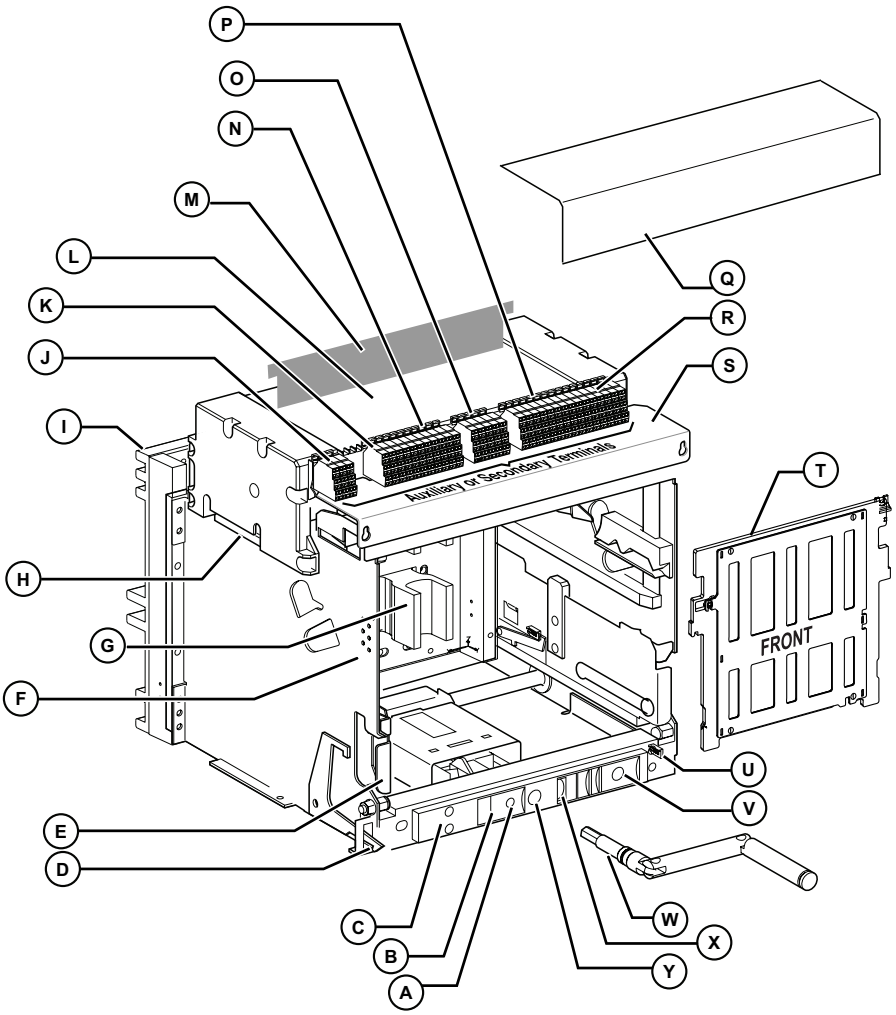
MasterPact NW Circuit Breaker Design

A	Overcurrent Trip Switch (SDE1)
B	Circuit Breaker Communication Module
C	Overcurrent Trip Switch (SDE2) or Electric Reset
D	Cluster
E	Cradle Rejection Kit
F	Lifting Tab
G	Trip Connection to Overcurrent Trip Switch
H	Auxiliary Control Connection
I	Shunt Trip (MX2) or Undervoltage Trip Device
J	Arc Chamber
K	Shunt Trip (MX1)
L	Auxiliary Contact Connection
M	Two Blocks of Four Additional Switches (OF) or Combined “Connected,Closed” Switches (EF)
N	Block of Four Form C Auxiliary Contacts (OF)
O	Shunt Close (XF)
P	Ready-to-Close Contact (PF)
Q	Charging Handle
R	Spring-Charging Motor (MCH)
S	Closing Push Button
T	Opening Push Button
U	Operations Counter
V	Trip Unit
W	Accessory Cover
X	Open/Close Push Button Close (Lockable with Padlock)
Y	Faceplate
Z	Charged/Discharged Indicator
AA	Open/Close Indicator
AB	Push-to-Reset on Fault Trip
AC	Electrical Close Push Button (BPFE)
AD	Padlock Attachment
AE	Key Interlock
AF	Mounting Plate for Fixed Circuit Breaker

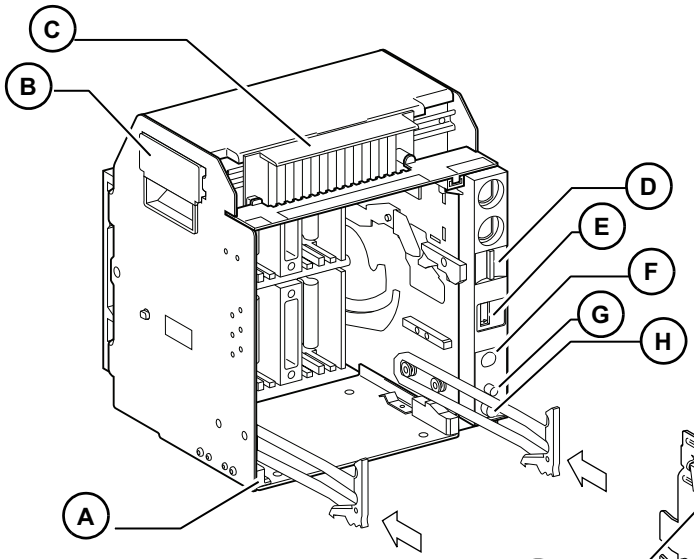


MasterPact NW Cradle Design

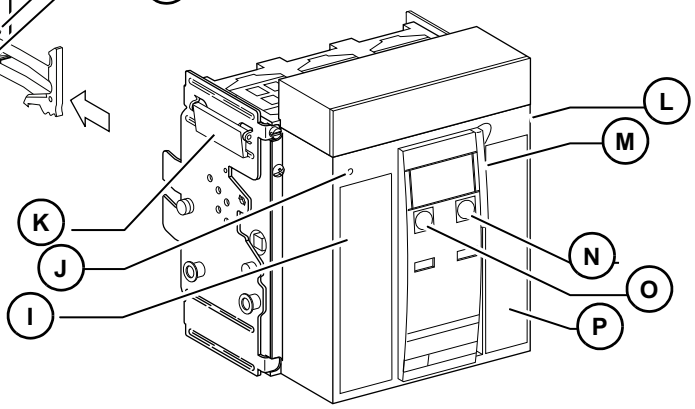
A	Stop Release Button
B	Padlock Provision
C	Key Interlock
D	Door Interlock for Connected Device
E	Pull-Out Hand Grip
F	Rejection Feature
G	Primary Stabs (UL)/Clusters (IEC)
H	Lifting Tab
I	Cradle Back Mold
J	Position Indicating Contact Terminal Block
K	Overcurrent Trip Switch Terminal Block
L	Arc Chamber Cover
M	Tool Shield
N	Position Indicating Contact Terminal Block
O	Accessory Control Terminal Block
P	Auxiliary Contact Terminal Block
Q	Terminal Cover
R	Position Indicating Contact Terminal Block
S	Wiring Cover
T	Shutter
U	Racking Interlock for Open Door
V	Crank Storage Space
W	Racking Crank
X	Position Indicator
Y	Crank Insertion Opening



MasterPact NT Circuit Breaker and Cradle Design

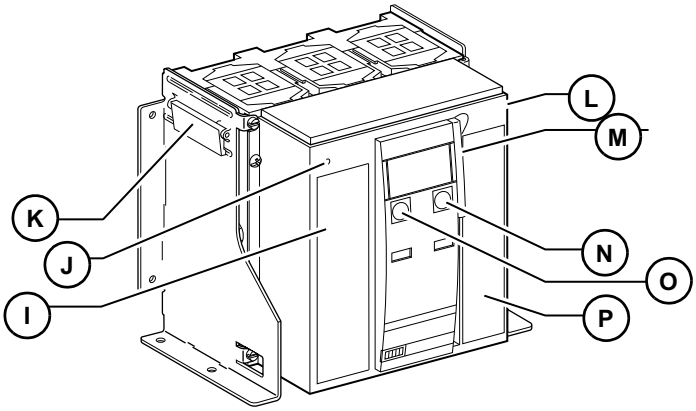


NT Cradle



NT Drawout Circuit Breaker

A	Extension Rail Handle
B	Lifting Handle
C	Terminal Cover
D	Padlock Provision
E	Position Indicator
F	Racking Handle Insertion Opening
G	Stop Release Button
H	Racking Handle Storage Space
I	Lifting Tab
J	Fault Trip Reset Button
K	Trip Unit
L	Accessory Cover
M	Charging Handle
N	:Push-to-close” Button
O	“Push-to-open” Button
P	Faceplate



NT Fixed Circuit Breaker

NOTE: ITAR (International Traffic in Arms Regulations) controlled parts needed for ship motion tests are not shown

Correction Factors

Table 1 - Temperature Correction Factors

Maximum Ambient Temperature													
°F	158	140	122	104	86	77	68	50	32	14	-4	-13	-22
°C	70	60	50	40	30	25	20	10	0	-10	-20	-25	-30
Current	0.75	0.83	0.92	1	1.07	1.11	1.14	1.21	1.27	1.33	1.39	1.42	1.44

Ratings

Table 2 - Ratings for Rated MasterPact NW Circuit Breakers 800–2000 A

Frame Rating			800/1000/1250/1600 A					2000 A					
Interrupting Rating Code			N1	H1	H2	L1	H10	N1	H1	H2	H3	L1	H10
Ultimate Breaking Capacity (kA) 50/60 Hz	Icu	220/415 Vac	42	65	100	150	—	42	65	100	150	150	—
		440 Vac	42	65	100	150	—	42	65	100	150	150	—
		525 Vac	42	65	85	130	—	42	65	85	130	130	—
		690 Vac	42	65	85	100	—	42	65	85	100	100	—
		1150 Vac	—	—	—	—	50	—	—	—	—	—	50
Service Breaking Capacity	Ics	%Icu	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Short-Time Withstand Current (kA)	Icw	Vac 50/60 Hz, 1 s	42	65	85	30	50	42	65	85	65	30	50
		Vac 50/60 Hz, 3 s	22	36	50	30	50	22	36	75	65	30	50
Built-In Instantaneous Override (Peak kA ±10%)			—	—	190[1]	80[1]	—	—	—	190	150	80	—
Rated making Current (Peak kA) 50/60 Hz	Icm	220/415 Vac	88	143	220	330	—	88	88	220	330	330	—
		440 Vac	88	143	220	330	—	88	88	220	330	330	—
		525 Vac	88	143	187	286	—	88	88	187	286	286	—
		690 Vac	88	143	187	220	—	88	88	187	220	220	—
		1150 Vac	—	—	—	—	105	—	—	—	—	—	105
Break Time		ms	25					25					
Closing Time		ms	< 70					< 70					
Endurance Rating (with no maint.) C/O Cycles x 1000		Mechani-cal	12.5					10					
		Electrical 440 V	10	10	10	3	—	8	8	8	3	3	—
		Electrical 1150 V	—	—	—	—	0.5	—	—	—	—	—	0.5

1. 55 kA for 800 A circuit breaker frame with 100 or 250 A sensor.

Table 3 - Ratings for Rated MasterPact NW Circuit Breakers 2500–6300 A

Frame Rating			2500/3200/4000 A				4000B/5000/6300 A	
Interrupting Rating Code			H1	H2	H3	H10	H1	H2
Ultimate Breaking Capacity (kA) 50/60 Hz	Icu	220/415 Vac	65	100	150	—	100	150
		440 Vac	65	100	150	—	100	150
		525 Vac	65	85	130	—	100	130
		690 Vac	65	85	100	—	100	100
		1150 Vac	—	—	—	50	—	1
Service Breaking Capacity	Ics	%Icu	100%	100%	100%	100%	100%	100%
Short-Time Withstand Current (kA)	Icw	Vac 50/60 Hz, 1 s	65	85	65	50	100	100
		Vac 50/60 Hz, 3 s	65	75	65	50	100	100
Built-In Instantaneous Override (Peak kA ±10%)			—	190	150	—	—	117
Rated making Current (Peak kA) 50/60 Hz	Icm	220/415 Vac	143	220	330	—	220	330
		440 Vac	143	220	330	—	220	330
		525 Vac	143	189	286	—	187	286
		690 Vac	143	189	220	—	187	220
		1150 Vac	—	—	—	105	—	—
Break Time		ms	25				25	
Closing Time		ms	< 70				< 80	
Endurance Rating (with no maint.) C/O Cycles x 1000		Mechanical	10				5	
		Electrical 440 V	5	5	1.25	—	1.5	1.5
		Electrical 1150 V	—	—	—	0.5	—	—

Table 4 - Ratings for Rated MasterPact NW Switches

Frame Rating			800/1000/1250/1600 A				2000 A			2500/3200/4000 A			4000B/ 5000/ 6300 A
Withstand Rating Code[2]			NA	HA	HF	HA10	HA	HF	HA10	HA	HF	HA10	HA
Rated Making Current (Peak kA)	Icm	220/415 Vac, 50/60 Hz	88	105	187	—	105	187	—	121	189	—	187
		440 Vac, 50/60 Hz	88	105	187	—	105	187	—	121	189	—	187
		500/690 Vac, 50/60 Hz	88	105	187	—	105	187	—	121	189	—	187
		1150 Vac, 50/60 Hz	—	—	—	105	—	—	105	121	—	105	—
Short-Time Withstand Current (kA)	Icw	Vac 50/60 Hz, 1 s	42	50	85	50	50	85	50	50	85	50	85
Ultimate Breaking Capacity (with external protection relay) (kA)	Icu	Maximum Delay 350 ms	42	50	85	50	50	85	50	50	85	50	85

2. NA, HA, and HA10 are non-automatic switches; HF is an automatic switch.

Table 5 - Ratings for MasterPact NT Circuit Breakers

Frame Rating			800/1000 A			1250/1600 A	
Interrupting Rating Code			H1	H2	L1	H1	H2
Ultimate Breaking Capacity (kA)	Icu	220/415 Vac, 50/60 Hz	42	50	100	42	50
		440 Vac, 50/60 Hz	42	50	100	42	50
		525 Vac, 50/60 Hz	42	50	100	42	42
		690 Vac, 50/60 Hz	42	50	100	42	42
Service Breaking Capacity (kA)	Ics	%Icu	100%	100%	100%	100%	100%
Short-Time Withstand Current (kA)	Icw	Vac 50/60 Hz, 1 s	42	36	10[3]	42	36
Built-In Instantaneous Override (kA ±10%)			—	—	10[4]	—	—
Close and Latch Rating (kA)	Icm	220/415 Vac, 50/60 Hz	38	45	143	38	45
		440 Vac, 50/60 Hz	38	45	124	38	45
		525 Vac, 50/60 Hz	38	38	96	38	38
		690 Vac, 50/60 Hz	38	38	23	38	38
Break Time		ms	25	25	9	25	25
Closing Time		ms	50	50	50	50	50
Endurance Rating (C/O cycles) (with no maintenance)		Mechanical	12,500	12,500	12,500	12,500	12,500
		Electrical 440 V	6000	6000	3000	6000	6000[5]

Table 6 - Ratings for Non-Automatic MasterPact NT Switches

Frame Rating			800/1000 A	1250/1600 A
Withstand Rating Code			HA	HA
Close and Latch Rating (kA)	Icm	220/415 Vac, 50/60 Hz	33	33
		440 Vac, 50/60 Hz	33	33
		500/690 Vac, 50/60 Hz	33	33
Short-Time Withstand Current (kA)	Icw	Vac 50/60 Hz, 0.5 s	42	42
Breaking Capacity (kA at 690 Vac) (with external protection relay)	Icu	maximum delay 350 ms	35	35

3. For Icw 10 kA is for 0.5 s.
4. SELLIM system.
5. 1600 A, 3000 cycles.

Shipping Weights

Table 7 - Shipping Weights for MasterPact NW Circuit Breakers

Circuit Breaker Rating (A)	Circuit Breaker[6] (lb/kg)		Cradle (lb/kg)		Connector Type and Weight (lb/kg)			Pallet (lb/kg)	Total Weight (lb/kg)	
	3P	4P	3P	4P	Type	3P	4P		3P	4P
800	109/50	132/60	97/44	116/53	FCF	42/19	55/25	17/8	265/121	320/146
1000, 1250, 1600, 2000					RCTH or RCTV	17/8	22/10	17/8	240/110	287/131
2500	127/58	165/75	124/57	149/68	FCF	42/19	55/25	17/8	310/142	386/176
3200					RCTH or RCTV	17/8	22/10	17/8	285/131	353/161
4000	127/58	165/75	124/57	149/68	RCTH or RCTV	42/19	55/25	17/8	310/142	386/176
5000, 6300	227/103	295/134	278/126	334/152	RCTH or RCTV	52/24	68/31	39/18	596/271	736/335

Table 8 - Shipping Weights for MasterPact NT Circuit Breakers

Circuit Breaker Rating (A)	Circuit Breaker[6] (lb/kg)		Cradle (lb/kg)		Connector Type and Weight (lb/kg)			Pallet (lb/kg)	Total Weight (lb/kg)	
	3P	4P	3P	4P	Type	3P	4P		3P	4P
800	35/16	46/21	31/14	37/14	FCF	15/7	20/9	10/5	91/42	113/52
1000, 1250, 1600					RCTH or RCTV	6/3	8/4	10/5	82/38	101/47

6. Fixed circuit breaker weight = total weight – cradle weight.

Energy Management

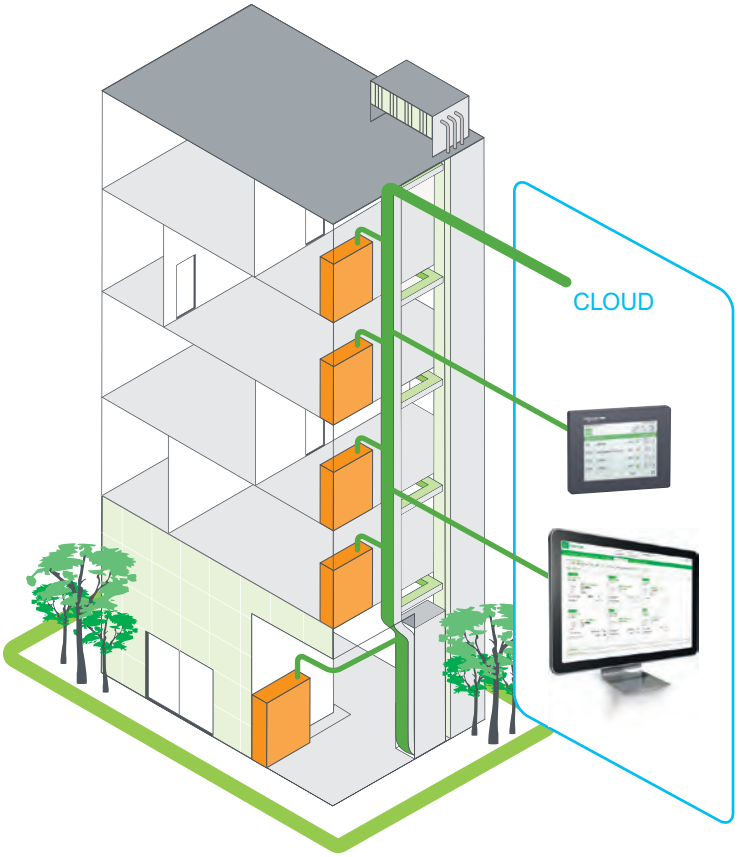
Energy Management Using the Smart System

Use the Smart System to connect a building to real savings in three steps:

A. Measure
   - Embedded and stand-alone metering and control

B. Connect
   - Integrated communication interfaces
   - Ready to connect to energy management platforms

C. Save
   - Data-driven energy efficiency actions
   - Real-time monitoring and control
   - Access to energy and site information through on-line services



Measure

Smart System communications mean visible information.

Grouping most of the electrical protection, command and metering components, the switchboards are now significant sources of data locally displayed and sent via communication networks.

Connect

Smart Systems use reliable, simple-to-install-and-use displays, and Ethernet and Modbus interfaces.

Information is safely transmitted through the most efficient networks:

- Modbus SL inside switchboards, between components,
- Ethernet, on cable or WiFi, inside the building and connecting switchboards and computers,
- Ethernet or GPRS, for access to on-line services by Schneider Electric.

Energy experts, no matter where they are located, can now provide advise based on the updated data of the building.

Save

On-Site Real-Time Monitoring and Control

The FDM128 touch screen display connected to the Ethernet:

- shows essential electrical information and alarms concerning the electrical network,
- allows control (open, close, reset…) of various equipment.

The FDM128 touch screen provides real-time value checking and control, directly on the front panel of the main switchboard.

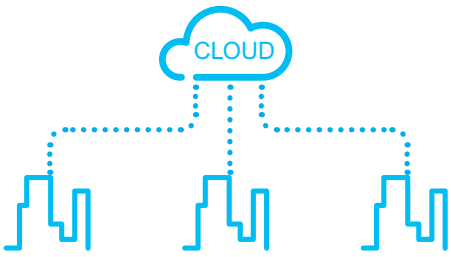
On a PC display with common browser:

- shows monitoring web pages hosted into the local Ethernet interface,
- alarm events generate automatic email notifications,
- allows control (open, close, reset…) of various equipment.

The data is displayed graphically or recorded into files for optimizing the use of energy in the building.

As an example, the data can help validate the change of temperature settings, time scheduling in a Building Management System or other automated devices.

On-Line Energy Management Services



StruXureWare Energy Operation automates data collection using an open, scalable, and secure energy management information system.

With the help of the Schneider Electric energy management services team, data is turned into information to enable customers to understand their facilities' performance on an ongoing basis.

Energy Operation leverages companies' current investments in their existing systems, and can be used to communicate advanced results and performance to a broad audience for a shared understanding throughout an organization.

Smart System Communication Components

MasterPact Circuit Breakers with MicroLogic Trip Units

Ammeter A

- 3.0 basic protection
- 5.0 selective protection
- 6.0 selective + ground-fault protection

Power Meter P

- 5.0 selective protection
- 6.0 selective + ground-fault protection

Harmonic Meter H

- 5.0 selective protection
- 6.0 selective + ground-fault protection
- See *MicroLogic 5.0H and 6.0H Trip Units with Harmonic Metering, page 55* for more information.

Displays

Power Meter

FDM121

- One-to-one front display module
- See *Display Function, page 24* for more information.

Operating Assistance Functions

FDM128

- One-to-eight front display module
- See *Display Function, page 24* for more information.

Communication

Communication

- MasterPact circuit breakers in a communication network
- I/O application module
- IFE: Ethernet interface module
- IFM: Modbus interface module
- Com'X 200: Energy server

I/O Module

IFE Module

IFM Module

Com'X 200

See *Smart System Communication Wiring System, page 59* for more information.

Power Meter Functions

In addition to protection functions, MicroLogic A/P/H trip units offer all the functions of Power Meter products as well as operating assistance for the circuit breaker.

MicroLogic A/P/H trip unit measurement functions are made possible by the MicroLogic trip unit's intelligence and the accuracy of the sensors. They are handled by a microprocessor that operates independent of protection functions.

Display Function

Display Function

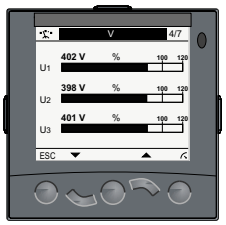
FDM121 Display Unit (One to One)

The FDM121 switchboard display unit can be connected to a communication (COM) option (Breaker Communication Module [BCM ULP]) using a circuit breaker ULP cord to display all measurements on a screen. The LCD screen is 3.78 x 3.78 in. (96 x 96 mm). The FMD121 display unit requires a 24 Vdc power supply. The COM option (BCM ULP) unit is supplied by the same power supply via the circuit breaker ULP cord connecting it to the FDM121. See *FDM121 Display, page 29* for more information.

FDM121 Display Navigation

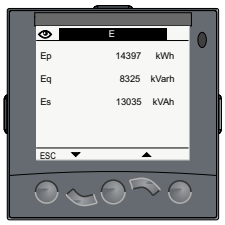
FDM121 Display Current

FDM121 Display: Voltage



FDM121 Display: Power

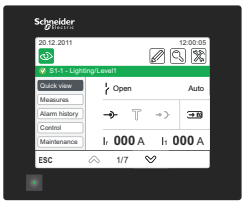
FDM121 Display: Consumption



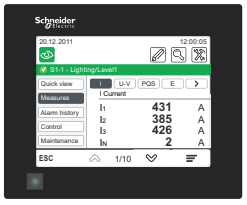
FDM128 Display Unit (One to Eight)

The FDM128 display unit uses an IFE Ethernet interface for low-voltage circuit breakers.

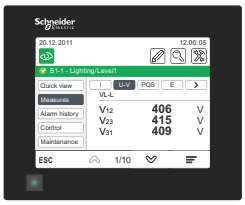
FDM128 Display Navigation



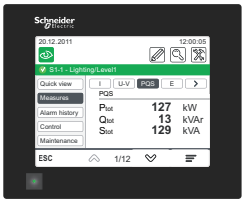
FDM128 Display Current



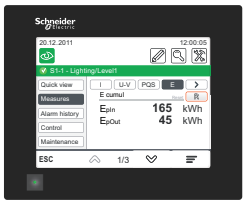
FDM128 Display: Voltage



FDM128 Display: Power



FDM128 Display: Consumption



For all FDM, in addition to the information displayed on the MicroLogic trip unit LCD, the FDM screen shows demand, power quality, and maximum/minimum ammeter values along with histories and maintenance indicators.

Measurement Function

Instantaneous RMS Measurements

Measurement Function

The MicroLogic trip unit continuously displays the RMS value of the highest current of the three phases and neutral (Imax). The navigation buttons can be used to scroll through the main measurements.

In the event of a fault trip, the trip cause is displayed.

The MicroLogic A trip unit measures phase, neutral, and ground fault currents.

MicroLogic P/H trip units offer voltage, power, power factor, frequency, and cos ? in addition to the measurements provided by MicroLogic A trip units.

Maximum / Minimum Ammeter

Every instantaneous measurement provided by MicroLogic A trip units can be associated with a maximum/minimum ammeter. The maximum for the highest current of the three phases, neutral, and demand current can be reset using the FDM display unit or the communication system.

Energy Metering

The MicroLogic P/H trip units also measures the energy consumed since the last reset of the meter. The active energy meter can be reset using the MicroLogic trip unit keypad, the FDM display unit, or the communication system.

Demand and Maximum Demand Values

MicroLogic P/H trip units also calculate demand current and power values. These calculations can be made using a block or sliding interval that can be set from five to sixty minutes in steps of one minute. The window can be synchronised with a signal sent through the communication system. Whatever the calculation method, the calculated values can be recovered on a PC through the communication network.

Ordinary spreadsheet software can be used to provide trend curves and forecasts based on this data. They provide a basis for load shedding and reconnection operations used to adjust consumption to the subscribed power.

Power Quality

The MicroLogic H trip unit calculates power quality indicators taking into account the presence of harmonics up to the fifteenth harmonic, including the total harmonic distortion (THD) of current and voltage.

Table 9 - MicroLogic A/P/H Trip Units Integrated Power Meter Functions

MicroLogic A/P/H Integrated Power Meter Functions			Type	Display	
				MicroLogic LCD	FDM Display
Display of protection settings					
Pick-ups (A) and delays	All settings can be displayed	Ir, tr, Isd, tsd, Ii, Ig, tg	A/P/H	X	—
Measurements					
Instantaneous rms measurements					
Currents (A)	Phases and neutral	I_A, I_B, I_C, I_N	A/P/H	X	X
	Average of phases	Iavg = (I_A + I_B + I_C) / 3	A/P/H	—	X
	Highest current of the 3 phases and neutral	Imax of I_A, I_B, I_C, I_N	A/P/H	X	X
	Ground fault (MicroLogic 6)	% Ig (pick-up setting)	A/P/H	X	X
	Current unbalance between phases	% Iavg	P/H	—	X
Voltages (V)	Phase-to-phase	V_{AB}, V_{BC}, V_{CA}	P/H	X	X
	Phase-to-neutral	V_{AN}, V_{BN}, V_{CN}	P/H	X	X
	Average of phase-to-phase voltages	Vavg = (V_{AB} + V_{BC} + V_{CA}) / 3	P/H	—	X
	Average of phase-to-neutral voltages	Vavg = (V_{AN} + V_{BN} + V_{CN}) / 3	P/H	—	X
	Ph-Ph and Ph-N voltage unbalance	% Vavg	P/H	—	X
	Phase sequence	ABC, ACB	P/H	X	X[7]
Frequency (Hz)	Power system	f	P/H	X	X
Power	Active (kW)	P, total	P/H	X	X
		P, per phase	P/H	X	X
	Reactive (kVAR)	Q, total	P/H	X	X
		Q, per phase	P/H	X	X
	Apparent (kVA)	S, total	P/H	X	X
		S, per phase	P/H	X	X
	Power Factor	PF, total	P/H	X	X
		PF, per phase	P/H	X	X
	Cos φ	Cos φ, total	P/H	X	X
		Cos φ, per phase	P/H	X	X
Maximum/ Minimum Ammeter	Associated with instantaneous rms measurements	Reset using the FDM display unit and MicroLogic keypad	A/P/H	X	X
Energy Metering					
Energy	Energy Active (kW), reactive (kVARh), apparent (kVAh)	Total since last reset	P/H	X	X
Demand and Maximum Demand Values					
Demand Current (A)	Phases and neutral P	Present value on the selected window	P/H	X	X
		Maximum demand since last reset	P/H	X	X
Demand Power	Active (kWh), reactive (kVAR), apparent (kVA)	Present value on the selected window	P/H	X	X

7. FDM121 only.

Table 9 - MicroLogic A/P/H Trip Units Integrated Power Meter Functions (Continued)

MicroLogic A/P/H Integrated Power Meter Functions			Type	Display	
				MicroLogic LCD	FDM Display
		Maximum demand since last reset	P/H	X	X
Calculation Window	Sliding, fixed or com-synchronised	Adjustable from 5 to 60 minutes in 1 minute steps[8]	P/H	—	—
Power Quality					
Total Harmonic Distortion (%)	Of voltage with respect to rms value	THDU,THDV of the Ph-Ph and Ph-N voltage	H	X	X
	Of current with respect to rms value	THDI of the phase current	H	X	X

Histories

- Trip indications in clear text in a number of user-selectable languages
- Time-stamping: date and time of trip.

Maintenance Indicators

MicroLogic trip units have indicators for, among other items, the number of operating cycles, contact wear P/H, load profile and operating times (operating hours counter) of the MasterPact circuit breaker.

It is possible to assign an alarm to the operating cycle counter to plan maintenance.

The various indicators can be used together with the trip histories to analyze the level of stresses the device has been subjected to.

Contact Wear

Each time a MasterPact circuit breaker opens, the MicroLogic P/H trip unit measures the interrupted current and increments the contact-wear indicator as a function of the interrupted current, according to test results stored in memory. Breaking under normal load conditions results in a very slight increment. The indicator value may be read on the FDM display.

It provides an estimation of contact wear calculated on the basis of the cumulative forces affecting the circuit breaker. When the indicator reaches 100%, it is advised to visually inspect the contacts per the instructions in the circuit breaker user guide.

8. Available via the communcation system only.

Circuit Breaker Load Profile

MicroLogic A/P/H trip units calculate the load profile of the circuit breaker protecting a load circuit. The profile indicates the percentage of the total operating time at four current levels (% of circuit breaker In):

- 0 to 49% In
- 50 to 79% In
- 80 to 89% In
- ≥ 90% In.

This information can be used to optimize use of the protected equipment or to plan ahead for maintenance interval extensions.

Management of Installed Devices

Each circuit breaker equipped with a COM option (BCM ULP) can be identified using the communication system:

- serial number
- firmware version
- hardware version
- device name assigned by the user.

This information together with the previously described indications provides a clear description of the installed devices.

Table 10 - MicroLogic A/P/H Trip Units Operating Assistance Functions

MicroLogic A/P/H Operating Assistance Functions			Type	Display	
				MicroLogic LCD	FDM Display
Operating Assistance					
Trip History					
Trips	Cause of tripping	Ir, Isd, Ii, Ig, IDn	A/P/H	X	X
Maintenance Indicators					
Counter	Mechanical cycles	Assignable to an alarm	A/P/H	—	X
	Electrical cycles	Assignable to an alarm	A/P/H	—	X
	Hours	Total operating time (hours)[9]	A/P/H	—	—
Indicator	Contact wear	%	P/H	X	X
Load Profile	Hours at different load levels	% of hours in four current ranges: 0-49% In, 50-79% In, 80-89% In and ≥ 90% In	P/H	—	X

9. Available through the communication system only.

FDM121 Display

MicroLogic trip unit measurement capabilities come into full play with the FDM121 display. It connects to the COM option (BCM ULP) with a circuit breaker ULP cord and displays the MicroLogic trip unit information. The result is a true integrated unit combining a circuit breaker and a power meter. Additional operating assistance functions can also be displayed.

An FDM121 display unit can be connected to ULP communication devices using a prefabricated cord to display all measurements, alarms, histories and event tables, maintenance indicators, and management of installed devices on a screen.

The FMD121 display unit requires a 24 Vdc power supply.

The FDM121 is a display that can be integrated with the PowerPact H/J/L/P/R or MasterPact NT circuit breaker systems. It uses the sensors and processing capacity of the MicroLogic trip unit. It is easy to use and requires no special software or settings. It is immediately operational when connected to the circuit breaker by a ULP cord.

It also provides monitoring and control with the use of the I/O application module, the motor mechanism module, or the circuit breaker communication module (BCM ULP).

The FDM121 has a large display, but requires very little depth. The anti-glare graphic screen is backlit for very easy reading even under poor ambient lighting and at sharp angles.

Display of MicroLogic Trip Unit Measurements and Alarms

The FDM121 is intended to display MicroLogic trip unit measurements, alarms and operating information. It cannot be used to modify the protection settings.

Measurements can be easily accessed using a menu. All user-defined alarms are automatically displayed. The display mode depends on the priority level selected during alarm set-up:

- high priority: a pop-up window displays the time-stamped description of the alarm and the orange Alarm LED flashes;
- medium priority: the orange Alarm LED goes continuously on;
- low priority: no display on the screen.

All faults resulting in a trip automatically produce a high-priority alarm, without any special settings required. In all cases, the alarm history is updated. The MicroLogic trip unit saves the information in its non-volatile memory in the event of an FDM121 power loss.

Status Indications and Remote Control

FDM121 Display

Surface Mount Accessory

Connection with FDM121 Display Unit

When the circuit breaker is equipped with the Breaker Communications Module (BCM ULP), the FDM121 display can also be used to view circuit breaker status conditions:

- O/F: ON/OFF
- SD: trip indication
- SDE: fault-trip indication (overload, short-circuit, or ground fault).

When the circuit breaker system is equipped with the I/O application module, the FDM121 can monitor and control:

- cradle management
- circuit breaker operation
- light and load control
- custom applications.

When the circuit breaker is equipped with the COM option (BCM ULP) (including connection to shunt close [XF] and shunt trip [MX1] communication voltage releases), the FDM121 display can also be used to control (open/close) the circuit breaker.

Two operating mode are available:

- local mode: open/close commands are enabled from the FDM121 while disabled from the communication network;
- remote mode: open/close commands are disabled from the FDM121 while enabled from the communication network.

Main Characteristics

- A 3.78 x 3.78 x 1.18 in. (96 x 96 x 30 mm) screen requiring 0.39 in. (10 mm) behind the door (or 0.79 in. [20 mm] when the 24 V power supply connector is used).
- White backlighting.
- Wide viewing angle: vertical ±60°, horizontal ±30°.
- High resolution: excellent reading of graphic symbols.
- Alarm LED: flashing orange for alarm pick-up, steady orange after operator reset if the alarm condition persists.
- Operating temperature range: +14°F (-10°C) to +131°F (+55°C).
- CE / UL / CSA marking.
- 24 Vdc power supply, with tolerances 24 V -20% (19.2 V) to 24 V +10% (26.4 V).

When the FDM121 is connected to the communication network, the 24 Vdc can be supplied by the communication system wiring system. Consumption is 40 mA.

Mounting

The FDM121 is easily installed in a switchboard.

- Standard door cut-out is 3.6 x 3.6 in. (92 x 92 mm).
- Attached using clips.

To avoid a cut-out in the door, an accessory is available for surface mounting by drilling only two 0.87 in. (22 mm) diameter holes.

Connection

The FDM121 is equipped with a 24 Vdc terminal block:

- A plug-in type terminal block with two wire inputs per point for easy daisy-chaining.
- A power supply range of 24 Vdc -20% (19.2 V) to 24 Vdc +10% (26.4 V). A 24 Vdc type auxiliary power supply must be connected to a single point on the ULP system. The FDM121 display has a two-point screw connector on the rear panel of the module for this purpose. The ULP module to which the auxiliary power supply is connected distributes the supply via the ULP cable to all the ULP modules connected to the system and therefore also to MicroLogic trip unit. See wiring diagram later in this section.
- Two RJ45 jacks.

The MicroLogic trip unit connects to the internal communication terminal block on the MasterPact circuit breaker with the circuit breaker ULP cord. Connection to one of the RJ45 connectors on the FDM121 automatically establishes communication between the MicroLogic trip unit and the FDM121 and supplies power to the MicroLogic trip unit measurement functions.

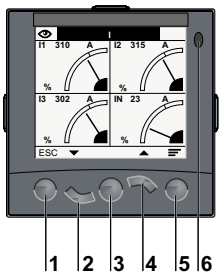
When the second connector is not used, it must be fitted with a line terminator.

Navigation

Five buttons are used for intuitive and fast navigation.

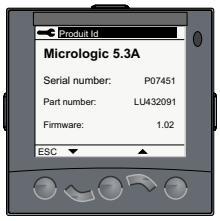
The “Context” button may be used to select the type of display (digital, bargraph, analogue).

The user can select the display language (Chinese, English, French, German, Italian, Portuguese, Spanish, etc.).



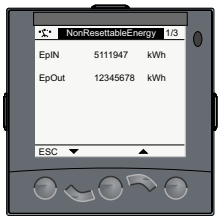
1	Escape
2	Down
3	OK
4	Up
5	Context
6	Alarm LED

Product Identification

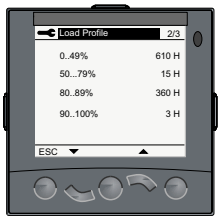


Metering: Submenu

Metering: Meter



Services



Screens

Main Menu

When powered up, the FDM121 screen automatically displays the ON/OFF status of the device.

Quick View

Metering

Control

Alarms

Services

When not in use, the screen is not backlit. Backlighting can be activated by pressing one of the buttons. Goes off after three minutes.

Fast Access to Essential Information

- “Quick view” provides access to five screens that display a summary of essential operating information (I, U-V, f, P, E, THD, circuit breaker ON/OFF).

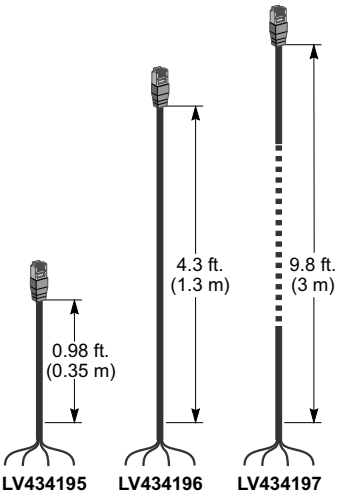
Access to Detailed Information

- “Metering” can be used to display the measurement data (I, U-V, f, P, Q, S, E, THD, PF) with the corresponding min/max values.
- “Alarms” displays active alarms and the alarm history.
- “Services” provides access to the operation counters, energy and maximum ammeter reset function, maintenance indicators, identification of modules connected to the internal bus, and FDM121 internal settings (language, contrast, etc.).

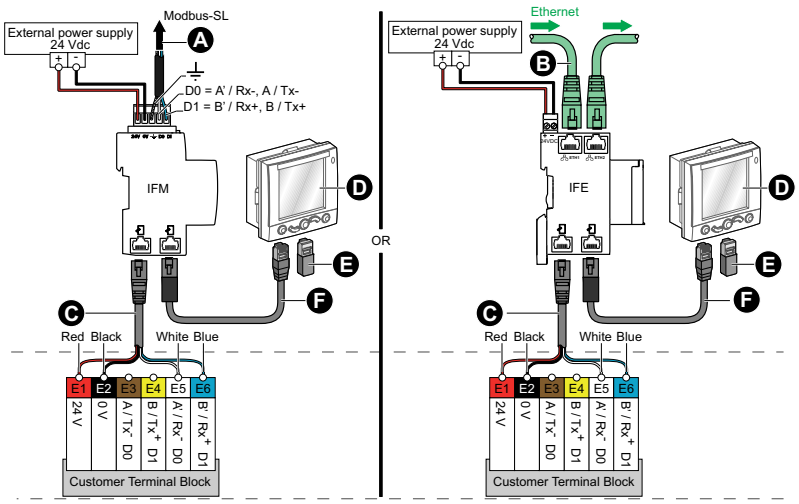
Communication Components and FDM121 Connections

The FDM121 degree of protection is IP54 in front. IP54 is maintained after switchboard mounting by using the supplied gasket during installation.

Figure 5 - FDM121 Connections



Circuit Breaker ULP Cord



Connections

MasterPact circuit breaker is connected to the ULP devices (FDM121 display, IFM, IFE or IO unit) via the circuit breaker ULP cord.

- Cord is available in three lengths: 0.98 ft. (0.35 m), 4.3 ft. (1.3 m) and 9.8 ft. (3 m).
- Lengths up to 32.9 ft. (10 m) are possible using extensions.

A	Modbus Network
B	Ethernet Network
C	Circuit Breaker ULP Cord
D	FDM Display
E	ULP Termination
F	ULP cable

FDM128 Display

The MicroLogic trip unit measurement capabilities are fully utilized with the FDM128 display. The FDM128 display connects to Ethernet communication using the RJ45 port and displays MicroLogic trip unit information. The result is an integrated unit combining a circuit breaker with a power meter. Additional operating assistance functions can also be displayed.

The FDM128 display unit can be connected to a MicroLogic COM option (BCM ULP through an IFE). It uses the sensors and processing capacity of the MicroLogic trip unit and requires no special software or settings. The FDM128 is a large display, but requires very little depth. The anti-glare graphic screen is backlit for easy reading even under poor ambient lighting and at sharp angles.

The FDM128 display is designed to manage up to eight devices (PowerPact H/J/L/P/R or MasterPact NW/NT circuit breakers).

Display of MicroLogic Trip Unit Measurement and Trips

The FDM128 is intended to display MicroLogic A/P/H trip unit measurements, trips, and operating information. It cannot be used to modify the protection settings.

- Measurements may be easily accessed using a menu.
- Trips are automatically displayed.
- A pop-up window displays the time-stamped description of the trip.

Status Indications

When the circuit breaker is equipped with the COM option (BCM ULP) (including its set of sensors) the FDM128 display can also be used to view circuit breaker status conditions:

- O/F: ON/OFF
- SDE: Fault-trip indication (overload, short-circuit, ground fault)
- PF: ready to close
- CH: charged (spring loaded)
- CE, CD, CT cradle management with I/O application module

Remote Control

When the circuit breaker is equipped with the COM option (BCM ULP) (including connection to shunt close [XF] and shunt trip [MX1] communication voltage releases), the FDM128 display can also be used to operate (open/close) the circuit breaker.

Two operating mode are available:

- Local mode: open/close commands are enabled from the FDM128 while disabled from the communication network.
- Remote mode: open/close commands are disabled from the FDM128 while enabled from the communication network.

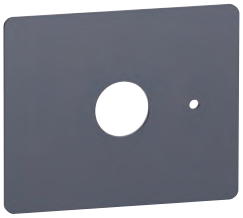
Main Characteristics

FDM128 Display

- 4.54 x 3.40 in. (115.2 x 86.4 mm) with 5.7 in. (145 mm) QVGA display 320 x 240 pixels.
- Color TFT LCD, with LED backlight.
- Wide viewing angle: vertical ±80°, horizontal ±70°.
- High resolution: excellent reading of graphic symbols.
- Operating temperature range: +14°F (-10°C) to +131°F (+55°C).
- CE / UL / CSA marking.
- 24 Vdc power supply, -10%/+20% (limit 20.4 - 28.8 Vdc).
- Consumption 6.8 W.

Mounting

Surface Mount Accessory



The FDM128 is easily installed in a switchboard.

- Standard door hole Ø 0.87 in. (22 mm).
- The FDM128 degree of protection is IP65 at the touch screen cover. IP54 is maintained after installation by using the supplied gasket.

Connection

Connection with Display Unit

The FDM128 is equipped with:

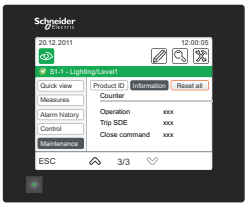
- a 24 Vdc terminal block:
  - power supply range of 24 Vdc (limit 20.4 - 28.8 Vdc).
  - The FDM128 display unit has a 2-point screw connector on the rear panel of the module for this purpose.
- One RJ45 Ethernet jacks.

The MicroLogic trip unit connects to the internal communication terminal block on the MasterPact circuit breakers through the circuit breaker ULP cord and Ethernet connection through the IFE.

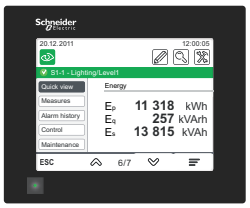
Navigation

- A touch screen is used for intuitive and fast navigation.
- The user can select the display language (Chinese, English, French, German, Italian, Portuguese, Spanish, etc.).

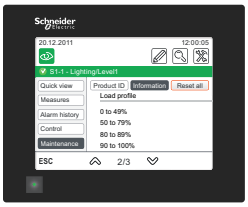
Product Identification



Metering: Meter



Services



Screens

Main Menu

Quick View

Metering

Control

Alarms

Services

When not in use, the screen is automatically shifted to low back-lighting.

Fast Access to Essential Information

- “Quick view” provides access to five screens that display a summary of essential operating information (I, U-V, f, P, E, THD, circuit breaker On / Off).

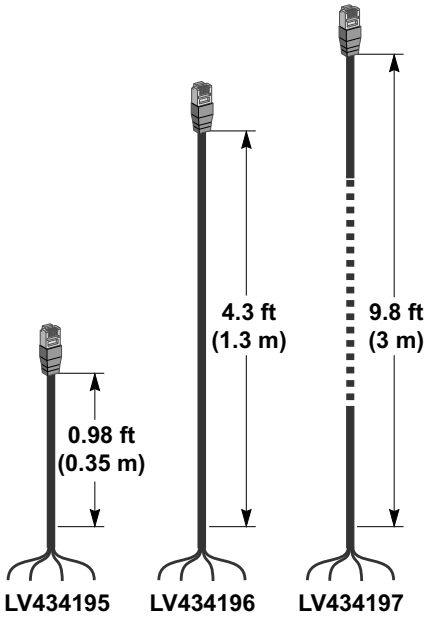
Access to Detailed Information

- "Metering" can be used to display the measurement data (I, U-V, f, P, Q, S, E, THD, PF) with the corresponding min/max values.
- “Alarms” displays the trip history.
- “Services” provides access to the operation counters, energy and maximum ammeter reset function, maintenance indicators, identification of modules connected to the internal bus and FDM128 internal settings (language, contrast, etc.).

Communication Components and FDM128 Connections

The FDM128 degree of protection is IP65 at the touch screen cover. IP54 is maintained after installation by using the supplied gasket.

Figure 6 - FDM128 Connections

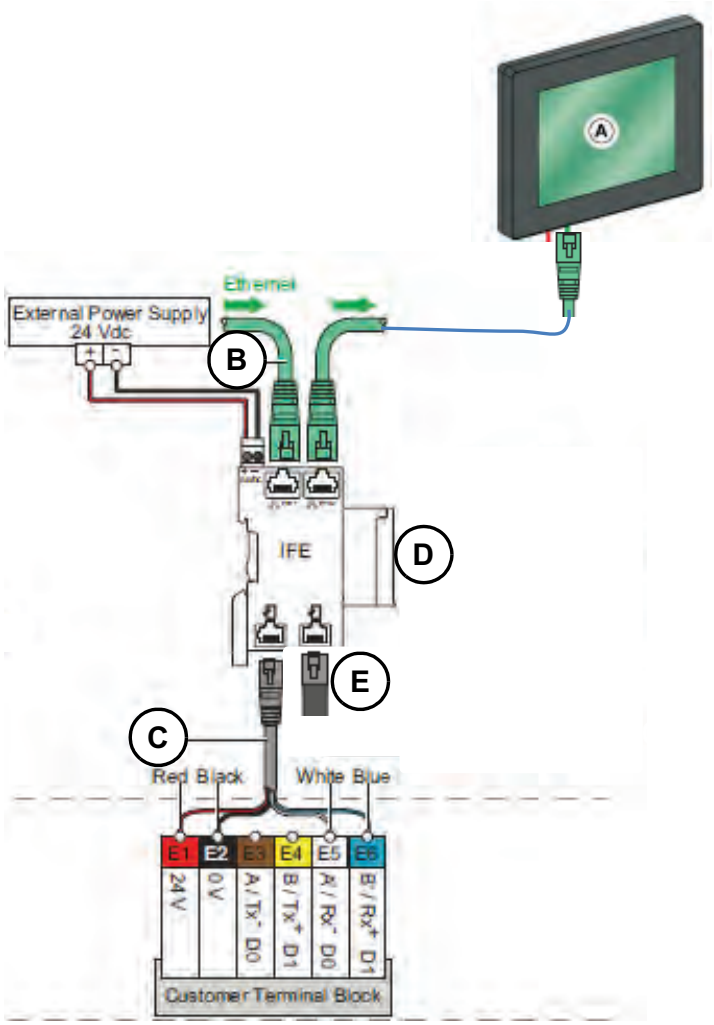


Circuit Breaker ULP Cord

Connections

MasterPact is connected to the ULP devices (FDM display, IFM, IFE or IO unit via the circuit breaker ULP cord.

- *Cord is available in three lengths:* 0.98 ft. (0.35 m), 4.3 ft. (1.3 m) and 9.8 ft. (3 m).
- Lengths up to 32.9 ft. (10 m) possible using extensions.



A	FDM128
B	Ethernet Network
C	Circuit Breaker ULP Cord
D	UFE
E	ULP Termination

Figure 7 - Panelboard and Switchboard Connections

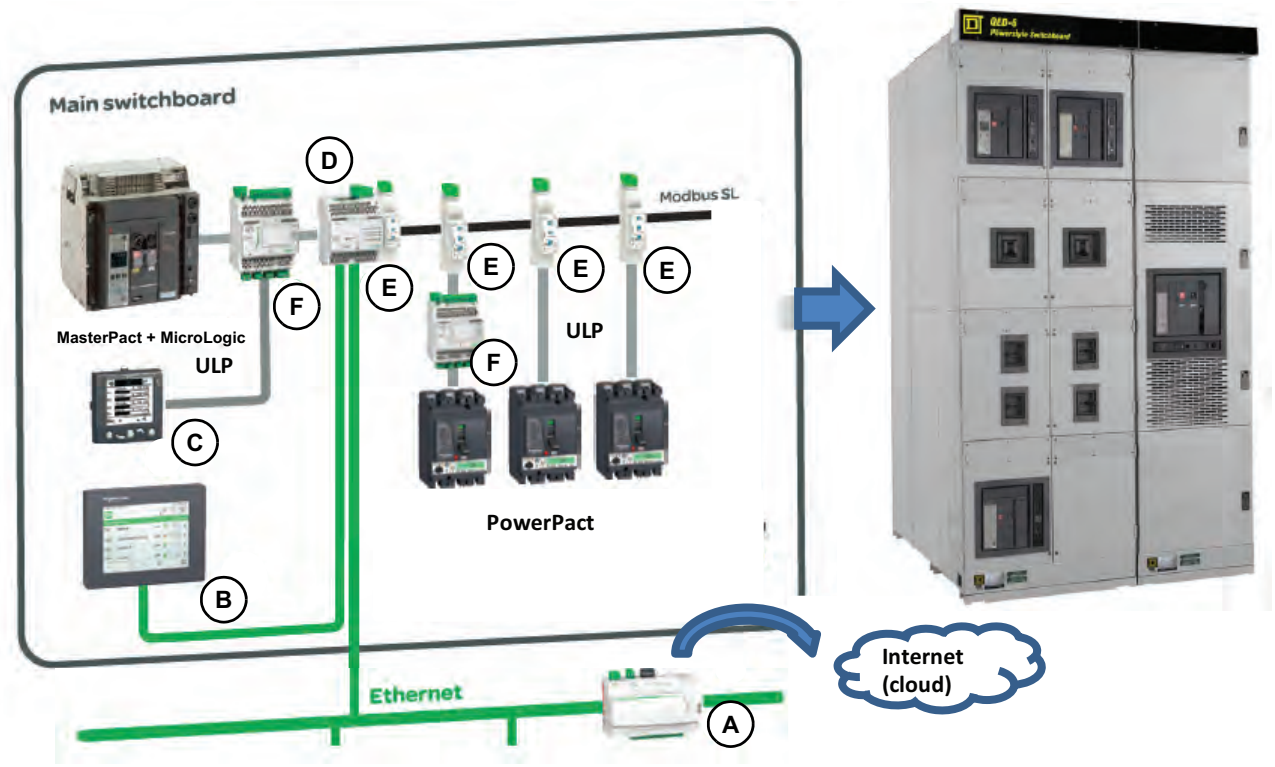


Table 11 - Smart System Communication Devices and Displays

		Name	Function	Port		Bin. Input	Analog. Input	Bin. Output
				To Device	To Server			
A		Com'X 200	Energy Server with Ethernet Gateway® Function	Modbus Master	Ethernet Cable + WiFI	6	2	—
B		FDM128	Ethernet LCD Color Touch Screen	—	Ethernet	—	—	—
C		FDM121	LCD Display for Circuit Breaker	ULP	—	—	—	—

		Name	Function	Port		Bin. Input	Analog. Input	Bin. Output
				To Device	To Server			
D		IFE Interface + Gateway	Ethernet Interface & Gateway	Modbus Master & ULP	Ethernet	—	—	—
		IFE Interface	Ethernet Interface for Circuit Breakers	ULP	Ethernet	—	—	—
E		IFM	Modbus Interface for Circuit Breakers	ULP	Modbus Slave	—	—	—
F		I/O	Input/Output Application Module for Circuit Breakers	ULP	ULP	6	1	1

MicroLogic Electronic Trip Systems

Overview of MicroLogic Trip Systems

Figure 8 - MicroLogic P Trip Unit with Power Metering

Model	(LS0)	(LSI)	(LSIG)
	Long-Time + Short-Tme + Zero delay	Long-Time + Short-Time + Instantaneous Protection	Long-Time + Short-Time + Instantaneous Protection + Equipment Ground-Fault Protection
Basic Trip Unit	2	5	—
A Trip Unit	2.0A	5.0A	6.0A
P Trip Unit	—	5.0P	6.0P
H Trip Unit	—	5.0H	6.0H

All MasterPact circuit breakers are equipped with the MicroLogic trip system to protect power circuits and loads. MicroLogic trip systems use a set of current transformers (called CTs or sensors) to sense current, a trip unit to evaluate the current, and a tripping solenoid to trip the circuit breaker. Adjustable rotary switches on the trip unit allow the user to set the proper overcurrent or equipment ground-fault current protection required in the electrical system. If current exceeds a set value for longer than its set time delay, the trip system opens the circuit breaker. Alarms may be programmed for remote indications. Measurements of current, voltage, frequency, power, and power quality optimize continuity of service and energy management. MicroLogic trip units can be changed on-site.

Integration of protection functions in the Application Specific Integrated Circuit (ASIC) electronic component used in all MicroLogic trip units guarantees a high degree of reliability and immunity to conducted or radiated disturbances. On MicroLogic P and H trip units, advanced functions are managed by an independent microprocessor.

MasterPact circuit breakers are shipped with the long-time pickup switch set at 1.0 and all other trip unit adjustments set at their lowest settings. Actual settings required for a specific application must be determined by a qualified consultant or plant engineer. A coordination study is recommended to provide coordination between all circuit breakers in the distribution system.

Thermal Imaging

The thermal imaging function protects the cables or bus bars from overheating in case of low amplitude repetitive faults. Such overheating can be due to repetitive motor starting, fluctuating load, intermittent ground faults, or subsequent closing after a fault.

Traditional electronic protection does not protect against repetitive faults because the duration of each overload above the pickup setting is too short to achieve effective tripping. Nevertheless, each overload involves a temperature rise in the installation, the cumulative effect of which could lead to overheating of the system.

The thermal imaging function remembers and integrates the thermal heating caused by each pickup setting overrun. Before tripping, the integrated heating value will reduce the associated time delay and, therefore, the reaction of the trip unit will be closer to the real heating of the power network system. After tripping, the function will also reduce the time delay when closing the circuit breaker on an overload.

Power Supply Information

Ammeter (A) Trip Unit Without 24 Vdc Power Supply at F1 and F2

- Provides fault protection for LSIG functions.
- Provides LED trip indication (powered by an onboard battery).
- All display functions and trip unit features power-up with current flow on one phase greater than or equal to the values in the following table.
- The ground-fault push-to-trip button works for testing ground fault with current flow on one phase greater than or equal to the values shown in the following table.

Sensor Plug Value (In)	Minimum Ground-Fault Pickup
100–250 A	30% of sensor rating
400–1200 A	20% of sensor rating
1600–6300 A	500 A

Ammeter (A) Trip Unit With 24 Vdc Power Supply at F1 and F2

The Ammeter (A) trip unit provides all of the above plus additional functionality when powered by external 24 Vdc power supply:

- Ammeter and bar graph displays are functional with or without current flowing through the circuit breaker.
- Trip settings and (Max) current readings can be accessed on the display by pressing navigation button with or without current flowing through the circuit breaker.
- Ground-fault push-to-trip button works for testing ground fault with or without current flowing through the circuit breaker.
- Optional Modbus™ communications—also requires a separate 24 Vdc power supply for the circuit breaker communications module.

NOTE: Ground-fault push-to-trip button will also be functional if a hand-held test kit or full-function test kit is powering the trip unit.

Power (P) and Harmonic (H) trip unit without 24 Vdc power supply at F1 and F2

The P and H trip units were designed to be used with the external 24 Vdc power supply. The large LCD display requires too much current to be powered by current flow through the circuit breaker. The P and H trip units do have a voltage power supply which will power the trip unit with 100 Vac or more between two phases or phase to neutral. The standard configuration for the voltage probes inside the circuit breaker is at the bottom connections. If the circuit breaker was open in a top fed application, there would be no voltage at the bottom of the circuit breaker and the trip unit would not be powered.

- Provides fault protection for LSIG functions.
- Provides LED trip indication (powered by an onboard battery).

NOTE: Ground-fault push-to-trip button works for testing ground fault if the trip unit is powered by the voltage power supply. The ground-fault push-to-trip is also functional if a hand-held test kit or full-function test kit is powering the trip unit.

Power (P) and Harmonic (H) Trip Unit With 24 Vdc Power Supply at F1 and F2

- Provides all of the above.
- LCD display and backlight are functional.
- Ground-fault push-to-trip button works for testing ground fault.
- All metering, monitoring, and history logs are functional.
- Communications from trip unit to M2C and M6C programmable contact modules are powered by a 24 Vdc supply at F1 and F2. M6C also requires a 24 Vdc external power supply.
- Modbus communications—also requires a separate 24 Vdc power supply for the circuit breaker communications module.

NOTE: Ground-fault push-to-trip button will also be functional if hand-held test kit or full-function test kit is powering the trip unit.

MicroLogic Trip Units—Overview

True RMS Current Sensing

The sensing system responds to the flow of current through the circuit breaker. Electronic trip circuit breakers are limited to ac systems because the electronic trip system uses current transformers to sense the current. The MicroLogic trip unit samples the current waveform to provide true RMS protection through the 15th harmonic.

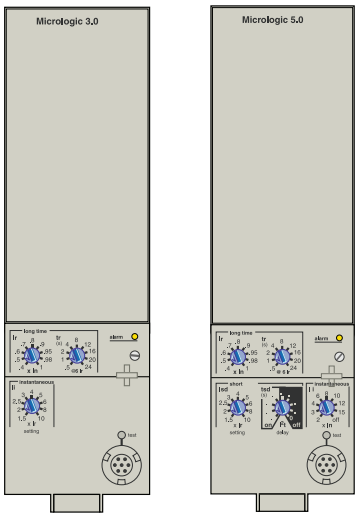
This true RMS sensing gives accurate values for the magnitude of a non-sinusoidal waveform. Therefore, the heating effects of harmonically distorted waveforms are accurately evaluated.

The MicroLogic H trip unit provides additional sampling of the waveforms to measure and provide waveform capture of harmonic distortion to the 31st harmonic.

MasterPact Universal Power Circuit Breakers use MicroLogic electronic trip systems to sense overcurrents and trip the circuit breaker. The MicroLogic basic trip unit is standard and all MasterPact circuit breakers can be equipped with the optional MicroLogic trip systems listed below:

- MicroLogic Basic Trip Unit (standard).
  - 2.0 basic protection (LS0)
  - 5.0 selective protection (LSI)
- MicroLogic A: Trip Unit with Ammeter.
  - 2.0A basic protection (LS0)
  - 5.0A selective protection (LSI)
  - 6.0A selective protection with ground-fault protection for equipment (LSIG)
- MicroLogic P: Trip Unit with Power Metering.
  - 5.0P selective protection (LSI)
  - 6.0P selective protection with ground-fault protection for equipment (LSIG)
- MicroLogic H: Trip Unit with Harmonic Metering.
  - 5.0H selective protection (LSI)
  - 6.0H selective protection with ground-fault protection for equipment (LSIG)

MicroLogic 3.0 and 5.0 Basic Trip Units



MicroLogic 3.0A, 5.0A and 6.0A Trip Units

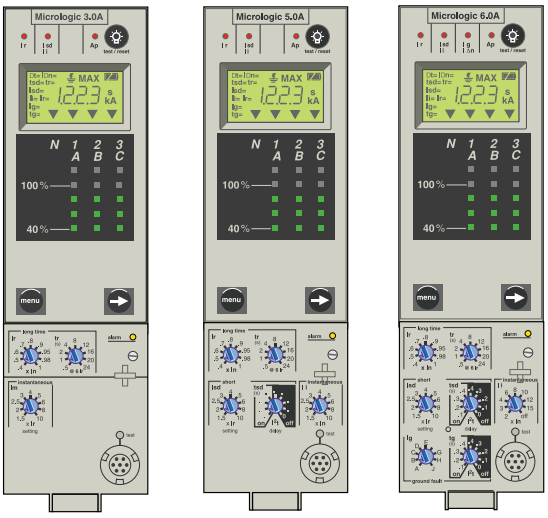
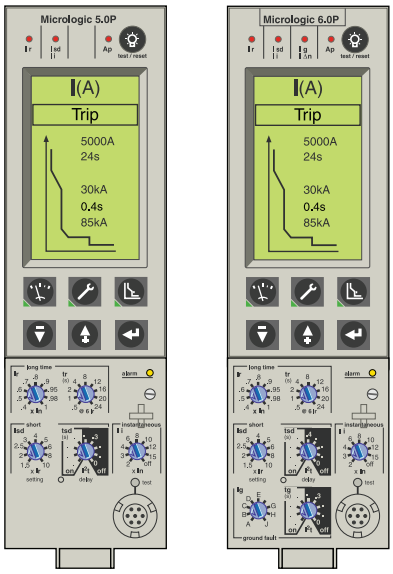


Table 12 - MicroLogic Trip Unit Features

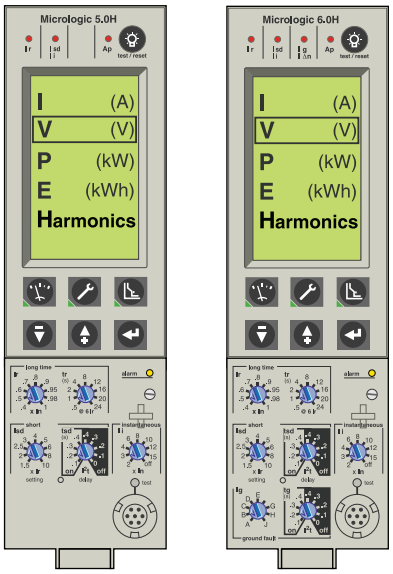
	MicroLogic Trip Unit (X = Standard Feature O = Available Option)								
	Standard		Ammeter			Power		Harmonics	
Feature	**2.0**	**5.0**	**2.0A**	**5.0A**	**6.0A**	**5.0P**	**6.0P**	**5.0H**	**6.0H**
LI									
LS0	X		X						
LSI		X		X		X		X	
LSIG/Ground-Fault Trip[10]					X		X		X
Ground-Fault Alarm/No Trip[10], [11]						X		X	
Ground-Fault Alarm and Trip[10], [11]							X		X
Adjustable Rating Plugs	X	X	X	X	X	X	X	X	X
True RMS Sensing	X	X	X	X	X	X	X	X	X
UL Listed		X		X	X	X	X	X	X
Thermal Imaging	X	X	X	X	X	X	X	X	X
Phase-Loading Bar Graph			X	X	X	X	X	X	X
LED for Long-Time Pick-Up	X	X	X	X	X	X	X	X	X
LED for Trip Indication			X	X	X	X	X	X	X
Digital Ammeter			X	X	X	X	X	X	X
Zone-Selective Interlocking[12]			X	X	X	X	X	X	X
Communications			O	O	O	X	X	X	X
LCD Dot Matrix Display						X	X	X	X
Advanced User Interface						X	X	X	X
Protective Relay Functions						X	X	X	X
Neutral Protection[10]						X	X	X	X
Contact Wear Indication						X	X	X	X
Incremental Fine Tuning of Settings						X	X	X	X
Selectable Long-Time Delay Bands						X	X	X	X
Power Measurement						X	X	X	X
Power Quality Measurements								X	X
Waveform Capture								X	X

10. Requires neutral current transformer on three-phase four-wire loads.
11. Requires the M2C/M6C Programmable Contact Module.
12. Not available for 2.0A trip unit as upstream devices.

MicroLogic 5.0P and 6.0P Trip Units



MicroLogic 5.0H and 6.0H Trip Units



MicroLogic 2.0 and 5.0 Basic Trip Units

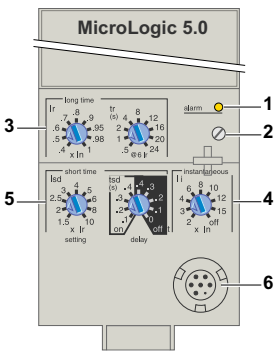
The MicroLogic 2.0 and 5.0 trip units protect power circuits.

Protection Settings

Protection thresholds and delays are set using the rotary switches.

A full-range of long-time settings are available via the field-installable adjustable rating plugs.

- Overload protection:
  - True RMS long-time protection
  - Thermal imaging: active thermal imaging before and after tripping
- Short-circuit protection:
  - Short-time RMS
  - Selection of I^2t type (ON or OFF) for short-time delay
- Instantaneous protection
- Neutral protection on four-pole circuit breakers



1	Overload signal (LED)
2	Long-time rating plug screw
3	Long-time current setting and tripping delay
4	Instantaneous pickup
5	Short-time pickup and tripping delay
6	Test connector

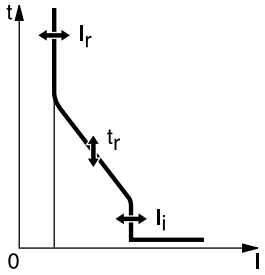


Table 13 - MicroLogic 2.0 Basic Trip Unit Settings

Long-Time Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I_r	$I_r = I_n$ x...	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
			Other ranges are available by changing rating plug								
	Maximum Time Delay (s) Accuracy: 0 to –20%	t_r at 1.5 x I_r	12.5	25	50	100	200	300	400	500	600
		t_r at 6 x I_r	0.5	1	2	4	8	12	16	20	24
		t_r at 7.2 x I_r	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	Thermal Imaging		20 minutes before or after tripping								
Short-Time Protection	Current Setting (A) Accuracy: ±10% No Delay	$I_{sd} = I_r$ x...	1.5	2	2.5	3	4	5	6	8	10

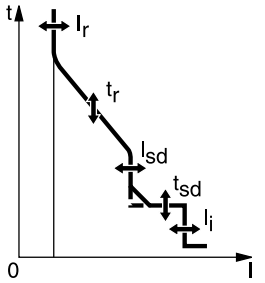


Table 14 - MicroLogic 5.0 Basic Trip Unit Settings

Long-Time Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I_r	$I_r = I_n$ x...	IEC:	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
			Other ranges are available by changing rating plug									
	Maximum Time Delay (s) Accuracy: 0 to –20%	t_r at 1.5 x I_r		12.5	25	50	100	200	300	400	500	600
		t_r at 6 x I_r		0.5	1	2	4	8	12	16	20	24
		t_r at 7.2 x I_r		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	Thermal Imaging		20 minutes before or after tripping									
Short-Time Protection	Current Setting (A) Accuracy: ±10%	$I_{sd} = I_r$ x...		1.5	2	2.5	3	4	5	6	8	10
	Time Delay (s) at 10 x I_r	Settings	I2t OFF	0	0.1	0.2	0.3	0.4	–	–	–	–
			I2t ON		0.1	0.2	0.3	0.4	–	–	–	–
		t_{sd}	Min. trip time (ms)	20	80	140	230	350	–	–	–	–
			Max. trip time (ms)	80	140	200	320	500	–	–	–	–
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	$I_i = I_n$ x...		2	3	4	6	8	10	12	15	off

MicroLogic 2.0A, 5.0A, and 6.0A Trip Units with Ammeter

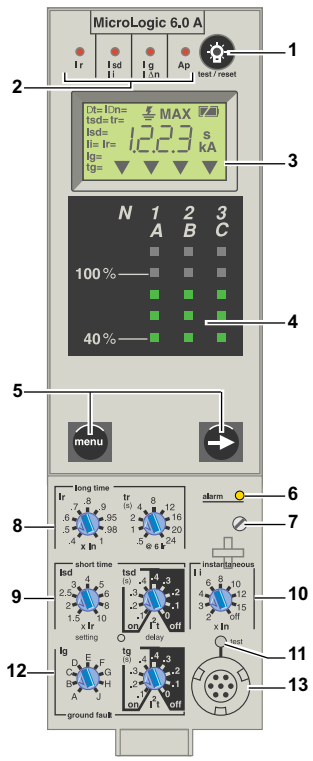
MicroLogic A trip units protect power circuits and provide current measurements, overload protection, and short-circuit protection. In addition, the 6.0A trip units also provide ground-fault protection for equipment.

Protection Settings

Protection thresholds and delays are set using the rotary switches. The selected values are momentarily displayed in amperes and in seconds. A full-range of long-time settings are available via the field-installable rating plug.

- Overload protection (true RMS long-time protection)
- Thermal imaging (active thermal imaging before and after tripping)
- Short-circuit protection
  - Short-time RMS
  - I^2t ON or OFF for short-time delay
- Instantaneous protection
- Ground-fault protection for equipment
  - Residual ground-fault protection for equipment
  - Source ground-return ground-fault protection for equipment
  - Modified differential ground-fault protection (MDGF) for equipment
- Neutral protection on four-pole circuit breakers
- ZSI: Zone-selective interlocking
  - A ZSI terminal block may be used to interconnect a number of trip units to provide total discrimination for short-time and equipment ground-fault protection, without delay for tripping)
  - Not available for 2.0 A trip unit if installed as upstream device.

MicroLogic 6.0A Trip Unit



1	Test lamp and reset
2	Indication of tripping cause
3	Digital display
4	Three-phase bar graph and ammeter
5	Navigation buttons
6	Overload signal (LED)
7	Long-time rating plug screw
8	Long-time current setting and tripping delay
9	Short-time pickup and tripping delay
10	Instantaneous pickup
11	Electronic push-to-trip
12	Ground-fault pickup and tripping delay
13	Test connector

Ammeter Measurements

MicroLogic A trip units measure the true RMS value of currents. They provide continuous current measurement from 0.2 to 20 x I_n with an accuracy of 1.5% (including sensors). No auxiliary source is needed where I > 0.2 x I_n. The optional external power supply (24 Vdc) makes it possible to display currents where I < 0.2 x I_n and to store values of the interrupted current. A digital LCD screen continuously displays the most heavily loaded phase (Imax) or displays the Ia, Ib, Ic, Ig, and (on 4-pole circuit breakers only) In stored current and setting values by successively pressing the navigation button.

Communication Network

Four wire Modbus, RTU, RS485 or two-wire Modbus, TRU, RS485 plus ULP. See *4P Fixed Circuit Breakers, page 122*.

In conjunction with an optional communication network, the trip unit transmits the following parameters:

- Setting values
- All ammeter measurements
- Tripping causes

NOTE: Current-based protection functions require no auxiliary power source. When an external power supply is added, the value of the interrupted current is stored by the trip unit. The reset button resets alarms and stored interrupted current indications.

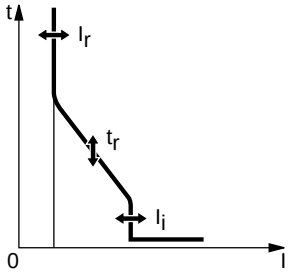


Table 15 - MicroLogic 2.0A Trip Unit Settings

Long-Time Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I_r	$I_r = I_n$ x...	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
			Other ranges are available by changing rating plug								
	Maximum Time Delay (s) Accuracy: 0 to –20%	t_r at 1.5 x I_r	12.5	25	50	100	200	300	400	500	600
		t_r at 6 x I_r	0.5	1	2	4	8	12	16	20	24
		t_r at 7.2 x I_r	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	Thermal Imaging		20 minutes before or after tripping								
Short-Time Protection	Current Setting (A) Accuracy: ±10% No delay	$I_{sd} = I_r$ x...	1.5	2	2.5	3	4	5	6	8	10

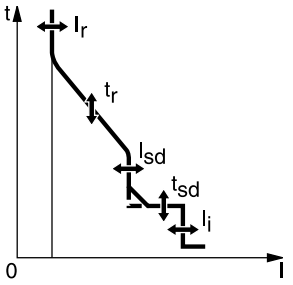


Table 16 - MicroLogic 5.0A and 6.0A Trip Unit Settings

Long-Time Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I_r	$I_r = I_n$ x...	IEC:	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
			Other ranges are available by changing rating plug									
	Maximum Time Delay (s) Accuracy: 0 to –20%	t_r at 1.5 x I_r		12.5	25	50	100	200	300	400	500	600
		t_r at 6 x I_r		0.5	1	2	4	8	12	16	20	24
		t_r at 7.2 x I_r		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	Thermal Imaging		20 minutes before or after tripping									
Short-Time Protection	Current Setting (A) Accuracy: ±10%	$I_{sd} = I_r$ x...		1.5	2	2.5	3	4	5	6	8	10
	Maximum Time Delay (s) at 10 x Ir	Settings	I2t OFF	0	0.1	0.2	0.3	0.4	–	–	–	–
			I2t ON		0.1	0.2	0.3	0.4	–	–	–	–
		t_{sd}	Min. trip time (ms)	20	80	140	230	350	–	–	–	–
			Max. trip time (ms)	80	140	200	320	500	–	–	–	–
Instantane-ous Protection	Current setting (A) Accuracy: ±10%	$I_i = I_n$ x...		2	3	4	6	8	10	12	15	off

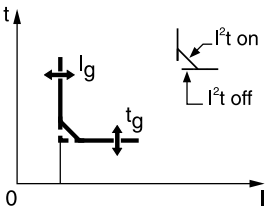


Table 17 - MicroLogic 6.0A Trip Unit Ground-Fault Settings

Ground-Fault Pickup (A) Accuracy: ±10%		$I_g = I_n$ x...	A	B	C	D	E	F	G	H	J
		$I_n \leq 400$ A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		400 A < $I_n \leq$ 1200 A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		In > 1200 A	500	640	720	800	880	960	1040	1120	1200
Maximum Time Delay (s) at 1 x I_n	Settings	I^2t OFF	0	0.1	0.2	0.3	0.4	–	–	–	–
		I^2t ON		0.1	0.2	0.3	0.4	–	–	–	–
	t_g	Minimum Trip Time (ms)	20	80	140	230	350	–	–	–	–
		Maximum Trip Time (ms)	80	140	200	320	500	–	–	–	–

MicroLogic 5.0P and 6.0P Trip Units with Power Metering

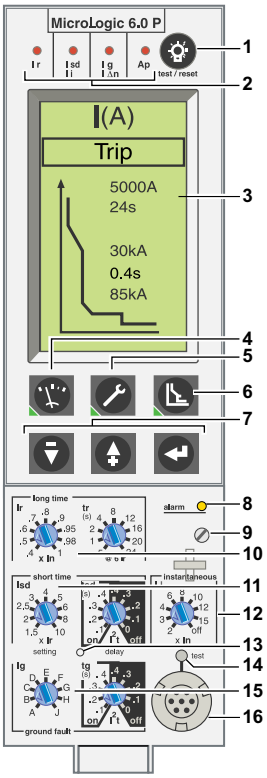
Protection Settings

The adjustable protection functions of the 5.0P and 6.0P trip units are identical to those of MicroLogic A trip unit (overloads, short circuits, equipment ground-fault protection); see *MicroLogic 2.0A, 5.0A, and 6.0A Trip Units with Ammeter, page 46*.

These units also feature:

- **Fine adjustment**: Within the range below the rotary switch setting, fine adjustments of pickups/delays in steps of 1 A/s (except for short-time and ground-fault) are possible on the keypad or remotely by the communication network.
- **Inverse definite minimum time lag (IDMTL) setting**: Coordination with fuse-type or medium-voltage protection systems is optimized by adjusting the long-time delay curve around 6 x I_r axis. This setting ensures better coordination with certain loads.
- **Neutral protection**: On three-pole circuit breakers, neutral protection may be set using the keypad or remotely using the communication network to one of four positions:
  - OFF
  - 1/2N (1/2 x I_n)
  - 1N (1 x I_n)
  - 2N (2 x I_n)

MicroLogic 6.0P Trip Unit



1	Test lamp and indication reset
2	Indication of tripping cause
3	High resolution screen
4	Measurement display
5	Maintenance indicators
6	Protection settings
7	Navigation buttons
8	Overload signal (LED)
9	Long-time rating plug screw
10	Long-time current setting and tripping delay
11	Short-time pickup and tripping delay
12	Instantaneous pickup
13	Hole for settings lockout pin
14	Electronic push-to-trip
15	Ground-fault pickup and tripping delay
16	Test connector

NOTE: The neutral protection is disabled if the long-time curve is set to one of the IDMTL protection settings.

Configuring Alarms and Other Protection Functions

When the cover is closed, the keypad may no longer be used to change the protection settings, but it still provides access to the displays for measurements, histories, indicators, etc. Depending on the thresholds and time delays set, the MicroLogic P trip unit monitors current, voltage, power, frequency, and phase sequence. Each threshold overrun may be via the communication network.

Each threshold overrun may be combined with tripping (protection) or an indication carried out by an optional M2C/M6C programmable contact (alarm), or both (protection and alarm).

Maintenance Record

The maintenance record can be consulted using the full-function test kit or remotely via the communication network. It can be used as an aid in troubleshooting and to assist scheduling for device maintenance operations.

Recorded indications include:

- Highest current measured
- Operation counter (both cumulative total and total since last reset)
- Number of test kit connections
- Number of trips in operating mode
- Contact wear (MasterPact NW circuit breakers only)

Load Shedding and Reconnection Parameters

Load shedding and reconnection parameters can be set according to the power or the current flowing through the circuit breaker. Load shedding is carried out by a remote computer via the communication network or by an M2C or M6C programmable contact.

Indication Option via Programmable Contacts

The M2C (two contacts) and M6C (six contacts) programmable contacts may be used to signal threshold overruns or status changes. They can be programmed using the keypad on the MicroLogic P and H trip units or remotely using the communication network. These contacts are required to obtain data from the protective relay functions on Type P and Type H trip units.

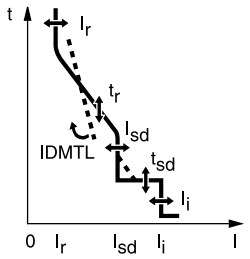


Table 18 - MicroLogic 5.0P and 6.0P Trip Unit Settings

Long-Time (RMS) Protection	Current Setting (A) Tripping Between 1.05 and 1.20 x I^r	$I^r = I_n$ x...	IEC:	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.98	1.00
			Other ranges are available by changing rating plug									
	Maximum Time Delay (s) Accuracy: 0 to –20%	t_r at 1.5 x I_r		12.5	25	50	100	200	300	400	500	600
		t_r at 6 x I_r	–	0.5	1	2	4	8	12	16	20	24
		t_r at 7.2 x I_r	–	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6
	IDMTL Setting	Curve slope	–	SIT		VIT		EIT		HV Fuse		DT
	Thermal Imaging		20 minutes before or after tripping									
Short-Time (RMS) Protection	Current Setting (A) Accuracy: ±10%	$I_{sd} = I_r$ x...	–	1.5	2	2.5	3	4	5	6	8	10
	Maximum Time Delay (s) at 10 x I_r	Settings	I2t OFF	0	0.1	0.2	0.3	0.4	–	–	–	–
			I2t ON		0.1	0.2	0.3	0.4	–	–	–	–
		t_{sd}	Min. trip time (ms)	20	80	140	230	350	–	–	–	–
			Max. trip time (ms)	80	140	200	320	500	–	–	–	–
Instantaneous Protection	Current Setting (A) Accuracy: ±10%	$I_i = I_n$ x...	–	2	3	4	6	8	10	12	15	off

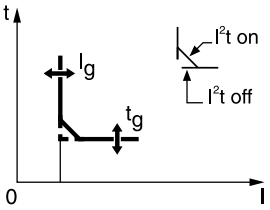


Table 19 - MicroLogic 6.0P Trip Unit Ground-Fault Setting

		$I_g = I_n$ x...	A	B	C	D	E	F	G	H	J
Ground-Fault Pickup (A) Accuracy: ±10%		$I_n \leq 400$ A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		400 A < $I_n \leq$ 1200 A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		I_n > 1200 A	500	640	720	800	880	960	1040	1120	1200
Maximum Time Delay (s) at 10 x I_r	Settings	I^2t OFF	0	0.1	0.2	0.3	0.4	–	–	–	–
		I^2t ON		0.1	0.2	0.3	0.4	–	–	–	–
	t_g	Minimum trip time (ms)	20	80	140	230	350	–	–	–	–
		Maximum trip time (ms)	80	140	200	320	500	–	–	–	–

Table 20 - Settings for Alarms for Other Protection Functions for MicroLogic 5.0P and 6.0P Trip Units

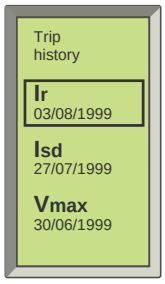
			Threshold	Time Delay
Current	Current Imbalance		0.05 to 0.6 x I_{max}	1 to 40 s
	Maximum Current	I_{max}: I_a, I_b, I_c, I_n, I_g	0.2 to 1.0 x I_n	15 to 1500 s
Voltage	Voltage Imbalance		0.02 to 0.3 x V_n	1 to 40 s
	Minimum Voltage	V_{min}	100 to 725 V (phase total)	0.25 to 0.5 s
	Maximum Voltage	V_{max}	100 to 1200 V (between phases)	0.20 to 5.0 s
Power	Maximum Power	P_{max}	5 to 500 kW	0.2 to 20 s
	Reverse Power	P_r	0.02 to 0.2 x P_n	0.5 to 20 s
Frequency	Minimum Frequency	F_{min}	45 to 65 Hz	0.2 to 5 s
	Maximum Frequency	F_{max}	45 to 540 Hz	0.2 to 5 s
Phase	Sequence	ΔØ	ØA-ØB-ØC or ØA-ØC-ØB	Instantaneous

Table 21 - Load-Shedding Settings for Current and Power Metering for MicroLogic 5.0P and 6.0P Trip Units

		Pick-Up		Drop-Out	
		Threshold	Time Delay	Threshold	Time Delay
Current	I	0.5 to 1.0 x I_r per phase	20% to 80% x t_r	0.3 to 1.0 x I_r per phase	10 to 600 s
Power	P	200 kW to 10 MW	10 to 3600 s	100 kW to 10 MW	10 to 3600 s

Trip and Alarm Histories

The last ten trips and ten alarms are recorded in two separate history files that can be displayed on the screen (sample displays are shown to the right). The following information is contained in these files:

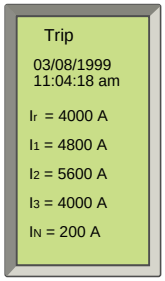


Trip History

- Type of fault
- Date and time of fault
- Interrupted current
- Contact wear

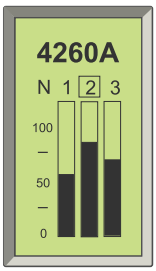
Alarm History

- Type of alarm
- Date and time of the alarm
- Values measured at the time of the alarm

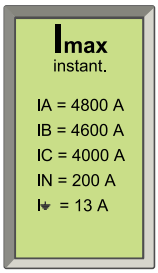


Metering

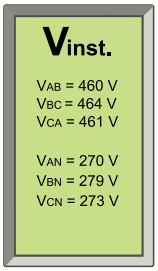
Current Metering



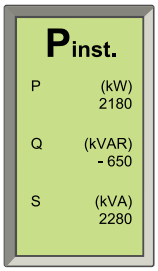
Maximum Current



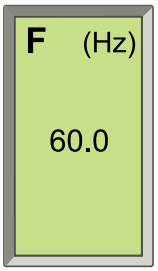
Voltage Metering



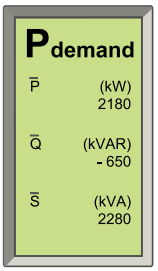
Power Metering



Frequency



Power Demand



The MicroLogic P trip unit calculates in real time all electrical values V, A, W, VAR, VA, Wh, VARh, VAh, Hz, power factor, and crest factor. The MicroLogic P trip unit also calculates demand current and demand power over an adjustable time period.

Real-Time Metering: The value displayed on the screen is refreshed every second. Minimum and maximum measurement values are stored in memory.

Type of Measurement		Unit of Measurement	Measurement Source
Current	I_{RMS}	A	ØA, ØB, ØC or N
	$I_{AVERAGE}$	A	(ØA + ØB + ØC)/3
	$I_{PEAK/\sqrt{2}}$	A	ØA, ØB, ØC or N
Voltage	V_{RMS}	V	(ØA–ØB), (ØB–ØC) and (ØC–ØA)
	V_{RMS}	V	(ØA–N), (ØB–N) and (ØC–N)
	$V_{IMBALANCE}$	%	V_{RMS}
Power	P, Q and S	W, VAR, VA	Total
	EP, EQ and ES	Wh, VARh, VAh	Total
	Power factor		Total
Frequency	F	Hz	50/60

Demand Metering: The demand is calculated over a fixed or sliding time window that can be programmed from five to sixty minutes. Depending on the contract signed with the power supplier, specific programming makes it possible to avoid or minimize the cost of overrunning the subscribed power. Maximum demand values are systematically stored and time stamped.

Type of Measurement		Unit of Measurement	Measurement Source
Current	I_{DEMAND}	A	ØA, ØB, ØC or N
Power	P, Q and S_{DEMAND}	W, VAR, VA	Total

Communication Network

Four wire Modbus, RTU, RS485—The communication network may be used to:

- Remotely read parameters for the protection functions.
- Transmit all the measurements and calculated values.
- Signal the causes of tripping and alarms.
- Consult the history files and the maintenance indicator record.

In addition, an event log of the last 100 events and a maintenance record, which is stored in the trip unit memory but not available locally, may be accessed via the communication network.

The Modbus communication system is compatible with Powerlogic System Manager™ (SMS) software.

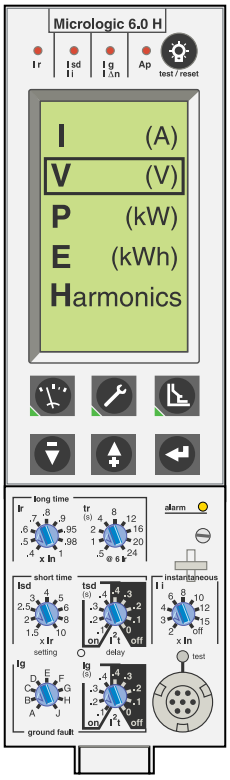
Event Log

The event log may be accessed by a remote computer via the communication network. All events are time stamped and include:

- Trips
- Beginning and end of alarms
- Modifications to settings and parameters
- Loss of time
- Overrun of wear indicators
- Test kit connections.
- Counter resets
- System faults (thermal self-protection, major fault and minor fault alarms)

MicroLogic 5.0H and 6.0H Trip Units with Harmonic Metering

MicroLogic 6.0H Trip Unit



In addition to the P functions, the MicroLogic H trip units offer:

- In-depth analysis of power quality including calculation of harmonics and the fundamentals.
- Diagnostics aid and event analysis through waveform capture.
- Customized alarm programming to analyze and track down a disturbance on the ac power system.
- Systematic time stamping of all events and creation of logs.

Metering

The MicroLogic H trip unit offers all the measurements carried out by the MicroLogic P trip unit, with the addition of phase-by-phase measurements of power and energy as well as calculation of:

- Current and voltage total harmonic distortion (THD, thd).
- Current, voltage and power fundamentals (50/60 Hz).
- Harmonic components (amplitude and phase) up to the 31st current and voltage harmonic.

Real-time metering: The value displayed on the screen is refreshed every second. The table below shows what is measured in real-time metering.

Type of Measurement		Unit of Measurement	Measurement Source
Current	I_{RMS}	A	ØA, ØB, ØC or N
	$I_{AVERAGE}$	A	(ØA + ØB + ØC) / 3
	$I_{PEAK/÷2}$	A	ØA, ØB, ØC or N
	$I_{IMBALANCE}$	%	ØA, ØB, ØC or N
Voltage	V_{RMS}	V	(ØA–ØB), (ØB–ØC) and (ØC–ØA)
	V_{RMS}	V	(ØA–N), (ØB–N) and (ØC–N)
	$V_{IMBALANCE}$	%	VRMS
Power	P, Q and S	W, VAR, VA	Total
	EP, EQ and ES	Wh, VARh, VAh	Total
	Power factor	–	Total
Frequency	F	Hz	ØA, ØB, or ØC
Power Quality Indicators	Fundamentals	50/60 Hz component	V, I, P, Q, and S
	THD	%	V/I
	V and I harmonics	Amplitude to phase	1, 2, 3, 4...50

Demand Metering: Similar to the MicroLogic P trip unit, demand values are calculated over a fixed or sliding time window that can be set from five to 60 minutes.

Type of Measurement		Unit of Measurement	Measurement Source
Current	I_{DEMAND}	A	ØA, ØB, ØC or N
Power	P, Q and S_{DEMAND}	W, VAR, VA	Total

Waveform Capture

MicroLogic H trip units can capture and store current and voltage waveforms using digital sampling techniques similar to those used in oscilloscopes. Using the information available in the captured waveform, it is possible to determine the level of harmonics as well as the direction and amplitude of the flow of harmonic power.

Users of MicroLogic H trip units can record manually via the keypad the following waveforms:

- The four currents: I_a, I_b, I_c, and I_N
- The three phase-to-phase voltages: V_{ab}, V_{bc}, and V_{ca}

Waveforms may be displayed on the graphic screen of MicroLogic H trip units or communicated over a networked system. The recording takes place over one cycle with a measurement range of 0 to 1.5 I_N for current and 0 to 690 volts for voltage. The resolution is sixty-four points per cycle.

Customizing Alarm Programming

The instantaneous value of each measurement can be compared to user-set high and low thresholds. Overrun of a threshold generates an alarm. Programmable action can be linked to each alarm, including circuit breaker opening, activation of an M2C or M6C contact, recording of measurements in a log, etc.

Event Logs

Each event is recorded with:

- The date, time, and name of the event.
- The event characteristics.

Additional Technical Characteristics for Type P and Type H Trip Units

- Setting the display language: System messages can be displayed in six different languages:
  - English - US
  - English - UK
  - French
  - German
  - Spanish
  - Italian

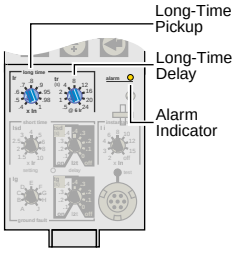
The desired language is selected via the keypad.

- Protection functions: All current-based protection functions require no auxiliary source. Voltage-based protection functions are connected to ac power via a voltage measurement input built into the circuit breaker on the bottom side. (Optional external voltage measurement is available.)
- Accuracy of measurements (including sensors):
  - Voltage (V) 1%
  - Current (A) 1.5% (higher accuracy [1%] may be achieved with special calibration on the current transformer [CT characterization option])
  - Frequency (Hz) 0.1 Hz
  - Power (W) and energy (Wh) 2.5%
  - The MicroLogic H trip unit uses a dedicated metering data chain separate from the protection data chain so that a greater number of data samples can be used for metering. This increases the number of samples taken per time period, which in turn gives the H trip unit a higher degree of metering accuracy.
- Stored information: The fine setting adjustments, the last 100 events and the maintenance record remain in the trip unit memory even when power is lost.
- Reset: An individual reset, via the keypad or remotely, will reset alarms, minimum and maximum data, peak values, counters and the indicators.

MicroLogic Trip Unit Functions

Long-Time Trip Functions

Long-Time Trip Functions



The *long-time pickup* switch sets the maximum current level the circuit breaker will carry continuously. The maximum current level (I_r) is the long-time pickup setting multiplied by the sensor plug amperage (I_n). If the current exceeds this value for longer than the long-time delay time, the circuit

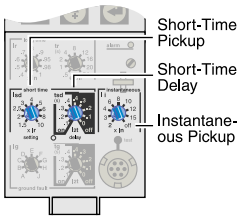
breaker will trip.

The *long-time delay* switch sets the length of time that the circuit breaker will carry a sustained overload before tripping. Delay bands are labeled in seconds of overcurrent at six times the ampere rating. For maximum coordination, there are eight delay bands. Long-time delay is an “inverse time” characteristic in that the delay time decreases as the current increases.

The trip unit includes an *alarm indicator* that will be lit continuously when the current is above 100% of the pickup setting.

Short-Time Trip Functions

Short-Time and Instantaneous Trip Functions



The *short-time pickup* switch sets the short-circuit current level at which the circuit breaker will trip after the set short-time delay. The short-time current (I_{sd}) equals the short-time pickup setting multiplied by the long-time pickup (I_r).

The *short-time delay* switch sets the length of time the circuit breaker will carry a short circuit within the short-time pickup range. The delay (based on 10 times the ampere rating I_r) can be adjusted to four positions of I^2t ramp operation (I^2t ON) or five positions of fixed time delays (I^2t OFF). I^2t ON delay is an “inverse time” characteristic in that the delay time decreases as the current increases. Short-time delay for the 2.0 trip unit is fixed at a delay band of 20 to 80 ms.

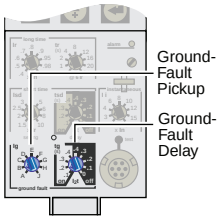
Instantaneous Trip Function

The *instantaneous pickup* switch sets the short-circuit current level at which the circuit breaker will trip with no intentional time delay. The instantaneous current (I_i) is equal to the instantaneous pickup setting multiplied by the sensor plug amperage (I_n).

The instantaneous function will override the short-time function if the instantaneous pickup is adjusted at the same or lower setting than the short-time pickup. In trip units with both adjustable short-time and instantaneous trip functions, the adjustable instantaneous trip can be disabled by setting Instantaneous pickup to OFF.

Ground-Fault Trip Functions

Ground-Fault Trip Functions



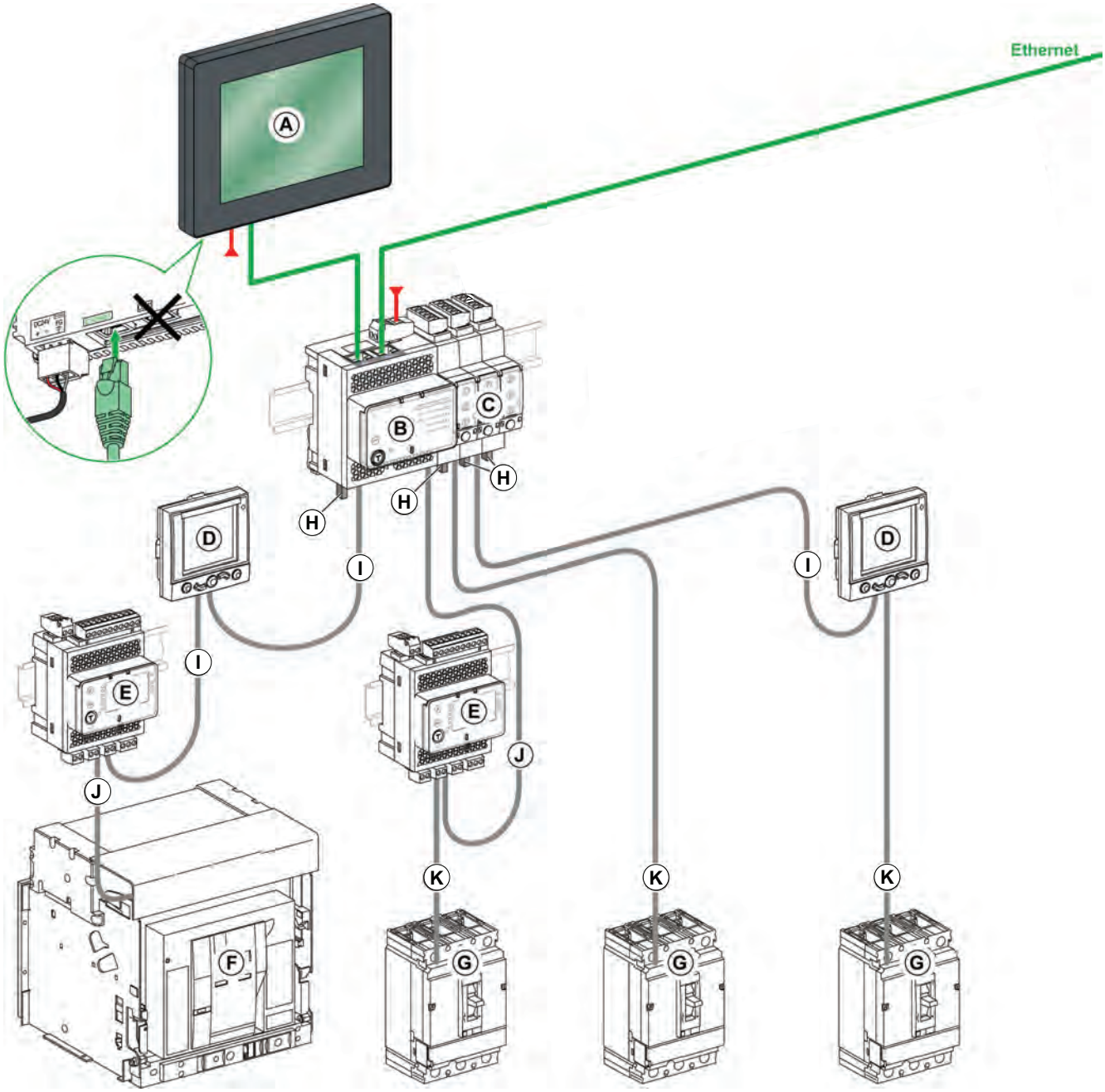
The *ground-fault pickup* switch sets the current level at which the circuit breaker will trip after the set ground-fault delay. Ground-fault pickup values (I_g) are based on circuit breaker sensor plug (I_n) only, not on the rating plug multiplier (I_r). Changing the rating plug multiplier has no effect on ground-fault pickup values.

The *ground-fault delay* switch sets the length of time the circuit breaker will carry ground-fault current which exceeds the ground-fault pickup level before tripping. The delay (based on the sensor plug amperage (I_n) can be adjusted to four positions of I^2t ramp operation (I^2t ON) or five positions of fixed time delays (I^2t OFF). I^2t ON delay is an “inverse time” characteristic in that the delay time decreases as the current increases.

Smart System Communication Wiring System

Wiring System ULP

The wiring system is designed for low-voltage power switchboards. Installation does not require special tools or training. The prefabricated wiring ensures both data transmission (Modbus protocol) and 24 Vdc power distribution for the communications modules on the MicroLogic trip units.



A	FDM128 display for 8 LV devices
B	IFE Ethernet interface for LV circuit breaker and gateway
C	IFM Modbus-SL interface for LV circuit breaker
D	FDM121 display for LV circuit breaker
E	IO input/output interface module for LV circuit breaker
F	MasterPact NT/NW circuit breaker

G	PowerPact H-, J-, or L-frame circuit breaker
H	ULP line terminator
I	ULP cable
J	Circuit breaker ULP cord
K	NSX cord

Four Functional Levels

The MasterPact can be integrated into Ethernet and Modbus communication environment.

There are four possible functional levels that can be combined.

A: MicroLogic trip unit with ammeter

P: MicroLogic trip unit “Power”

H: MicroLogic trip unit “Harmonics”

NOTE: See *MicroLogic Trip Units—Overview, page 42* for details about the trip units.

Functional Level	Switch	Circuit Breaker		
Status Indications				
ON/OFF (O/F) \	X	A	P	H
Spring charged	X	A	P	H
Ready to close	X	A	P	H
Fault-trip SDE	X	A	P	H
Connected / disconnected / test position CE/CD/ CT (CCM only)	—	A	P	H
Controls				
MX1 shunt trip	X	A	P	H
XF shunt close	X	A	P	H
Measurements				
Instantaneous measurement information	—	A	P	H
Averaged measurement information	—	—		H
Maximum / minimum Ammeter	—	A	P	H
Energy metering	—	—	P	H
Demand for current and power	—	—	P	H
Power quality	—	—	—	H
Operating Assistance				
Protection and alarm settings	—	—	P	H
Histories	—	—	P	H
Time stamped event tables	—	—	P	H
Maintenance indicators	—	A	P	H

Modbus Principle

The Modbus RS 485 (RTU protocol) system is an open bus on which communicating Modbus devices (MasterPact NW with Modbus COM, Power Meter PM700, PM800, PowerPact P/Rframe, etc.) are installed. All types of PLCs and microcomputers may be connected to the bus.

Addresses

The Modbus communication parameters (address, baud rate, parity) are entered using the keypad on the MicroLogic A, P, or H trip unit. For a switch, it is necessary to use the Electrical Asset Manager or RSU (Remote Setting Utility) MicroLogic utility.

Number of Devices

The maximum number of devices that may be connected to the Modbus bus depends on the type of device (Compact circuit breaker with Modbus COM, PM700, PM800, MasterPact circuit breaker, etc.), the baud rate (19200 is recommended), the volume of data exchanged and the desired response time. The RS 485 physical layer offers up to thirty-two connection points on the bus (one master, thirty-one slaves).

Length of Bus

The maximum recommended length for the Modbus bus is 3940 feet (1200 meters).

Bus Power Source

A 24 Vdc power supply is required (less than 20% ripple, insulation class II).

Ethernet Principle

Ethernet is a data link and physical layer protocol defined by IEEE 802 10 and 100 Mbps specifications that connects computer or other Ethernet devices. Ethernet is an asynchronous Carrier Sense Multiple Access with Collision detection (referred as CSMA/CD) protocol. Carrier Sense means that the hosts can detect whether the medium (coaxial cable) is idle or busy.

Multiple Access means that multiple hosts can be connected to the common medium. Collision Detection means a host detects whether its transmission has collided with the transmission of another host (or hosts).

IFE Ethernet interface can be connected to a PC or a laptop over Ethernet. The maximum length of Ethernet cable is 325 feet (100 meters). IFE Ethernet interface + gateway provides a Modbus TCP/IP gateway over Ethernet to enable Modbus TCP communication from a Modbus TCP master to any Modbus slave devices connected to it. The maximum active Modbus TCP client connection is twelve.

IFE Ethernet interface has an embedded web server (web page).

COM Option in MasterPact Circuit Breakers

All MasterPact devices can be fitted with the communication function thanks to the COM option. MasterPact uses the Ethernet or Modbus communications protocol for full compatibility with the supervision management systems.

For fixed and drawout devices, the common communication option is made up of:

BCM ULP Module

- A BCM ULP module, installed behind the MicroLogic trip unit and supplied with a set of switches (OF, SDE, PF and CH switches), a kit for connection to shunt close (XF) and shunt trip (MX1) communicating voltage releases, and a COM terminal block (inputs E1 to E6). This module is independent of the trip unit and receives and transmits information on the communication network. An infra-red link transmits data between the trip unit and the communication module. Consumption: 30 mA, 24 V.

and

- The IFM module, the Modbus interface for connection to the network, contains the Modbus address (1 to 99) declared by the user using the two dials in front. It automatically adapts (baud rate, parity) to the Modbus network in which it is installed.

or

- The IFE module, the Ethernet interface for low-voltage circuit breakers, enables an intelligent modular unit (IMU) such as a MasterPact NT/NW or PowerPact circuit breaker to be connected to an Ethernet network. Each circuit breaker has its own IFE and a corresponding IP address.

For drawout devices the Cradle Management option must be added:

I/O Application Module

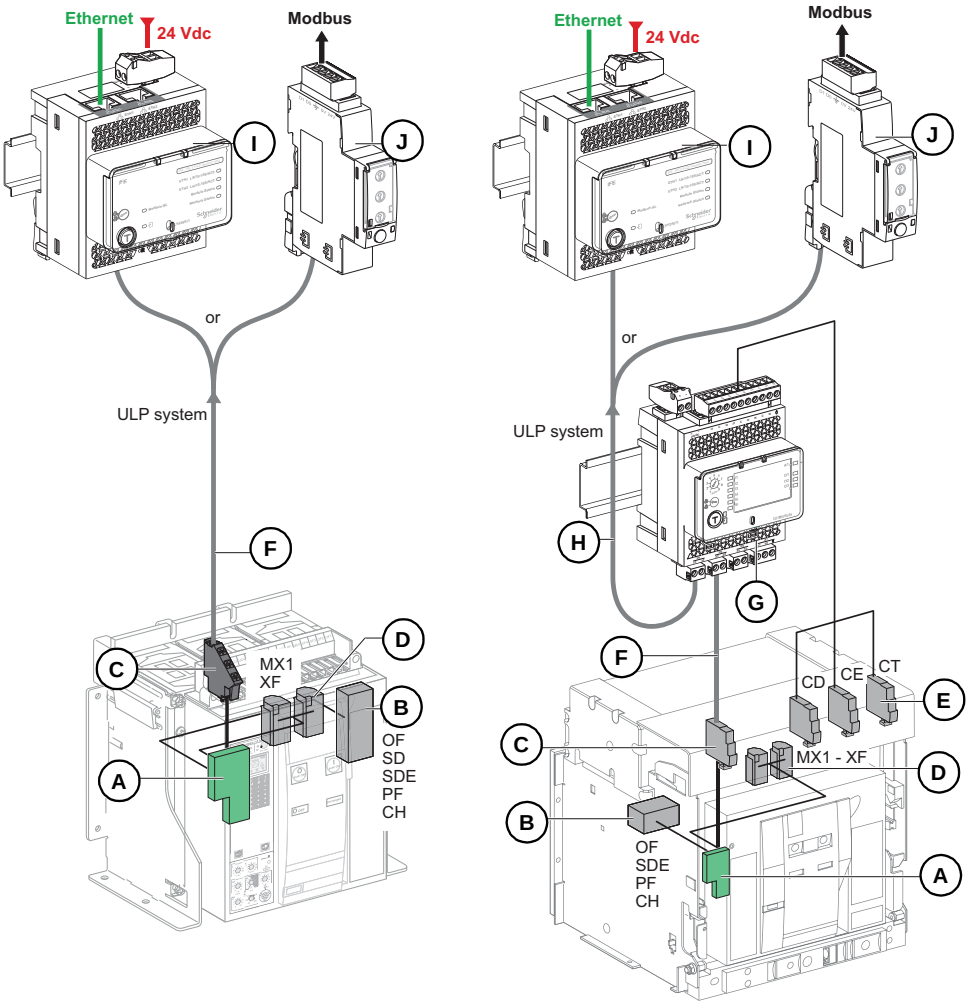
The I/O (Input/Output) application module for low-voltage circuit breakers is delivered with the drawout devices ordered with the COM option for cradle management. It must be installed on a steel DIN rail that is properly grounded near the device. The I/O module must be connected to the ULP system and to the cradle position contacts (CD, CT, CE) that transmit the position of the circuit breaker in the cradle.

For communicating remote control, shunt close (XF) and shunt trip (MX1) communicating voltage releases must be added:

The shunt close (XF) and shunt trip (MX1) communicating voltage releases are equipped for connection to the communication module.

The remote-tripping function shunt trip (MX2) and undervoltage release (MN) are independent of the communication option. They are not equipped for connection to the communication module.

Figure 9 - Communication Architecture–Electrically Operated



A	BCM ULP
B	OF, SDE, SD, PF, CH (tripped, Open/closed, overcurrent trip, ready to close, charged Switches
C	COM Terminal Block (E1 to E6)
D	Shunt Trip (MX1) and Shunt Close (XF)
E	CE, CD, and CT (connected, disconnected, test) Contacts
F	Circuit Breaker ULP Cord
G	I/O Application Module
H	ULP Cable
I	IFE Module
J	IFM Module

IFE Ethernet Interface

IFE Interface, IFE Interface + Gateway Description

IFE Interface

IFE Interface + Gateway

Introduction

The IFE interface and IFE interface + gateway enable low-voltage circuit breakers such as MasterPact NT/NW or PowerPact P/R-frame to be connected to an Ethernet network.

IFE Interface

Provides Ethernet access to a single low-voltage circuit breaker.

Function: Interface - one circuit breaker is connected to the IFE interface using its ULP port.

IFE Interface + Gateway

Provides Ethernet access to one or several low-voltage circuit breakers.

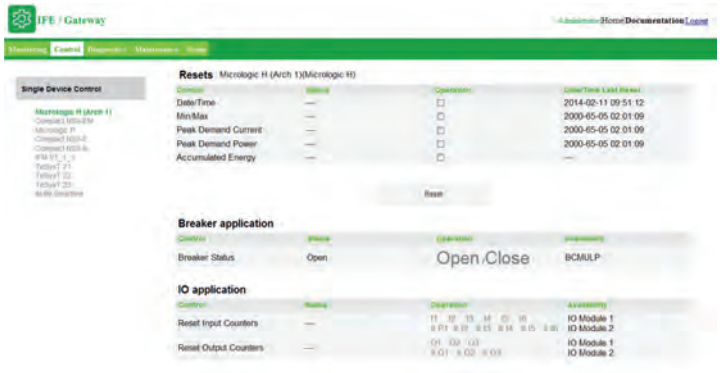
Functions:

- Interface - one circuit breaker is connected to the IFE interface using its ULP port.
- Gateway: several circuit breakers on a Modbus network are connected using the IFE interface + gateway master Modbus port.

IFE Interface, IFE Interface + Gateway Features

- Dual 10/100 Mbps Ethernet port for simple daisy chain connection.
- Device profile web service for discovery of the IFE interface, IFE interface + gateway on the LAN.
- Ethernet interface for MasterPact and PowerPact circuit breakers.
- Gateway for Modbus-SL connected devices (IFE interface + gateway only).
- Embedded set-up web pages.
- Embedded monitoring web pages.
- Embedded control web pages.
- Built-in e-mail alarm notification.

Figure 10 - IFE Interface, IFE Interface + Gateway Screen



Mounting

The IFE interface and IFE interface + gateway are DIN rail mounted devices. A stacking accessory enables the user to connect several IFMs (ULP to Modbus interfaces) to an IFE interface + gateway without additional wiring.

24 Vdc Power Supply

The IFE interface and the IFE interface + gateway must always be supplied with 24 Vdc.

The IFMs stacked to an IFE interface + gateway have power supplied by the IFE interface + gateway, thus it is not necessary to supply them separately. It is recommended to use a UL listed and recognized limited voltage/limited current or a class 2 power supply with a 24 Vdc, 3 A maximum.

Required Circuit Breaker Communication Modules

The connection to an IFE interface or IFE interface + gateway requires a communication module embedded into the circuit breaker:

- MasterPact NT/NW (fixed or drawout) circuit breakers: BCM ULP communication module
- Drawout MasterPact NT/NW circuit breakers: BCM ULP and its respective I/O (Input/Output) application module

All connection configurations for MasterPact NT/NW circuit breakers require the circuit breaker ULP cord. The insulated NSX cord is mandatory for system voltages greater than 480 Vac. When the second ULP RJ45 connector is not used, it must be closed with a ULP terminator (TRV00880).

Table 22 - Network Communication Interface

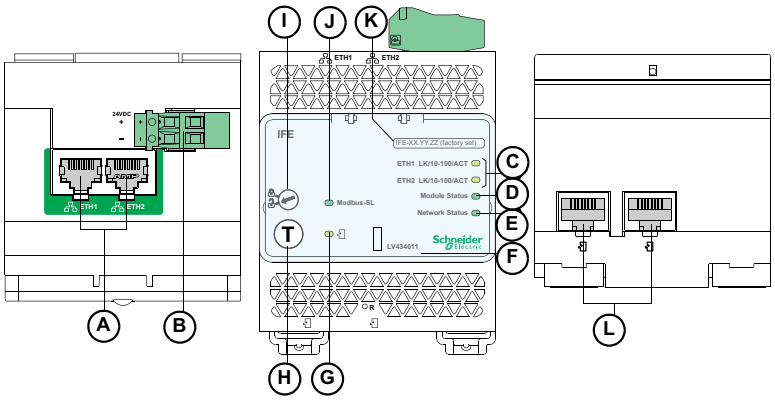
Characteristic		Value
Type of interface module		Modbus RTU, RS485 serial connection
		Modbus TCP/IP Ethernet
Transmission	Modbus RS485	• Transfer rate: 9,600–19,200 Baud
		• Medium Double shielded twisted pair
		• Impedance 120 Ω
	Ethernet	Transfer rate: 10/100 Mbps
		Medium STP, Cat5e, straight cable
Structure	Type	Modbus, Ethernet
	Method	Master/Slave
Device type	Modbus	Master
	Ethernet	Server
Turnaround time	Modbus	10 ms
	Ethernet	1 ms
Maximum length of cable	Modbus	1000 m
	Ethernet	100 m
Type of bus connector	Modbus	4-pin connector
	Ethernet	RJ45 (Shielded)

Table 23 - General Characteristics

Environmental Characteristics	
Conforming to standards	UL 508, UL 60950, IEC 60950, 60947-6-2
Certification	cUIUs, FCC, CE
Ambient temperature	Storage: -40 to +185°F (-40 to +85°C)
	Operation: -13 to +158°F (-25 to +70°C)
Protective Treatment	ULVO, conforming to IEC 60068-2-30
Pollution	Level 3
Mechanical Characteristics	
Shock resistance	Conforming to IEC 60068-2-27 15g/11ms, 1/2 sinusoidal
Resistance to sinusoidal vibrations	Conforming to IEC 60068-2-6
Electrical Characteristics	
Power Supply	24 Vdc, -20%/+10% (19.2 to 26.4 Vdc)
Consumption	Typical: 4 Vdc, 120 mA at 68°F (20°C)
	Maximum with gateway: 26.4 Vdc, 3 A at 140°F (60°C)
Physical Characteristics	
Dimensions	2.83 x 4.13 x 2.79 in. (72 x 105 x 71 mm)
Mounting	Mounting DIN rail
Weight	182.5 g (0.41 lb)
Degree of protection of the installed module	On the front panel (wall mounted enclosure): IP4x
	Connectors: IP2x
	Other parts: IP3x
Connections	Screw type terminal blocks
Technical Characteristics - 24 Vdc Power Supply	
Power supply type	Regulated switch type
Rated power	72 W
Input voltage	100–120 Vac for single phase
	200–500 Vac phase-to-phase
PFC filter	With IEC 61000-3-2
Output voltage	24 Vdc
Power supply out current	3:00 AM

IFE Web Page Description	
Monitoring Web Page	
Real time data	X
Device logging	X
Control Web Page	
Single device control	X
Diagnostics Web Page	
Statistics	X
Device information	X
IMU (circuit breaker) information	X
Read device registers	X
Communication check	X
Maintenance Web Page	
Maintenance log	X
Maintenance counters	X
Setup Web Page	
Device localization/name	X
Ethernet configuration (dual port)	X
IP configuration	X
Modbus TCP/IP filtering	X
Serial port	X
Date and time	X
E-mail server configuration	X
Alarms to be e-mailed	X
Device list	X
Device logging	X
Device log export	X
SNMP parameters	X
Documentation links	X
Preferences	X
Advanced services control	X
User accounts	X

NOTE: Use a UL Listed/UL Recognized limited voltage/limited current or a Class 2 power supply with a 24 Vdc, 3 A maximum.



A	Ethernet 1 and Ethernet 2 communication port
B	24 Vdc power supply terminal block
C	Ethernet communication LEDs: • yellow: 10 Mb • green: 100 Mb
D	Module status LED: • • steady off: no power • steady green: device operational • steady red: major fault • flashing green: standby • flashing red: minor fault • flashing green/red: self-test
E	Network status LED: • • steady off: no power/no valid IP address • steady green: connected, valid IP address • steady orange: default IP address • steady red: duplicated IP address • flashing green/red: self-test
F	Sealable transparent cover
G	ULP status LED
H	Test button (accessible closed cover)
I	Locking pad
J	Modbus traffic status LED (IFE Interface + Gateway only)
K	Device name label
L	ULP ports

IFM Modbus Communication Interface

Function

IFM Modbus Communication Interface. Ref.: TRV00210

An IFM Modbus communication interface is required for connection of a MasterPact or PowerPact circuit breaker to a Modbus network as long as this circuit breaker is provided with a ULP (Universal Logic Plug) port. The port is available on the BCM ULP.

Once connected, the circuit breaker is considered as a slave by the Modbus master. Its electrical values, alarm status, open/close signals can be monitored or controlled by a Programmable Logic Controller or any other system.

Characteristics

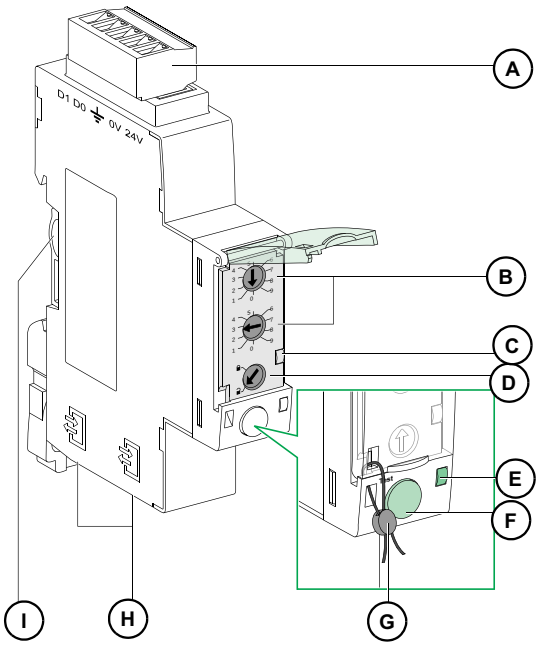
ULP Port

Two RJ45 sockets, internal parallel wiring.

- Connection of a single circuit breaker.
- A ULP line terminator or an FDM121 display unit must be connected to the second RJ45 ULP socket.
- The RJ45 sockets deliver a 24 Vdc supply fed from the Modbus socket.
- Built-in test function, for checking the correct connection to the circuit breaker and FDM121 display unit.

Modbus Slave Port

- Top socket for screw-clamp connector, providing terminals for:
  - 24 Vdc input supply (0 V, +24 V)
  - Modbus line (D1, D2, Gnd) two-wire Modbus system
- Lateral socket, for DIN-rail stackable connector. Both top and lateral sockets are internally parallel wired.
- Multiple IFMs can be stacked, thus sharing a common power supply and Modbus line without individual wiring.
- On the front face:
  - Modbus address setting (1 to 99): two coded rotary switches
  - Modbus locking pad: enables or disable the circuit breaker remote control and modification of IFM parameters
- Self-adjusting communication format (Baud rate, parity).



A	Modbus Screw Clamp Connector
B	Modbus Address Switches
C	Modbus Traffic LED
D	Modbus Locking Pad
E	ULP Activity LED
F	Test Button
G	Mechanical Lock
H	ULP RJ45 Connectors
I	Stacking Accessory Connection

Technical Characteristics

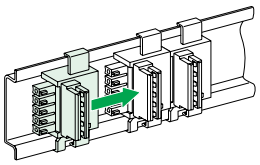
Table 24 - IFM Modbus Communication Interface

Dimensions		0.71 x 2.83 x 3.78 in. (18 x 72 x 96 mm)
Maximum number of stacked IFM		12
Degree of protection of the installed module	Part projecting beyond the escutcheon	IP4x
	Other module parts	IP3x
	Connectors	IP2x
Operating temperature		-25 to +70°C
Power supply voltage		24 Vdc -20%/+10% (19.2–26.4 Vdc)
Consumption	Typical	21 mA/24 Vdc at 68°F (20°C)
	Maximum	30 mA/19.2 Vdc at 140°F (60°C)
Certification	CE	IEC/EN 60947-1
	UL	UL 508 - Industrial Control Equipment
	CSA	No. 142-M1987 - Process Control Equipment • CAN/CSA C22.2 No. 0-M91 - General requirements - Canadian Electrical Code Part • CAN/CSA C22.2 No. 14-05 - Industrial Control Equipment

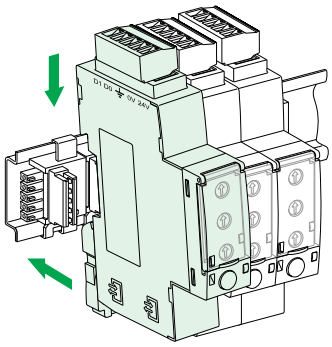
Simplified IFM Installation

Stacking an IFM

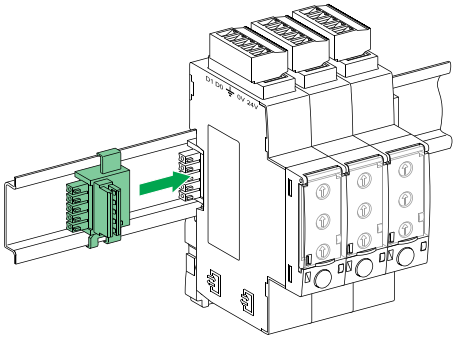
Stacking Accessories

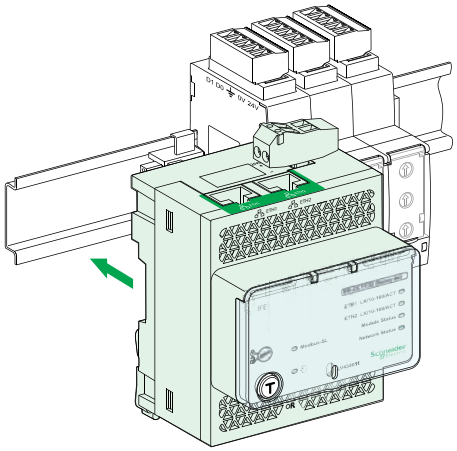


Up to 12 Stacked IFM



Stacking an IFE Interface + Gateway with IFMs





I/O Application Module

Description

I/O Application Module

The I/O (Input/Output) application module for an low-voltage circuit breaker is part of an ULP system with built-in functions and applications to enhance the application needs. The ULP system architecture can be built without any restrictions using the wide range of circuit breakers.

The I/O application module is compliant with the ULP system specifications.

Two I/O application modules can be connected in the same ULP network.

The ranges of low-voltage circuit breakers enhanced by the I/O application module are:

- MasterPact NW
- MasterPact NT
- PowerPact R-Frame
- PowerPact P-Frame

I/O (Input/Output) Application Module for Low-Voltage Circuit Breaker Resources

The I/O application module resources are:

- Six digital inputs that are self powered for either NO and NC dry contact or pulse counter.
- Three digital outputs that are a bistable relay (5 A maximum).
- One analog input for PT100 temperature sensor.

Pre-Defined Application

The pre-defined application adds new functions to the I/O application module by:

- Selection by the application rotary switch on the I/O application module, defining the application with pre-defined input/output assignment and wiring diagram.
- No additional setting with the customer engineering tool required.

The resources not assigned to the pre-defined application are free for additional user-defined applications:

- cradle management
- circuit breaker operation
- cradle management + ERMS (Energy Reduction Maintenance Setting)

  NOTE: Use only MicroLogic P or H trip units with the blue ERMS label for energy reduction maintenance setting systems. Review the I/O module user guide 0613IB1317 and ERMS installation instructions NHA67346 for details on installation, testing, and operation of the ERMS system.
- light and load control
- custom

User-Defined Applications

User-defined applications are processed by the I/O application module in addition to the pre-defined application selected.

The user-defined applications are available depending on:

- the pre-defined application selected
- the I/O application module resources (inputs and outputs) not used by the application

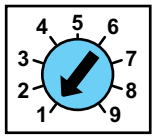
The resources required by user-defined applications are assigned using the customer engineering tool:

- protection
- control
- energy management
- monitoring

Mounting

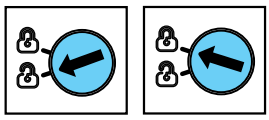
The I/O application module is a DIN rail mounted device. Install on a steel DIN rail that is properly grounded near the device.

Application Rotary Switch

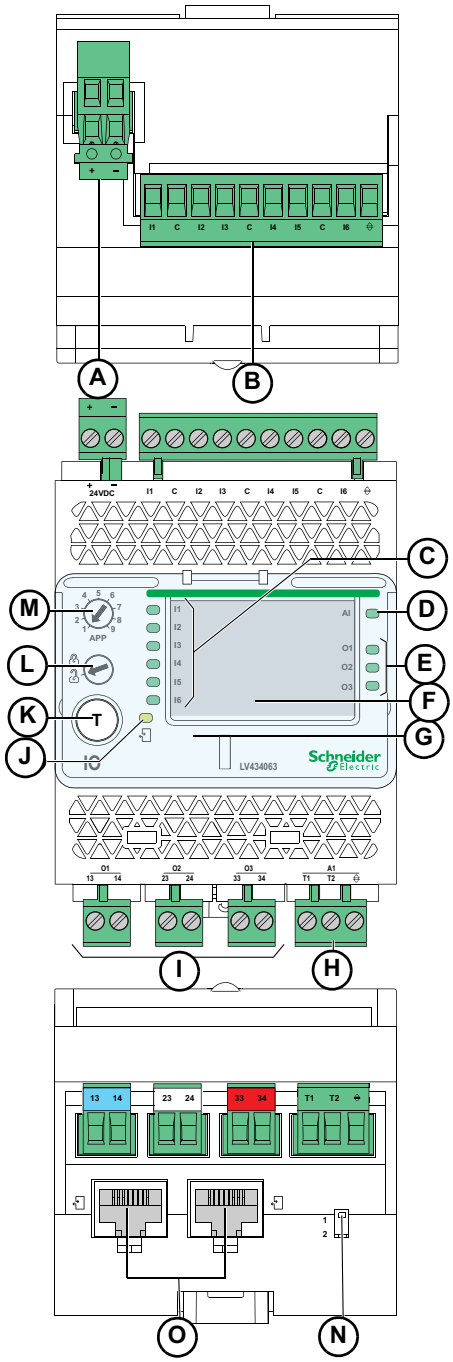


The application rotary switch enables the selection of the pre-defined application. It has nine positions and each position is assigned to a pre-defined application. The factory set position of the switch is pre-defined application one.

Setting Locking Pad



The setting locking pad on the front panel of the I/O application module enables the setting of the I/O application module by the customer engineering tool.



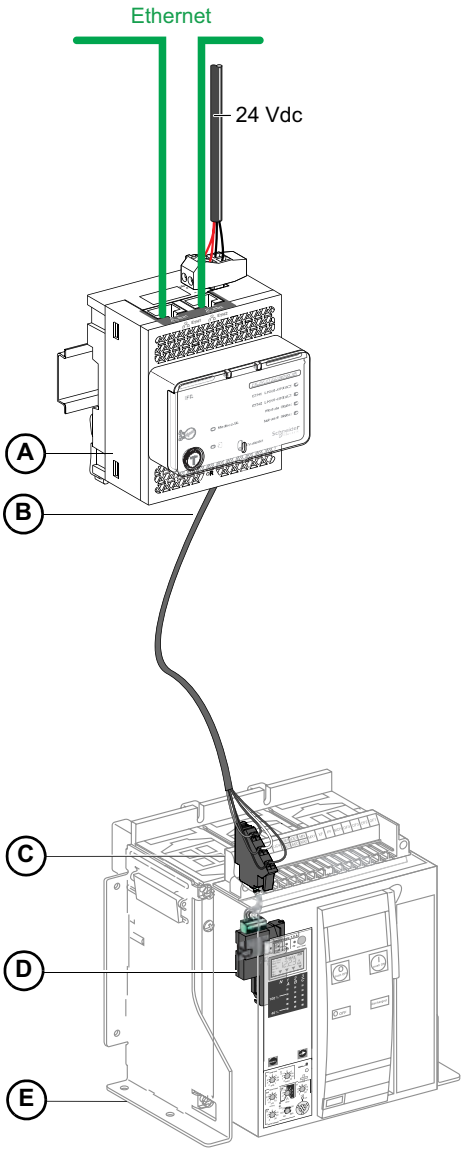
A	**24 Vdc power supply terminal block.**
B	**Digital input terminal block: 6 inputs, 3 commons and 1 shield**
C	**6 input status LEDs**
D	**Analog input status LED**
E	**3 output status LEDs**
F	**I/O application module identification labels**
G	**Sealable transparent cover**
H	**Analog input terminal block**
I	**Digital output terminal blocks**
J	**ULP status LED**
K	**Test/reset button (accessible with cover closed)**
L	**Setting locking pad**
M	**Application rotary switch: 1 to 9**
N	**Switch for I/O addressing (I/O 1 or I/O 2)**
O	**ULP connectors**

General Characteristics		
Environmental Characteristics	Conforming to standards	UL 508, UL 60950, IED 60950, 60947-6-2
	Certification	cULus, EAC, FCC, CE
	Ambient temperature	Storage: -40 to +185°F (-40 to +85°C) Operation: -13 to +158°F (-25 to +70°C)
	Protective Treatment	ULVO, conforming to IEC 60068-2-30
	Pollution	Level 3
Mechanical Characteristics	Shock resistance	Conforming to IEC 60068-2-27 15g/11ms, 1/2 sinusoidal
	Resistance to sinusoidal vibrations	Conforming to IEC 60068-2-6
Electrical Characteristics	Power Supply	24 Vdc, -20%/+10% (19.2 to 26.4 Vdc)
	Consumption	Typical: 24 Vdc, 165 mA at 20°C Maximum with gateway: 26.4 Vdc, 420 mA at 60°C

General Characteristics		
Physical Characteristics	Dimensions	2.83 x 4.52 X 2.79 in. (72 x 115 x 71 mm)
	Mounting	DIN rail
	Weight	0.51 lb. (229.5 g)
	Degree of protection of the installed I/O application module	• On the front panel (wall mounted enclosure): IP4x • I/O parts: IP3x • Connectors: IP2x
	Connections	Screw type terminal blocks
Technical Characteristics 24 Vdc power supply	Power supply type	Regulated switch type
	Rated power	72 W
	Input voltage	100–120 Vac for single phase@200–500 Vac phase-to-phase maximum
	PFC filter	With IEC 61000-3-2
	Output voltage	24 Vdc
	Power supply out current	3 A
	NOTE: It is recommended to use an UL listed/UL listed recognized limited voltage/limited current or a class 2 power supply with a 24 Vdc, 3 A maximum.	
Digital Inputs	Digital input type	Self powered digital input with current limitations as per IEC 61131-2 type 2 standards (7 mA)
	Input limit values at state 1 (close)	19.8–25.2 Vdc, 6.1–8.8 mA
	Input limit values at state 0 (open	0–19.8 Vdc, 0 mA
	Maximum cable length	33 ft (10 m)
	NOTE: For a length greater than 10 m (33 ft) and up to 300 m (1,000 ft), it is mandatory to use a shielded twisted cable. The shield cable is connected to the I/O functional ground of the I/O application module.	
Digital Outputs	Digital output type	Bistable relay
	Rated load	5 A at 250 Vac
	Rated carry current	5 A
	Maximum switching voltage	380 Vac, 125 Vdc
	Maximum switch current	5 A
	Maximum switching power	1250 VA, 150 W
	Minimum permissible load	10 mA at 5 Vdc
	Contact resistance	30 mΩ
	Maximum operating frequency	18000 operations/hr (Mechanical)@1800 operations/hr (Electrical)
	Digital output relay protection by an external fuse	External fuse of 5 A or less
	Maximum cable length	10 m (33 ft)
Analog Inputs	The I/O application module analog input can be connected to a Pt100 temperature sensor	
	Range	-22 to 392°F (-30 to 200°C)
	Accuracy	-22 to 68°F (-30 to 20°C): ±3.6°F (2°C) 68 to 284°F (20 to 140°C): ±1.8°F (1°C) 284 to 392°F (140 to 200°C): ±3.6°F (2°C)
	Refresh interval	5 s

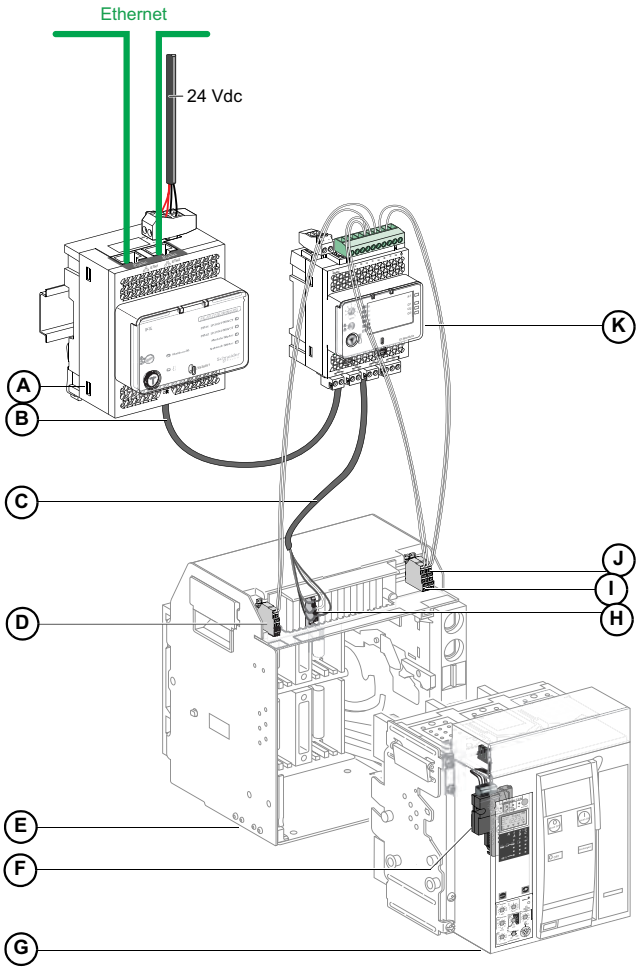
Figure 11 - Connection of the IFE to MasterPact NT/NW

Connect the IFE to a fixed electrically operated MasterPact NT/NW or circuit breaker using the circuit breaker ULP cord.



A	IFE Ethernet interface for low-voltage circuit breaker
B	Circuit breaker ULP cord
C	Fixed terminal block
D	BCM ULP communication module
E	Fixed electrically operated circuit breaker

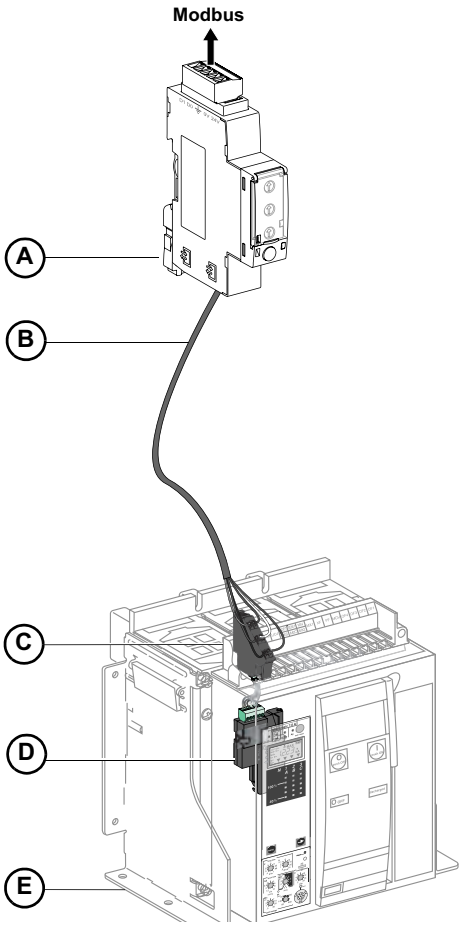
Connect the IFE to a drawout MasterPact NT/NW or circuit breaker using the circuit breaker ULP cord.



A	IFE Ethernet interface for low-voltage circuit breaker
B	ULP cable
C	Circuit breaker ULP cord
D	Circuit breaker disconnected position contact (CD)
E	Circuit breaker cradle
F	BCM ULP communication module
G	Drawout circuit breaker
H	Drawout terminal block
I	Circuit breaker connected position contact (CE)
J	Circuit breaker test position contact (CT)
K	I/O (Input/Output) application module for low-voltage circuit breaker

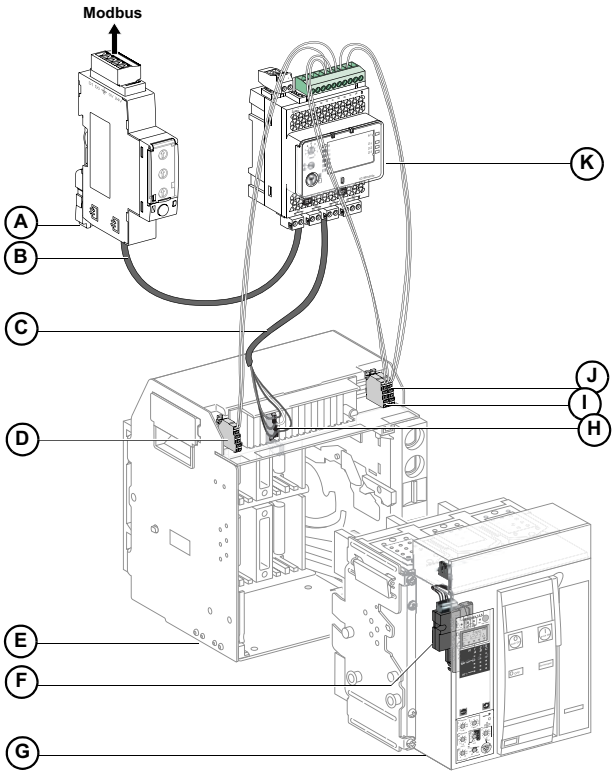
Figure 12 - Connection of the IFM to MasterPact NT/NW

Connect the IFM to a fixed electrically-operated MasterPact NT/NW circuit breaker using the circuit breaker ULP cord.



A	IFM Ethernet interface for low voltage circuit breaker
B	Circuit breaker ULP cord
C	Fixed terminal block
D	BCM ULP communication module
E	Fixed electrically-operated circuit breaker

Connect the IFM to a drawout MasterPact NT/NW circuit breaker using the circuit breaker ULP cord.

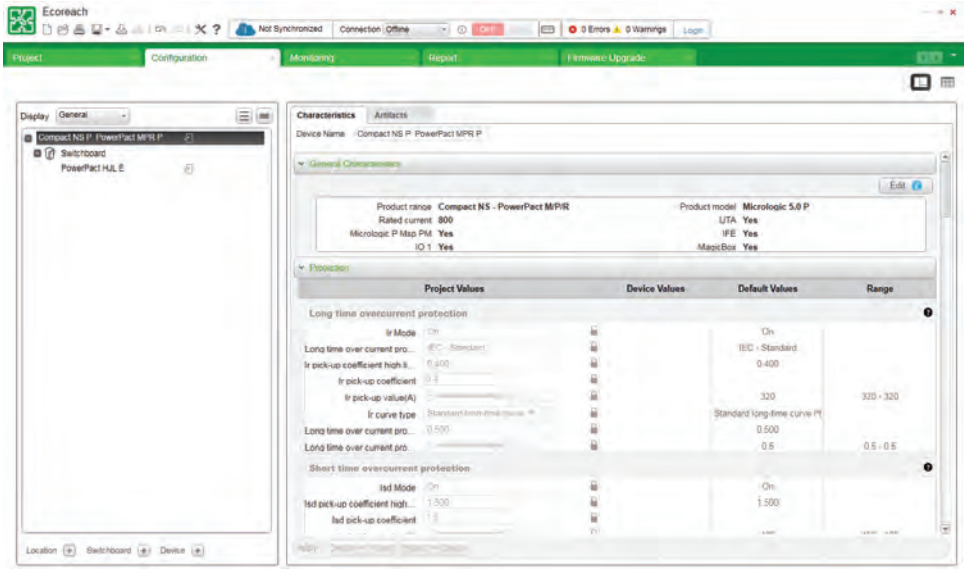


A	IFM Ethernet interface for low voltage circuit breaker
B	ULP cable
C	Circuit breaker ULP cord
D	Circuit breaker disconnected position contact (CD)
E	Circuit breaker cradle
F	BCM ULP communication module
G	Drawout circuit breaker
H	Drawout terminal block
I	Circuit breaker connected position contact (CE)
J	Circuit breaker test position contact (CT)
K	I/O (Input/Output) application module for low voltage circuit breaker

Electrical Asset Manager Configuration Engineering Tool (Ecoreach™)

Introduction

The Ecoreach engineering tool is a software application that helps the user to manage a project as part of designing, testing, site commissioning, and maintenance of the project life cycle. It enables the user to prepare the settings of the devices offline (without connecting to the device) and configure them when connected with the devices. It also provides other value-added features for the user to manage the project such as: safe repository in cloud, attach artifacts to each device or at the project level, organize devices in switchboard, manage a hierarchical structure of the installation, etc.



Compatible Devices (Configuration and Device Management)

The Ecoreach engineering tool is compatible with the following devices:

- Compact NSX100-630 (IEC) circuit breakers
- PowerPact (UL) circuit breakers
- Compact NS630b-3200 (IEC) circuit breakers
- MasterPact NT/NW (IEC and UL) circuit breakers
- Compatible devices (Device Management in the project)
- Switches (Compact NSX, MasterPact & PowerPact Family)
- Third party devices

References:

The Ecoreach software package can be downloaded from our website:

www.se.com

Features

The Ecoreach engineering tool includes the Schneider Electric customer engineering tools such as the Remote Setting Utility (RSU) and Remote Control Utility (RCU) with additional features.

The Ecoreach engineering tool supports the connection of Schneider Electric communicable devices to:

- create projects by device discovery, selection of devices, and importing a Bill of Material (BOM)
- monitor the status of protection and I/O status
- read information (alarms, measurements, parameters)
- check protection discrimination between two devices
- upload and download of configuration or settings in batch mode to multiple devices.
- carry out commands and tests
- generate and print a device settings report and communication test report
- manage multiple devices with a electrical and communication hierarchy model
- manage artifacts (project documents)
- check consistency in settings between devices on a communication network
- compare configuration settings between PC and device (online)
- download latest firmware

The Ecoreach engineering tool enables the user to access the advanced features of the software once the project is saved in the Schneider Electric cloud.

Accessories

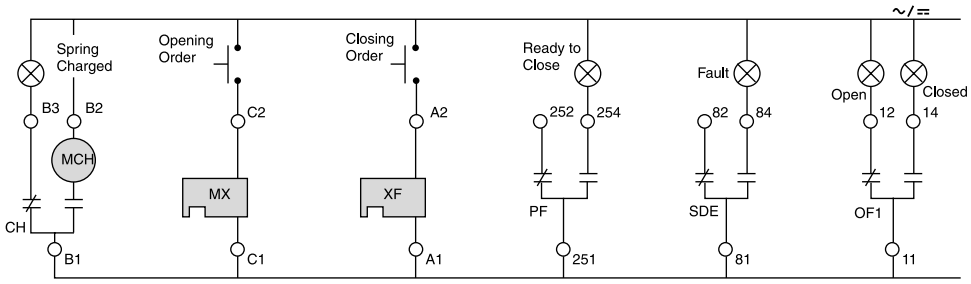
Options for Remote Operation

Two options are available for remote operation of MasterPact circuit breakers: direct connection or a communication network.

NOTE: When remote operation features are used, a minimum of four seconds is required for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

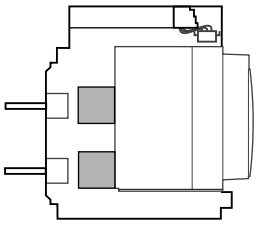
The wiring diagrams for these two options are shown below.

Figure 13 - Wiring Diagram for Remote ON/OFF Function by Direct Connection



Remote Operation Accessories

MasterPact Circuit Breaker Equipped for Remote ON/OFF Function Cluster shield is not shown



The remote ON/OFF function is used to remotely open and close the circuit breaker. It is made up of the following components:

- A spring-charging motor (MCH) equipped with a spring-charged limit switch; see *Spring-Charging Motor (MCH), page 81* for more information.
- A shunt close (XF); see *Shunt Trip (MX1) and Shunt Close (XF), page 81* for more information.
- A shunt trip (MX1); see *Shunt Trip (MX1) and Shunt Close (XF), page 81* for more information.

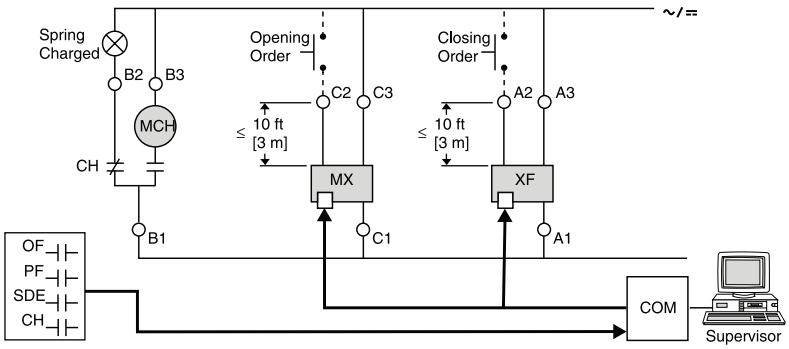
Optionally, the function may be completed with:

- A ready-to-close contact (PF).
- An electrical closing push button (BPFE).
- A remote reset following a fault (RES).

The remote operation function may be completed with:

- Auxiliary contacts (OF).
- Overcurrent trip switch (SDE).

Figure 14 - Wiring Diagram for Remote ON/OFF Function by Communication Network



NOTE: Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt close to not work properly. The best way to prevent induced voltages is to keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than 10 feet (3 m), use an interposing relay near terminal C2 or A2.

NOTE: When communicating MX1 or XF coils are used, terminal (C3 or A3) must be connected to line even if the communication module is not installed. The bypass circuit through terminal C2/A2 is only momentary duty for 0.5 sec. For continuous duty, use the communications command.

Terminals

Terminal

Table 25 - Terminal Characteristics

Standards		UL 486E
Termination Capacity		22–14 AWG solid or stranded wire with max. O.D. of insulation 3.5 mm
Current	Nominal	10 A
	Minimum	100mA at 24 V
Pull-Out Forces		22 AWG = 4.5 lbs. (20 N)
		20 AWG = 6.75 lbs. (30 N)
		18 AWG = 6.75 lbs. (30 N)
		16 AWG = 9 lbs. (40 N)
		14 AWG = 11.5 lbs. (50 N)

Spring-Charging Motor (MCH)

Spring-Charging Motor (NW)

Spring-Charging Motor (NT)

The spring-charging motor automatically charges the spring mechanism for closing the circuit breaker and also recharges the spring mechanism when the circuit breaker is in the ON position. Instantaneous reclosing of the circuit breaker is thus possible following circuit breaker opening. The spring-mechanism charging handle is used only as a backup if auxiliary power is absent.

The spring-charging motor is equipped as standard with a limit switch contact (CH) that signals the charged position of the mechanism (springs charged).

Table 26 - Spring-Charging Motor Characteristics

Characteristics		MCH
Voltage Ratings (V_n)	Vac 50/60 Hz	48/60, 100/130, 200/250, 240/277, 380/415, 400/440, 480
	Vdc	24/30, 48/60, 100/125, 200/250
Operating Threshold		0.85 to 1.1 V_n
Power Consumption		180 VA
Motor Overcurrent		2–3 x In for 0.1 s
Charging Time		4 s maximum on NW, 3 s maximum on NT
Duty Cycle		3 cycles per minute maximum
Endurance		10,000 cycles for NW < 4000 A
		5000 cycles for NW ≥ 4000 A
CH Contact		10 A at 240 V

Shunt Trip (MX1) and Shunt Close (XF)

The inrush currents for these devices are approximately 200 VA. When low supply voltages (12, 24 or 48 V) are used, the maximum allowable wire length is dependent on the voltage and the wire size.

Table 27 - Maximum Wire Length

Device[13]	Percent of Source Voltage	Source Voltage					
		12 Vdc		24 Vdc		48 Vdc	
Wire Size		14 AWG (2.08 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.08 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.08 mm^2)	16 AWG (1.31 mm^2)
UVR (MN)	100%	—	—	159 ft. (48.5 m)	100 ft. (30.5 m)	765 ft. (233.2 m)	472 ft. (143.9 m)
	85%	—	—	44 ft. (13.4 m)	29 ft. (8.8 m)	205 ft. (62.5 m)	129 ft. (39.3 m)
Shunt Trip (MX) and Shunt Close (XF)	100%	57 ft. (17.4 m)	34 ft. (10.4 m)	314 ft. (95.7 m)	200 ft. (61.0 m)	1503 ft. (457.8 m)	944 ft. (287.7 m)
	85%	27 ft. (8.2 m)	17 ft. (5.2 m)	205 ft. (62.5 m)	126 ft. (38.4 m)	957 ft. (291.7 m)	601 ft. (183.2 m)

13. The length shown in the table is for each of the two supply wires.

Shunt Trip (MX1) and Shunt Close (XF)

Shunt Trip (MX1): When energized, the shunt trip instantaneously opens the circuit breaker. The shunt trip may be energized continuously or intermittently.

Shunt Close (XF): Remotely closes the circuit breaker if the spring mechanism is charged.

> **NOTE:** Do not use a standing close order on the shunt close coil (XF). Any opening order will open the circuit breaker so a standing close order is not necessary. See Anti-Pump Feature.

Communication versions of the MX1 and XF are available for direct connection via the circuit breaker communication module (BCM ULP).

Table 28 - Shunt Trip and Shunt Close Characteristics

Characteristics		MX1 and MX2	XF	Min	Max
Voltage Ratings (V_n)	Vac 50/60 Hz	24 Vac		17 Vac	26 Vac
		48 Vac		34 Vac	52 Vac
		120 Vac		60 Vac	132 Vac
		240 Vac		168 Vac	264 Vac
		277 Vac		194 Vac	304 Vac
		380 Vac		266 Vac	418 Vac
		480 Vac		336 Vac	528 Vac
	Vdc	12 Vdc		8 Vdc	13 Vdc
		24 Vdc		17 Vdc	26 Vdc
		48 Vdc		34 Vdc	52 Vdc
		125 Vdc		88 Vdc	137 Vdc
		250 Vdc		175 Vdc	275 Vdc
Operating Threshold		0.7 to 1.1 V_n	0.85 to 1.1 V_n		
Power Consumption (VA or W)	Steady-State/ Inrush	4.5/200			
Circuit Breaker Response Time at V_n[14]		50 ms ±10 (NW and NT)	70 ms ±10 (NW ≤ 4000 A)		
			80 ms ±10 (NW > 4000 A) 55 ms (NT)		

Additional Shunt Trip (MX2) or Undervoltage Trip (MN)

Second Shunt Trip (MX2)

This function opens the circuit breaker via an electrical order.

It is made up of:

- Shunt trip (MX2, second MX) or,
- Undervoltage trip (MN)
  - Instantaneous trip
  - Fixed undervoltage trip (time delayed) or,
  - Adjustable undervoltage trip (time delayed)

As shown in the wiring diagram for the remote tripping function below, the delay unit (installed outside the circuit breaker) may be disabled by an emergency off button to obtain non-delayed opening of the circuit breaker.

When energized, the shunt trip (MX1 or MX2) instantaneously opens the circuit breaker.

The undervoltage trip (MN) instantaneously opens the circuit breaker when its supply voltage drops to a value between 35% and 70% of its rated voltage.

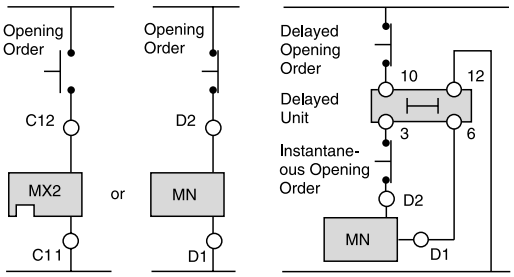
14. Shunt trip (MX1) and shunt close (XF) circuits must be energized for minimum of 200 ms.

If the undervoltage trip is not energized, it is impossible to close the circuit breaker, either manually or electrically. An attempt to close the circuit breaker produces no movement of the main contacts. Closing is allowed when the supply voltage of the undervoltage trip reaches 85% of rated voltage.

Table 29 - Undervoltage Trip Characteristics

Characteristics		MX2	Min	Max
Voltage Ratings (V_n)	Vac 50/60 Hz	24 Vac	17 Vac	26 Vac
		48 Vac	34 Vac	52 Vac
		120 Vac	60 Vac	132 Vac
		240 Vac	168 Vac	264 Vac
		277 Vac	194 Vac	304 Vac
		380 Vac	266 Vac	418 Vac
		480 Vac	336 Vac	528 Vac
	Vdc	12 Vdc	8 Vdc	13 Vdc
		24 Vdc	17 Vdc	26 Vdc
		48 Vdc	34 Vdc	52 Vdc
		125 Vdc	88 Vdc	137 Vdc
		250 Vdc	175 Vdc	275 Vdc
Power Consumption (VA or W)	Constant/Inrush	4.5/200		
Circuit Breaker Response Time at V_n		50 ms ±10		

Figure 15 - Wire Diagram for the Remote Tripping Function



Time-Delay Module for Undervoltage Trip

Time-Delay Module for Undervoltage Trip (MN)

To eliminate circuit breaker nuisance tripping during temporary voltage dips (micro-breaks), operation of the undervoltage trip (MN) can be delayed. This function is achieved by adding an external delay unit (either adjustable or non-adjustable) to the undervoltage trip (MN) circuit.

Table 30 - Time-Delay Module Characteristics

Voltage Ratings of Undervoltage Trip		Vac 50/60 Hz	24/30, 48/60, 100/130, 200/250, 380/480
		Vdc	24/30, 48/60, 100/130, 200/250
Voltage Ratings of Time-Delay Module	Adjustable	Vac 50/60 Hz	48/60, 100/130, 200/250, 380/480
		Vdc	48/60, 100/130, 200/250, 380/480
	Non-Adjustable	Vac 50/60 Hz	100/130, 200/250
		Vdc	100/130, 200/250
Operating Threshold		Opening	0.35 to 0.7 V_n
		Closing	0.85 V_n
Power Consumption			4.5 VA/W (Holding), 200 VA/W (Inrush)
Time-Delay Settings	Adjustable		0.5, 0.9, 1.5, and 3.0 s
	Non-Adjustable		0.25 s

Ready-to-Close Switch (PF)

Ready-to-Close Switch (PF)

The ready-to-close position switch indicates that the following conditions are met and the circuit breaker can be closed:

- The circuit breaker is open.
- The closing springs are charged.
- There is no standing closing or opening order.

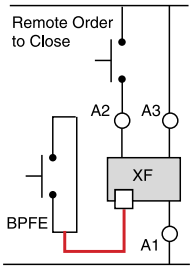
Table 31 - Ready-to-Close Switch Characteristics

Type of Contact	1a/1b Form C			
Maximum Number of Contacts	1			
Breaking Capacity at a Power Factor (p.f.) of 0.3	Standard: 100 mA/24V minimum load		Low-Level: 2 mA/15 V minimum load	
	240/380 Vac	5 A	24/48 Vac	3 A
	480 Vac	5 A	240 Vac	3 A
	600/690 Vac	3 A	380 Vac	3 A
	24/48 Vdc	3 A	24/48 Vdc	3 A
	240 Vdc	0.3 A	125 Vdc	0.3 A
	380 Vdc	0.15 A	250 Vdc	0.15 A

Electrical Closing Push Button (BPFE)

Located on the front panel of the circuit breaker, this push button carries out electrical closing of the circuit breaker, taking into account all of the safety functions that are part of the control/monitoring system of the installation. The push button is installed on the control circuit of the shunt close, and connects to the communicating shunt close module (XF-COM). Terminal A2 of XF-COM is used to remotely close the circuit breaker.

Electrical Closing Push Button (BPFE)



Remote Reset (RES) and Automatic Reset After Fault Trip

- Remote reset (RES): following tripping, the remote reset (RES) resets the overcurrent trip switch (SDE) and the mechanical indicator. (Voltage rating: 110/130 Vac and 200/240 Vac.) RES is not compatible with an additional overcurrent trip switch (SDE2).
- Automatic reset after fault-trip: Following tripping, a reset of the mechanical indicator (reset button) is no longer required to enable circuit breaker closing (factory adjustable only).

Switches and Switch Accessories

Auxiliary Switch (OF)

Auxiliary Switch (OF) with Four Contacts for MasterPact NW Circuit Breaker

MasterPact NT Aux Switch (OF) with One Contact

The rotary-type auxiliary switches are directly driven by the trip mechanism when the minimum isolation distance between the main circuit breaker contact is reached.

Table 32 - Auxiliary Switch Characteristics

Circuit Breaker Type			NT	NW
Supplied as Standard (Form C)			4	4
Maximum Number of Contacts			4	12
Breaking Capacity at a Power Factor (p.f.) of 0.3	Standard (100 mA/24 V minimum load)			
	Vac	240/380	6 A	10 A
		480	6 A	10 A
		600/690	6 A	6 A
	Vdc	24/48	2.5 A	10 A
		240	0.5 A	10 A
		380	0.3 A	3 A
	Low-Level (1 mA/4 V minimum load with a maximum current and voltage of 100 mA/10 V. **NOTE:** If the maximum voltage and current is exceeded, the low-level function of the switch will be lost but the switch will continue to function as a standard switch with the following specifications.			
	Vac	24/48 Vac	5 A	6 A
		240 Vac	5 A	6 A
		380 Vac	5 A	3 A
	Vdc	24/48 Vdc	5/2.5 A	6 A
		125 Vdc	0.5 A	6 A
		250 Vdc	0.3 A	3 A

Overcurrent Trip Switch (SDE)

Overcurrent Trip Switch (SDE)

Circuit breaker tripping due to a fault is signalled by a red mechanical fault indicator (reset) and one overcurrent trip switch (SDE).

Following tripping, the mechanical indicator must be reset before the circuit breaker may be closed. An additional overcurrent trip switch (SDE2) is supplied as an option and is not compatible with the remote reset (RES).

Table 33 - Overcurrent Trip Switch Characteristics

Supplied as Standard	1a/1b Form C			
Maximum Number of Contacts	2			
Breaking Capacity at a Power Factor (p.f.) of 0.3	Standard: 100 mA/24 V Minimum Load		Low-Level: 2 mA/15 V Minimum Load	
	240/380 Vac	5 A	24/48 Vac	3 A
	480 Vac	5 A	240 Vac	3 A
	600 Vac	3 A	380 Vac	3 A
	24/48 Vdc	3 A	24/48 Vdc	3 A
	240 Vdc	0.3 A	125 Vdc	0.3 A
	380 Vdc	0.15 A	250 Vdc	0.15 A

Connected Closed Switch (EF)

Connected/Closed Switch (EF)—NW only

This switch combines the “device connected” and “device closed” information to produce “circuit closed” information. The connected/closed switch (EF) is supplied as an option and must be used with an additional auxiliary switch (OF) and fits into its connector (it is not available for ring terminals).

Table 34 - Connected/Closed Switch Characteristics

Circuit Breaker Type	NW (not available for NT)			
Maximum Number of Contacts	8a/8b Form C			
Breaking Capacity at a Power Factor (p.f.) of 0.3	Standard: 100 mA/24 V Minimum Load		Low-Level: 2 mA/15 V Minimum Load	
	240/380 Vac	6 A	24/48 Vac	5 A
	480 Vac	6 A	240 Vac	5 A
	600/690 Vac	6 A	380 Vac	5 A
	24/48 Vdc	2.5 A	24/48 Vdc	2.5 A
	125 Vdc	0.8 A	125 Vdc	0.8 A
	250 Vdc	0.3 A	250 Vdc	0.3 A

Cradle Position Switch

Cradle Position Switch (CE, CD, CT)

Three series of optional auxiliary switches are available for the cradle:

- Cradle position switches to indicate the connected position (CE).
- Cradle position switches to indicate the disconnected position (CD). This position is indicated when the required clearance for isolation of the power and auxiliary circuits is reached.
- Cradle position switches to indicate the test position (CT). In this position, the power circuits are disconnected and the auxiliary circuits are connected.

Table 35 - Cradle Position Switch Characteristics

Circuit Breaker Type			NT			NW		
			CE	CD	CT	CE	CD	CT
Maximum Push-In Switches with Standard Actuators			3	2	1	3[15]	3[15]	3[15]
With Additional Actuators						9	0	0
						6	3	0
						3	6	0
						6	0	3
Breaking Capacity at a Power Factor (p.f) of 0.3	Standard (100 mA/24 V minimum load)							
	Vac	240	8 A			8 A		
		380	8 A			8 A		
		480	8 A			8 A		
		600/690	6 A			6 A		
	Vdc	24/48	2.5 A			2.5 A		
		125	0.8 A			0.8 A		
		250	0.3 A			0.3 A		
	Low-Level (2 mA/15 V minimum load)							
	Vac	24/48	5 A			5 A		
		240	5 A			5 A		

15. See *Possible Ring-Terminal Combinations, page 88*.

Table 35 - Cradle Position Switch Characteristics (Continued)

Circuit Breaker Type			NT			NW		
			CE	CD	CT	CE	CD	CT
		380	5 A			5 A		
	Vdc	24/48	2.5 A			2.5 A		
		125	0.8 A			0.8 A		
		250	0.3 A			0.3 A		

Table 36 - Possible Ring-Terminal Combinations

CE	CD	CT
1b	1a	1b
1b	1a, 1b	1b
1a, 2b	1a, 2b	1a
1a, 2b	2a, 1b	1b
2a, 1b	1a, 2b	1b
1a	1a	1a
3a	3a	1a
3b	3b	1b

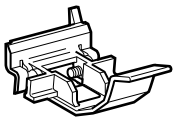
Additional Actuators for Cradle Position Switches on MasterPact NW Circuit Breakers

A set of additional actuators may be installed on the cradle to change or add the functions of the cradle position switches. Each standard actuator can be replaced by any other actuator to change the function of the cradle position switch.

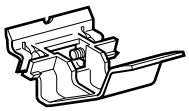
Figure 16 - Cradle Position Switch Actuators

Actuator for up to Three CE Switches (standard)

Actuator for up to Three CD Switches (standard)



Actuator for up to Three CT Switches (standard)



MicroLogic Trip Unit Accessories

External Neutral Current Transformer (CT)

External Neutral Current Transformer (CT)

The sensor is installed on the neutral conductor for neutral protection and metering and residual current ground-fault protection for equipment.

NOTE: The rating of the external neutral current transformer must be compatible with the rating of the circuit breaker.

External Sensor for Source Ground-Return (SGR) and Modified Differential Ground-Fault (MDGF) Protection

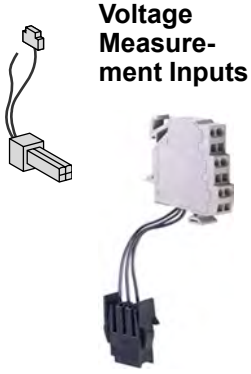
NOTE: SGR and MDGFare for use on circuit breakers with 1600 A and higher sensors.

For SGR System: The sensor is installed around the connection of the transformer neutral point to ground and connects to the MicroLogic 6.0A, 6.0P or 6.0H trip units. SGR requires a modified differential ground-fault (MDGF) sensor and MDGF interface module to connect to the trip unit.

For MDGF System: The MDGF sensor is installed on each phase and neutral of each circuit breaker and connects to the MicroLogic trip unit through an MDGF module. See MDGF instruction bulletin 48049-182.

Voltage Measurement Inputs

Voltage Measure-ment Inputs



Voltage measurement inputs are required for power measurements. As standard, the trip unit is supplied by internal voltage measurement inputs placed on the bottom terminals of the circuit breaker. On request, the internal voltage measurement inputs may be replaced by an external source.

Sensor Plugs

Sensor Plug

Sensor plugs (standard) are used to set the sensor rating (I_n) of the circuit breaker, are field replaceable and are offered at 50–100% of frame rating.

Adjustable Rating Plugs

Adjustable Rating Plug

Eight interchangeable rating plugs are available to limit the long-time threshold setting range for greater versatility.

Table 37 - Adjustable Rating Plug Settings

Rating Plug	Switch Settings $I_r = I_n$ x...								
Type R	0.4	0.5	0.6	0.7	0.8	0.9	0.95	0.98	1
Type S	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8
Type T	0.8	0.82	0.85	0.88	0.9	0.92	0.95	0.98	1
Type P (off plug)	No long-time protection.								

External Power Supply Module

External Power Supply Module

Power supply modules are available in six input voltages: 24/30 Vdc, 48/60 Vdc, 125 Vdc, 110/130 Vac, 200/240 Vac, and 380/415 Vac (all +10%, -15%). The output voltage for each is 24 Vdc; the output power is 5 VA/5 W (ripple < 5%). The modules are not UL® Listed.

When used with the MicroLogic A, P, and H trip units, a power supply module makes it possible to:

- Display currents less than 20% of sensor (I_n).
- Maintain display of tripping causes after opening of the circuit breaker (P and H trip units only).
- Store the value of the interrupted current (P and H trip units only).
- Power the M2C module (P and H trip units only).

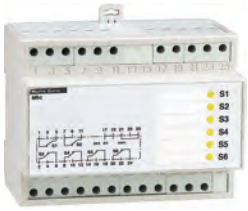
External Battery Backup Module

External Battery Backup Module

The external battery backup module provides up to 12 hours of backup power for the power supply module.

M2C/M6C Programmable Contact Modules

M6C Programmable Contact Module



M2C Programmable Contact Module

These contacts are used with the MicroLogic P and H trip units, and indicate the type of fault and instantaneous or delayed threshold overruns (i.e trip unit protection pick-up, current/voltage unbalance, under/over voltage, reverse power, phase rotation, under/over frequency, and load shedding). The M2C unit is powered from the trip unit's 24 Vdc source (100 mA consumption); the M6C unit requires an external 24 Vdc power supply (100 mA consumption).

They are programmed via the trip unit using a keypad or via a supervisory station with the COM communication option. They may be programmed:

- with instantaneous return to the initial state,
- without return to the initial state,
- with return to the initial state following a delay.

Table 38 - Characteristics for M2C/M6C Programmable Contacts

Minimum Load		**100 mA/24 V**
Breaking Capacity at a Power Factor (p.f.) of 0.7	240 Vac	5 A
	380 Vac	3 A
	24 Vdc	1.8 A
	48 Vdc	1.5 A
	125 Vdc	0.4 A
	250 Vdc	0.15 A

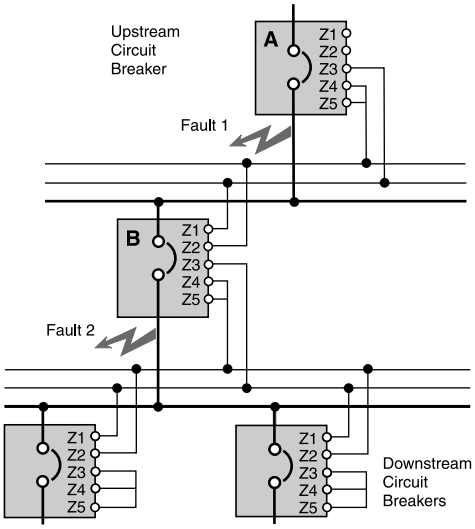
Zone-Selective Interlocking (ZSI)

Zone-selective interlocking (ZSI) is used to reduce the stress on electrical distribution equipment during fault conditions by reducing the time it takes to clear the fault, while maintaining system coordination between overcurrent protective devices.

During a short-circuit or ground-fault condition on a ZSI system, the device directly ahead of the fault sends a signal upstream via control wiring to restrain upstream circuit breakers from tripping and then trips with no intentional time delay to clear the fault. Upstream devices which receive a restraint signal obey their short-time and/or ground-fault delay settings to maintain coordination in other areas of the system. Upstream devices that do not receive a restraint signal trip with no intentional time delay.

For ZSI to work, trip settings must be coordinated so a downstream circuit breaker will trip before an upstream circuit breaker under overload, short-circuit or ground-fault conditions. (Effective coordination requires a system coordination study.)

Example of Zone-Selective Interlocking



Fault 1—The upstream circuit breaker (A) will clear the fault with no intentional delay, regardless of its time-delay setting.

Fault 2—Circuit breaker (B) will inform upstream circuit breaker (A) that it is clearing the fault. This will prevent circuit breaker (A) from tripping instantaneously. Circuit breaker (A) will trip at the end of its time delay setting if the fault is not cleared during this time.

Restraint Interface Module (RIM)

Restraint Interface Module (RIM)

The restraint interface module (RIM) is used to allow zone-selective interlocking communications between circuit breakers with old MicroLogic, Merlin Gerin™, or Federal Pioneer™ trip units and GC series ground-fault relays.

Downstream circuit breakers with MicroLogic 2.0A, 5.0A, 5.0P, 5.0H, 6.0A, 6.0P, and 6.0H trip units can restrain up to 15 upstream circuit breakers with MicroLogic 5.0A, 5.0P, 5.0H, 6.0A, 6.0P and 6.0H trip units without requiring a restraint interface module. If the number of upstream circuit breakers exceeds 15, then a RIM is required.

Table 39 - RIM Requirements (Number denotes maximum number of upstream circuit breakers that can be restrained without requiring a RIM).

Downstream Device (sends output to RIM)	Upstream Device (receives output to RIM)					
	MicroLogic Trip Unit[16]	MicroLogic Saries B Trip Unit	Square D GC-100 Relay	Square D GC-200 Relay	Merlin Gerin STR58 Trip Units	Federal Pioneer USRC and USRCM Trip Units
MicroLogic Trip Unit[16]	15[17]	R	R	15	15	R
Square D MicroLogic Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Relay	R	R	7	R	R	R
Square D GC-200 Relay	15	R	R	15	15	R
Merlin Gerin STR58 Trip Units	15	R	R	15	15	R
Merlin Gerin STR53 Trip Units	15	R	R	15	15	R
Federal Pioneer USRC and USRCM Trip Units	R	15	R	R	R	15
Square D Add-On Ground Fault Module for Equipment Protection	R	5	R	R	R	R

16. Includes 2.0A (as a downstream trip unit only), 5.0A, 5.0P, 5.0P, 5.0H, 6.0A, 6.0P, and 6.0H trip units.
17. Number denotes maximum number of upstream circuit breakers that can be restrained without requiring a RIM.

Cradle Connections

Table 40 - MasterPact NW 3P/4P Drawout Circuit Breakers

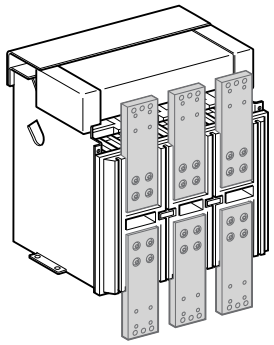
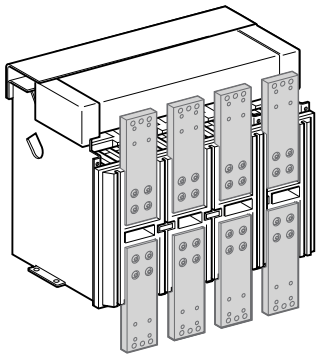
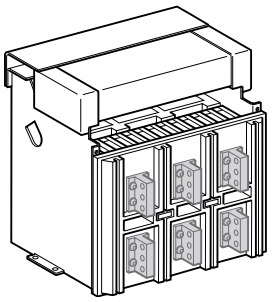
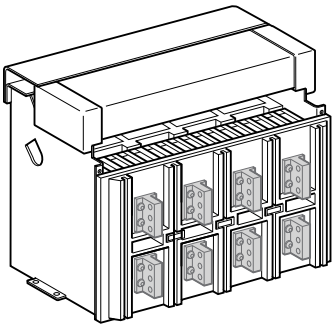
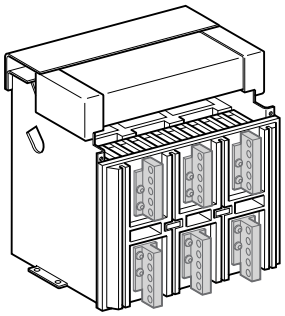
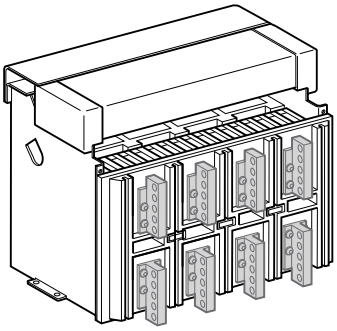
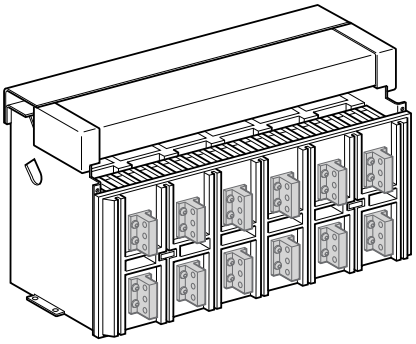
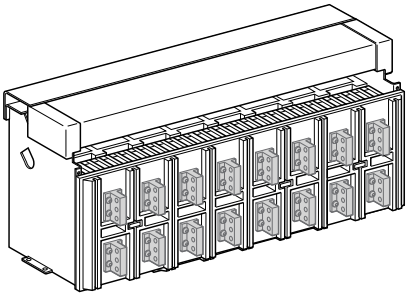
Connector Type	Ampere Rating	3P Layout	4P Layout
Front-Connected Flat (FCF)	3200 A		
Rear-Connected “T” Vertical (RCTV)	800—3200 A		
	4000 A		
	5000 A		

Table 40 - MasterPact NW 3P/4P Drawout Circuit Breakers (Continued)

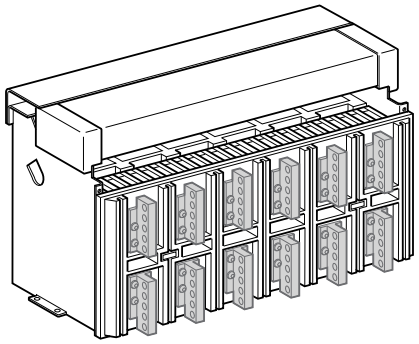
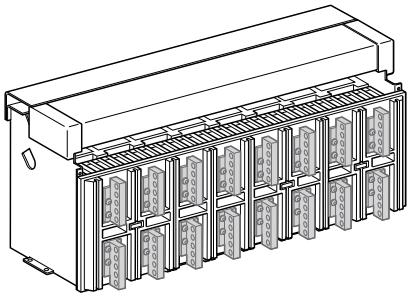
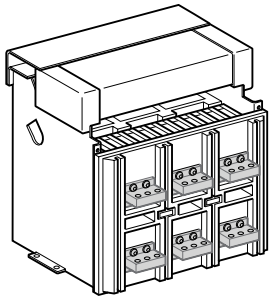
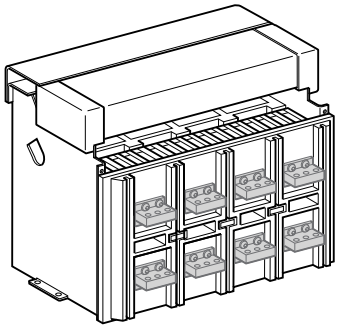
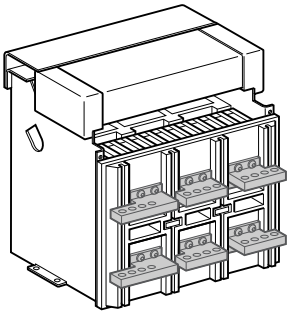
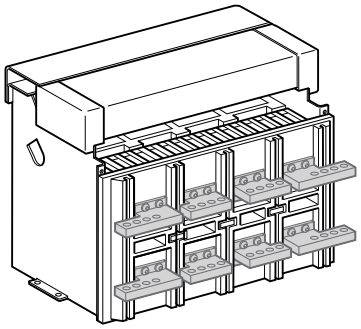
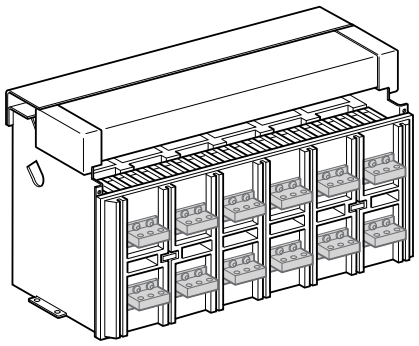
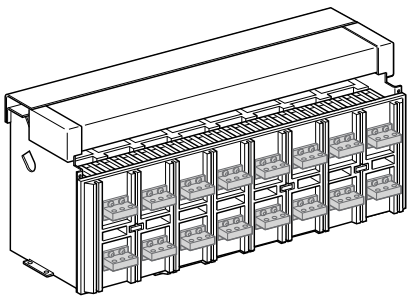
Connector Type	Ampere Rating	3P Layout	4P Layout
	6300 A		
Rear-Connected “T” Horizontal (RCTH)	800—3200 A		
	4000 A		
	5000 A		

Table 41 - MasterPact NW 3P/4P Fixed Circuit Breakers

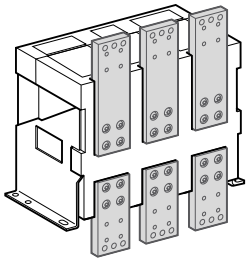
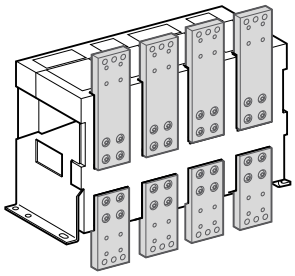
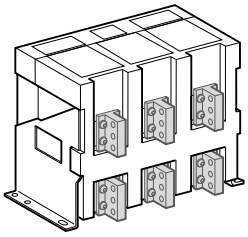
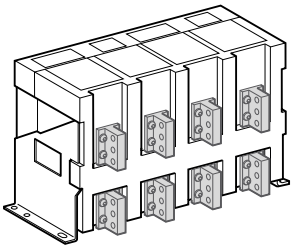
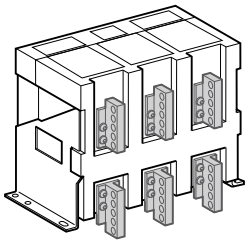
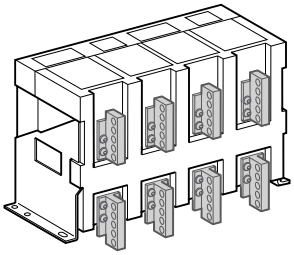
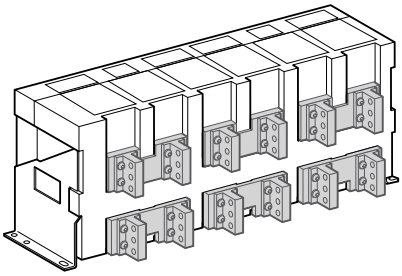
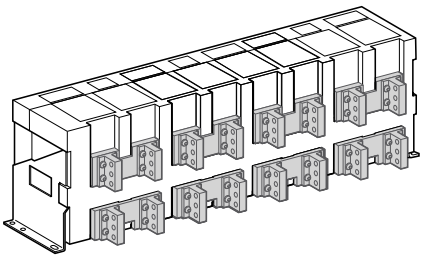
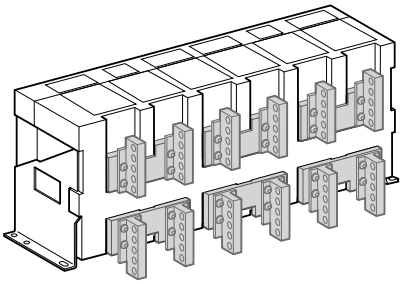
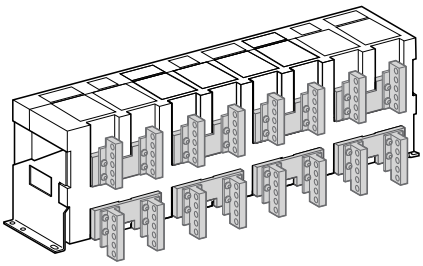
Connector Type	Ampere Rating	3P Layout	4P Layout
Front-Connected Flat (FCF)	800—3200 A		
Rear-Connected “T” Vertical (RCTV)	800—3200 A		
	4000 A		
	5000 A		
	6300 A		

Table 41 - MasterPact NW 3P/4P Fixed Circuit Breakers (Continued)

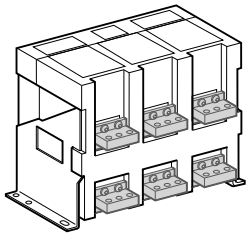
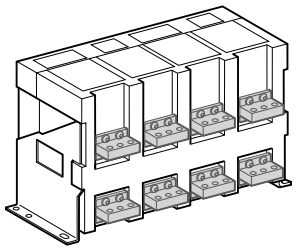
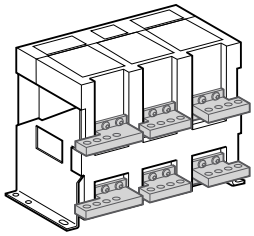
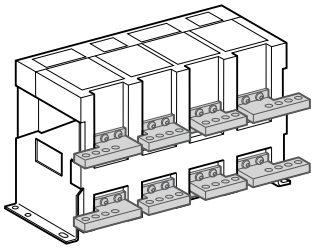
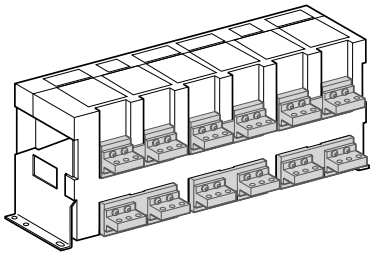
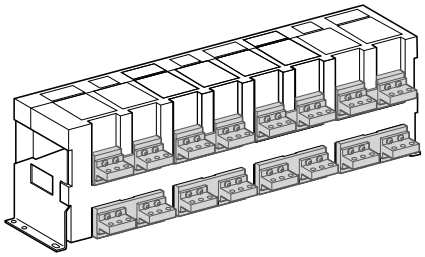
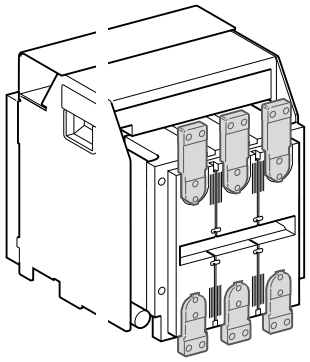
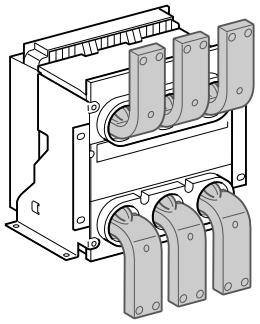
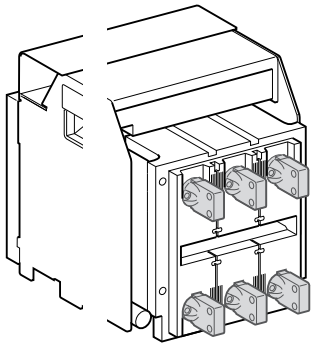
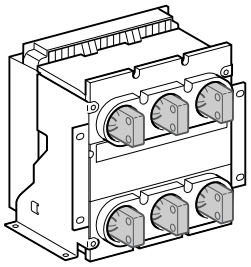
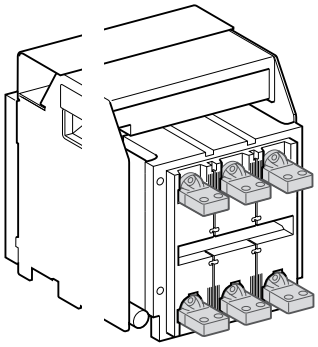
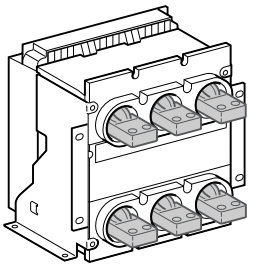
Connector Type	Ampere Rating	3P Layout	4P Layout
Rear-Connected “T” Horizontal (RCTH)	800—3200 A		
	4000 A		
	5000 A		

Table 42 - MasterPact NT 3P/4P Fixed and Drawout Circuit Breakers

Connector Type	Ampere Rating	Drawout Circuit Breakers	Fixed Circuit Breakers
Front-Connected Flat (FCF)	800—1600 A		
Rear-Connected “T” Vertical (RCTV)	800—1600 A		
Rear-Connected “T” Horizontal (RCTH)	800—1600 A		

Test Equipment

Hand-Held Test Kit

Hand-Held Test Kit

The hand held test kit may be used to:

- Verify trip unit operation, the mechanical operation of the circuit breaker, and the electrical continuity of the connection between the trip solenoid and the trip unit.
- Supply control power to the trip unit for settings via the keypad when the circuit breaker is open (MicroLogic type A, P or H trip units).
- Inhibit thermal imaging for primary injection test (MicroLogic type A, P or H trip units).
- Inhibit ground fault for primary injection test (MicroLogic type A, P or H trip units).
- Self-restrain zone-selective interlocking (ZSI).

Full-Function Test Kit

Full-Function Test Kit

The full-function test kit can be used to verify

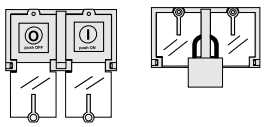
LSIG functionality.

- Optional
- Can be used to check trip unit operation, for example:
  - Display of settings.
  - Operating tests on the electronic component.
  - Automatic and manual tests on protection functions (trip curve verification).
  - Tests on the zone-selective interlocking (ZSI) functions.
  - Inhibit thermal imaging for primary injection testing.
  - Self-restrain zone-selective interlocking (ZSI).
- Can also be used to:
  - Check mechanical operation of the circuit breaker.
  - Check the electrical continuity of connection between the trip solenoid and the trip unit.
  - Print the trip unit and circuit breaker test report when used in conjunction with a PC. FFTK report generator software (cat. no. FFTKRPT-V1-0) is required.

Circuit Breaker Locking and Interlocking

Push Button Lock

Push Button Lock



A transparent cover blocks access to the push buttons used to open and close the device. It is possible to independently lock the opening button and/or the closing button. The push buttons may be locked using:

- One to three padlocks: 3/16–5/16 in. diameter, not supplied.
- A wire seal.
- Two screws.

Open Position Padlock and Key Lock Provisions

Open Position Key Lock (NW)

Open Position Padlock Provision (NW)

The circuit breaker is locked in the off position by physically keeping the opening push button pressed down using one of the following:

- One to three padlocks: 3/16–5/16 in. diameter, not supplied.
- Key locks: One or two Ronis, Castell, or Profalux key locks are available. (MasterPact NT circuit breakers may have only one key lock on the circuit breaker.)

Keys may be removed only when locking is effective. The key locks are available in any of the following configurations:

- One key lock.
- One key lock mounted on the device plus one identical key lock supplied separately for interlocking with another device.
- Two different key locks mounted on the circuit breaker for double locking.

A locking kit for installation of one or two key locks may be ordered separately.

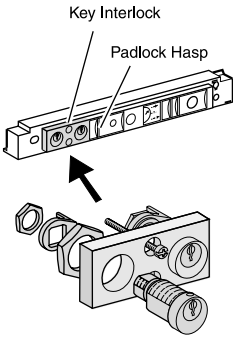
Table 43 - Circuit Breaker and Switch Locking Options

Type of Locking		Maximum Number of Locks
Pushbutton Locking	Using padlocks	Three padlocks
Open Position Locking	Using key locks	Two key locks (optional)
	Using padlocks and key locks	Up to three padlocks and two key locks (optional)

Cradle Locking and Interlocking

Disconnected Position Locking

Disconnected Position Locking Provisions

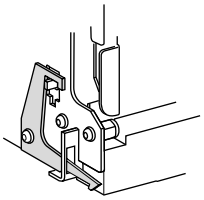


The circuit breaker can be locked in the disconnected position by key interlock (optional) or padlock (standard). The key interlock is on the cradle and accessible with the door locked.

- Key interlock, Ronis, Castell, or Profalux key locks are available. Key is captive when key interlock is unlocked.
- Locking on disconnected, test, and connected positions is optional.

Door Interlock

Door Interlock (NW)



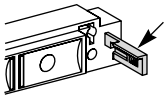
The door interlock prevents the compartment door from being opened when the circuit breaker is in the connected or test position. If the circuit breaker is put into the connected position with the door open, the door can be closed without disconnecting the circuit breaker. For greater protection, this interlock can be used in conjunction with the open door racking interlock.

Racking Interlock Between Racking Crank and Off Position

The racking interlock is optional. It prevents insertion of the racking crank unless the OFF push button is pressed. Not available for MasterPact NT circuit breakers.

Open Door Racking Interlock

Open Door Racking Interlock (NW)



The racking interlock prevents racking in the circuit breaker when the door is open. (Insertion of the circuit breaker racking crank is not possible when the compartment door is open.

Cable Door Interlock Kit

The optional cable door interlock prevents the compartment door from being opened when the circuit breaker is in the closed position. This kit includes:

Figure 17 - Cable Door Interlock Kit Contents

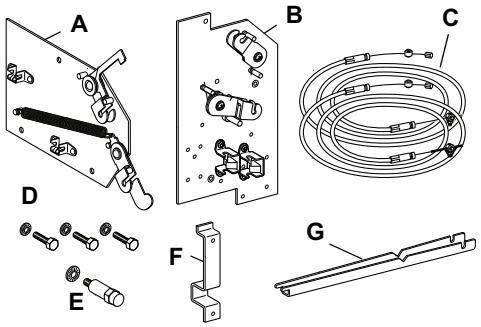


Table 44 - Kit Contents

A	Panel Interlocking Plate
B	Circuit Breaker Interlocking Plate
C	Interlocking Cables
D	Bolts with Washers
E	Guide-Bolt with Washer
F	Interlocking Bracket
G	Calibration Tray

Source Changeover Interlocks

Source changeover interlocks allow mechanical interlocking between two or three circuit breakers (fixed and drawout).

Interlocking Two Circuit Breakers

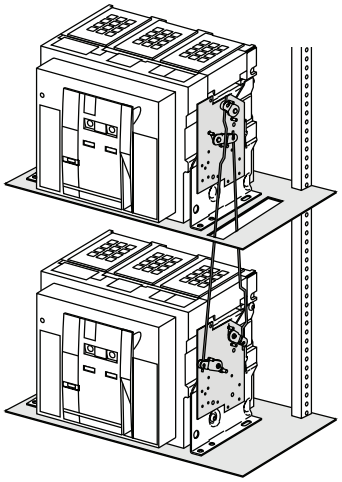
- Interlocking Two Mains Using Rods
- Interlocking Two Mains Using Cables

Interlocking Three Circuit Breakers Using Cables

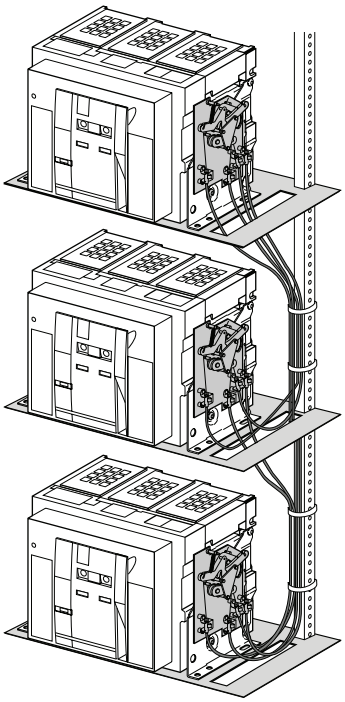
- Interlocking Two Mains and One Generator
- Interlocking Two Mains and One Tie
- Interlocking Three Mains

Figure 18 - Source Changeover Interlocks

Two NW Circuit Breakers Interlocked Using Rods



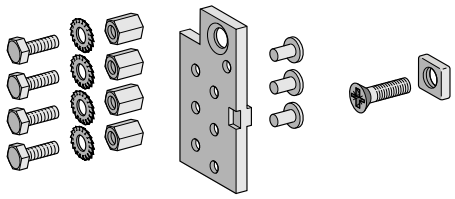
Three NW Circuit Breakers Interlocked Using Cables



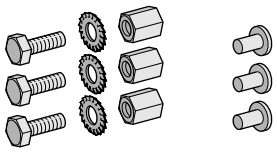
Cradle Rejection Kits

The cradle rejection feature (standard) ensures that only the properly designated circuit breaker or switch is matched with the selected cradle assembly.

Cradle Rejection Kit Contents (NW)

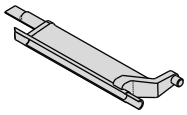


Cradle Rejection Kit Contents (NT)



Automatic Spring Discharge Mechanism

Automatic Spring Discharge Mechanism (NW)



The automatic spring discharge mechanism is optional. It releases the closing spring energy when the circuit breaker is moved from the disconnected position to the fully withdrawn position. Not available for MasterPact NT circuit breakers.

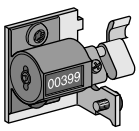
Rail Padlocking

Rail padlocking is standard for cradles. When used in combination with the disconnected position locking device, rail padlocking prevents the movement of the circuit breaker from the disconnected position to the fully withdrawn position when the padlock hasp is pulled out and locked.

Miscellaneous Accessories

Mechanical Operation Counter (CDM)

Mechanical Operation Counter (CDM)



The mechanical operation counter (CDM) registers the total number of operating cycles. One CDM is installed per circuit breaker.

Shutter and Shutter Lock

The shutters automatically block access to the main disconnects when the circuit breaker is in the disconnected, test, or fully withdrawn position. The shutter lock is used to prevent connection of the circuit breaker or to lock the shutters in the closed position.

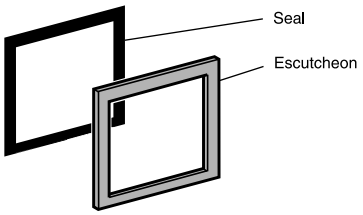
Not available on cradles with ArcBlok™ technology.

Door Escutcheon (CDP)

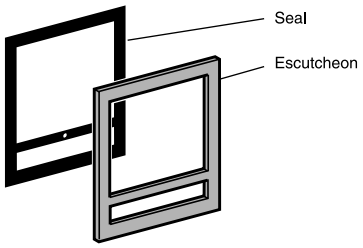
These door escutcheons provide a frame and seal for the circuit breaker.

Figure 19 - Door Escutcheons

Door Escutcheon (NW Fixed)

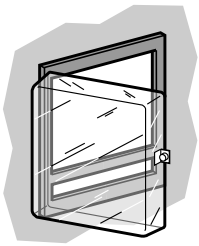


Door Escutcheon (NW Drawout)



Transparent Cover (CCP) for Door Escutcheon

Transparent Cover (CCP)

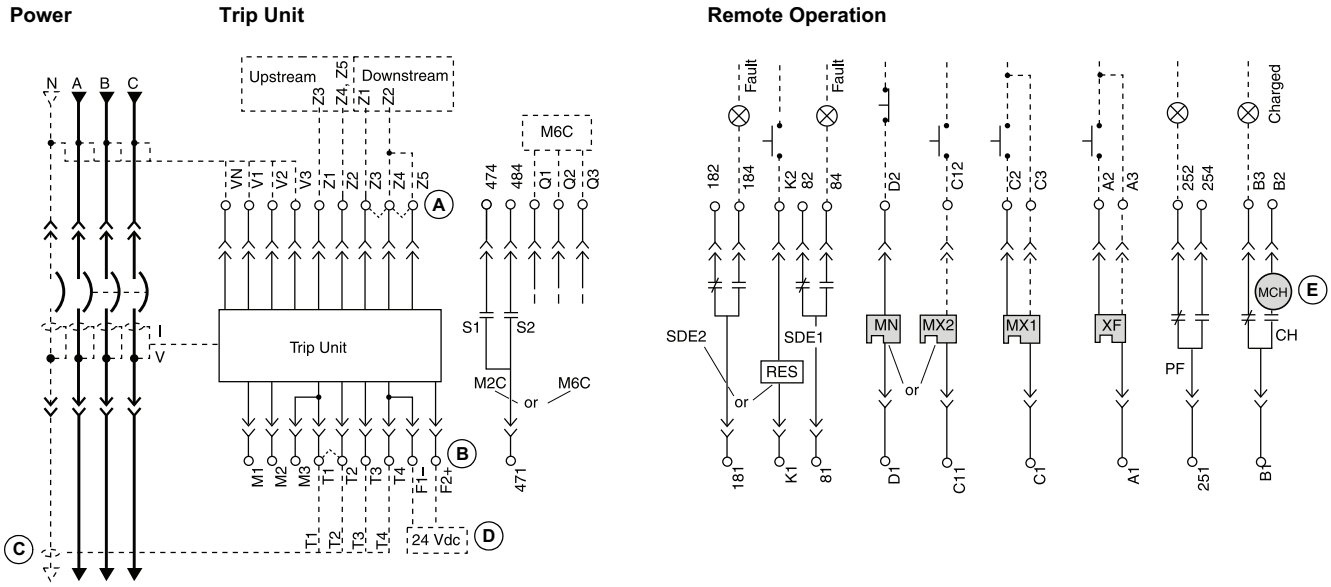


The cover is hinged-mounted and locked with a milled head, and is designed to be installed on the door escutcheon.

Wiring Diagrams

Wiring Diagrams for MasterPact NW Circuit Breakers

Figure 20 - Wiring Diagrams for MasterPact NW Circuit Breakers



NOTE: All diagrams show circuit breaker open, connected and charged.

A	Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B	Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C	For proper wiring of neutral CT, refer to Instruction Bulletin 48041-082-01 shipped with it.
D	24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
E	When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Terminals

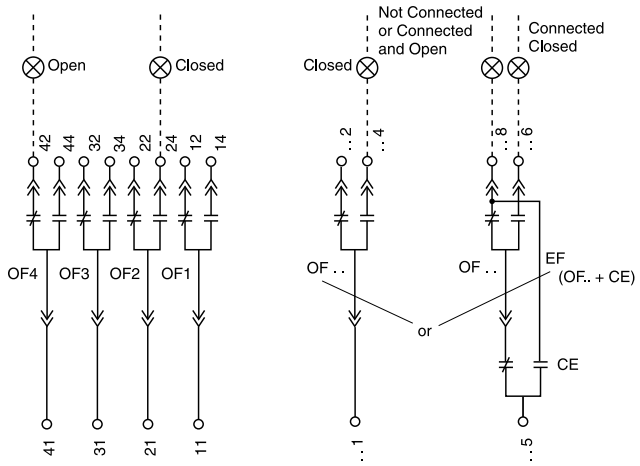
Cell Switches		
CD3	CD2	CD1
834	824	814
832	822	812
831	821	811

or

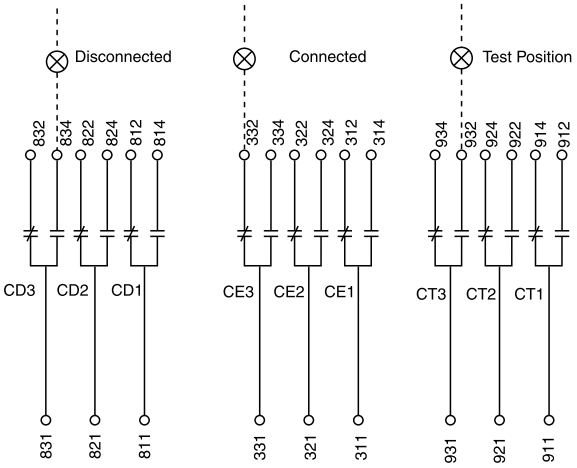
CE6	CE5	CE4
364	354	344
362	352	342
361	351	341

Trip Unit										Cell Switches			Remote Operation				
COM	UC1	UC2	UC3	UC4	M2C/M6C	SDE2/RES	SDE1	CE3	CE2	CE1	MN/MX2	MX1	XF	PF	MCH
E5 E6	Z5 M1	M2 M3	F2+	V3	484/Q3	184/K2	84	334	324	314	D2/C12	C2	A2	254	B2
E3 E4	Z3 Z4	T3 T4	VN	V2	474/Q2	182	82	332	322	312	C13	C3	A3	252	B3
E1 E2	Z1 Z2	T1 T2	F1−	V1	471/Q1	181/K1	81	331	321	311	D1/C11	C1	A1	251	B1

Auxiliary Contacts



Cell Switches



Markings for Push-In Type Terminals

Auxiliary Contacts											
OF24	OF23	OF22	OF21	OF14	OF13	OF12	OF11	OF4	OF3	OF2	OF1
244	234	224	214	144	134	124	114	44	34	24	14
242	232	222	212	142	132	122	112	42	32	22	12
241	231	221	211	141	131	121	111	41	31	21	11

Cell Switches		
CT3	CT2	CT1
934	924	914
932	922	912
931	921	911

or

EF24	EF23	EF22	EF21	EF14	EF13	EF12	EF11
248	238	228	218	148	138	128	118
246	236	226	216	146	136	126	116
245	235	225	215	145	135	125	115

or

CD6	CD5	CD4
864	854	844
862	852	842
861	851	841

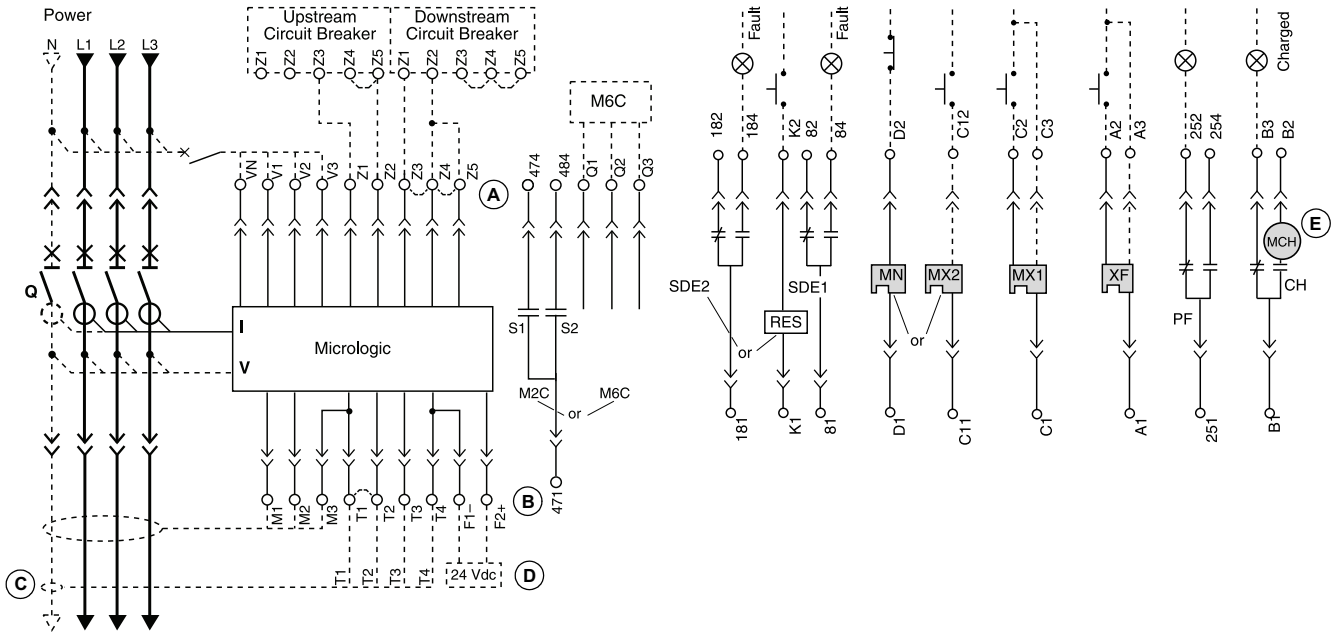
or

CE9	CE8	C7
394	384	374
392	382	372
391	381	371

Wiring Diagrams for MasterPact NT Circuit Breakers

Figure 21 - Markings for Push-In Type Terminals

Power **Trip Unit** **Remote Operation**



NOTE: All diagrams show circuit breaker open, connected and charged.

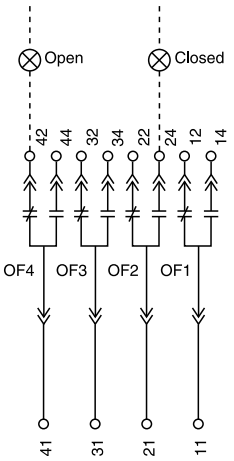
A	Do not remove factory-installed jumpers between Z3, Z4 and Z5 unless ZSI is connected.
B	Do not remove factory-installed jumper between T1 and T2 unless neutral CT is connected. Do not install jumper between T3 and T4.
C	For proper wiring of neutral CT, refer to Instrucion Bulletin 48041-082-01 shipped with it.
D	24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
E	When remote operation features are used, make sure there is a minimum of four seconds for the spring charging motor (MCH) to completely charge the circuit breaker closing springs prior to actuating the shunt close (XF) device.

Markings for Terminals

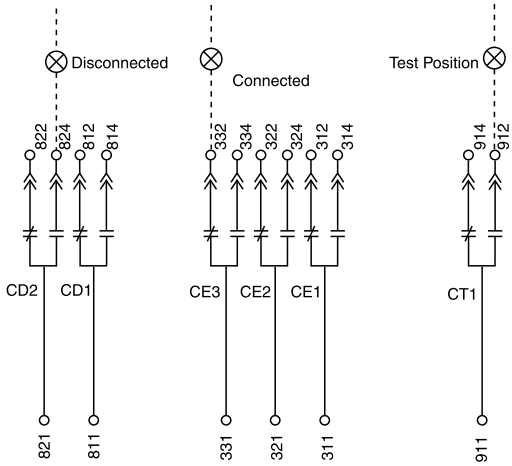
Cell Switches		Trip Unit						
CD2	CD1	COM	UC1	UC2	UC3	UC4 / M2C / M6C	SDE2 / RES	SDE1
824	814	E5 E6	Z5 M1	M2 M3	F2+	V3 / 484 / Q3	184 / K2	84
822	812	E3 E4	Z3 Z4	T3 T4	VN	V2 / 474 / Q2	182	82
821	811	E1 E2	Z1 Z2	T1 T2	F1–	V1 / 471 / Q1	181 / K1	81

Remote Operation				
MN / MX2	MX1	XF	PF	MCH
D2 / C12	C2	A2	254	B2
C13	C3	A3	252	B3
D1/C11	C1	A1	251	B1

Auxiliary Switches



Cell Switches

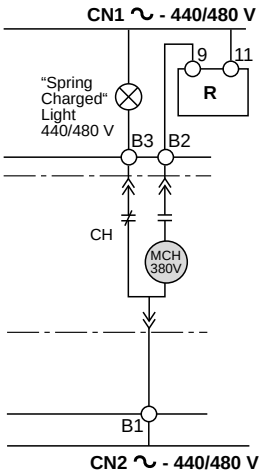


Markings for Terminals

Auxiliary Switches			
OF4	**OF3**	**OF2**	**OF1**
44	34	24	14
42	32	22	12
41	31	21	11

Cell Switches			
CE3	**CE2**	**CE1**	**CT1**
334	324	314	914
332	322	312	912
331	321	311	911

Figure 22 - Spring-Charging Motor 440/480 Vac (380 Vac Motor + Additional Resistor



Additional Wiring Information for MasterPact NWNT Circuit Breakers

Alarm Contacts (OF1, OF2, OF3 and OF4 are standard equipment)		
OF4 OF3 OF2 OF1	Open/Closed Circuit Breaker or Switch Position Contacts	OF24: Open/Closed Circuit Breaker or Switch Position Contact or EF24: Combined Connected and Closed Contact
		OF23 or EF23
		OF22 or EF22
		OF21 or EF21
		OF14 or EF14
		OF13 or EF13
		OF12 or EF12
		OF22 or EF22
		OF11 or EF11

Cradle Contacts					
CD3 CD2 CD1	Disconnected Position Contacts	CE3 CE2 CE1	Connected Position Contacts	CT3 CT2 CT1	Test Position Contacts
or				or	
CE6 CE5 CE4	Connected Position Contacts			CE9 CE8 CE7	Connected Position Contacts
				or	
				CD6 CD5 CD4	Disconnected Position Contacts

Trip Unit					
Basic	**A**	**P**	**H**		
	X	X	X	Com:	E1–E6 Communication
	X	X	X	UC1:	Z1–Z5 Logical Selectivity
	X	X	X		Z1 = ZSI OUT
	X	X	X		Z2 = ZSI OUT Source; Z3 = ZSI IN Source
	X	X	X		Z4 = ZSI IN Short-Time Delay
	X	X	X		Z5 = ZSI IN Ground Fault
	X	X	X	UC3:	F2+, F1– 24 Vdc External Power Supply
		X	X		External Neutral VN Plug
		X	X	UC4	External Phase Voltage Sensing
		X	X	M2C or M6C	Two Programmable Contacts (internal relay)
		X	X		Six Programmable Contacts (for connection to external M6C module)

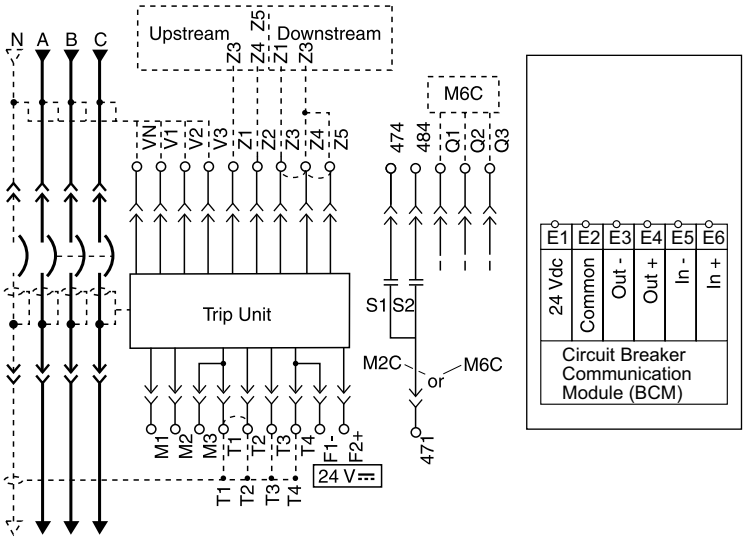
Remote Operation	
SDE2 or RES	Electrical Fault Alarm Contact
	Remote Reset
SDE1	Electrical Fault Alarm Contact (standard)
MN or MX2	Undervoltage Trip Device
	Additional Shunt Trip

Remote Operation	
MX1	Shunt Trip (standard or networked)
XF	Shunt Close (standard or networked)
PF	Ready-to-Close Contact
MCH	Spring-Charging Motor

NOTE: When communication version of the MX1 or XF coils are used, terminals (C3, A3) must be connected to line even if the communications module is not installed.

The bypass circuit through terminal C2/A2 is only momentary duty for 0.5 sec. For continuous duty, use the communications command.

Figure 23 - Connection of the Communications Option



A	24 Vdc power supply for trip unit must be separate and isolated from 24 Vdc power supply for communication modules.
B	Refer to instructions bulletin 48041-082 included with neutral CT for proper wiring.

NOTE: Fixed-mounted circuit breaker does not have cell switches (CE, CD, CT).

NOTE: A recommended wiring schematic for the communicating style shunt trip or shunt close coils is shown below.

Induced voltages in the circuit at terminal C2 and/or A2 can cause the shunt trip or shunt close to not work properly. The best way to prevent the induced voltages is keep the circuit to terminal C2 and A2 as short as possible. If it is impossible to keep the circuit less than 10 feet (3 m), use an interposing relay near terminal C2 or A2.

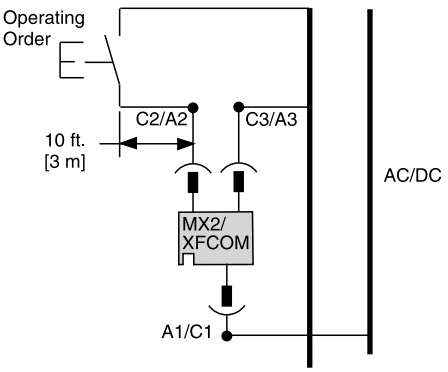
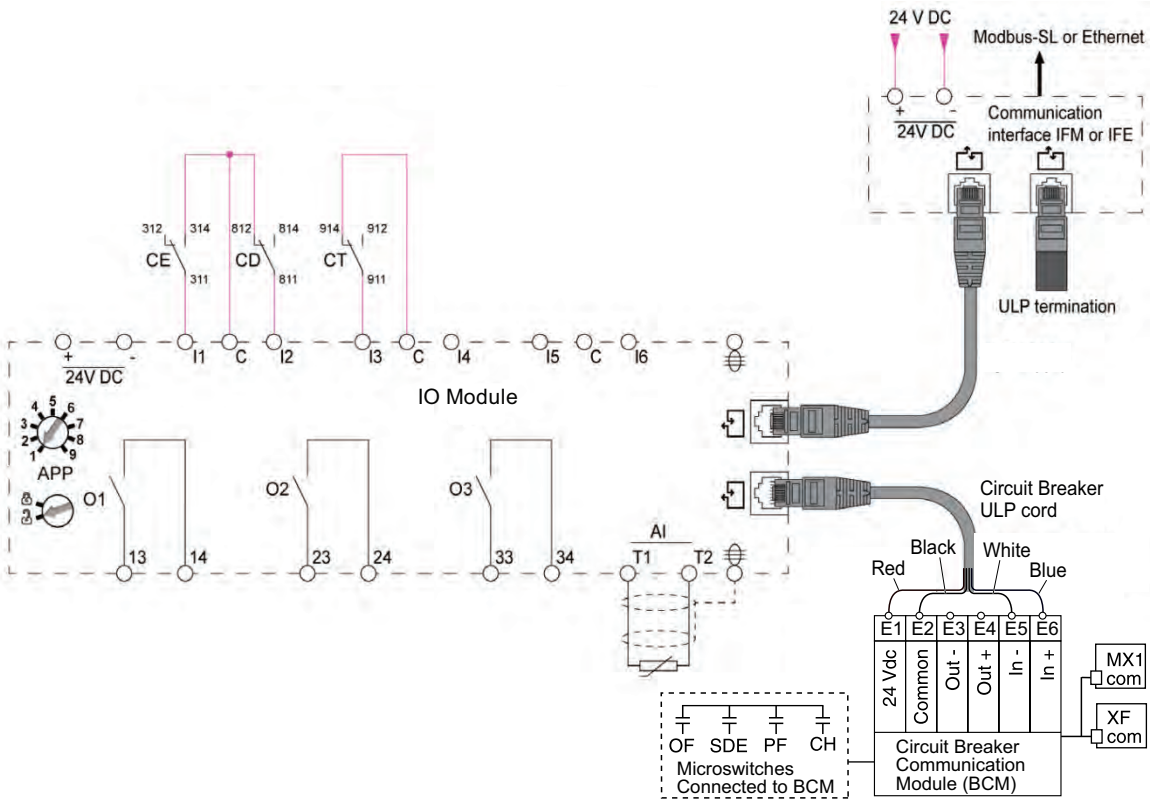


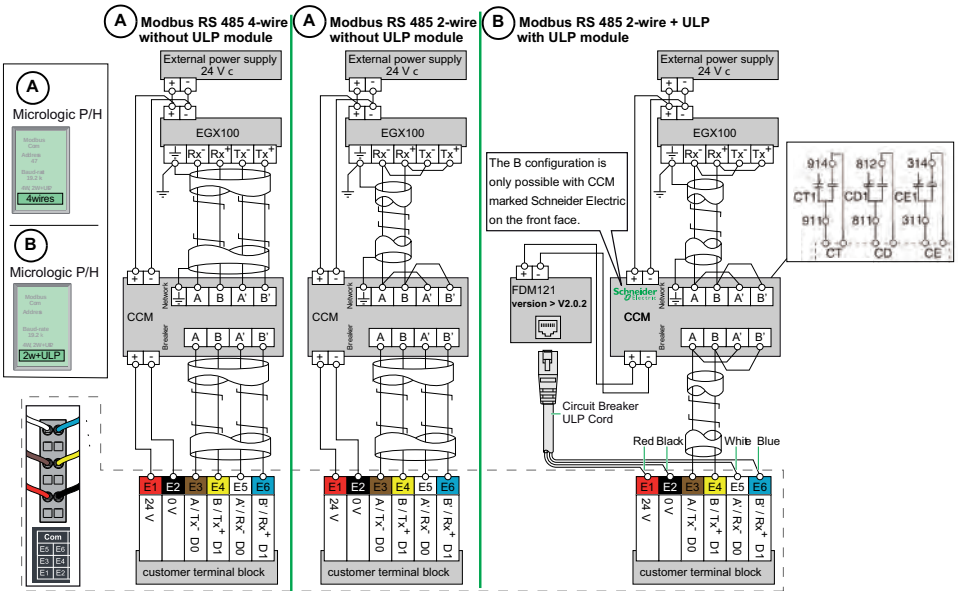
Figure 24 - Wiring Diagrams for the COM Option

Wiring of the I/O Modules



See *Connection of the Communications Option, page 109* for more information.

Wiring of the COM Option (Modbus BCM ULP and CCM Modules



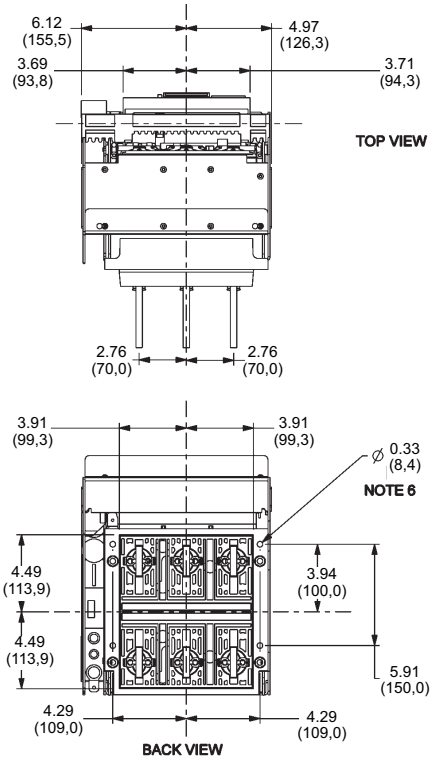
See *Connection of the Communications Option, page 109* for more information.

MasterPact NT Dimensional Drawings

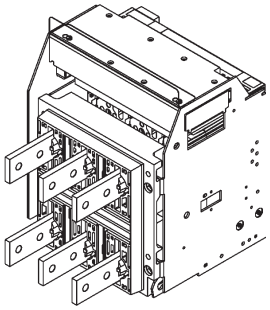
MasterPact NT Enclosure Information

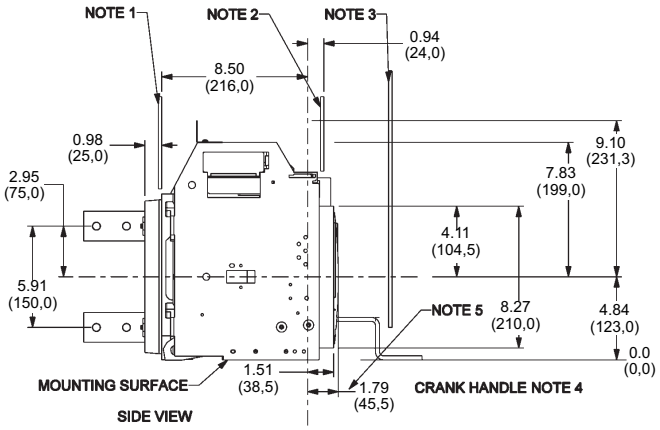
3P Drawout Circuit Breakers

Figure 25 - 800–1600 A MasterPact NT Three-Pole Drawout—Master Drawing



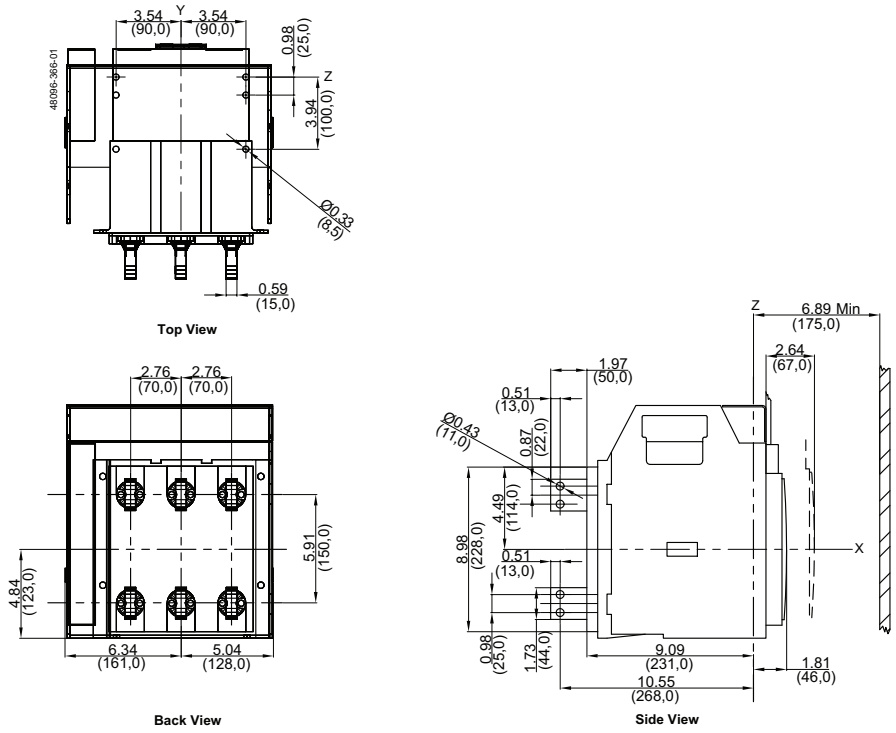
1. Rear Panel
2. Front Door
3. Distance to Drawout Position: 8.27 in. (210 mm)
4. Crank Handle Extension to Mounting Surface: Add 2.36 in. (60 mm)
5. Distance from Connect to Drawout Position: 1.81 in. (46 mm)
6. Rear Panel Mounting Holes





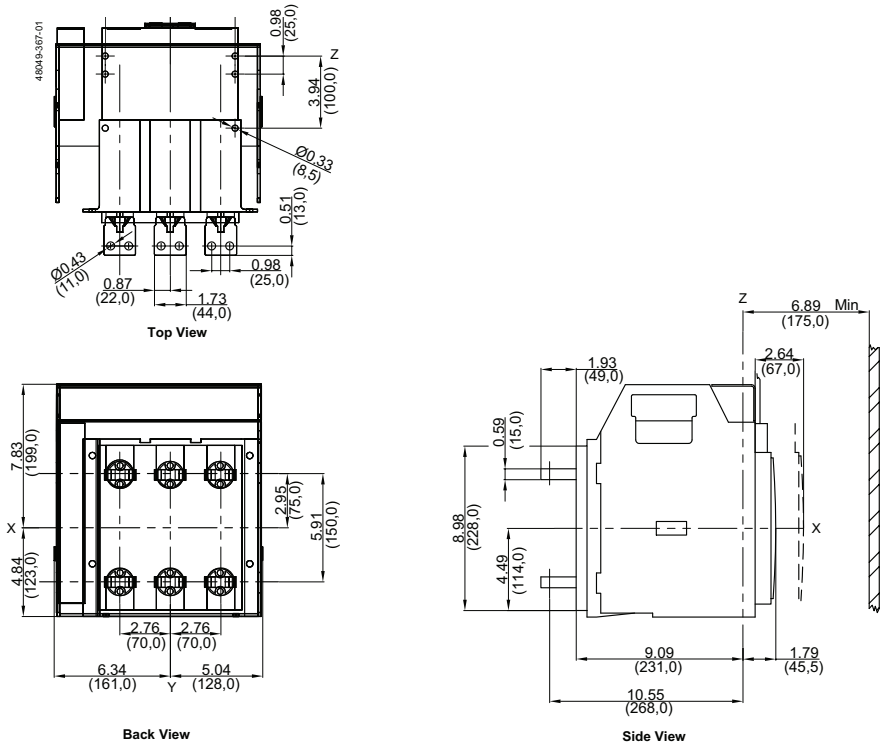
Dimensions: in (mm)

Figure 26 - 800–1600 A MasterPact NT 3P Drawout—RCTV Rear Connected “T” Vertical



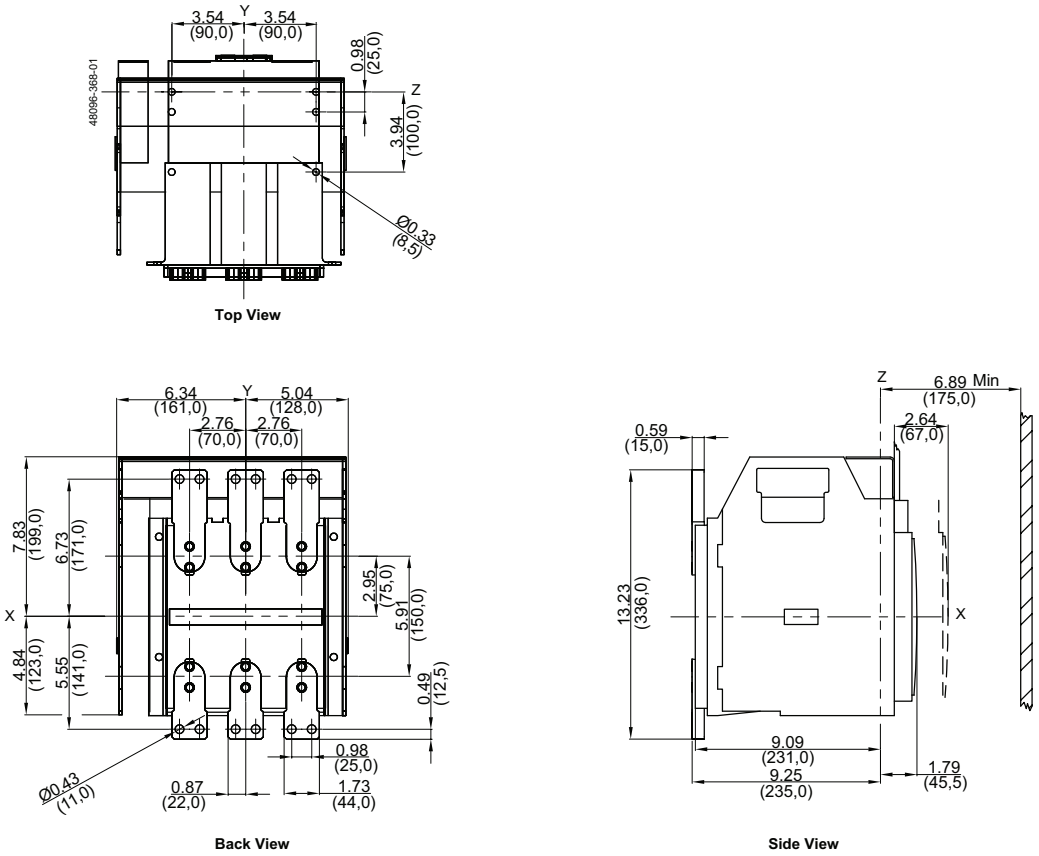
Dimensions: in (mm)

Figure 27 - 800–1600 A MasterPact NT 3P Drawout—RCTH Rear Connected “T” Horizontal



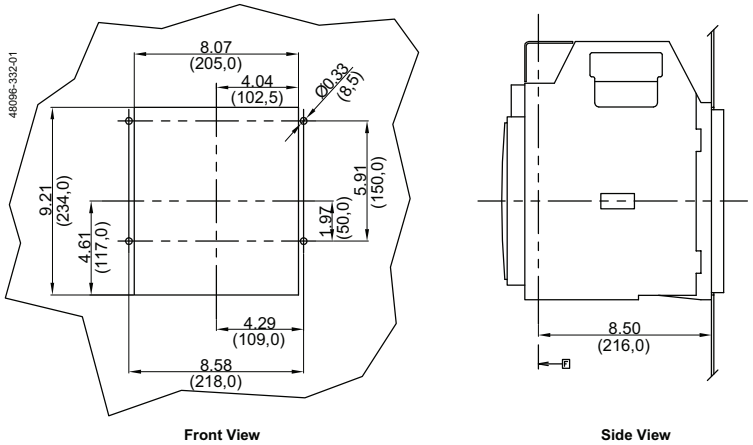
Dimensions: in (mm)

Figure 28 - 800–1600 A MasterPact NT 3P Drawout—FCF Front Connected Flat



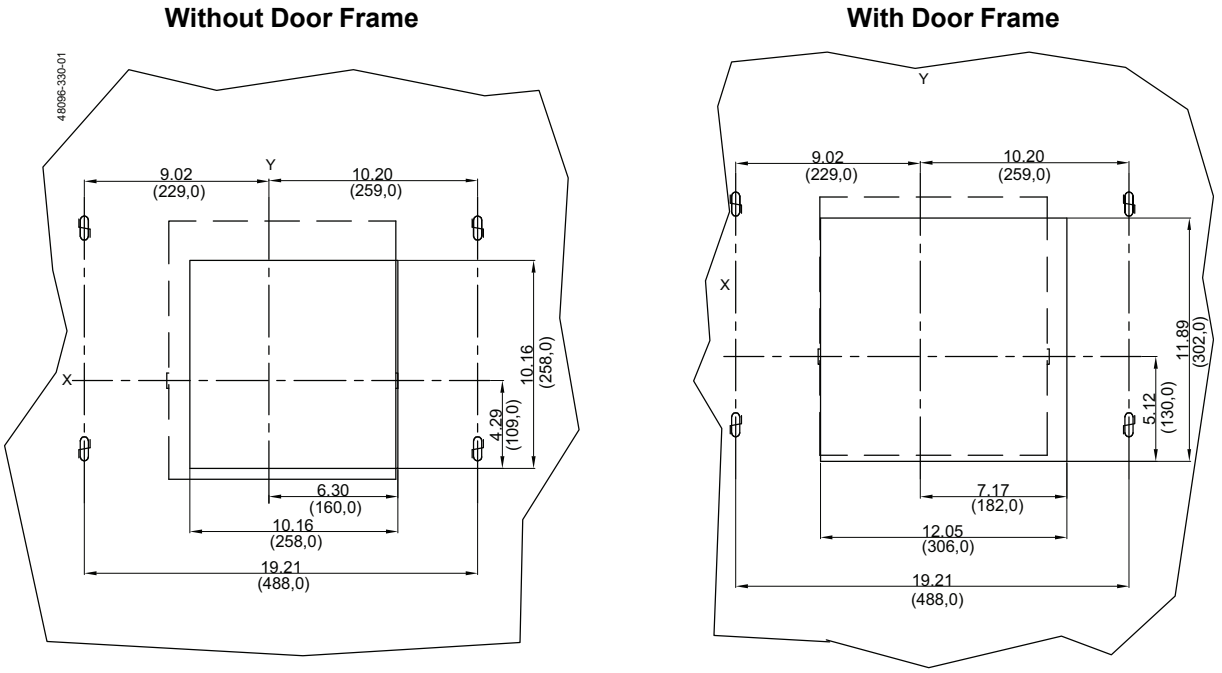
Dimensions: in (mm)

Figure 29 - 800–1200 A MasterPact NT 3P Drawout—Rear Cutout Dimensions



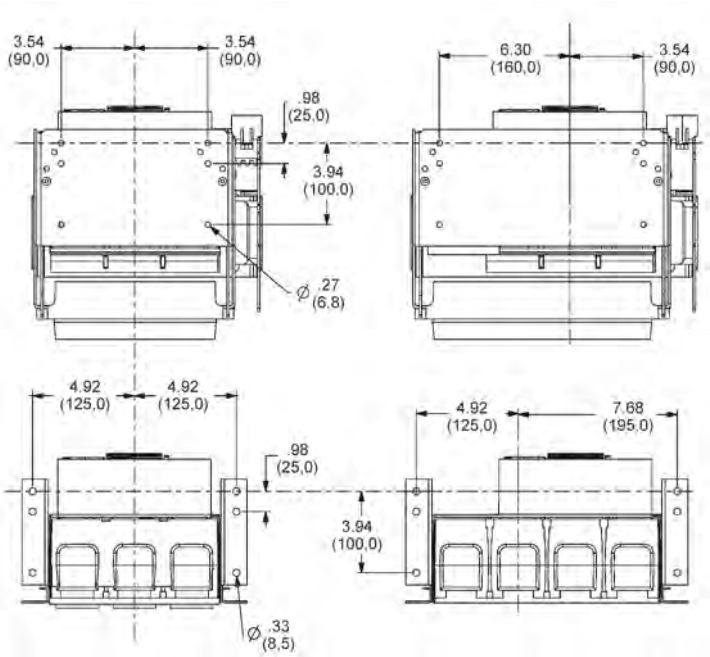
Dimensions: in (mm)

Figure 30 - 800–1200 A MasterPact NT 3P Drawout—Door Cutout Dimensions



Dimensions: in (mm)

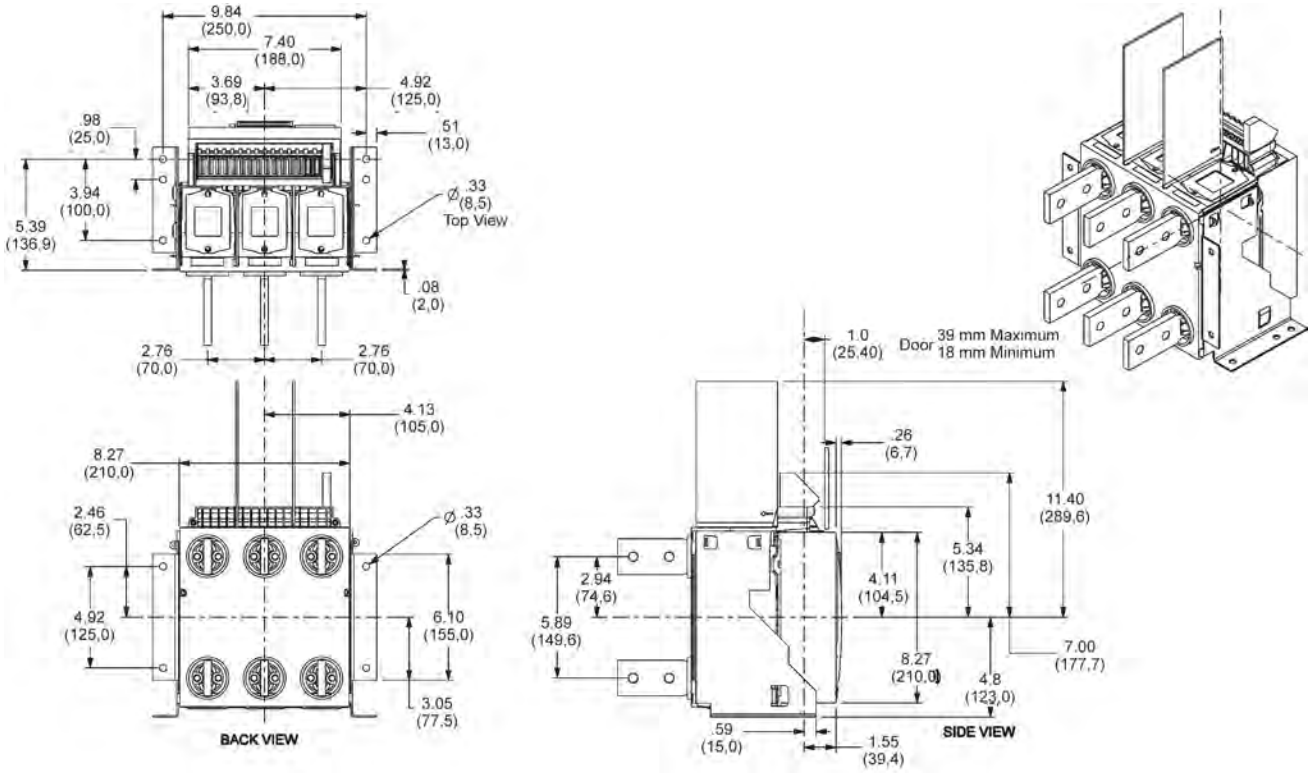
Figure 31 - 800–1200 A MasterPact NT Drawout—Pan Dimensions



Dimensions: in (mm)

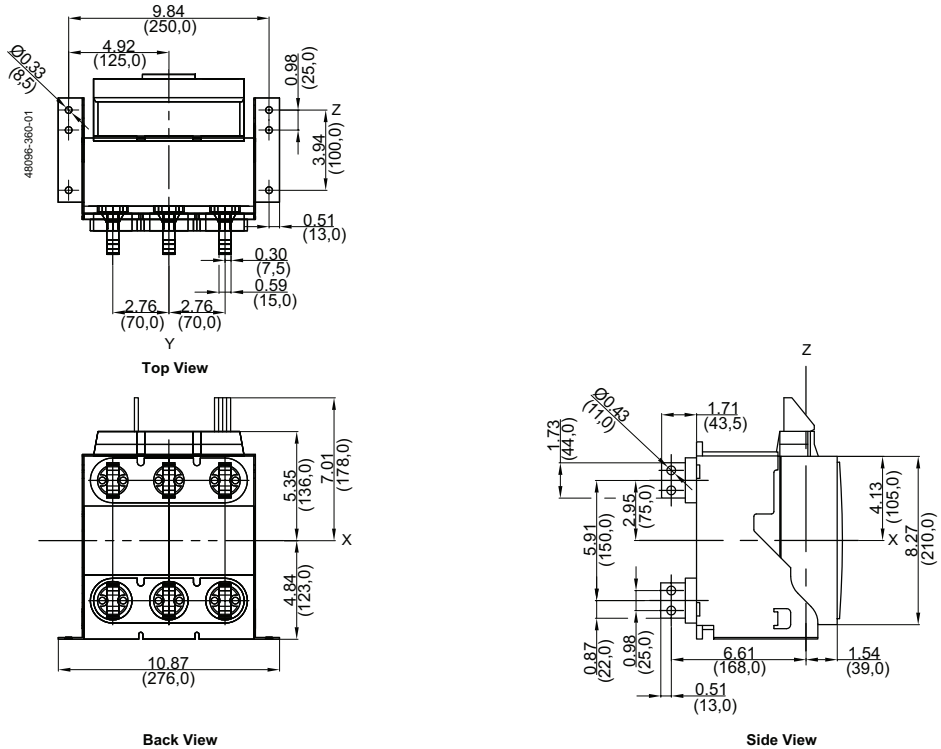
3P Fixed Circuit Breakers

Figure 32 - 800–1600 A MasterPact NT 3P Fixed—Master Drawing



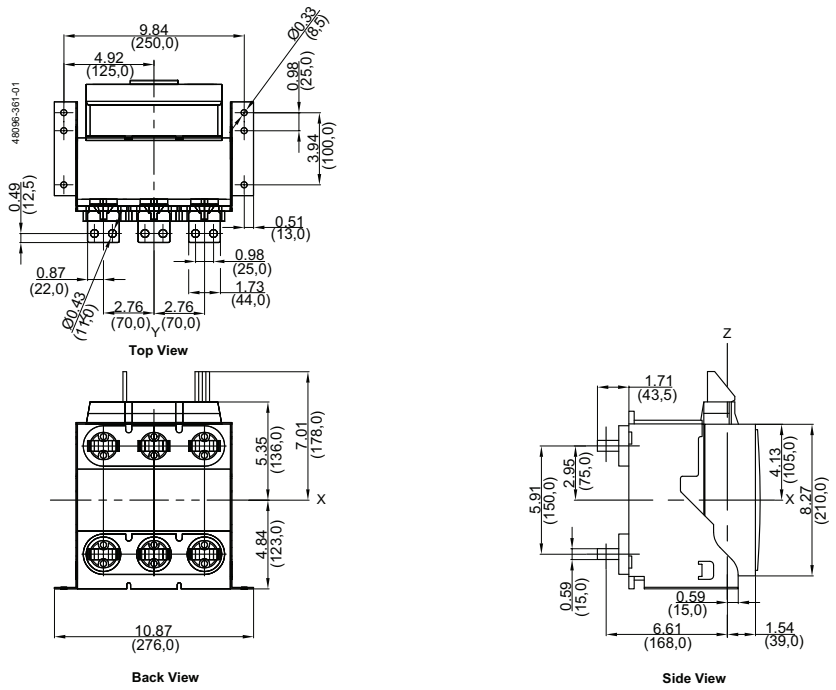
Dimensions: in (mm)

Figure 33 - 800–1600 A MasterPact NT 3P Fixed—RCTV Rear Connected “T” Vertical



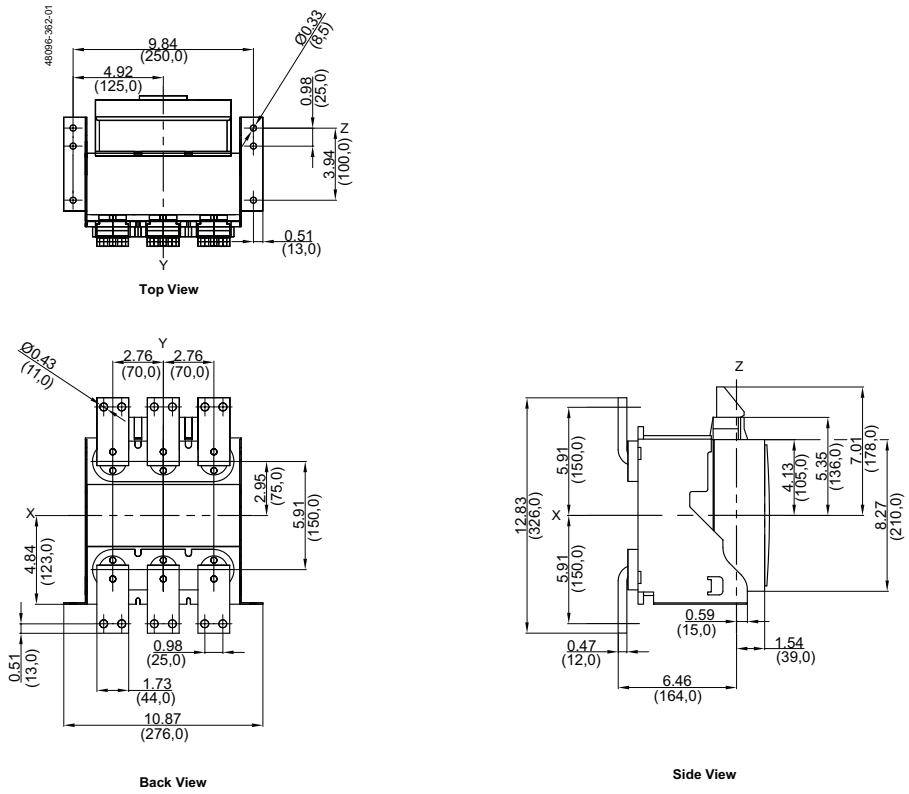
Dimensions: in (mm)

Figure 34 - 800–1600 A MasterPact NT 3P Fixed—RCTH Rear Connected “T” Horizontal



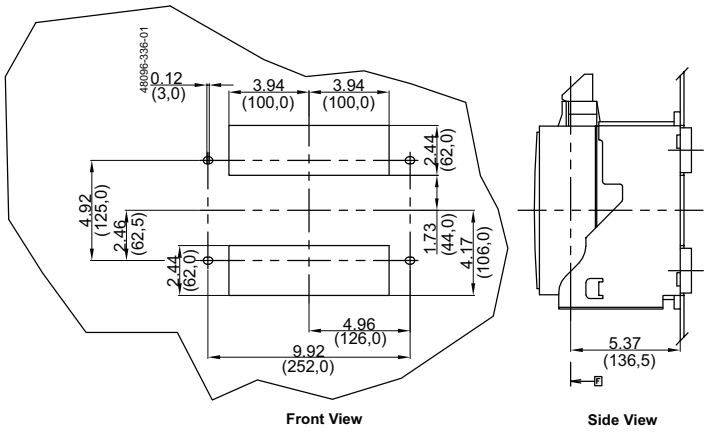
Dimensions: in (mm)

Figure 35 - 800–1600 A MasterPact NT 3P Fixed—FCF Front Connected Flat



Dimensions: in (mm)

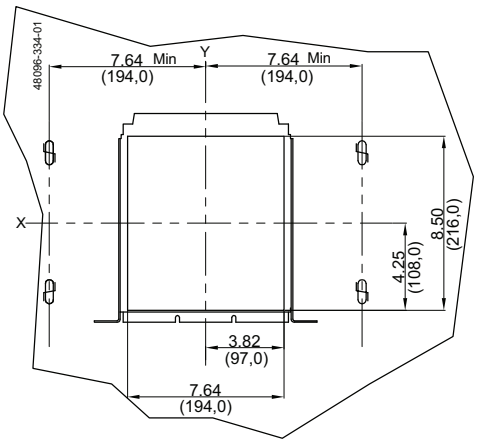
Figure 36 - 800–1200 A MasterPact NT 3P Fixed—Rear Cutout Dimensions



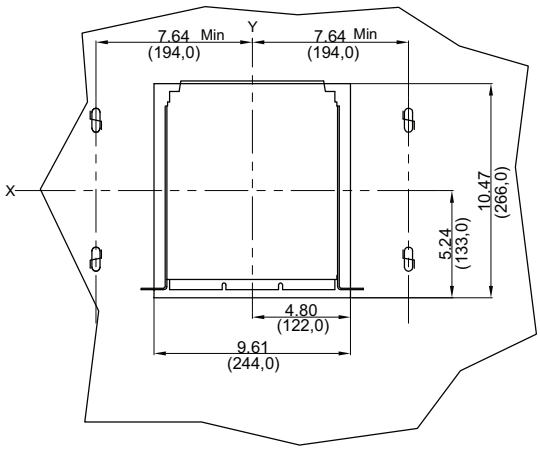
Dimensions: in (mm)

Figure 37 - 800–1200 A MasterPact NT 3P Fixed—Door Cutout Dimensions

Without the door frame

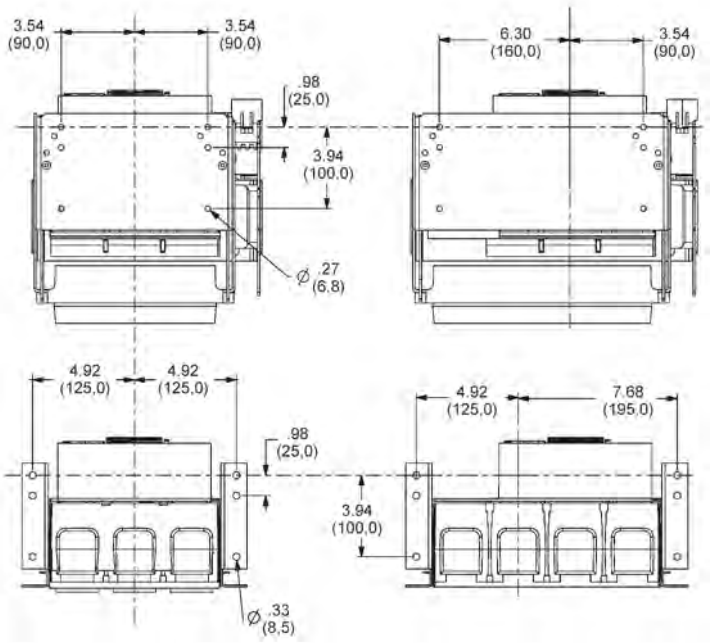


With the door frame



Dimensions: in (mm)

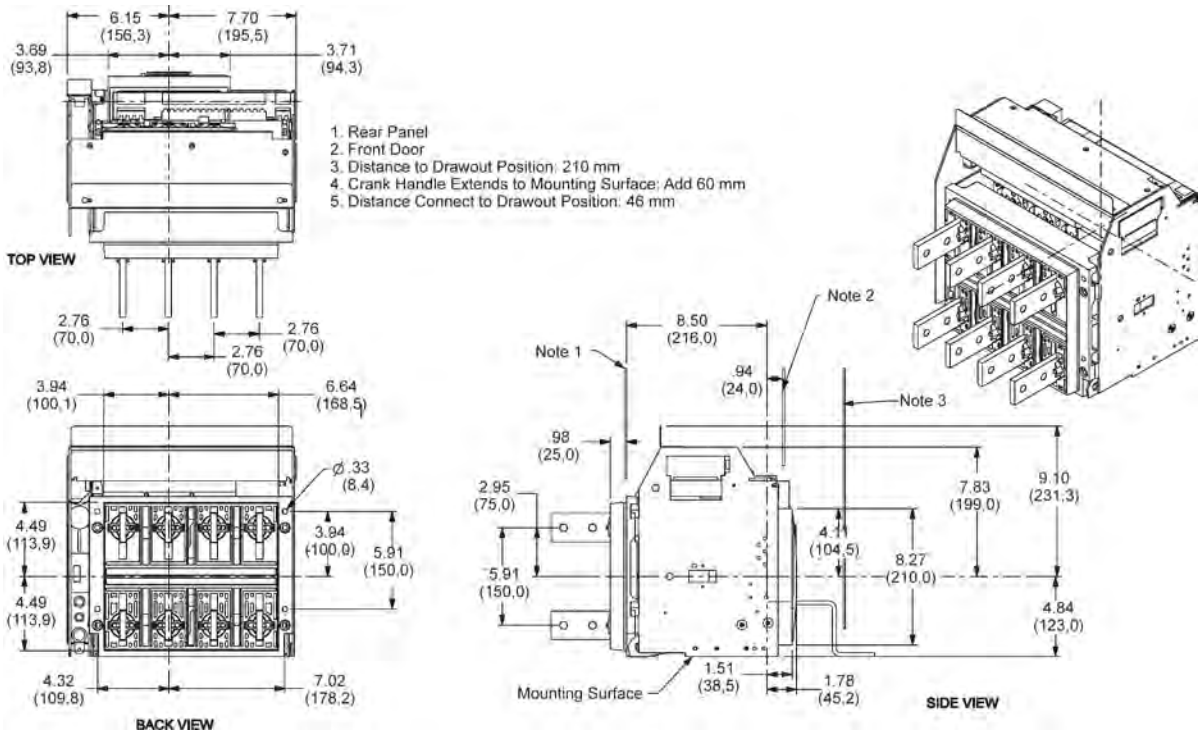
Figure 38 - 800–1200 A MasterPact NT Drawout and Fixed—Pan Dimensions



Dimensions: in (mm)

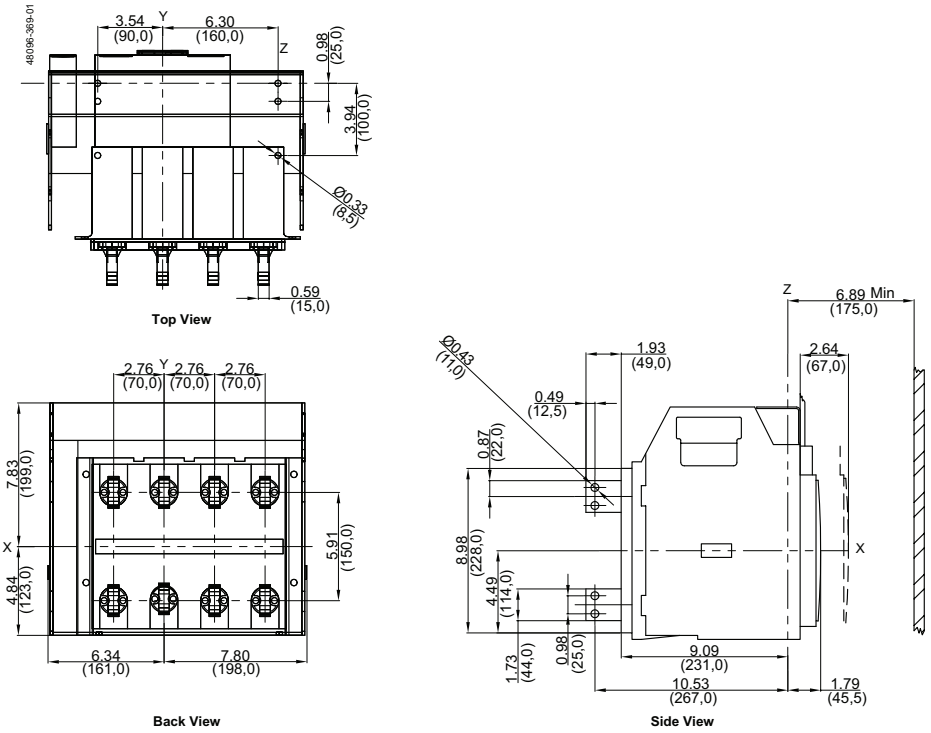
4P Drawout Circuit Breakers

Figure 39 - 800–1600 A MasterPact NT 4P Drawout—Master Drawing



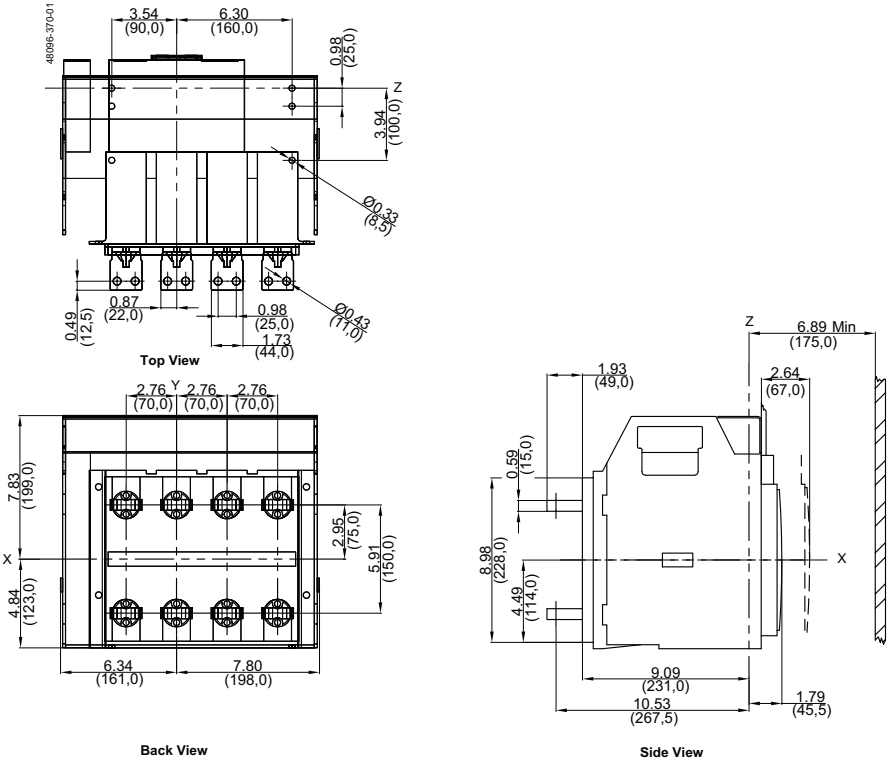
Dimensions: in (mm)

Figure 40 - 800–1600 A MasterPact NT 4P Drawout—RCTV Rear Connected “T” Vertical



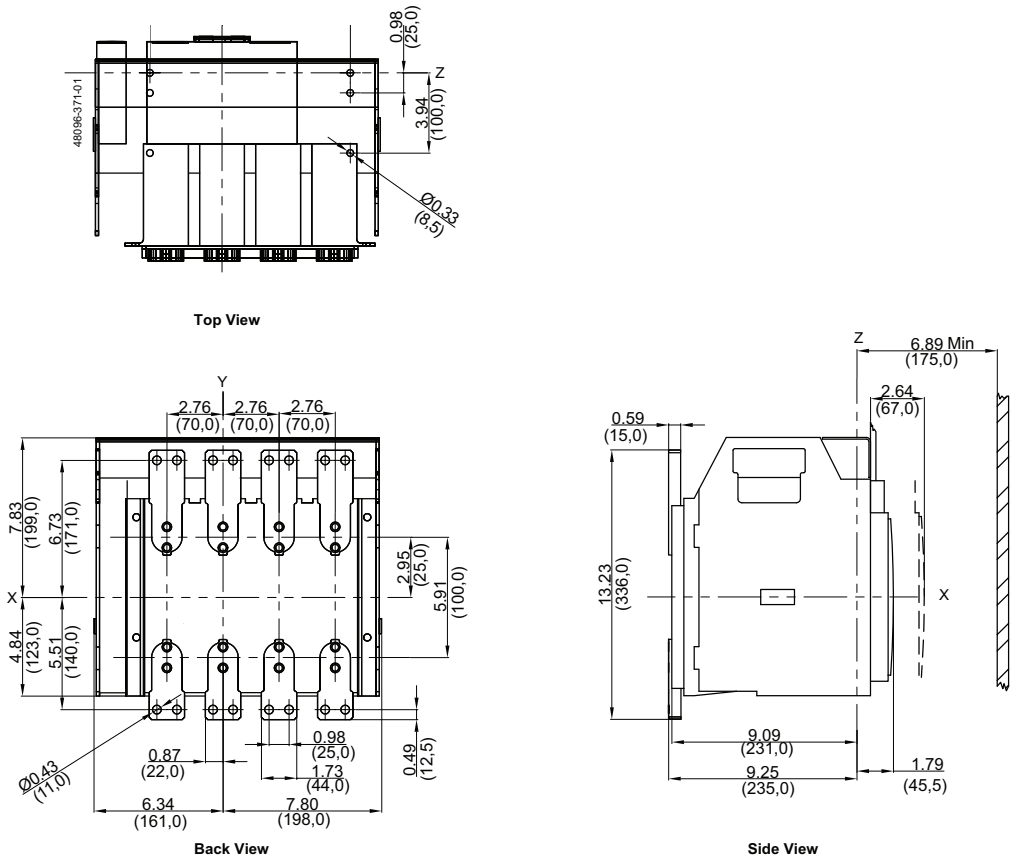
Dimensions: in (mm)

Figure 41 - 800–1600 A MasterPact NT 4P Drawout—RCTH Rear Connected “T” Horizontal



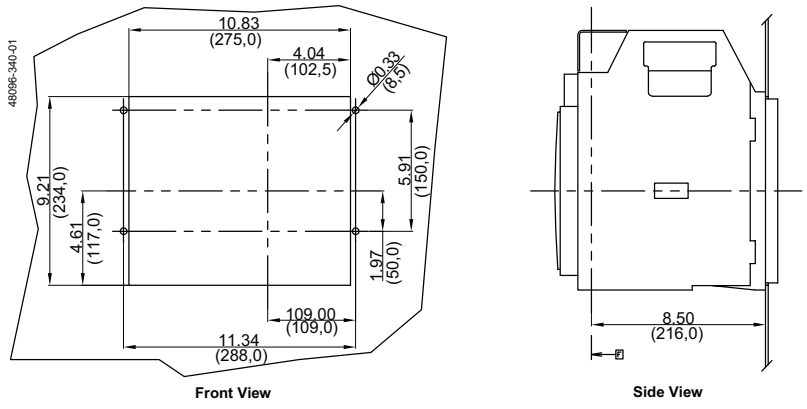
Dimensions: in (mm)

Figure 42 - 800–1600 A MasterPact NT 4P Drawout—FCF Front Connected Flat



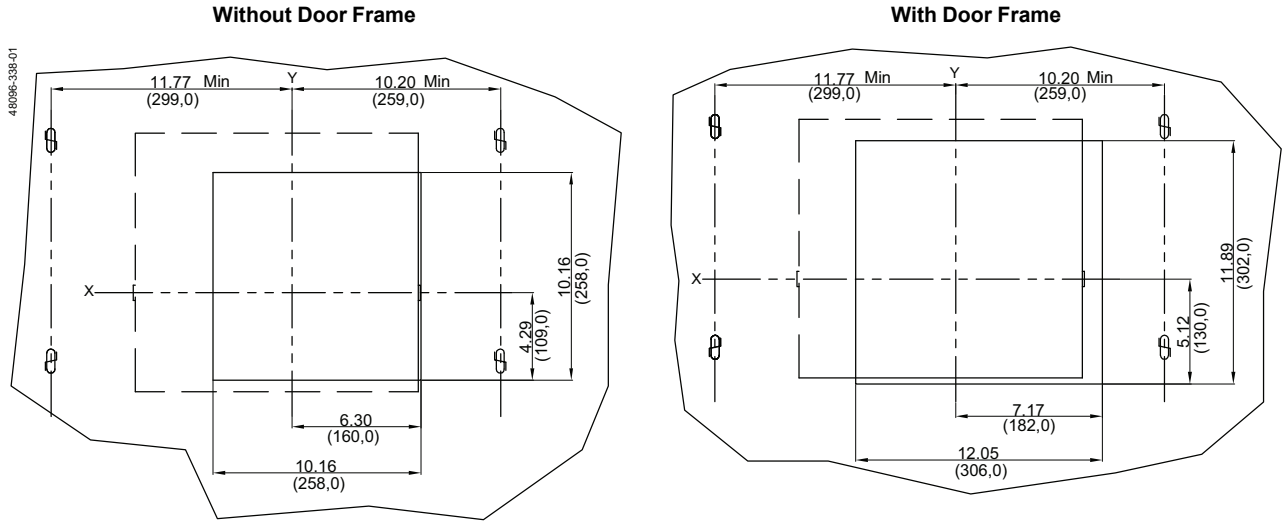
Dimensions: in (mm)

Figure 43 - 800–1200 A MasterPact NT 4P Drawout—Rear Cutout Dimensions



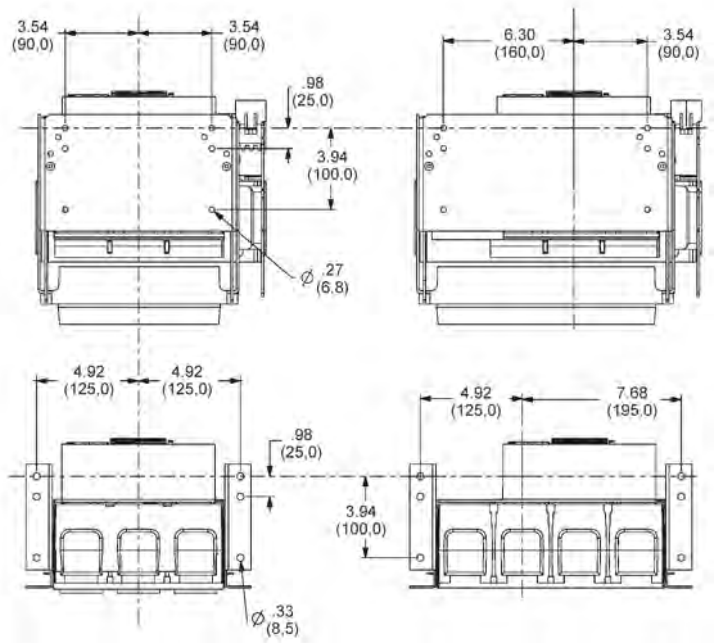
Dimensions: in (mm)

Figure 44 - 800–1200 A MasterPact NT 4P Drawout—Door Cutout Dimensions



Dimensions: in (mm)

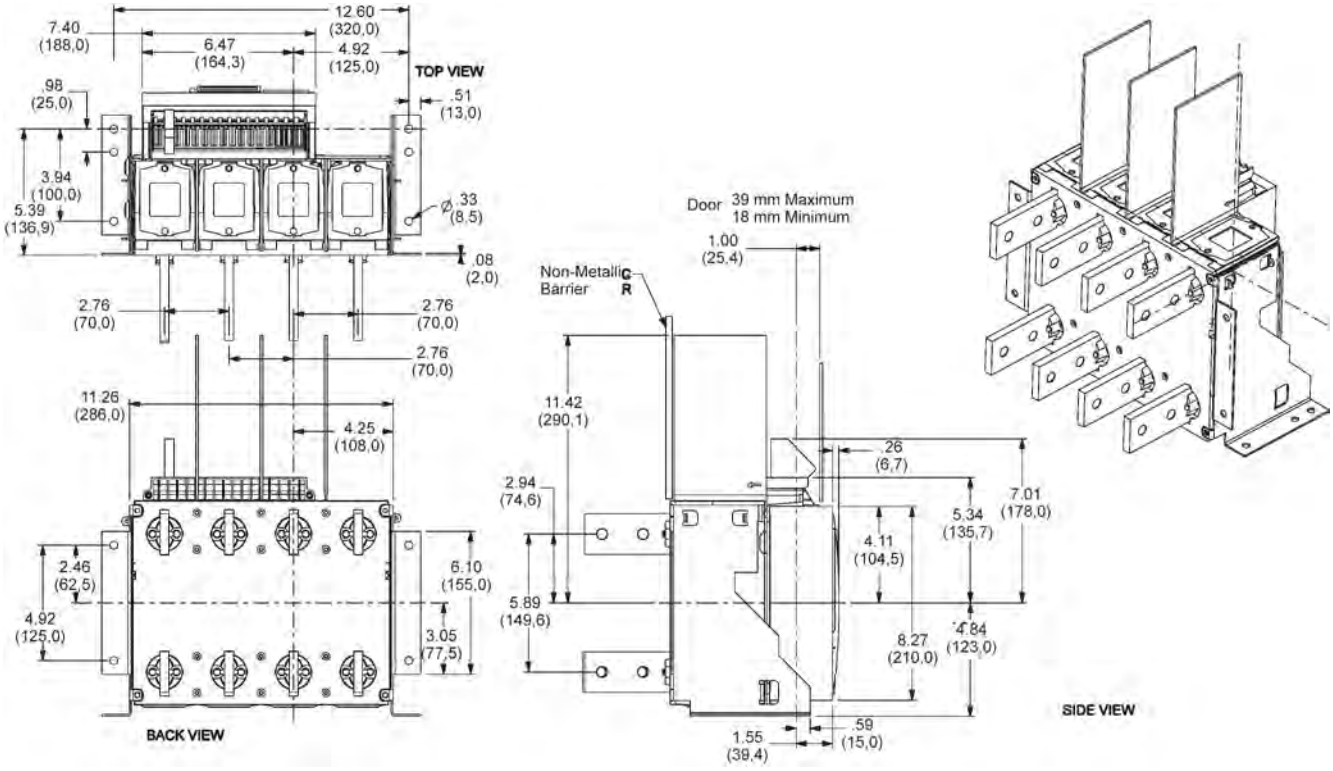
Figure 45 - 800–1200 A MasterPact NT Drawout and Fixed—Pan Dimensions



Dimensions: in (mm)

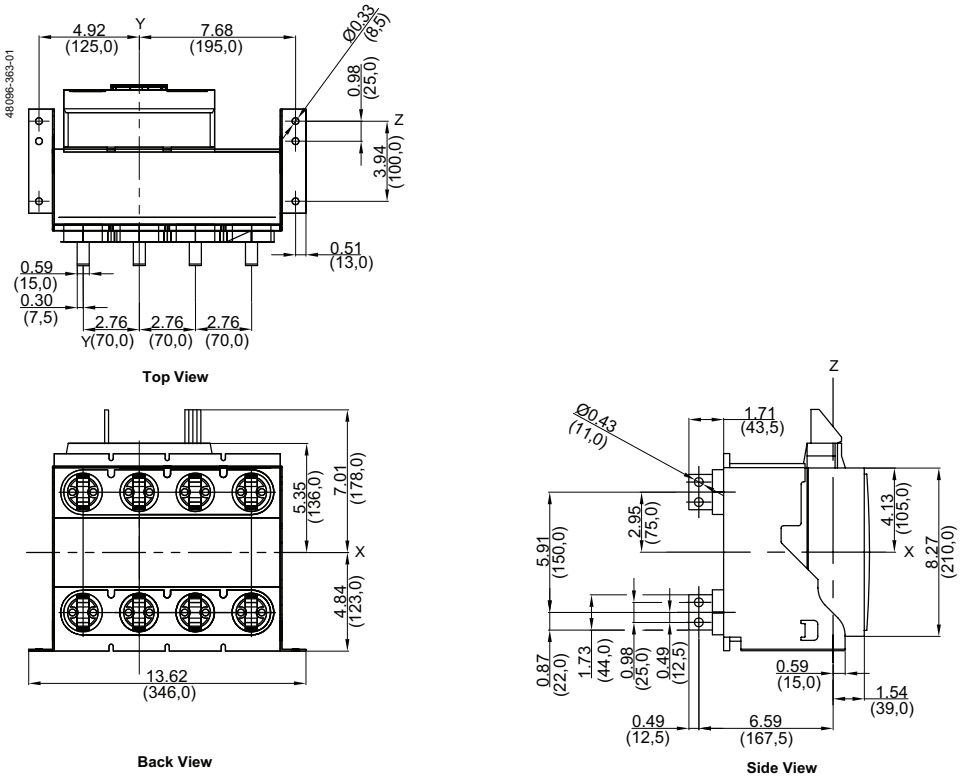
4P Fixed Circuit Breakers

Figure 46 - 800–1600 A MasterPact NT 4P Fixed—Master Drawing



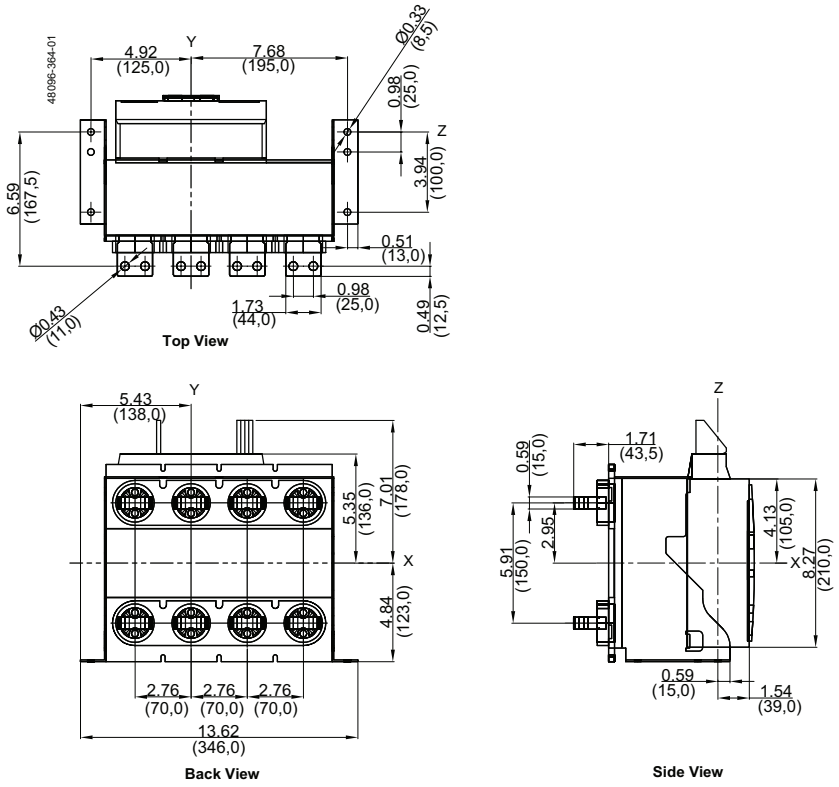
Dimensions: in (mm)

Figure 47 - 800–1600 A MasterPact NT 4P Fixed—RCTV Rear Connected “T” Vertical



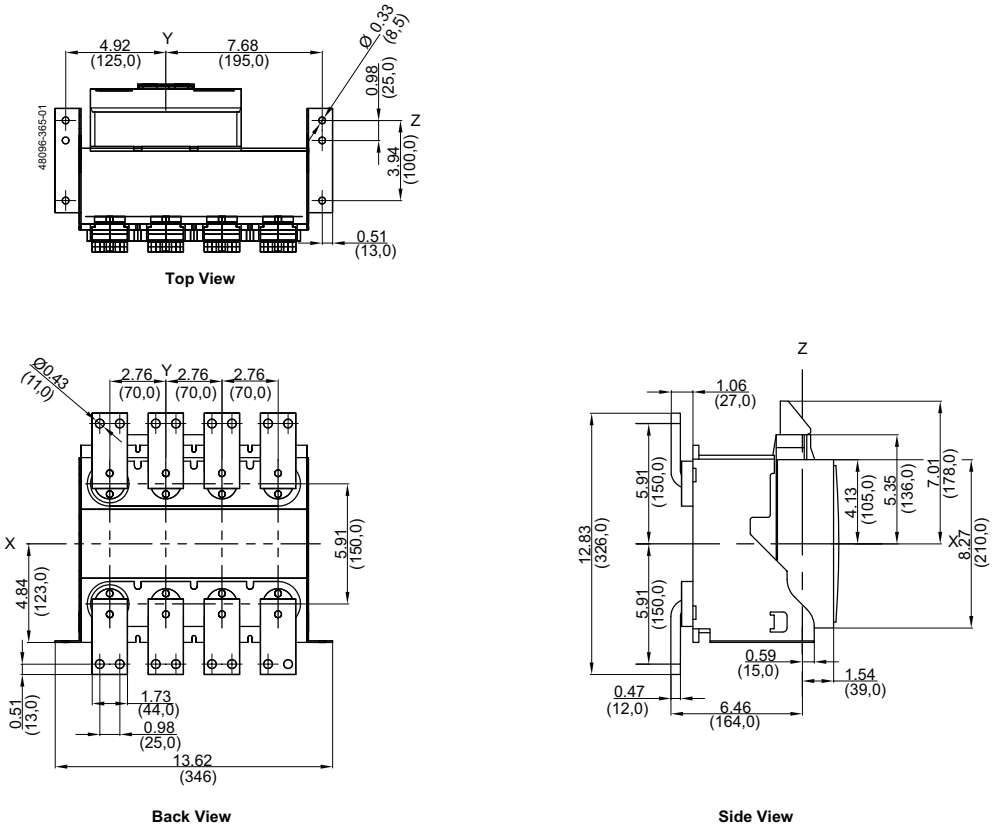
Dimensions: in (mm)

Figure 48 - 800–1600 A MasterPact NT 4P Fixed—RCTH Rear Connected “T” Horizontal



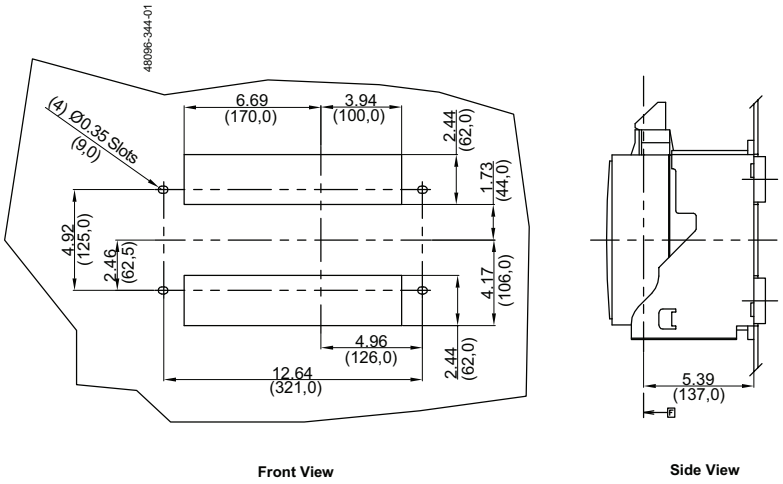
Dimensions: in (mm)

Figure 49 - 800–1600 A MasterPact NT 4P Fixed—FCF Front Connected Flat



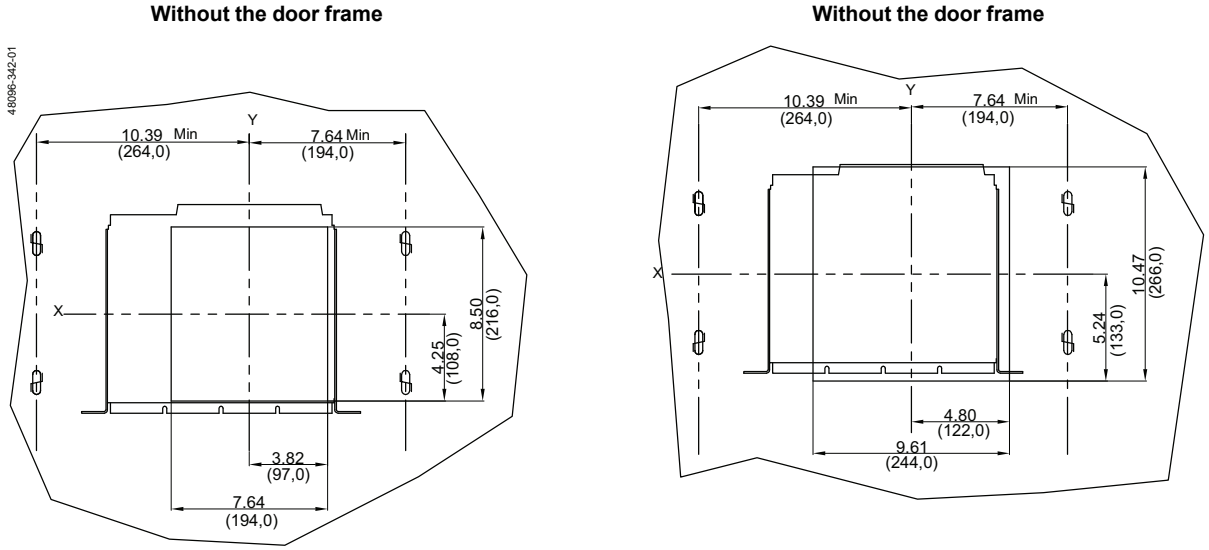
Dimensions: in (mm)

Figure 50 - 800–1200 A MasterPact NT 4P Fixed—Rear Cutout Dimensions



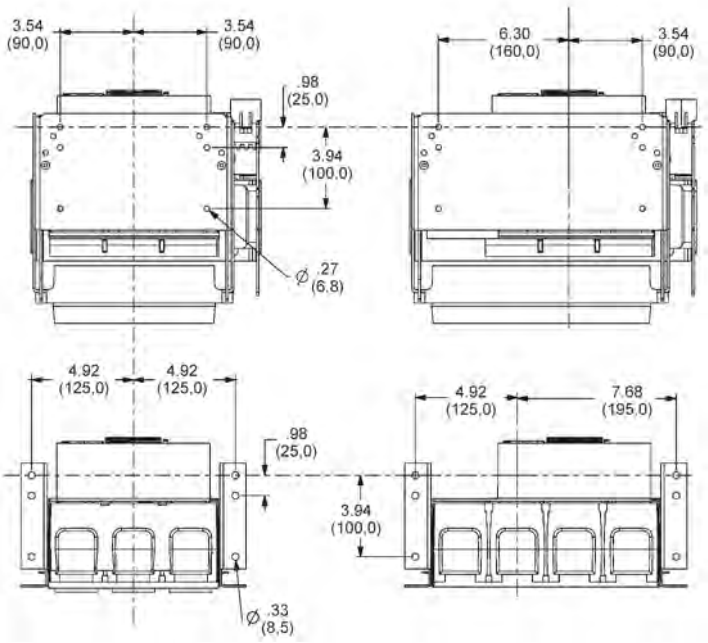
Dimensions: in (mm)

Figure 51 - 800–1200 A MasterPact NT 4P Fixed—Door Cutout Dimensions



Dimensions: in (mm)

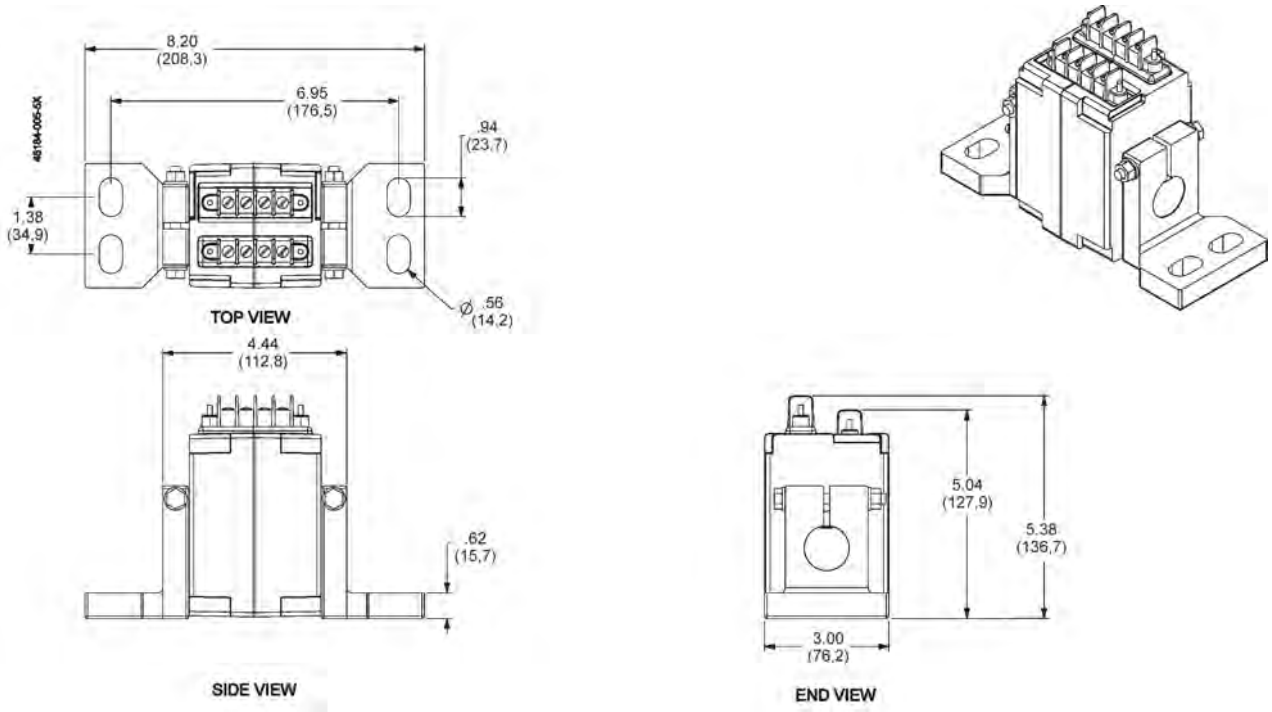
Figure 52 - 800–1200 A MasterPact NT Fixed—Pan Dimensions



Dimensions: in (mm)

Neutral Current Transformers

Figure 53 - 800–1600 A External Neutral Current Transformer

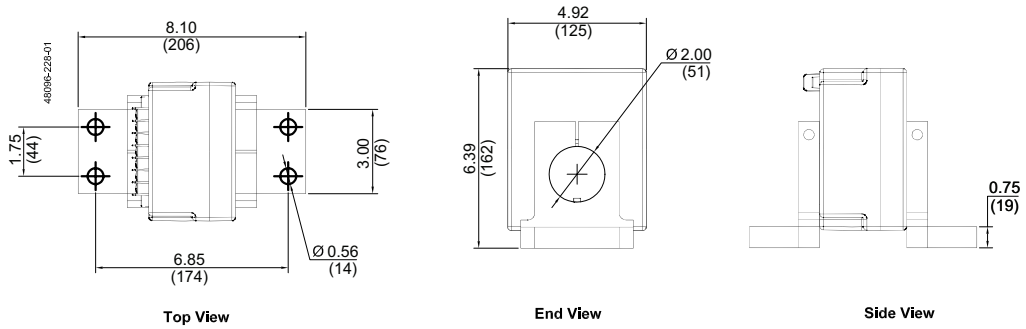


Dimensions: in (mm)

MasterPact NW Dimensional Drawings

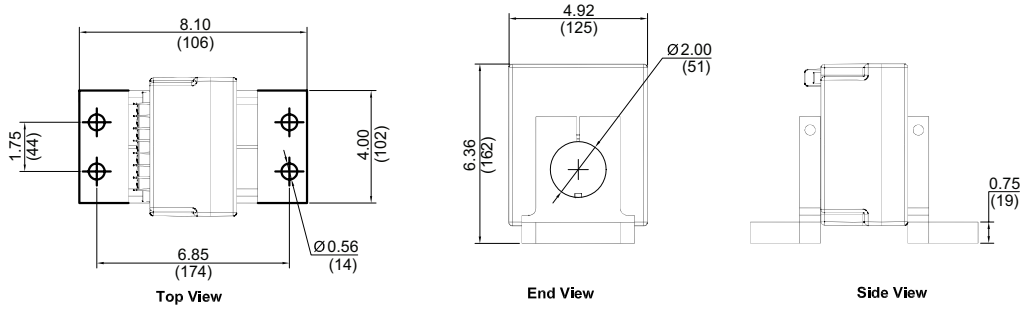
Neutral Current Transformers

Figure 54 - Neutral Current Transformer 100–250 A, 400–2000 A



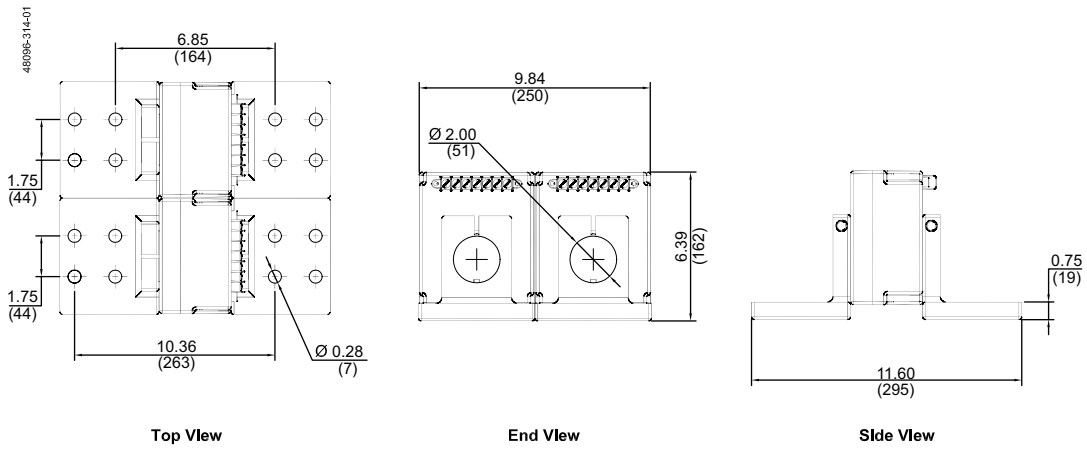
Dimensions: in (mm)

Figure 55 - Neutral Current Transformer 2000–4000 A



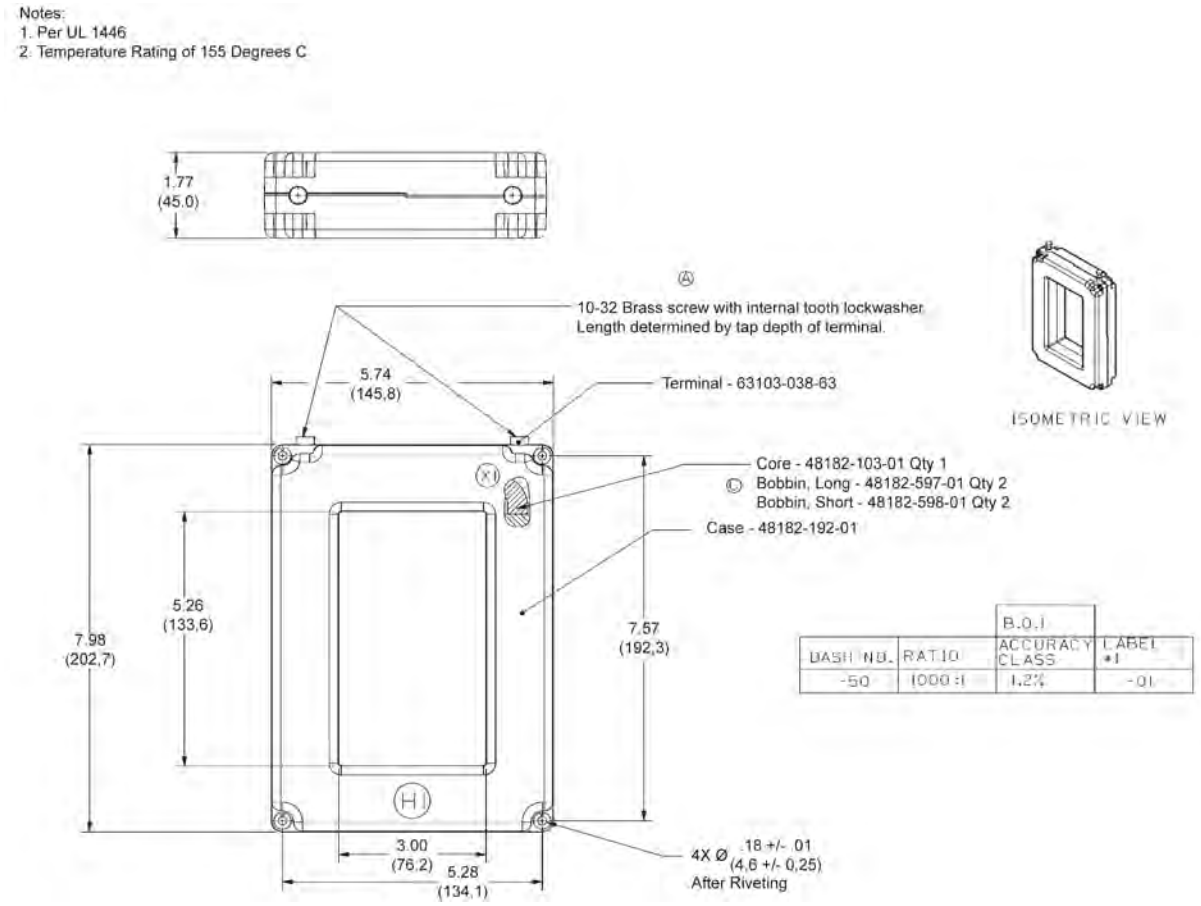
Dimensions: in (mm)

Figure 56 - Double Neutral Current Transformer 2000–6300 A



Dimensions: in (mm)

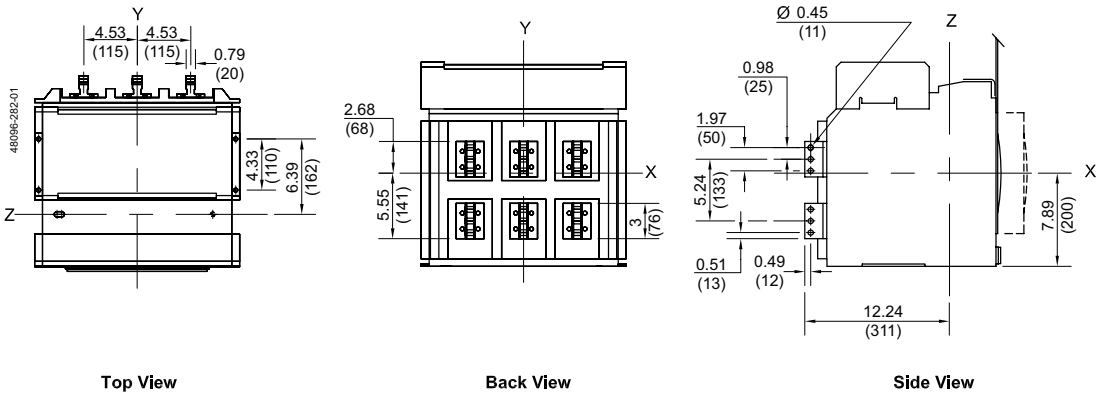
Figure 57 - MDGF/SGR Current Transformer



Dimensions: in (mm)

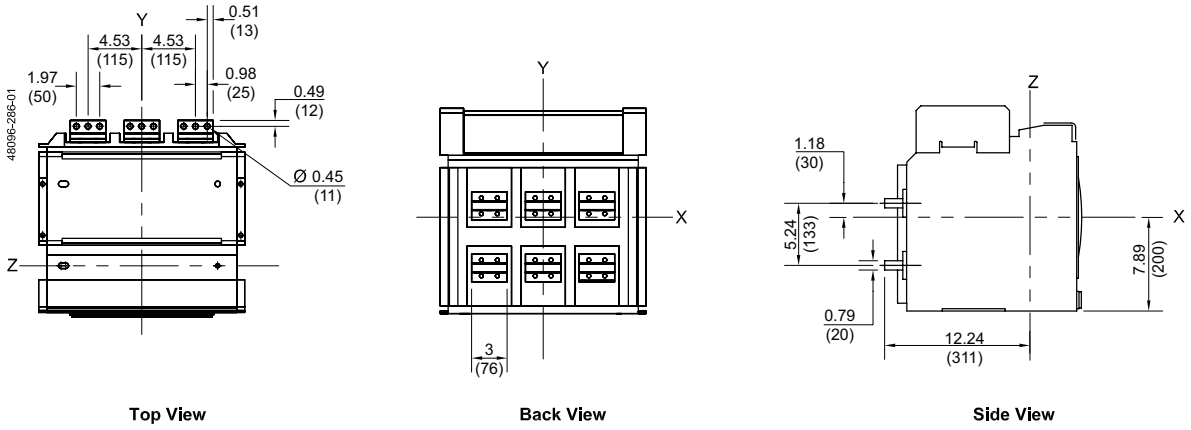
3P Drawout Circuit Breakers

Figure 58 - 800–3200 A Rear Connected "T" Vertical (RCTV)



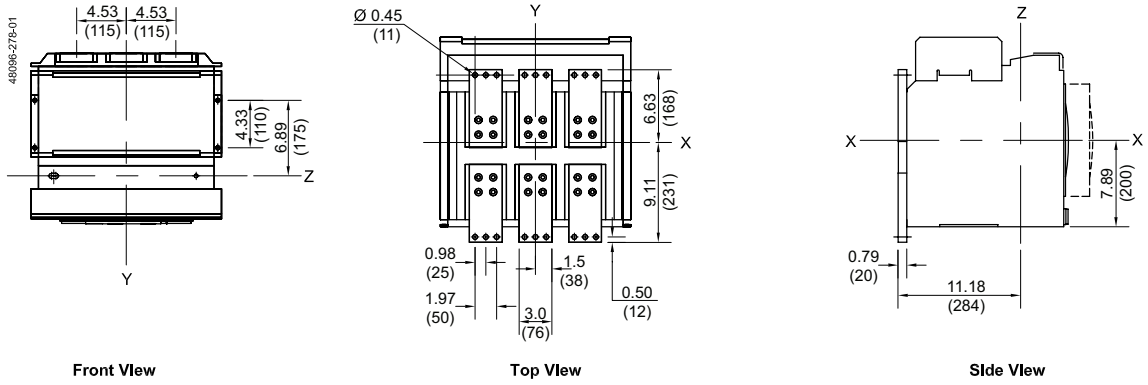
Dimensions: in (mm)

Figure 59 - 800–3200 A Rear Connected "T" Horizontal (RCTH)



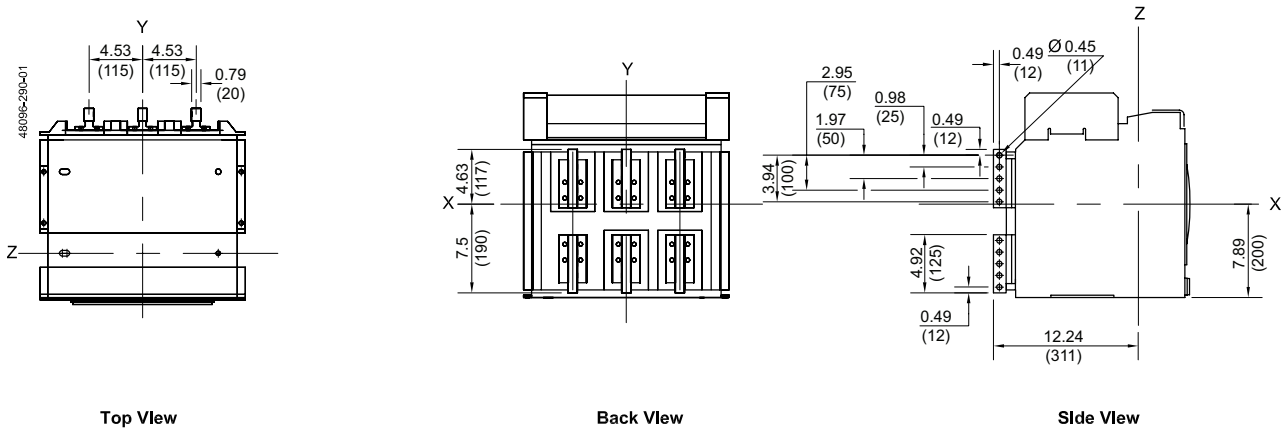
Dimensions: in (mm)

Figure 60 - 800–3200 A Front Connected Flat (FCF)



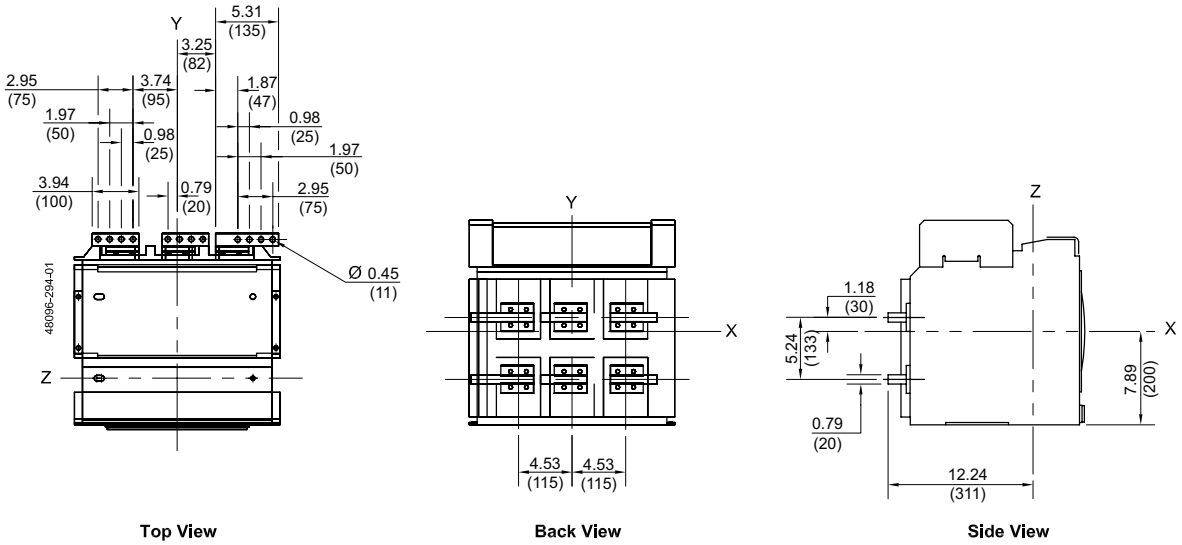
Dimensions: in (mm)

Figure 61 - 4000 A Rear Connected "T" Vertical (RCTV)



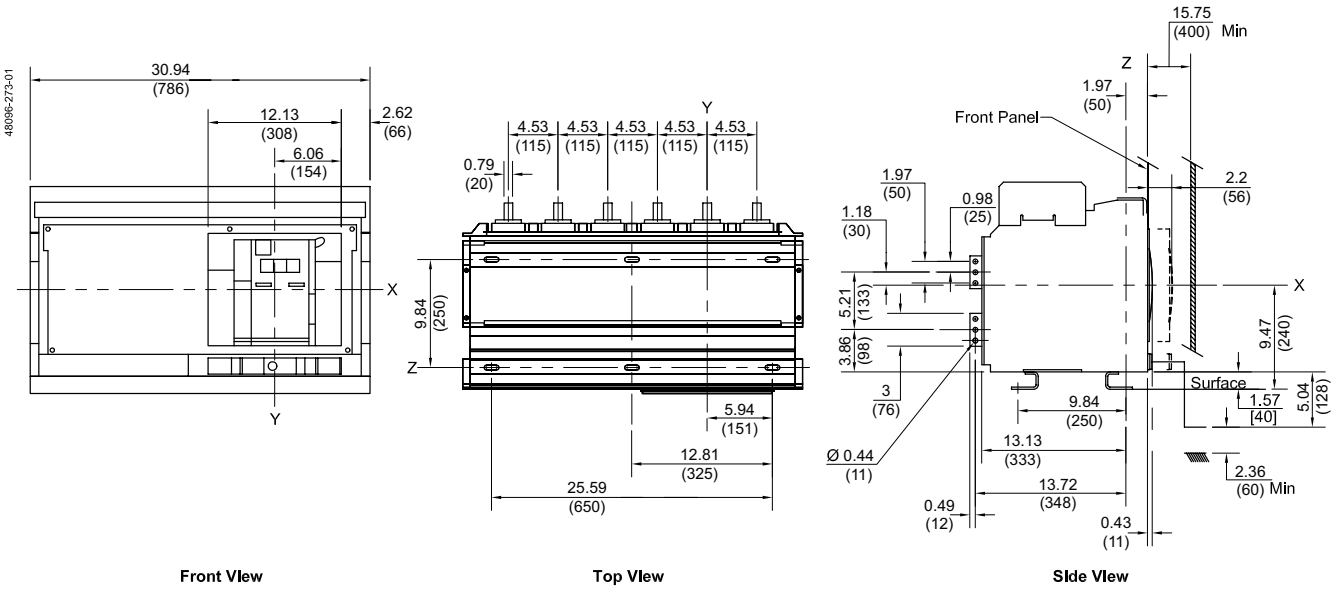
Dimensions: in (mm)

Figure 62 - 4000 A Rear Connected "T" Horizontal (RCTH)



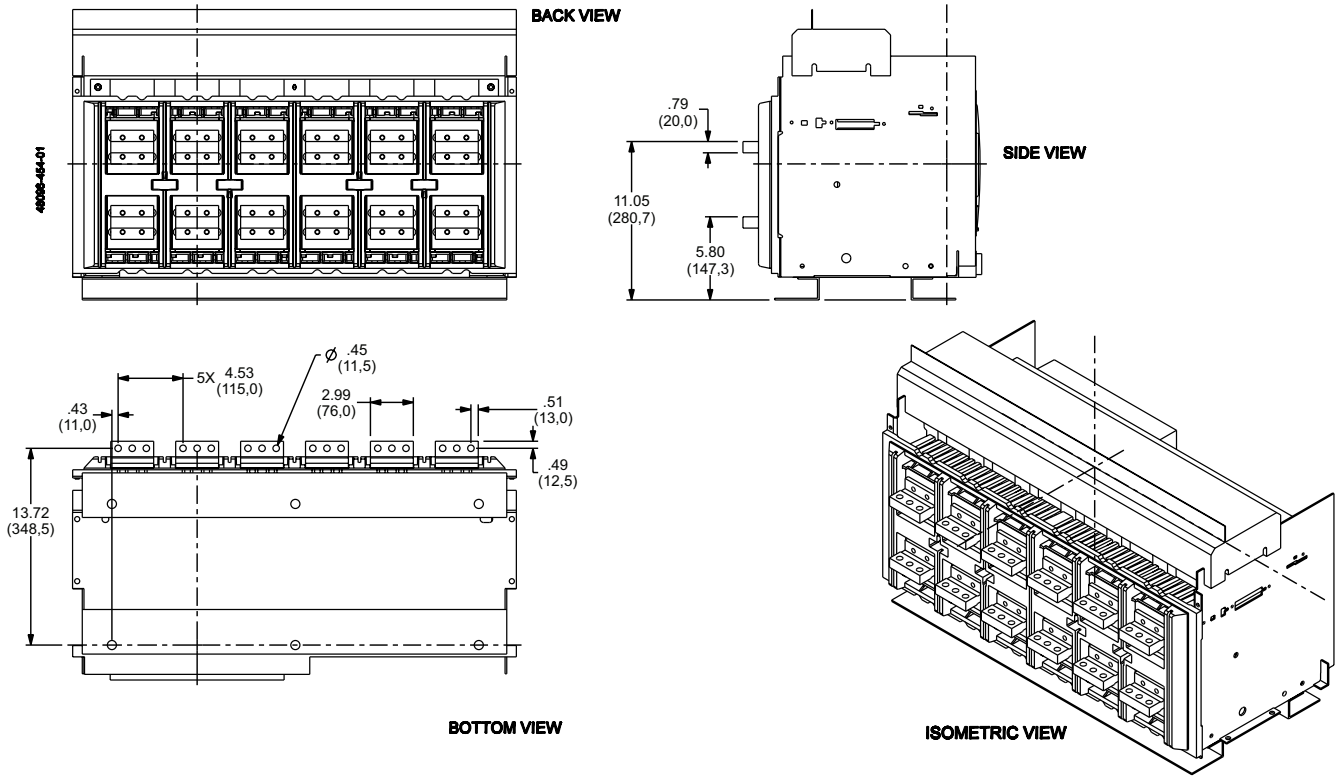
Dimensions: in (mm)

Figure 63 - 5000 A Rear Connected "T" Vertical (RCTV)



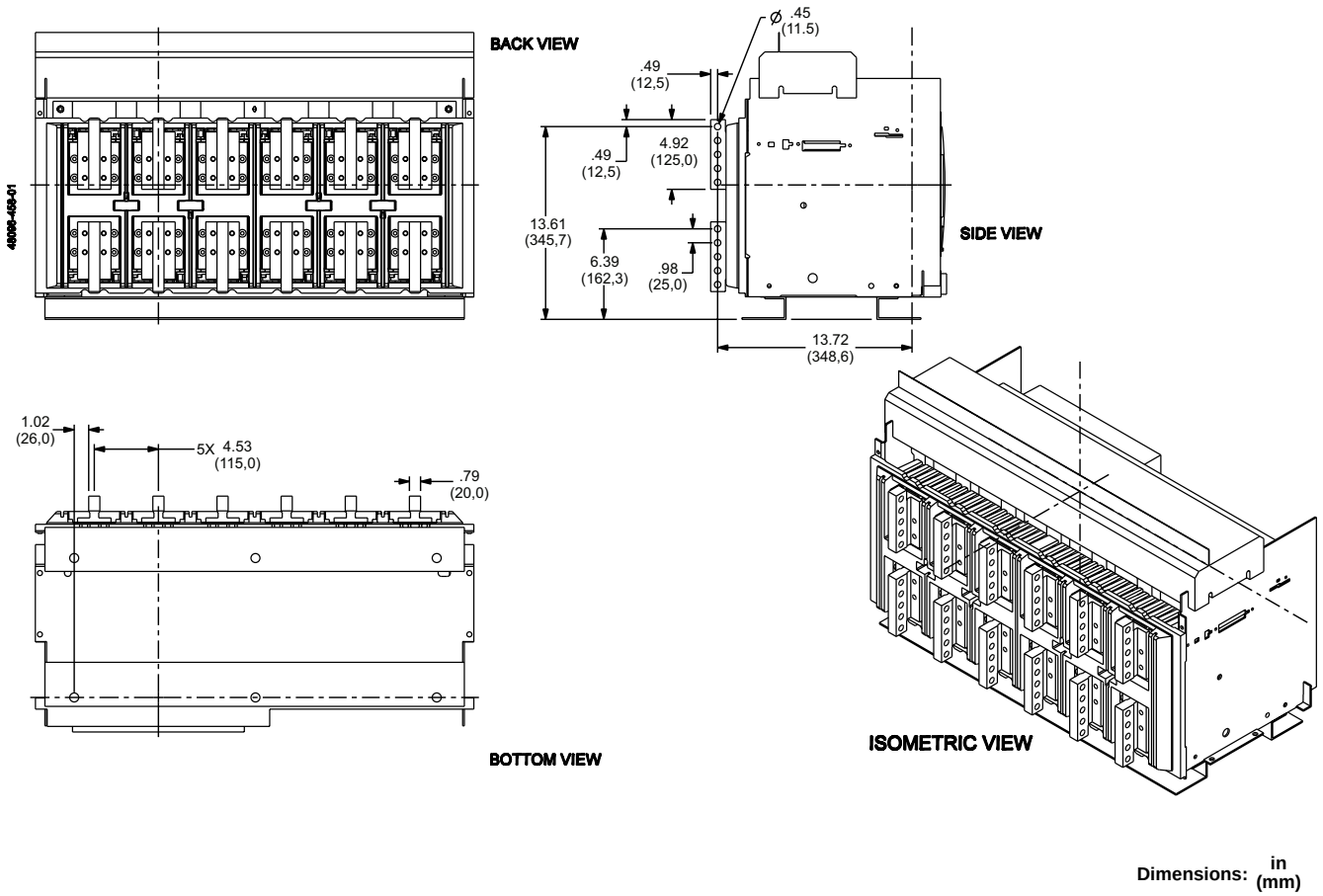
Dimensions: in (mm)

Figure 64 - 5000 A Rear Connected "T" Horizontal (RCTH)



Dimensions: in (mm)

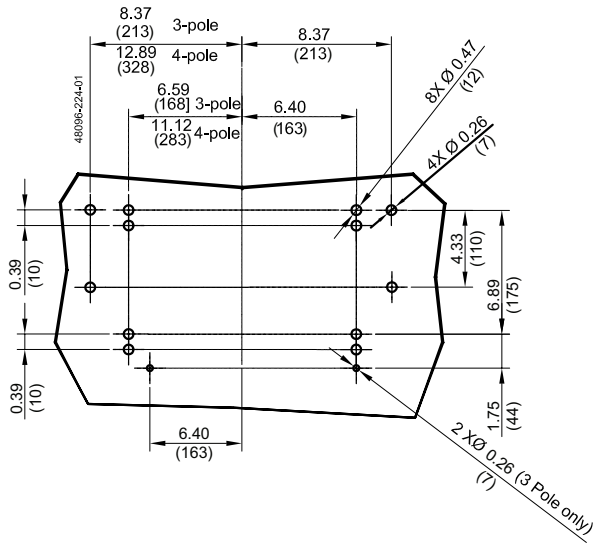
Figure 65 - 6300 A Rear Connected "T" Vertical (RCTV)



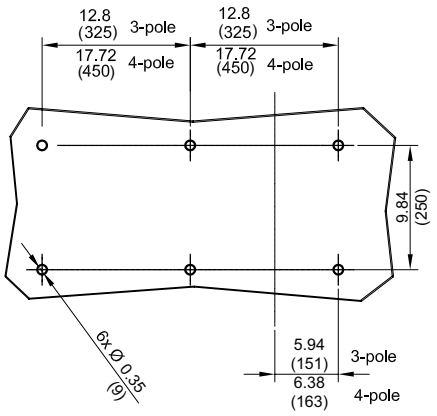
Dimensions: in (mm)

Figure 66 - Drawout Cradle Mounting

800—3000 A and 3200 A H1 and H2 Cradle

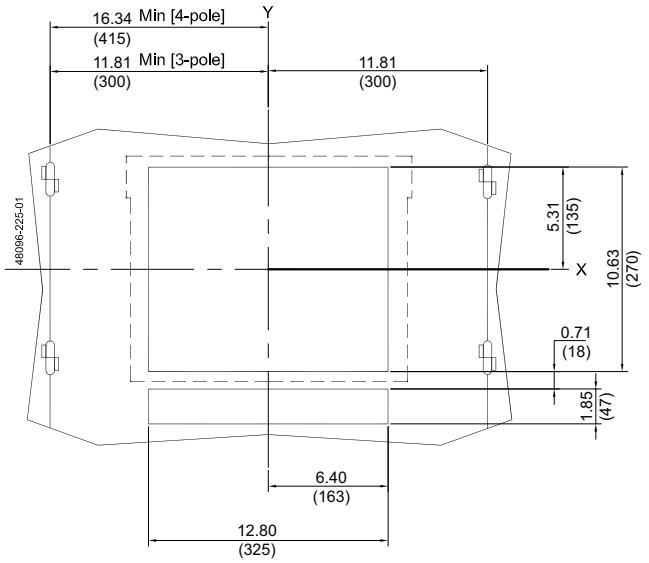


3200 A L1 and 4000—6000 A Cradle



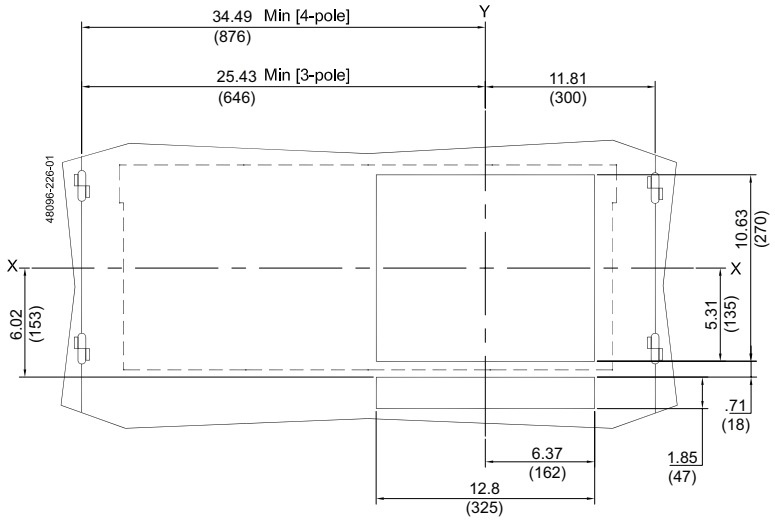
Dimensions: in (mm)

Figure 67 - 800–3000 A and 3200 A (H1, H2, H3) Door Cutout



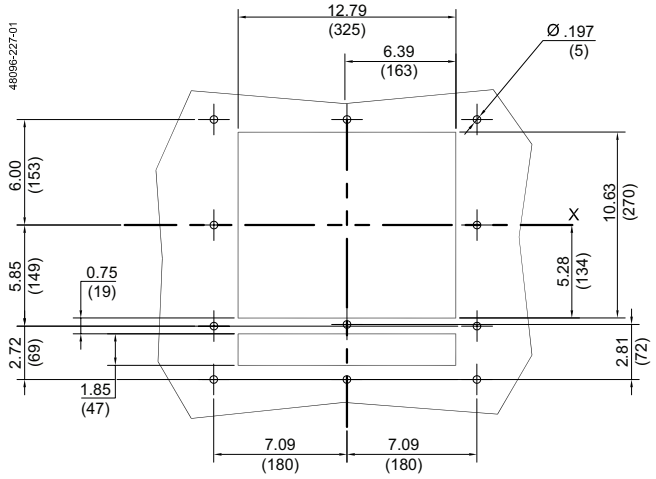
Dimensions: in (mm)

Figure 68 - 3200 A L1 and 4000–6000 A Door Cutout



Dimensions: in (mm)

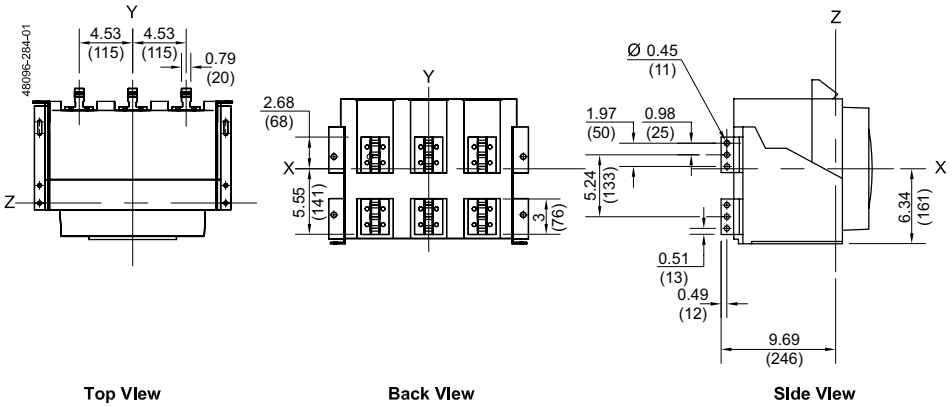
Figure 69 - Door Escutcheon Hole Pattern



Dimensions: in (mm)

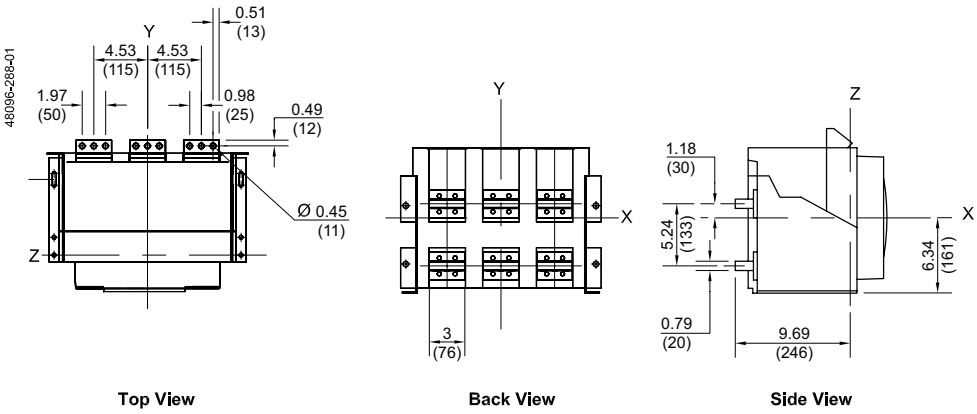
3P Fixed Circuit Breakers

Figure 70 - 800–3200 A Rear Connected "T" Vertical (RCTV)



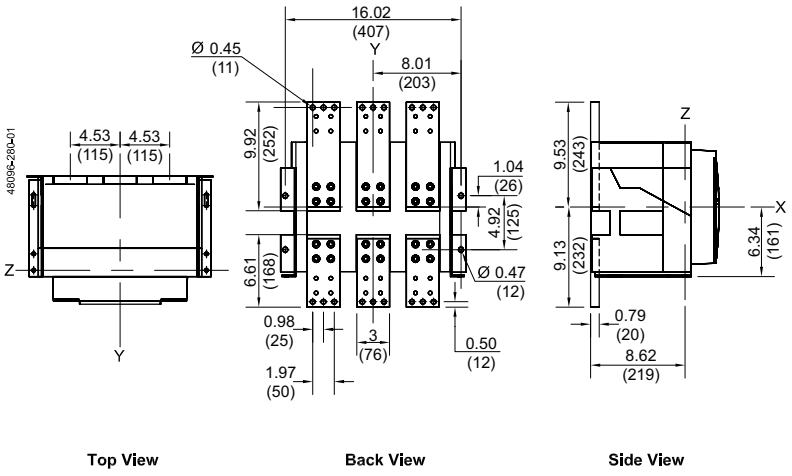
Dimensions: in (mm)

Figure 71 - 800–3200 A Rear Connected "T" Horizontal (RCTH)



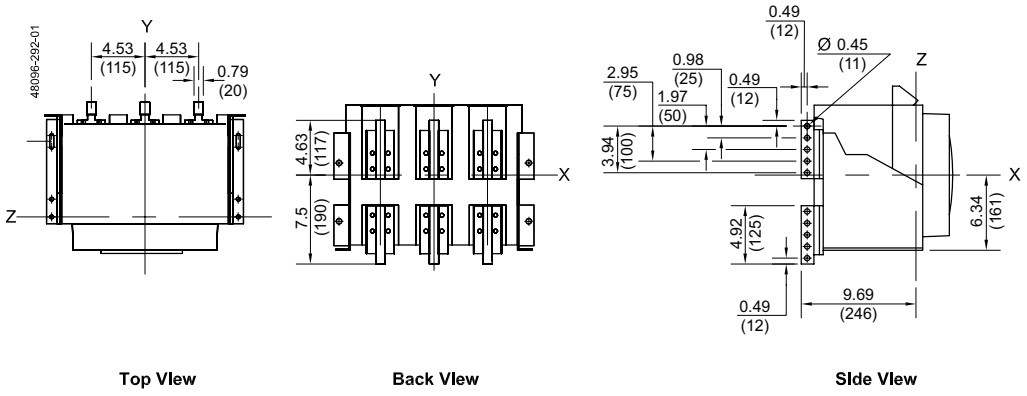
Dimensions: in (mm)

Figure 72 - 800–3200 A Front Connected Flat (FCF)



Dimensions: in (mm)

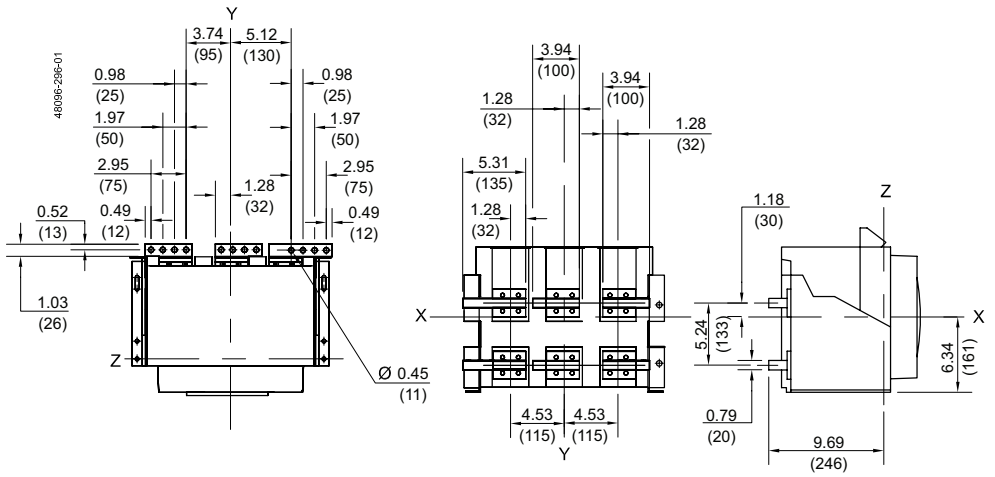
Figure 73 - 4000 A Rear Connected "T" Vertical (RCTV)



Top View **Back View** **Side View**

Dimensions: in (mm)

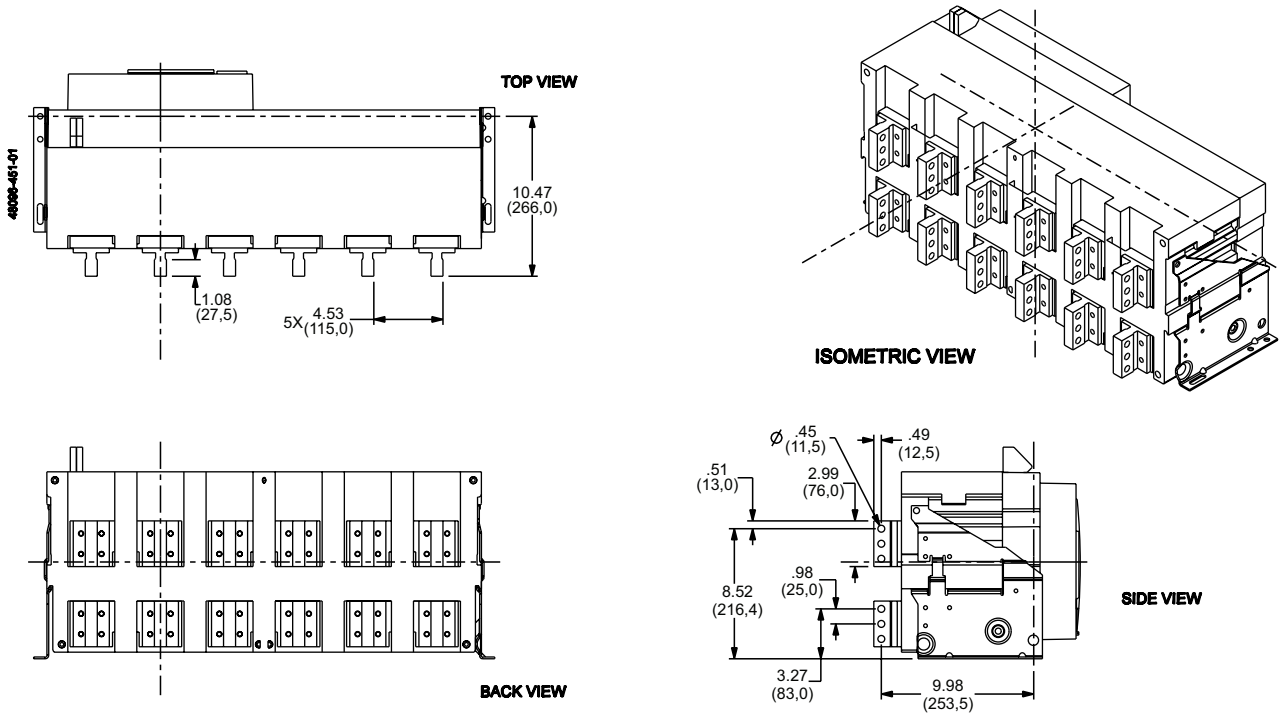
Figure 74 - 4000 A Rear Connected "T" Horizontal (RCTH)



Top View **Back View** **Side View**

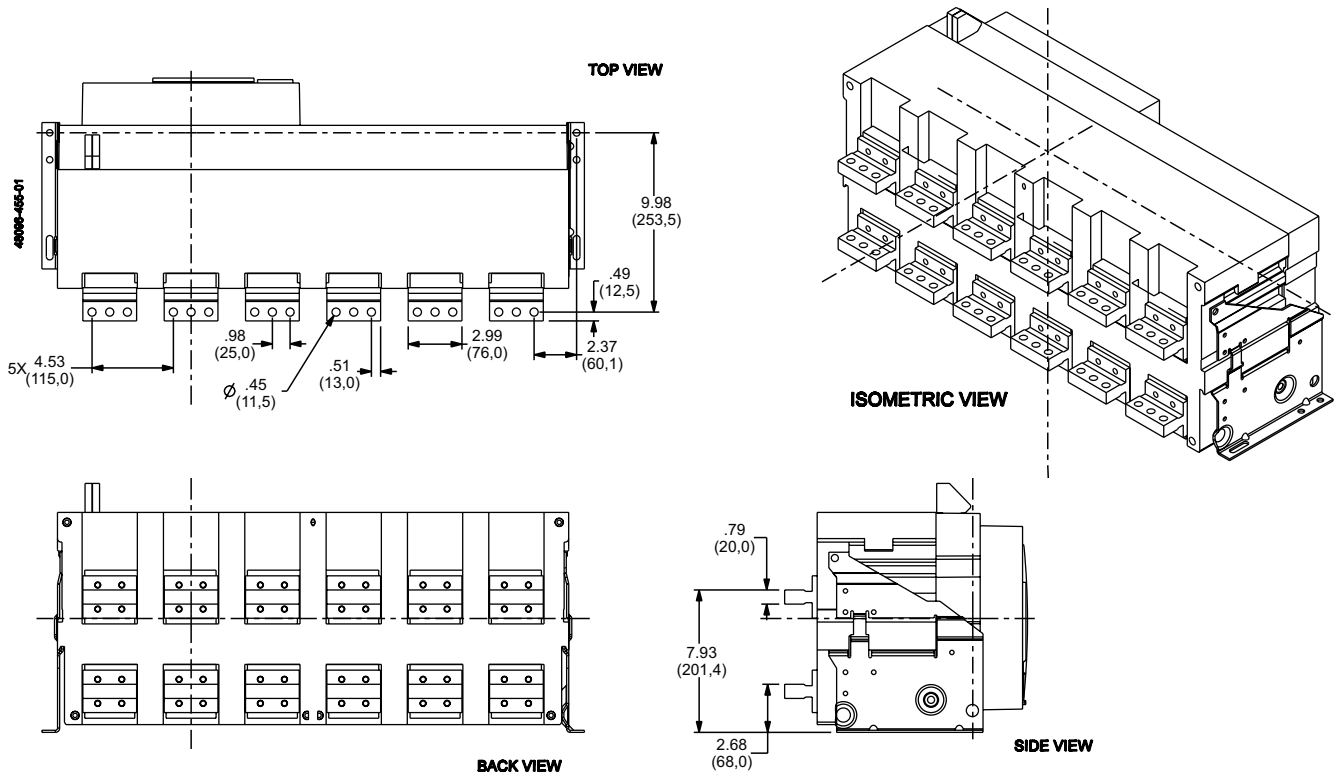
Dimensions: in (mm)

Figure 75 - 5000 A Rear Connected "T" Vertical (RCTV)



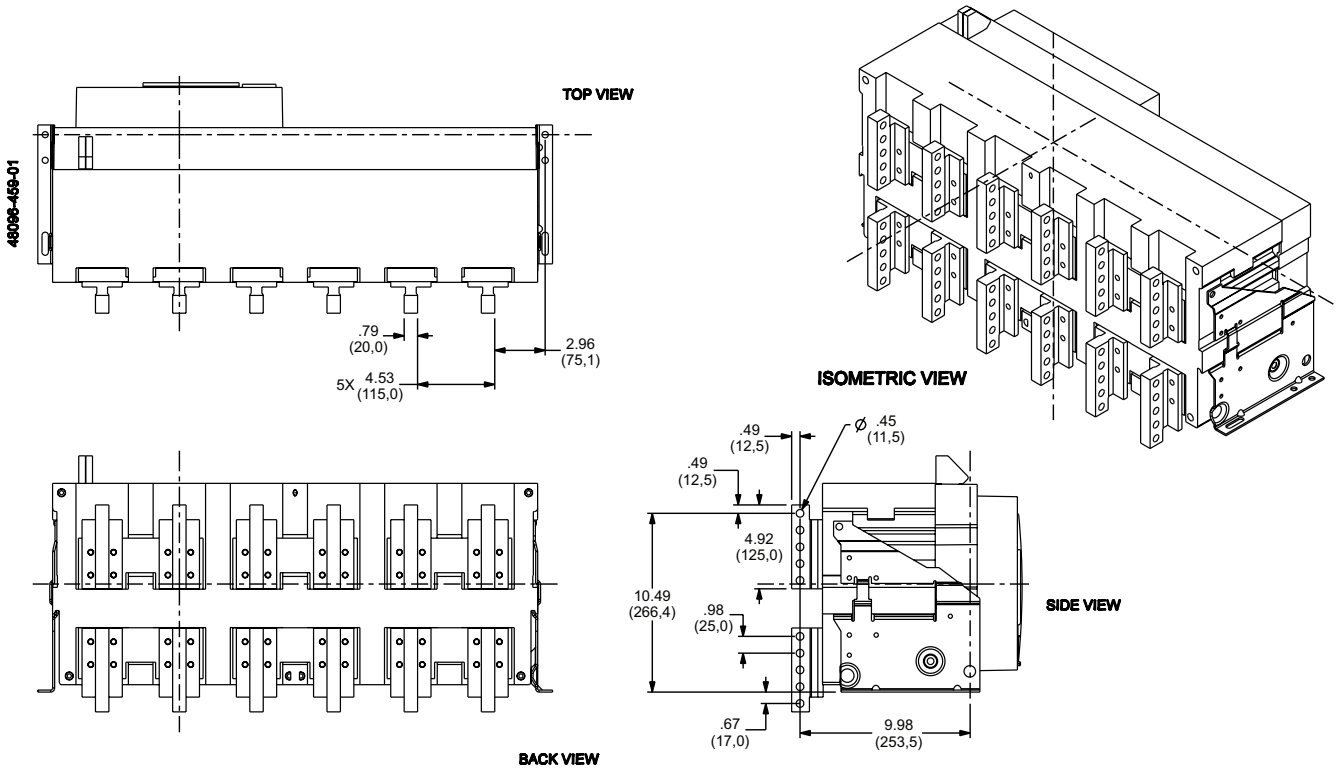
Dimensions: in (mm)

Figure 76 - 5000 A Rear Connected "T" Horizontal (RCTH)



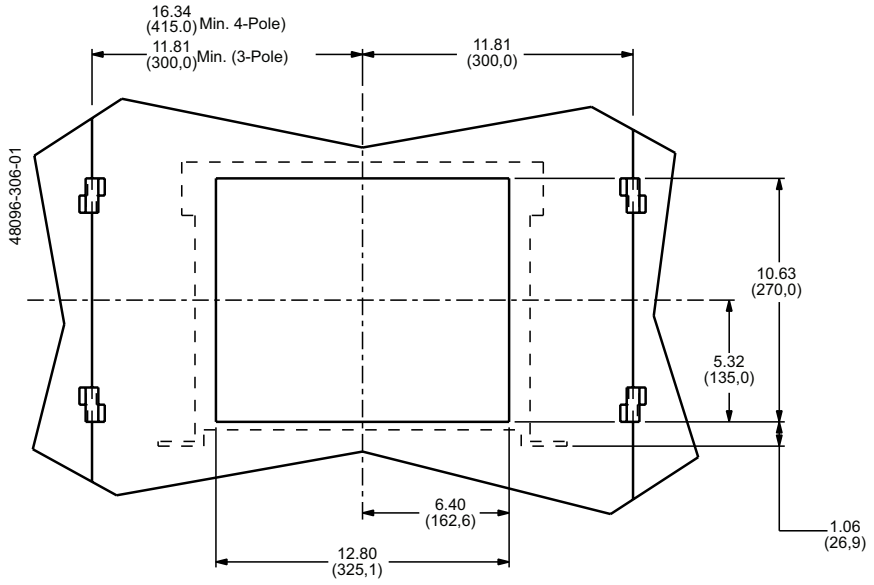
Dimensions: in (mm)

Figure 77 - 6300 A Rear Connected "T" Vertical (RCTV)



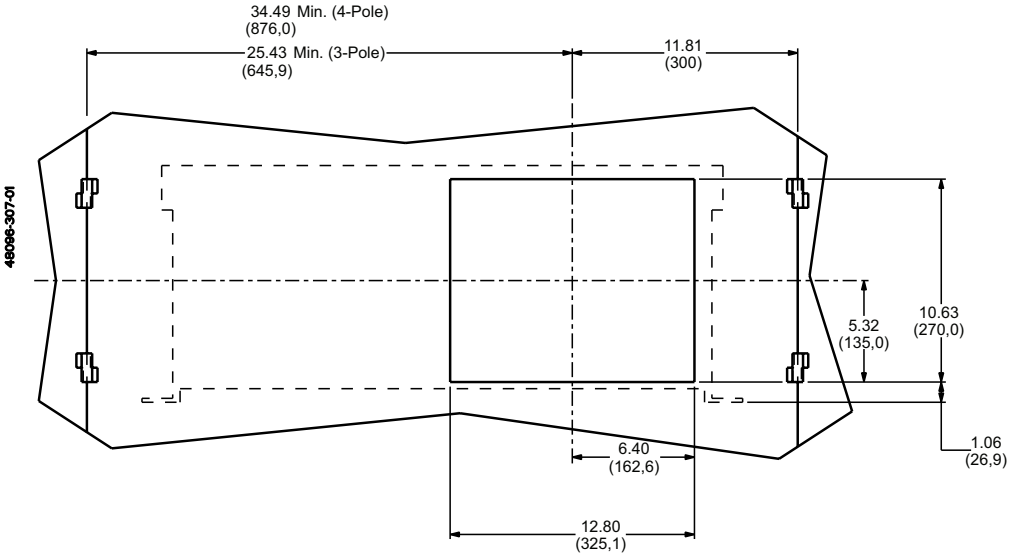
Dimensions: in (mm)

Figure 78 - 800–3200 A and 4000 A (W-Frame) Circuit Breaker Door Cutout



Dimensions: in (mm)

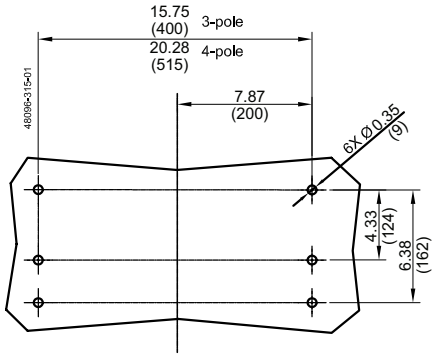
Figure 79 - 4000–6000 A Door Cutout



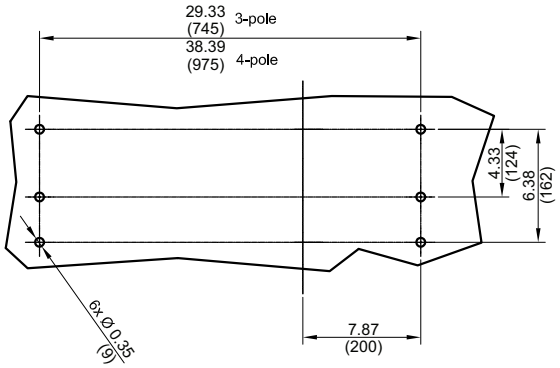
Dimensions: in (mm)

Figure 80 - Pan Drawings for 3P and 4P Circuit Breakers

800—3000 A Fixed Circuit Breaker



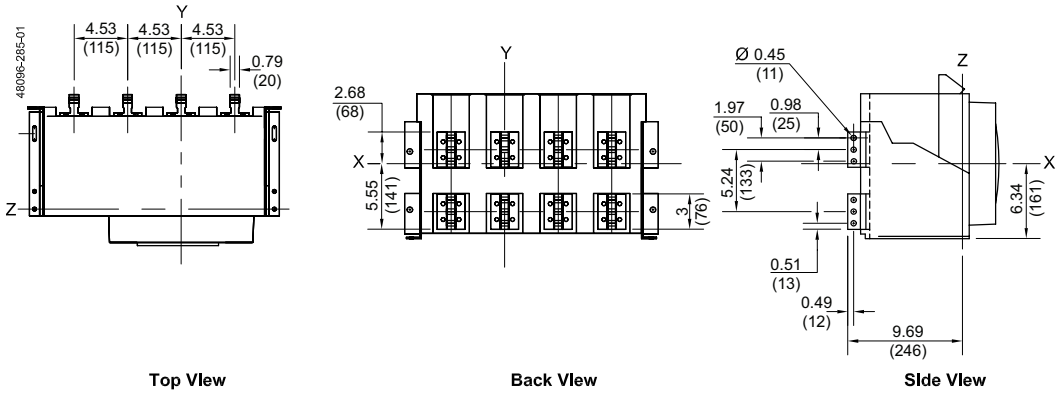
4000—6000 A Fixed Circuit Breaker



Dimensions: in (mm)

4P Drawout Circuit Breakers

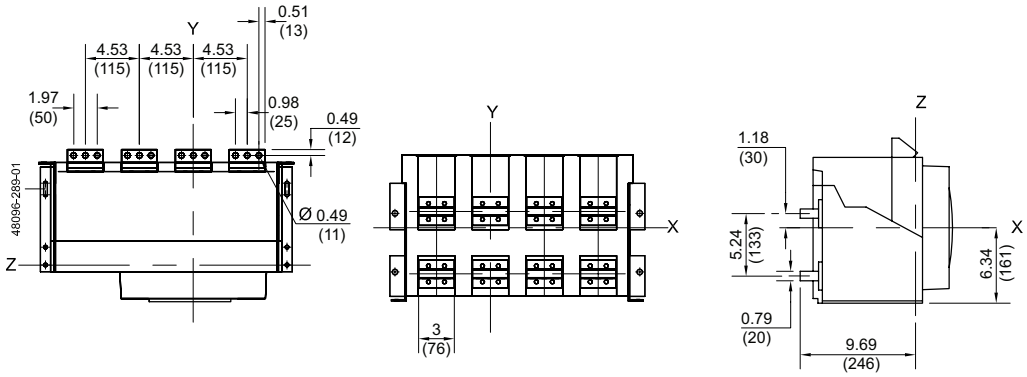
Figure 81 - 800–3200 A Rear Connected "T" Vertical (RCTV)



Top View Back View Side View

Dimensions: in (mm)

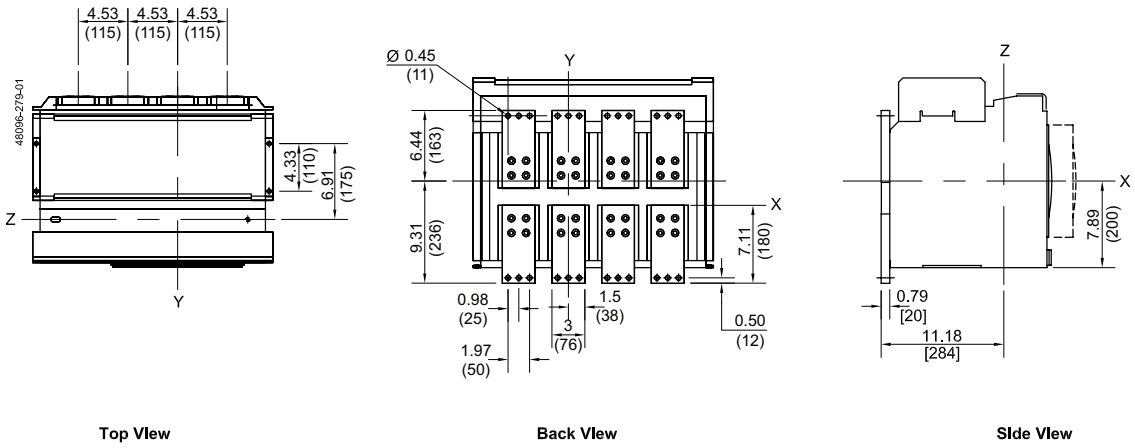
Figure 82 - 800–3200 A Rear Connected "T" Horizontal (RCTH)



Top View Back View Side View

Dimensions: in (mm)

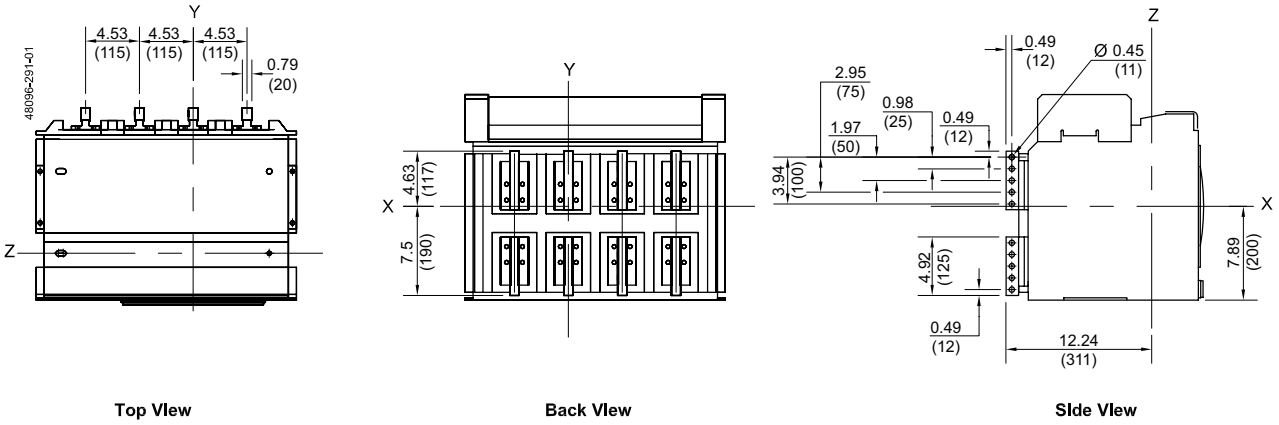
Figure 83 - 800–3200 A Front Connected Flat (FCF)



Top View Back View Side View

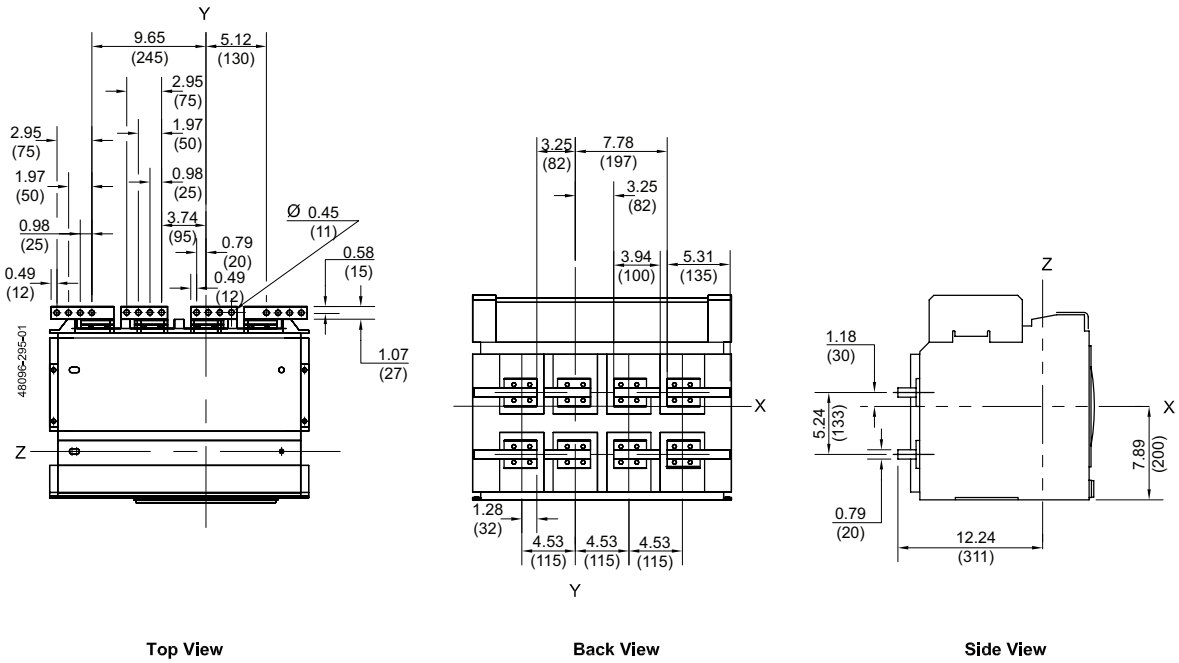
Dimensions: in (mm)

Figure 84 - 4000 A Rear Connected "T" Vertical (RCTV)



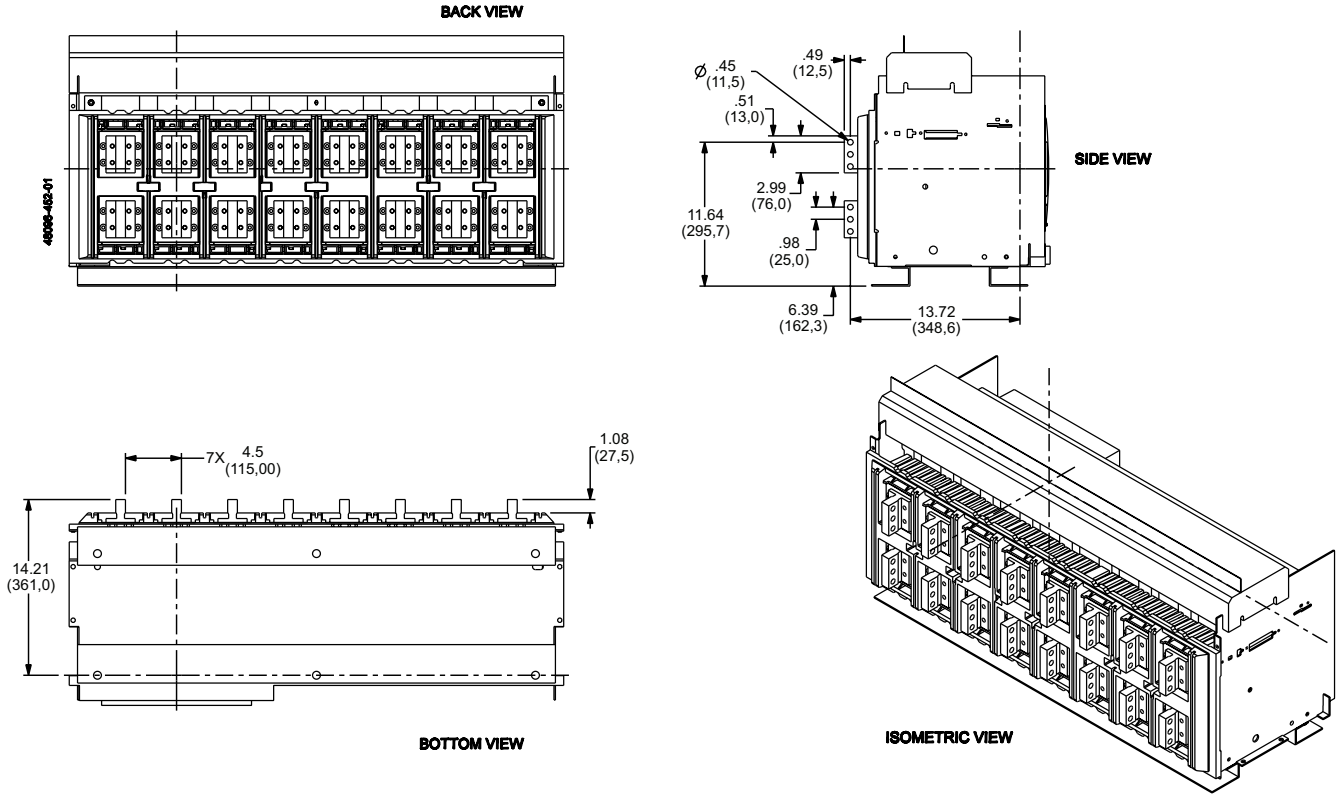
Dimensions: in (mm)

Figure 85 - 4000 A Rear Connected "T" Horizontal (RCTH)



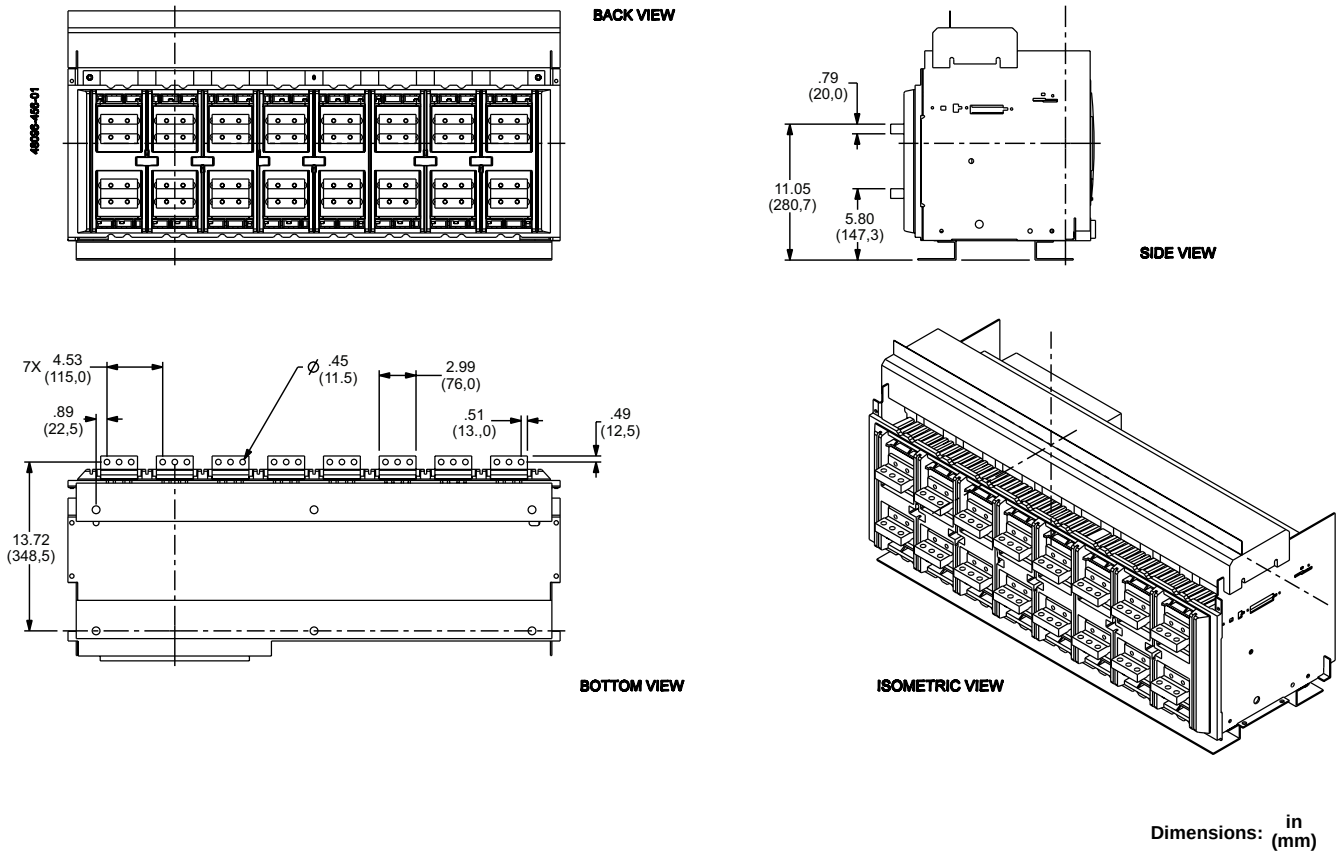
Dimensions: in (mm)

Figure 86 - 5000 A Rear Connected “T” Vertical (RCTV)



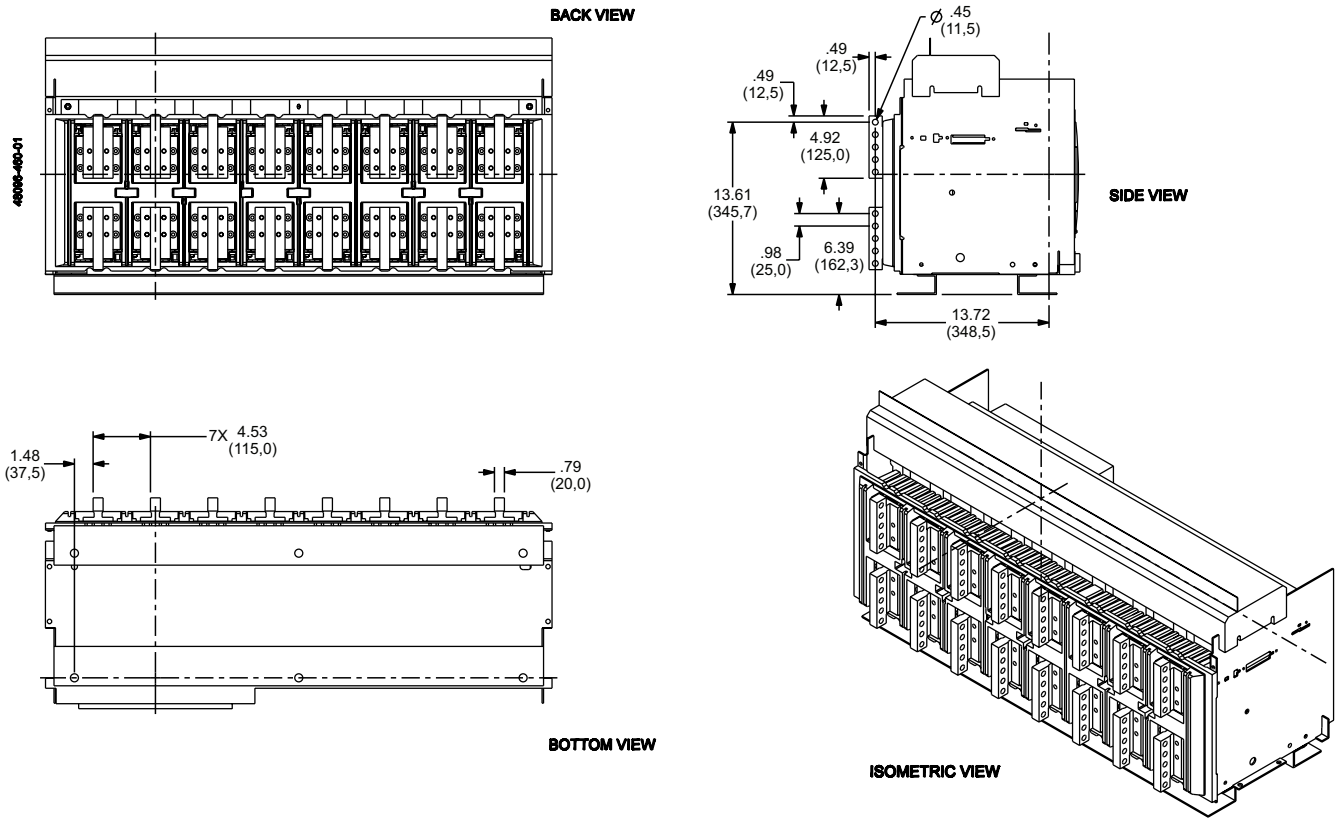
Dimensions: in (mm)

Figure 87 - 5000 A Rear Connected “T” Horizontal (RCTH)



Dimensions: in (mm)

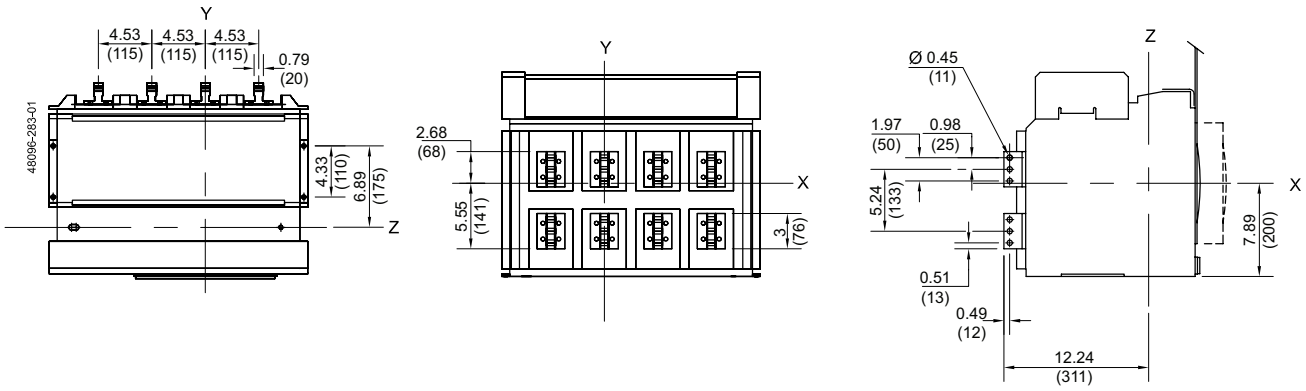
Figure 88 - 6300 A Rear Connected “T” Vertical (RCTV)



Dimensions: in (mm)

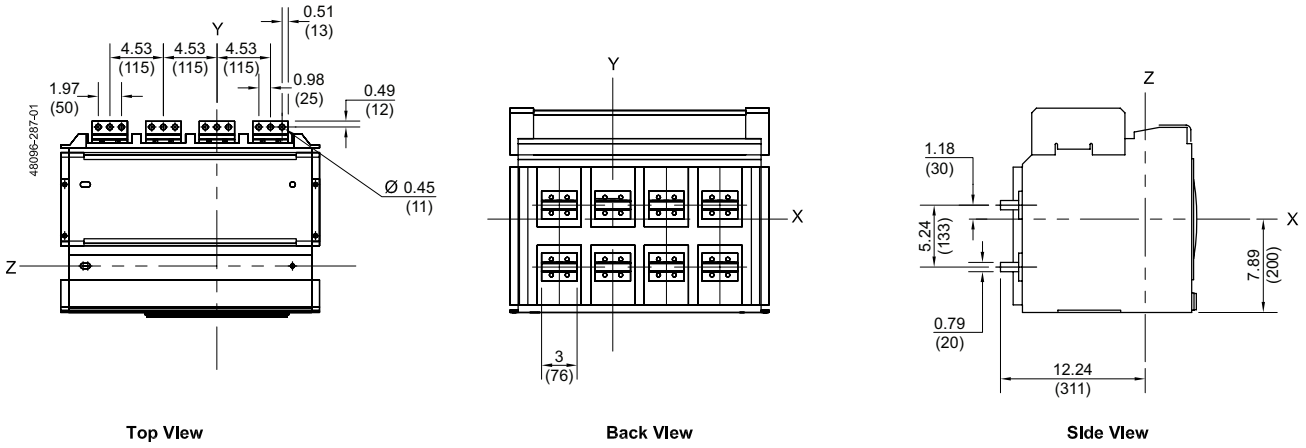
4P Fixed Circuit Breakers

Figure 89 - 800–3200 A Rear Connected "T" Vertical (RCTV)



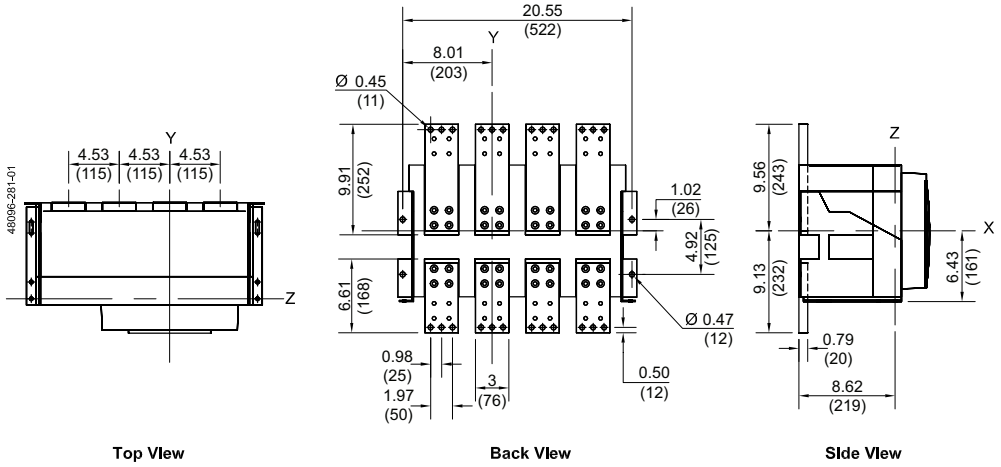
Dimensions: in (mm)

Figure 90 - 800–3200 A Rear Connected "T" Horizontal (RCTH)



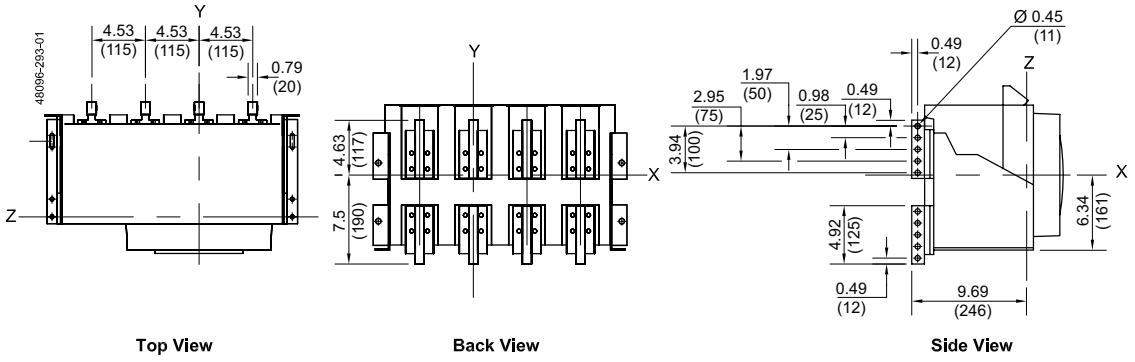
Dimensions: in (mm)

Figure 91 - 800–3200 A Front Connected Flat (FCF)



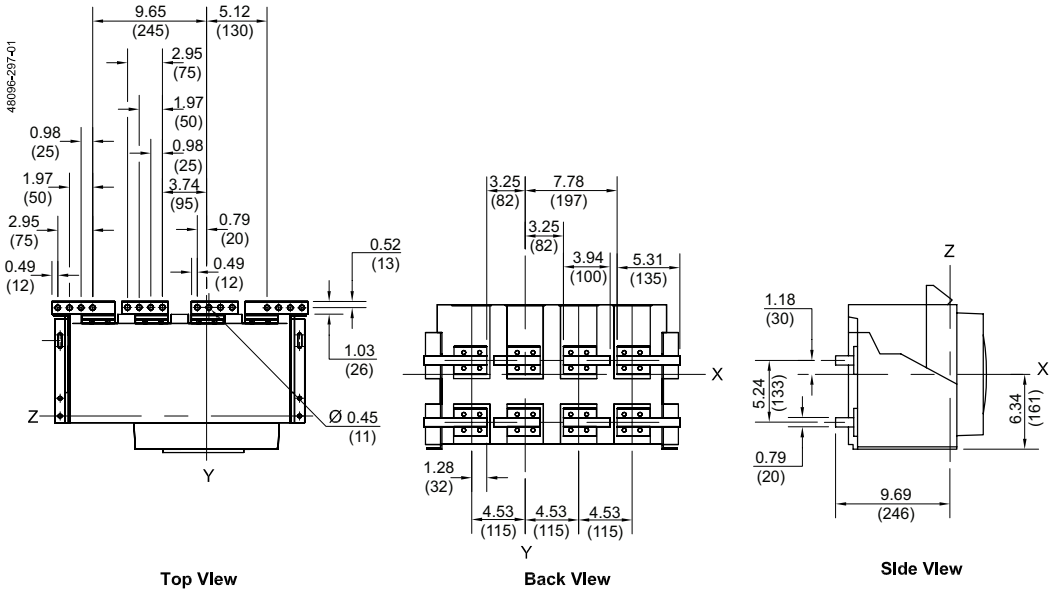
Dimensions: in (mm)

Figure 92 - 4000 A Rear Connected "T" Vertical (RCTV)



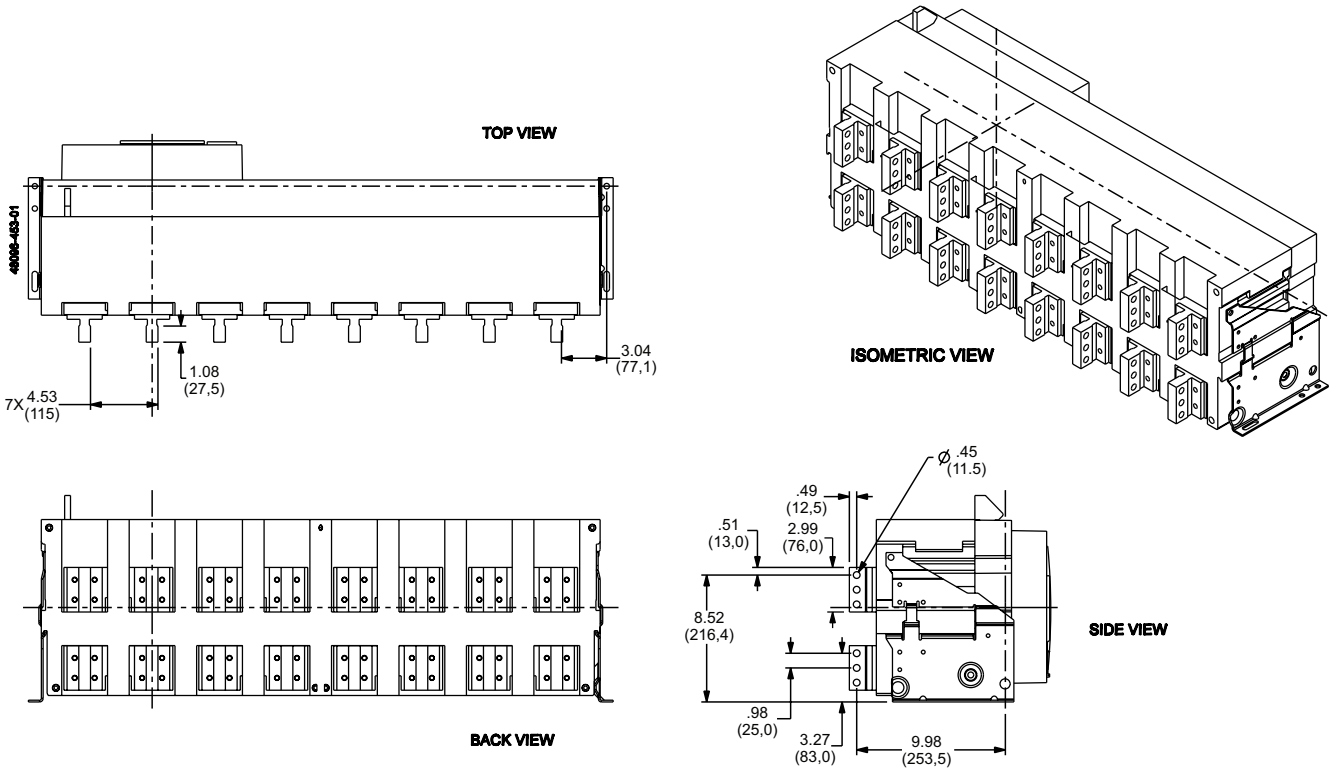
Dimensions: in (mm)

Figure 93 - 4000 A Rear Connected "T" Horizontal (RCTH)



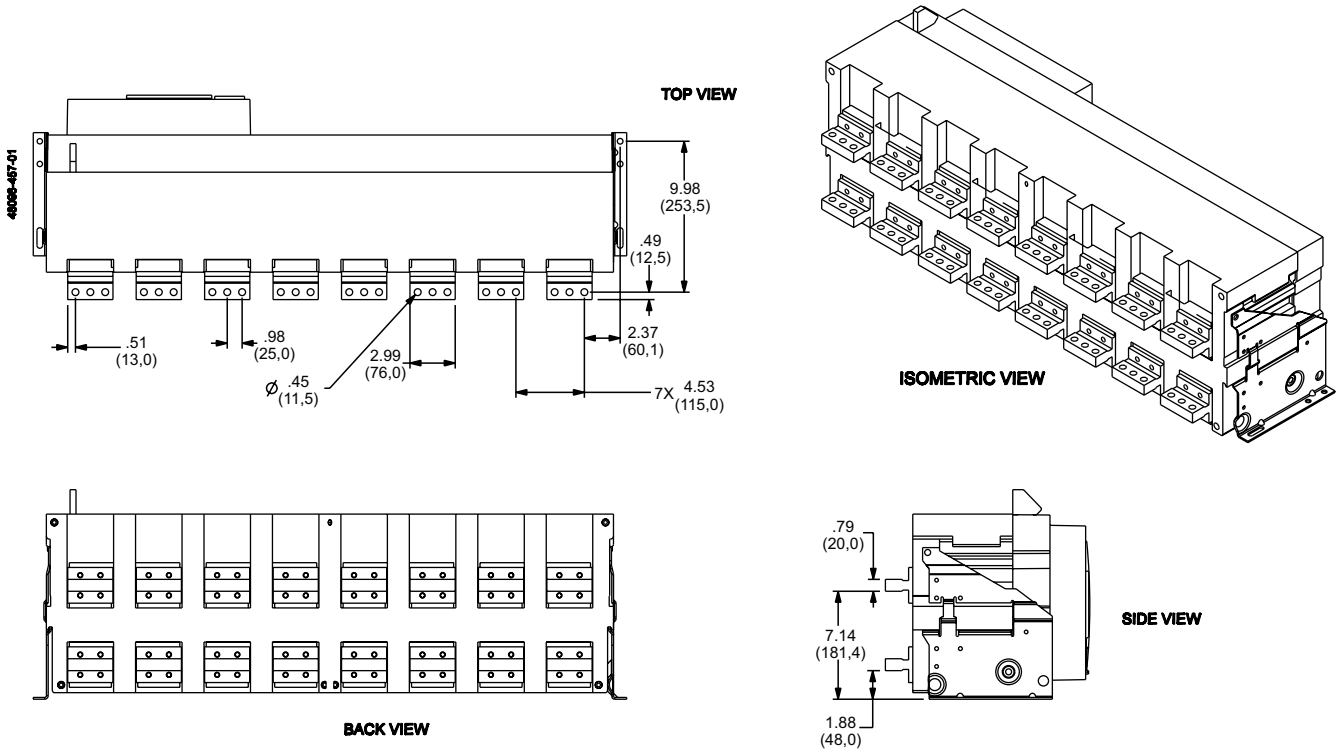
Dimensions: in (mm)

Figure 94 - 5000 A Rear Connected “T” Vertical (RCTV)



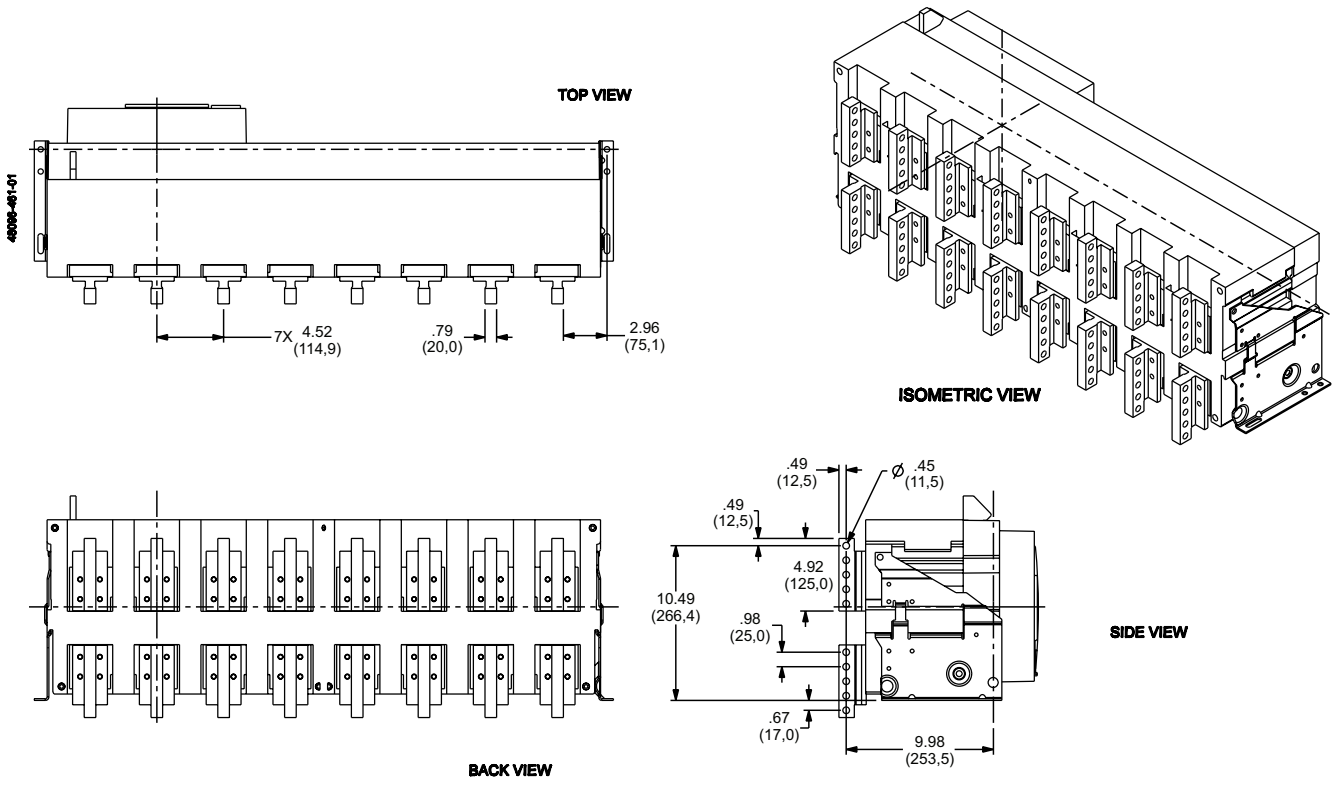
Dimensions: in (mm)

Figure 95 - 5000 A Rear Connected “T” Horizontal (RCTH)



Dimensions: in (mm)

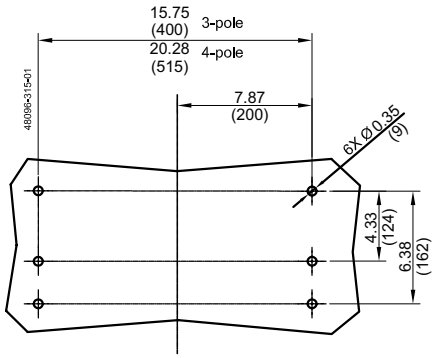
Figure 96 - 6300 Rear Connected “T” Vertical (RCTV)



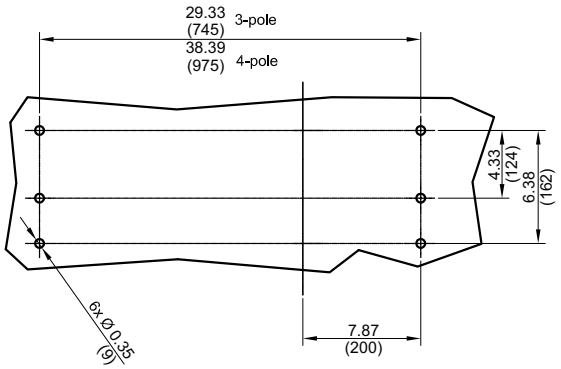
Dimensions: in (mm)

Figure 97 - Pan Drawings for 3P and 4P Circuit Breakers

800–3000 A Fixed Circuit Breaker



4000–6000 A Fixed Circuit Breaker

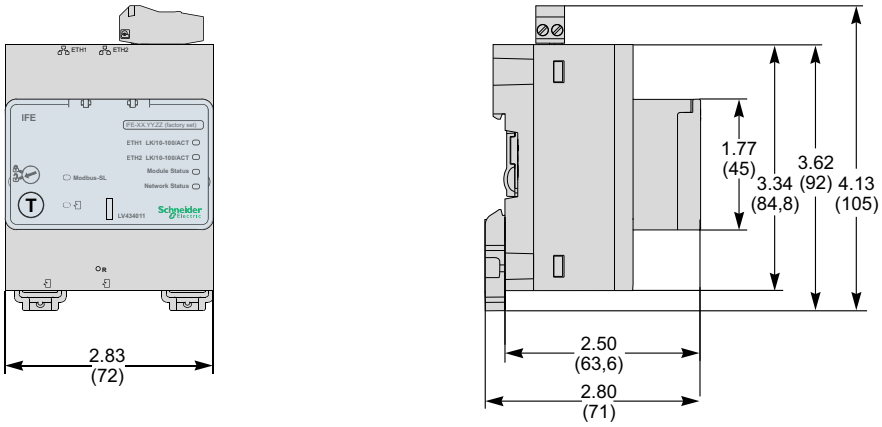


Dimensions: in (mm)

Accessory Dimensional Drawings

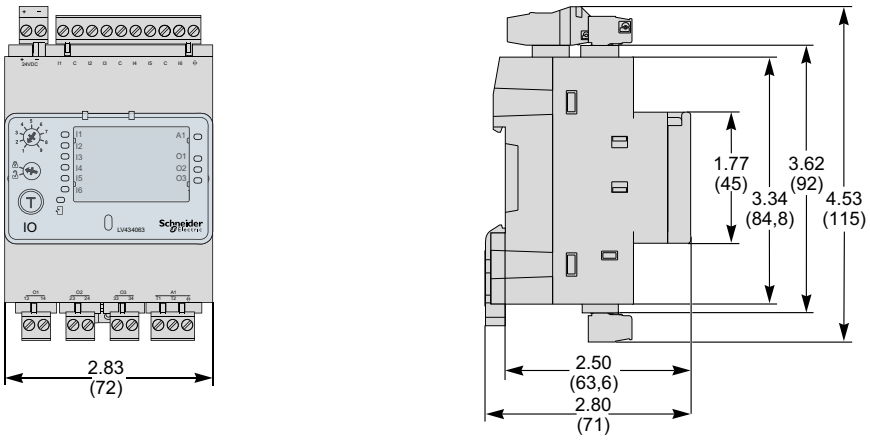
Accessory Dimensions

Figure 98 - IFE Ethernet Interface



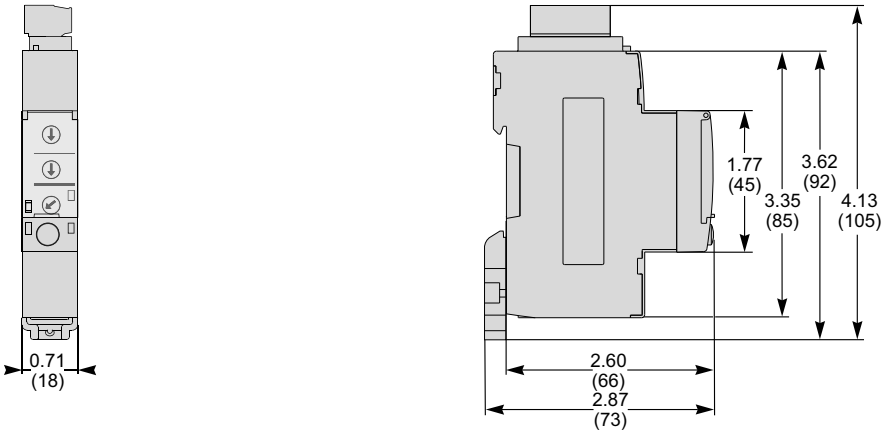
Dimensions: in (mm)

Figure 99 - I/O (Input/Output) Application Module



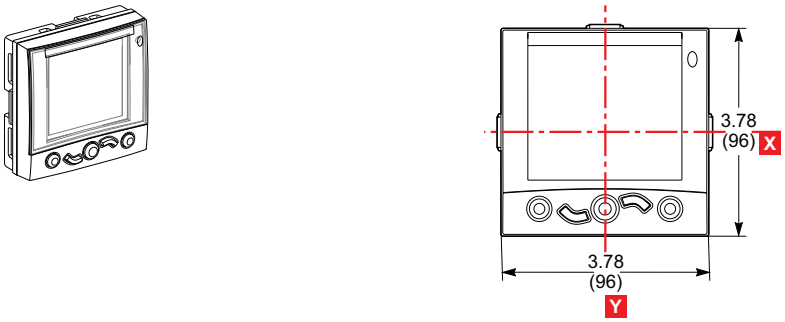
Dimensions: in (mm)

Figure 100 - IFM Modbus-SL Interface



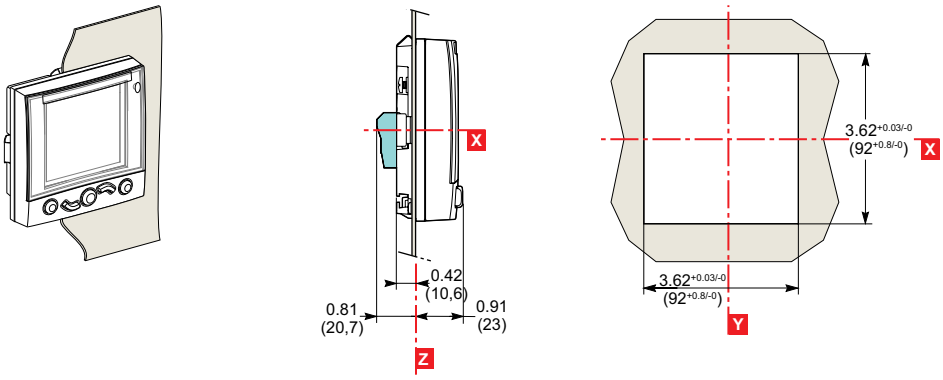
Dimensions: in (mm)

Figure 101 - FDM121 Switchboard Display Dimensions



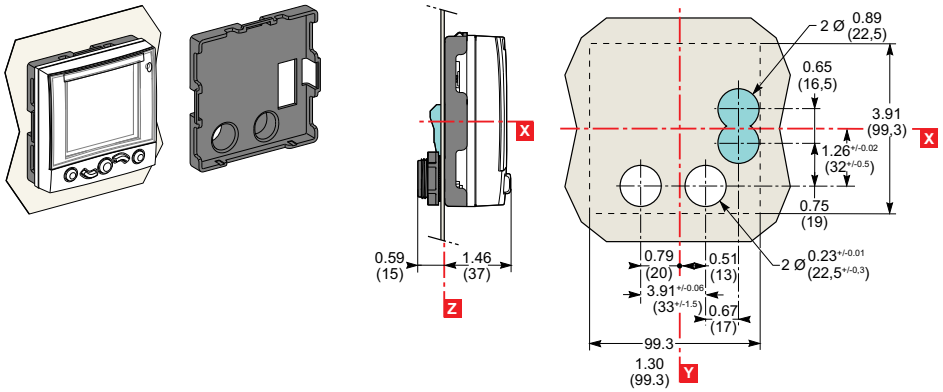
Dimensions: in (mm)

Figure 102 - FDM121 Switchboard Display Mounting Through Panel



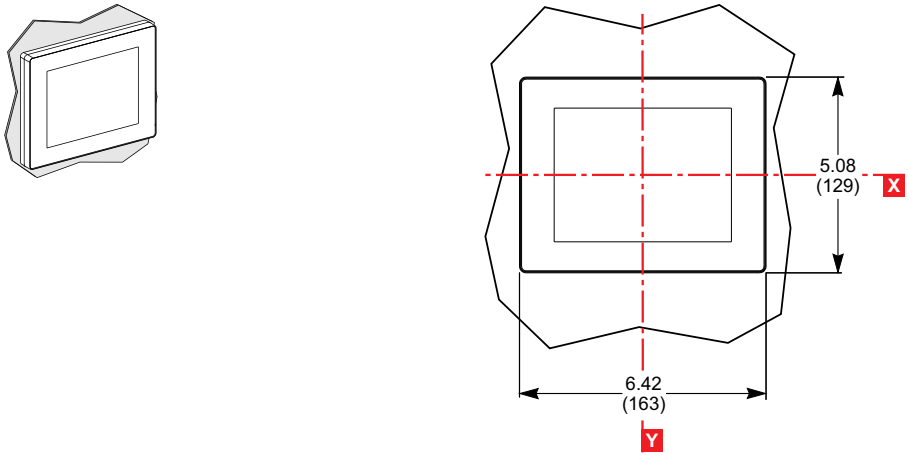
Dimensions: in (mm)

Figure 103 - FDM121 Switchboard Display Mounting On Panel



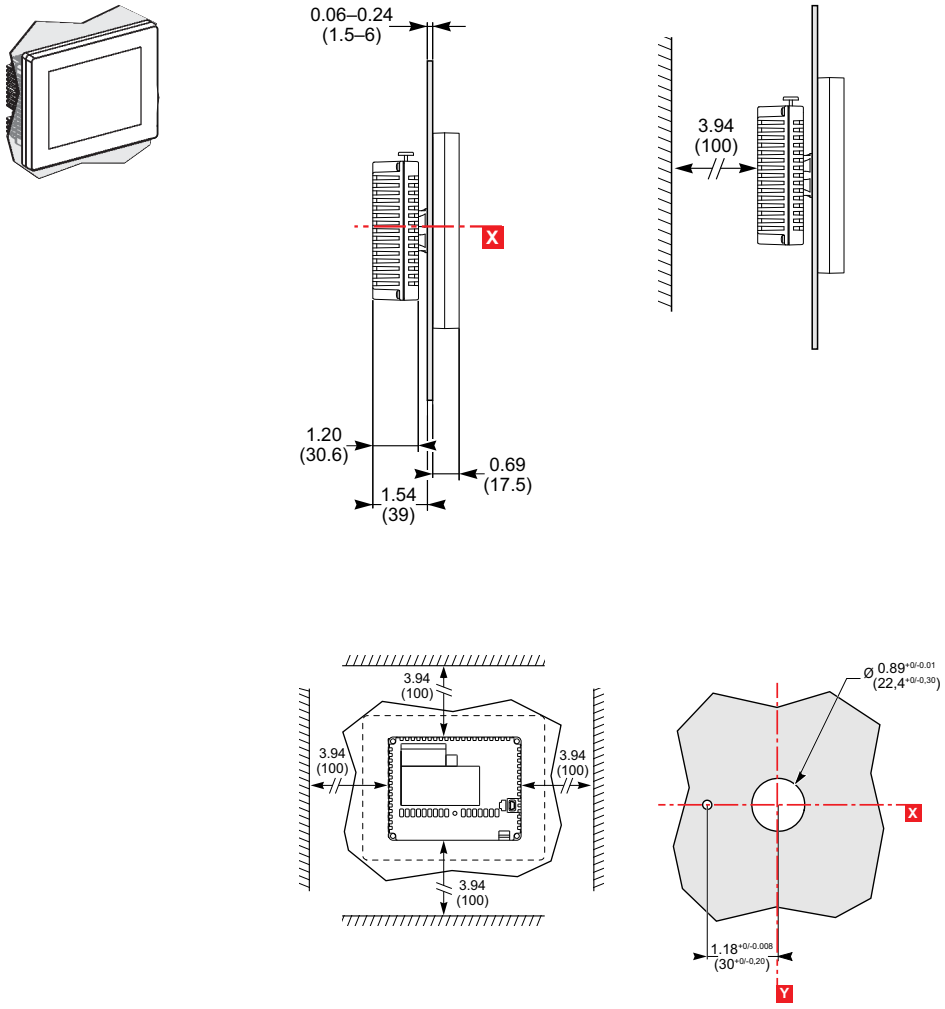
Dimensions: in (mm)

Figure 104 - FDM128 Switchboard Display Dimensions



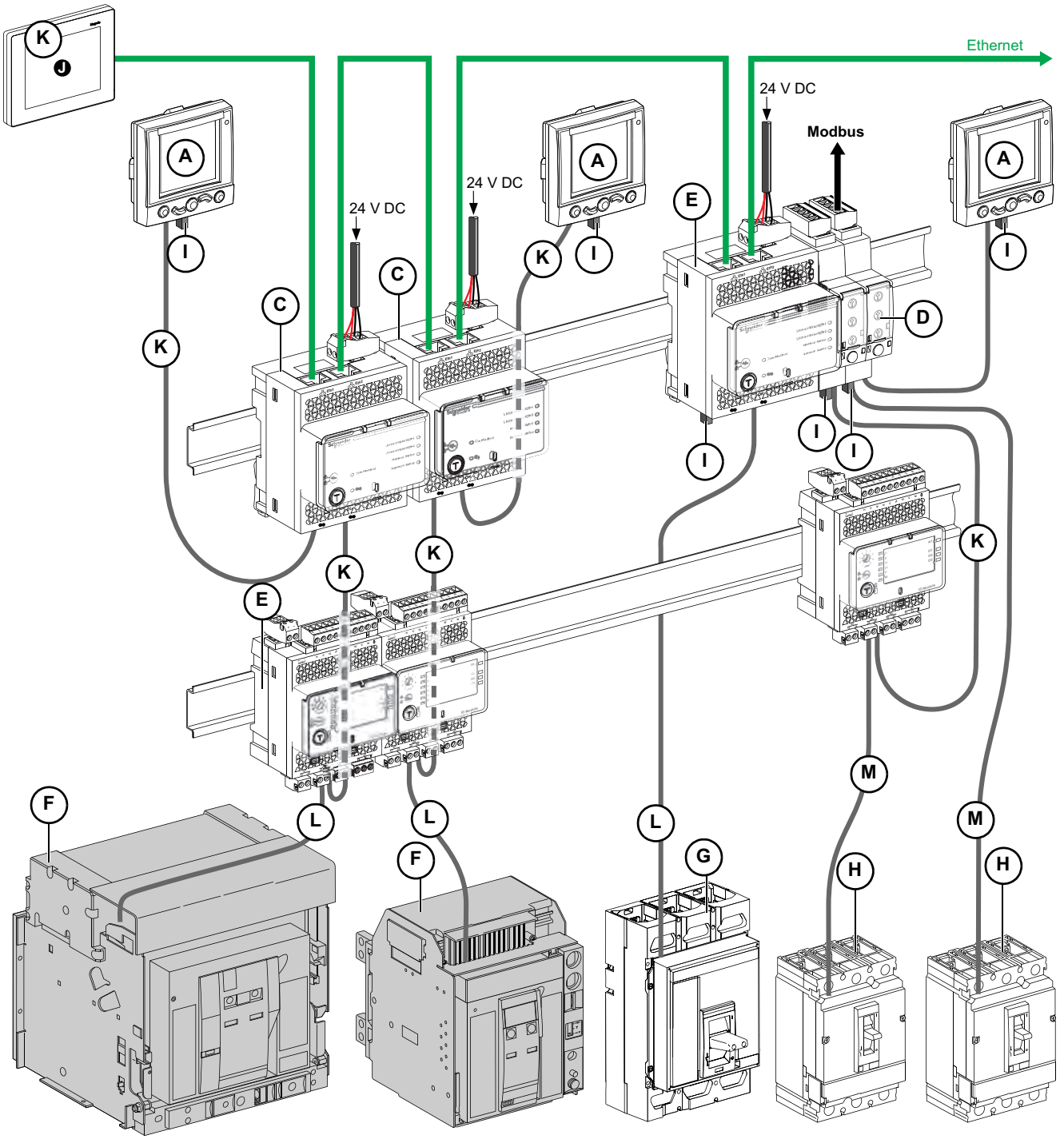
Dimensions: in (mm)

Figure 105 - FDM128 Switchboard Display Mounting on Panel



Dimensions: in (mm)

Figure 106 - MasterPact NT and NW Circuit Breaker Communication



A	FDM121 (TRV00121)	E	IO module (LV434063)	I	ULP termination (TRV00880)	M	NSX cord
B	IFE module master (LV434011	F	MasterPact NT/NW circuit breaker	J	FDM128 (LV434128)		
C	IFE module (LV434010)	G	PowerPact P/R circuit breaker	K	ULP cable		
D	IFM module (TRV00210)	H	PowerPact H/J/L circuit breaker	L	Circuit breaker ULP cord		

Figure 107 - Fixed MasterPact NT and NW Connection to the Communication Interface Module

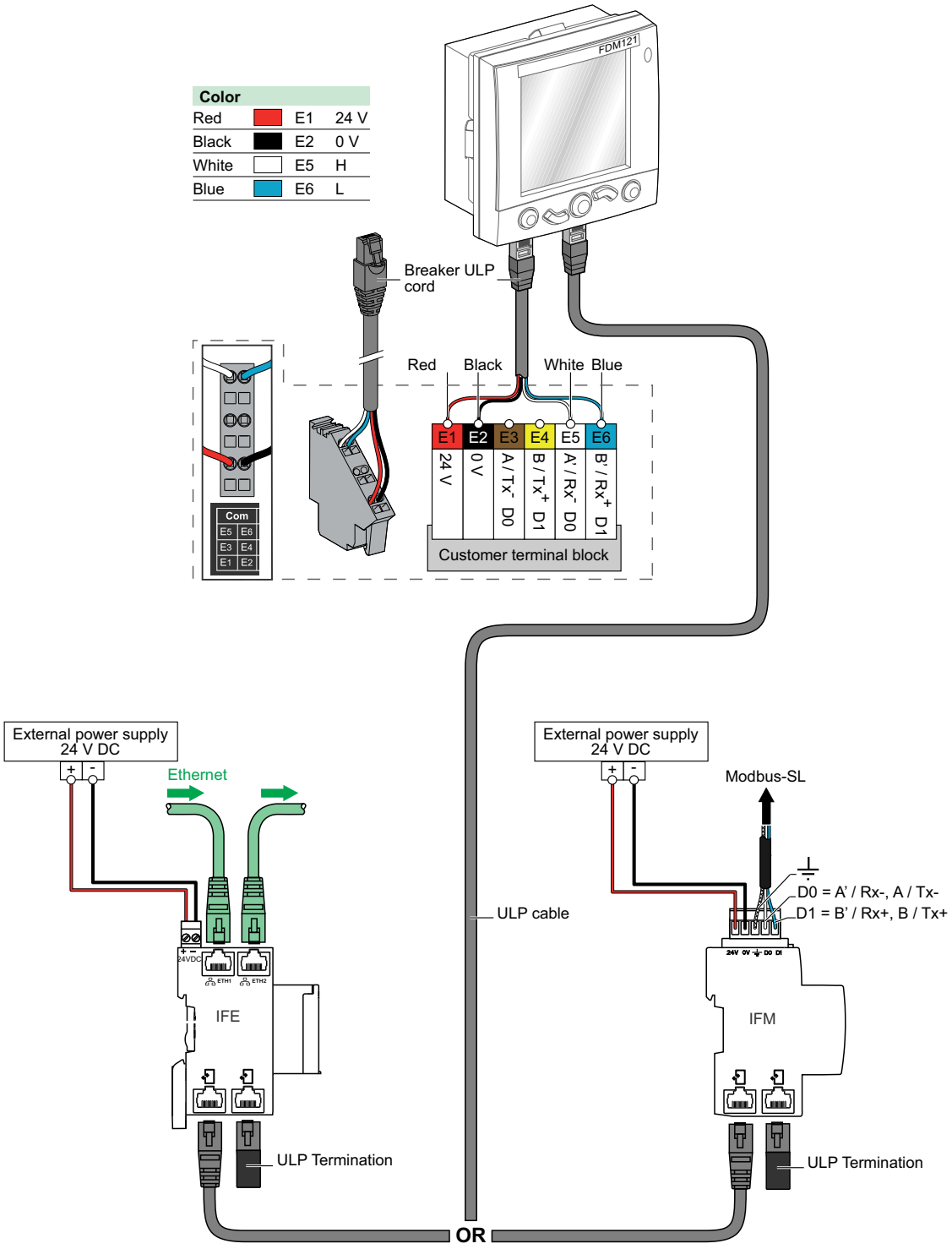
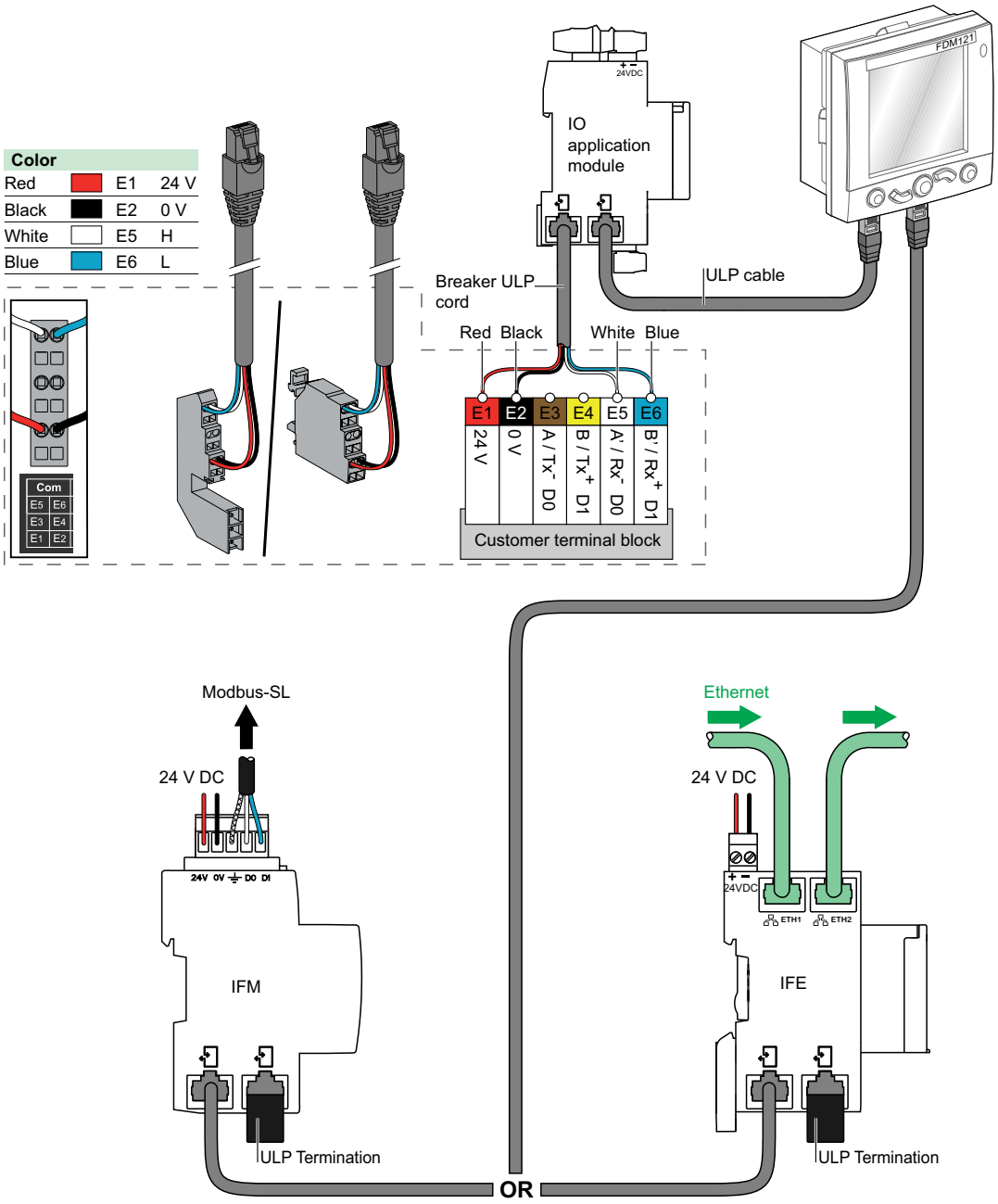


Figure 108 - Drawout MasterPact NT and NW Connection to the I/O and Communication Interface Module



Selection

Introduction

MasterPact circuit breakers are available in three frame sizes:

- T-frame circuit breakers: rated up to 1600 A.
- W-frame circuit breakers: rated up to 4000 A.
- Y-frame circuit breakers: rated up to 6300 A.

Within each range, several sensor plugs are available to determine the maximum trip rating of each circuit breaker. In addition to a sensor plug, an adjustable rating plug is available to get lower ampacity than that available with the sensor plug.

MasterPact circuit breakers can be equipped with a variety of MicroLogic electronic trip unit configurations, ranging from basic circuit protection to more advanced relay protection and power metering capabilities. Additionally all electronic trip units within the new MicroLogic family are field interchangeable and upgradeable. Each control unit is also equipped with an interchangeable and upgradeable adjustable rating plug which is used to select the long-time pickup setting of the circuit breaker.

NOTE: MasterPact circuit breakers are ordered by sensor plug rating, not ampere trip rating. The trip rating of the circuit breaker is determined by the setting of the adjustable rating plug. Sensor plugs and rating plugs are field replaceable.

Overview of Selection Procedure

Select the completely assembled circuit breaker (circuit breaker frame plus trip unit):

1. Select the trip unit, rating plug, and trip unit options.
   - Frame ampere rating required
   - Interrupting rating required
   - Sensor plug rating required
   - Connections
2. Select circuit breaker frame options, if required.
3. Select cradle options, if required.

Table 45 - Circuit Breaker Selection Options

Model Number	NT	NW	NW
Frame type	**T**	**W**	**Y (wide-construction)**
Maximum frame rating (A)	1600 A	4000 A	6300 A
Maximum Interrupting Rating (kA, 50/60 Hz)			
AC rating	240 V 150 kA	240 V 150 kA	240 V 150 kA
	440 V 130 kA	440 V 150 kA	440 V 150 kA
	690 V 42 kA	690 V 100 kA	690 V 100 kA
Construction			
Drawout	X	X	X
Fixed	X	X	X
Termination			
Rotatable rear terminals	X	X	X
Front-connected terminals	X	X	X
Accessories Available for the Circuit Breaker and Cradle			
• Shunt close • Shunt trip • Undervoltage trip • Fixed time delay • Adjustable time delay • Spring-charging motor • Auxiliary contacts (standard)	• Ready-to-close contact • Overcurrent trip switch (standard) • Rack in interlock • Key locks for circuit breaker and cradle • Padlock attachment (circuit breaker plus cradle) • Mechanical interlocks • Cradle position switches		• Door interlock • Operations counter • Safety Shutter • Cradle rejection kit (standard) • Rail Padlocking
Electronic Trip Unit Features			
• True RMS sensing • LSI • Ground-fault alarm (no trip) • Ground-fault trip • Ground-fault trip and programmable alarm • Adjustable rating plugs • Long-time pickup LED	• Trip indication LED • Zone-selective interlocking (ZSI) • Communications • LCD dot matrix display • Advanced user interface • Protective relay functions • Thermal imaging		• Neutral protection • Contact wear indication • Incremental fine-tuning of settings • Selectable long-time delay bands • Power measurement • Expanded memory • Enhanced power quality measurement

Table 46 - MicroLogic Trip Unit Selection

Design Platform Designation	Feature Type	Protection	Model Number
Basic Trip Unit	Basic	LS0	2.0
		LSI	5.0
Trip Unit with Ammeter	A	LS0	2.0A
		LSI	5.0A
		LSIG	6.0A
Trip Unit with Power Metering	P	LSI	5.0P
		LSIG	6.0P
Trip Unit with Harmonic Metering	H	LSI	5.0H
		LSIG	6.0H

Factory Assembled Circuit Breakers and Switches

T-Frame Selection

Table 47 - T-Frame Circuit Breakers

Frame Rating (A)	Model Number	Interrupting Rating (kA)				Sensor Plug Rating (A)
		240 V	440 V	690 V	1000 V	
800 A	*NT08H1*	42	42	42	—	250, 400, 630, 800
	NT08L1	150	130	25	—	250, 400, 630, 800
1000	*NT10H1*	42	42	42	—	400, 630, 800, 1000
	NT10L1	4150	130	25	—	400, 630, 800, 1000
1250	*NT12H1*	42	42	42	—	630, 800, 1000, 1250
1600	*NT16H1*	42	42	42	—	800, 1000, 1250, 1600

Table 48 - Non-Automatic T-Frame Switches

Frame Rating (A)	Model Number	Interrupting Rating (kA)[18]				Short-Time (0.5 s) Rating (kA)
		240 V	440 V	690 V	1000 V	
800	*NT08HA*	42	42	42	—	42
1000	*NT10HA*	42	42	42	—	42
1250	*NT12HA*	42	42	42	—	42
1600	*NT16HA*	42	42	42	—	42

W-Frame Selection

Table 49 - W-Frame Circuit Breakers

Frame Rating (A)	Model Number	Interrupting Rating (kA)				Sensor Plug Rating (A)
		240 V	440 V	690 V	1150 V	
800	*NW08N1*	42	42	42	—	400, 630, 800
	NW08H1	65	65	65	—	400, 630, 800
	NW08H2	100	100	85	—	400, 630, 800
	NW08L1[19]	150	150	100	—	400, 630, 800
	NW08H10[19]	—	—	—	50	400, 630, 800
1000	*NW10N1*	42	42	42	—	400, 630, 800, 1000
	NW10H1	65	65	65	—	400, 630, 800, 1000
	NW10H2	100	100	85	—	400, 630, 800, 1000
	NW10L1[19]	150	150	100	—	400, 630, 800, 1000
	NW10H10[19]	—	—	—	50	400, 630, 800, 1000
1250	*NW12N1*	42	42	42	—	630, 800, 1000, 1250
	NW12H1	65	65	65	—	630, 800, 1000, 1250
	NW12H2	100	100	85	—	630, 800, 1000, 1250
	NW12L1[19]	150	150	100	—	630, 800, 1000, 1250
	NW12H10[19]	—	—	—	50	630, 800, 1000, 1250
1600	*NW16N1*	42	42	42	—	800, 1000, 1250, 1600
	NW16H1	65	65	65	—	800, 1000, 1250, 1600

18. When used in conjunction with an overcurrent relay, circuit breaker, or fuse.
19. Not available for fixed-mounted circuit breakers.

Table 49 - W-Frame Circuit Breakers (Continued)

Frame Rating (A)	Model Number	Interrupting Rating (kA)				Sensor Plug Rating (A)
		240 V	440 V	690 V	1150 V	
	NW16H2	100	100	85	—	800, 1000, 1250, 1600
	NW16L1[20]	150	150	100	—	800, 1000, 1250, 1600
	NW16H10[20]	—	—	—	50	800, 1000, 1250, 1600
2000 A	*NW20H1*	65	65	65	—	1000, 1250, 1600, 2000
	NW20H2	100	100	85	—	1000, 1250, 1600, 2000
	NW20H3[20]	150	150	100	—	1000, 1250, 1600, 2000
	NW20L1[20]	150	150	100	—	1000, 1250, 1600, 2000
	NW20H10[20]	—	—	—	50	1000, 1250, 1600, 2000
2500	*NW25H1*	65	65	65	—	1250, 1600, 2000, 2500
	NW25H2	100	100	85	—	1250, 1600, 2000, 2500
	NW25H3[20]	150	150	100	—	1250, 1600, 2000, 2500
	NW25H10[20]	—	—	—	50	1250, 1600, 2000, 2500
3200	*NW32H1*	65	65	65	—	1600, 2000, 2500, 3200
	NW32H2	100	100	85	—	1600, 2000, 2500, 3200
	NW32H3[20]	150	150	100	—	1600, 2000, 2500, 3200
	NW32H10[20]	—	—	—	50	1600, 2000, 2500, 3200
4000	*NW40H1*	65	65	65	—	2000, 2500, 3200, 4000
	NW40H2	100	100	85	—	2000, 2500, 3200, 4000
	NW40H3[20]	150	150	100	—	2000, 2500, 3200, 4000
	NW40H10[20]	—	—	—	50	2000, 2500, 3200, 4000

Table 50 - Automatic Switch

Frame Rating (A)	Model Number	Withstand Rating (kA)[21]			Instantaneous Override (kA)
		240 V	440 V	690 V	
800	*NW08HF*	85	85	85	85
1000	*NW10HF*	85	85kA	85kA	85
1250	*NW12HF*	85	85	85	85
1600	*NW16HF*	85	85	85	85
2000	*NW20HF*	85	85	85	85
2500	*NW25HF*	85	85	85	85
3200	*NW32HF*	85	85	85	85
4000	*NW40HF*	85	85	85	85

Table 51 - Non-Automatic Switch

Frame Rating (A)	Model Number	Interrupting Rating (kA)[22]				Short-Time (1s) Rating (kA)
		240 V	440 V	690 V	1150 V	
800	*NW08NA*	42	42	42	—	42
	NW08HA	50	50	50	—	50
	NW08HA10[20]	—	—	—	50	50

20. Not available for fixed-mounted circuit breakers.
21. The withstand rating is the fault current (at rated voltage) that the switch will withstand without damage when protected by a circuit breaker with an equal continuous current rating.
22. When used in conjunction with an overcurrent relay, circuit breaker, or fuse.

Table 51 - Non-Automatic Switch (Continued)

Frame Rating (A)	Model Number	Interrupting Rating (kA)[23]				Short-Time (1s) Rating (kA)
		240 V	440 V	690 V	1150 V	
1000	*NW10NA*	42	42	42	—	42
	NW10HA	50	50	50	—	50
	NW10HA10[24]	—	—	—	50	50
1250	*NW12NA*	42	42	42	—	42
	NW12HA	50	50	50	—	50
	NW12HA10[24]	—	—	—	50	50
1600	*NW16NA*	42	42	42	—	42
	NW16HA	50	50	50	—	50
	NW16HA10[24]	—	—	—	50	50
2000	*NW20HA*	50	50	50	—	50
	NW20HA10[24]	—	—	—	50	50
2500	*NW25HA*	50	50	50	—	50
	NW25HA10[24]	—	—	—	50	50
3200	*NW32HA*	50	50	50	—	50
	NW32HA10[24]	—	—	—	50	50
4000	*NW40HA*	50	50	50	—	50
	NW40HA10[24]	—	—	—	50	50

Y-Frame Selection

Table 52 - Y-Frame Circuit Breakers

Frame Rating (A)	Model Number	Interrupting Rating (kA)			Sensor Plug Rating (A)
		240 V	440 V	690 V	
5000	*NW50H1*	100	100	100	2500, 3200, 4000, 5000
	NW50H2	150	150	100	2500, 3200, 4000, 5000
6300	*NW63H1*	100	100	100	3200, 4000, 5000, 6300
	NW63H2	150	150	100	3200, 4000, 5000, 6300

Table 53 - Non-Automatic Switches

Frame Rating (A)	Model Number	Interrupting Rating (kA)[23]			Short-Time (1s) Rating (kA)
		240 V	440 V	690 V	
5000	*NW50HA*	85	85	85	85
6300	*NW63HA*	85	85	85	85

23. When used in conjunction with an overcurrent relay, circuit breaker, or fuse.
24. Not available for fixed-mounted circuit breakers.

Request for Quotation

REQUEST FOR QUOTATION FORM

For faster quote processing, please use the following request for quotation form. For each section, check the applicable box or enter value corresponding to your choice. **Note:** this request for quotation form does not take into account incompatibilities. Orders to be placed on CSSS.

Date	
From	Location
Phone No.	Fax No.
Messages	

Customer Name:	RFQ No.:
Account No.:	Q2C No.:
Contact Name:	Phone No.:
Location:	Fax No.:

Circuit Breakers or Switches — Quantity:

Brand:			Square D ☐
			Schneider Electric ☐
Standard	ANSI ☐	UL ☐	IEC ☐
Type	NT ☐		NW ☐
Number of Poles	3 ☐		4 ☐
Frame rating			Amperes: _____
Sensor plug rating			Amperes: _____
Interrupting/Withstand rating: N, N1, NA, L, LF, L1, L1F, H, H2, H3, H10, HA, HA10, HF, HB, HC			_____
Cradle options:	Circuit breaker with cradle ■		☐
	Circuit breaker without cradle		☐
	Cradle only ♦♦		☐
	Fixed breaker		☐
Optional characterization for CTs			☐

Micrologic® Trip Units

Dummy Trip Unit (for switch only)	☐
Basic Trip Unit	
Basic protection	2.0 ☐
Selective protection	5.0 ☐
Trip Unit with Ammeter	
Basic protection	2.0A ☐
Selective protection	5.0A ☐
Selective protection + equip. ground fault	6.0A ☐
Trip Unit with Power Metering	
Selective protection	5.0P ☐
Selective protection + equip. ground fault	6.0P ☐
Trip Unit with Harmonic Metering	
Selective protection	5.0H ☐
Selective protection + equip. ground fault	6.0H ☐
Rating plug type (A=UL/ANSI; R=IEC) (for non-standard, see page 41)	_____
Choose one: External neutral sensor	(CT) ☐
Mod. differential ground-fault ♦	(MDGF) ☐
Source ground return	(SGR) ☐

Micrologic Trip Unit Accessories

Choose one: Programmable contact module	(M2C) ☐
Programmable contact module	(M6C) ☐
Modbus® circuit breaker com. module	(BCM) ☐
Modbus cradle com. module	(CCM) ☐
Restraint interface module	(RIM) ☐
External power supply (24 Vdc)	input voltage ____
Number of power supplies/circuit breaker: 1 ☐	or 2 ☐
Battery backup	quantity: 1 ☐ or 2 ☐
External voltage sensing	☐
Automatic reset	(RAR) ☐

Cradle Secondary Disconnects

Choose one:	
Push-in terminal (standard)	☐
Ring terminal ♦	☐

Accessories for Remote Operation

Spring-charging motor (MCH)	_____ Vac _____ Vdc
Shunt close (XF): Standard ☐ or Communication ☐	_____ Vac _____ Vdc
Shunt trip (MX1): Standard ☐ or Communication ☐	_____ Vac _____ Vdc
Additional shunt trip (MX2) OR	_____ Vac _____ Vdc
Undervoltage trip (MN)—choose one:	
Instantaneous	_____ Vac _____ Vdc
Fixed-time delayed	_____ Vac _____ Vdc
Adjustable-time delayed	_____ Vac _____ Vdc
Electrical closing push button	(BPFE) ☐
Remote reset after fault trip (RES)	110–130 Vac ☐
(incompatible with SDE2)	200–240 Vac ☐

Wiring for Cradle (Complete only if ordering cradle without circuit breaker)

Circuit breaker communication module (BCM) wiring	☐
Wiring for zone-selective interlocking (ZSI), modified differential ground fault (MDGF), neutral current transformer (CT) and 24 V power supply	☐
Wiring for programmable contact modules (M2C and M6C)	☐
Wiring for additional overcurrent trip switch (SDE2) or electrical reset (RES)	☐
Wiring for undervoltage trip (MN) or additional shunt trip (MX2)	☐
Wiring for shunt trip (MX), shunt close (XF) and spring-charging motor (MCH)	☐
Wiring for ready-to-close contact (PF)	☐
Wiring for four additional form C auxiliary switches (push-in terminals) or 2a+2b auxiliary switches (ring terminals) (OF)	☐
Wiring for eight additional form C auxiliary switches (push-in terminals) (OF)	☐

Manufacturing Numbers Provided with Quotation

Circuit Breaker: _____

Cradle: _____

■ See Delivery Schedule on the next page

REQUEST FOR QUOTATION FORM

Auxiliary, Alarm and Cradle Position Switches

Auxiliary switch (OF) choose one:
- Push-in type terminal 4a/4b form C (std.)
- 4a/4b low level NT ☐
- 8a/8b form C▼ ☐
- 12a/12b form C▼ ☐

Overcurrent trip switches
- Standard (1a/1b form C) (SDE1) standard

Additional overcurrent trip switches (choose one)
- (1a/1b form C) (incompatible with RES) (SDE2) ☐
- (1a/1b form C) (incompatible with RES) (low-level SDE2) ☐

Ready-to-close switch (PF) Std ☐ low-level ☐

Push-in type cradle postion switches (1a/1b form C) Qty.
- Connected position (max. qty.: 3 NW/3 NT) (CE) _____
- Test position (max. qty.: 3 NW/1 NT) (CT) _____
- Disconnected position (max. qty.: 3 NW/2 NT) (CD) _____

Low-level cradle position switch

Choose one: Qty.
- Connected/Closed switch▼ (max. qty.: 8) (EF) _____
- Connected/Closed switch▼ (max. qty.: 8) (low-level EF) _____

Locking and Interlocking

	Cradle	Brkr
Padlockable push button cover		☐
Padlock provision only		☐
One key lock (select manufacturer below)	☐	☐
Two key locks keyed alike (select manufacturer below)	☐	☐
Two key locks keyed differently (select manufacturer below)	☐	☐

Key lock manufacturer
- Ronis ☐ Kirk® ☐
- Profalux ☐ Castell ☐

▼ Not available on Masterpact® NT (T-frame circuit breaker)

Cradle Connections

- Front-connected ☐
- Rear-connected
  - 800–3200 A: Rear-connected "T" vertical (RCTV) ☐; Rear-connected "T" horizontal (RCTH) ☐

Cradle Interlocking and Accessories

- Door interlock ☐
- Racking interlock between racking crank and Off position ☐
- Open door recking interlock ☐
- Automatic spring discharge std. on UL/ANSI, check for IEC ☐
- Cradle rejection kit standard
- Terminal shield ☐
- Rail padlocking std. on UL/ANSI, check for IEC ☐

Miscellaneous Accessories

- Mechanical operation counter ☐
- Shutter ☐
- Shutter with padlock provision and position indicator ☐
- Transparent cover w/ door escutcheon (drawout circuit breaker only) ☐
- Lifting device: lifting hooks (Set of 2) ☐
- T-frame, W-frame, or Y-frame circuit breaker: lifting bar (short) ☐; lifting bar (long) ☐

Test Equipment

- Hand-held test kit ☐
- Full-function test kit ☐

Manufacturing Number (provided with quotation)

	List Price
Circuit Breaker: _____	$ _____
Cradle: _____	$ _____
Total	$ _____

Delivery (from receipt of order) _____

■ Delivery Schedule

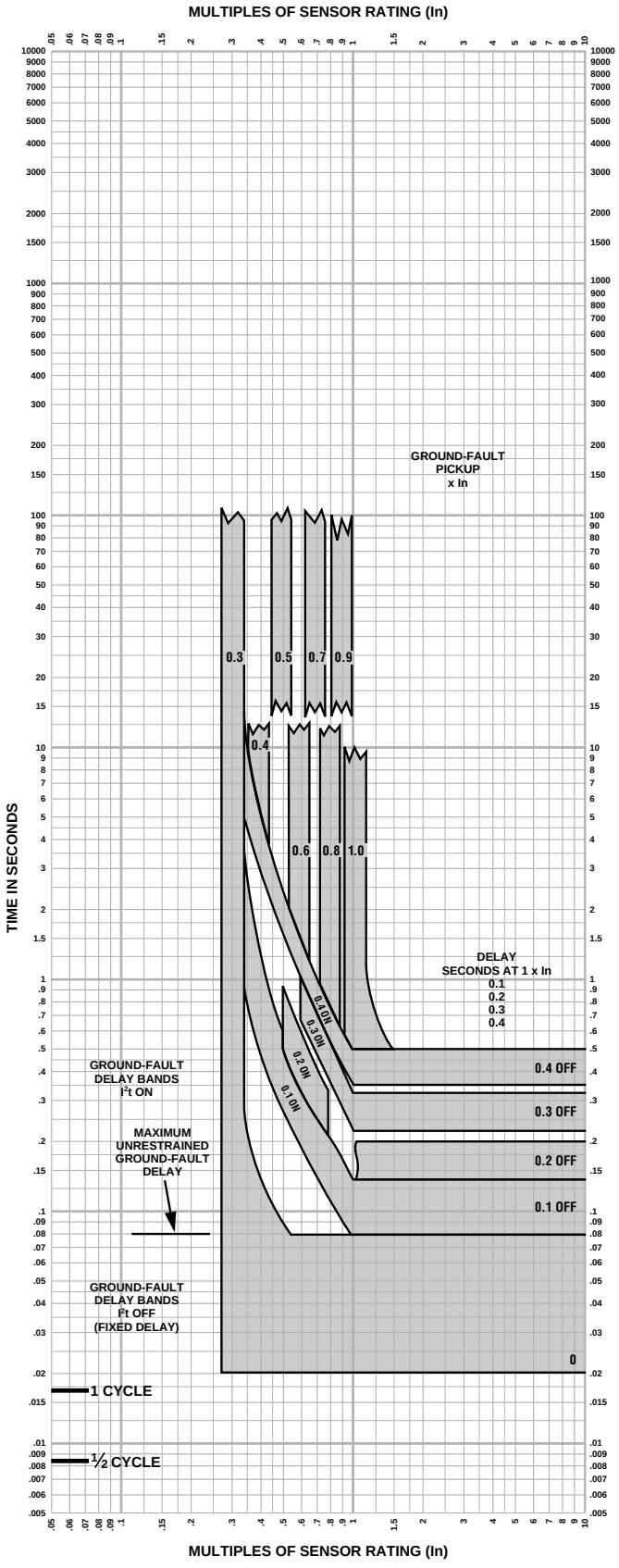
- Circuit breaker and cradle to be shipped together ☐
- Cradle to be shipped prior to circuit breaker ☐

Schneider Electric Conditions of Sale Apply

Trip Curves

MicroLogic 6.0 A/P/H Trip Units

Figure 109 - MicroLogic 6.0 A/P/H Trip Units: $I_n \leq 400$ A

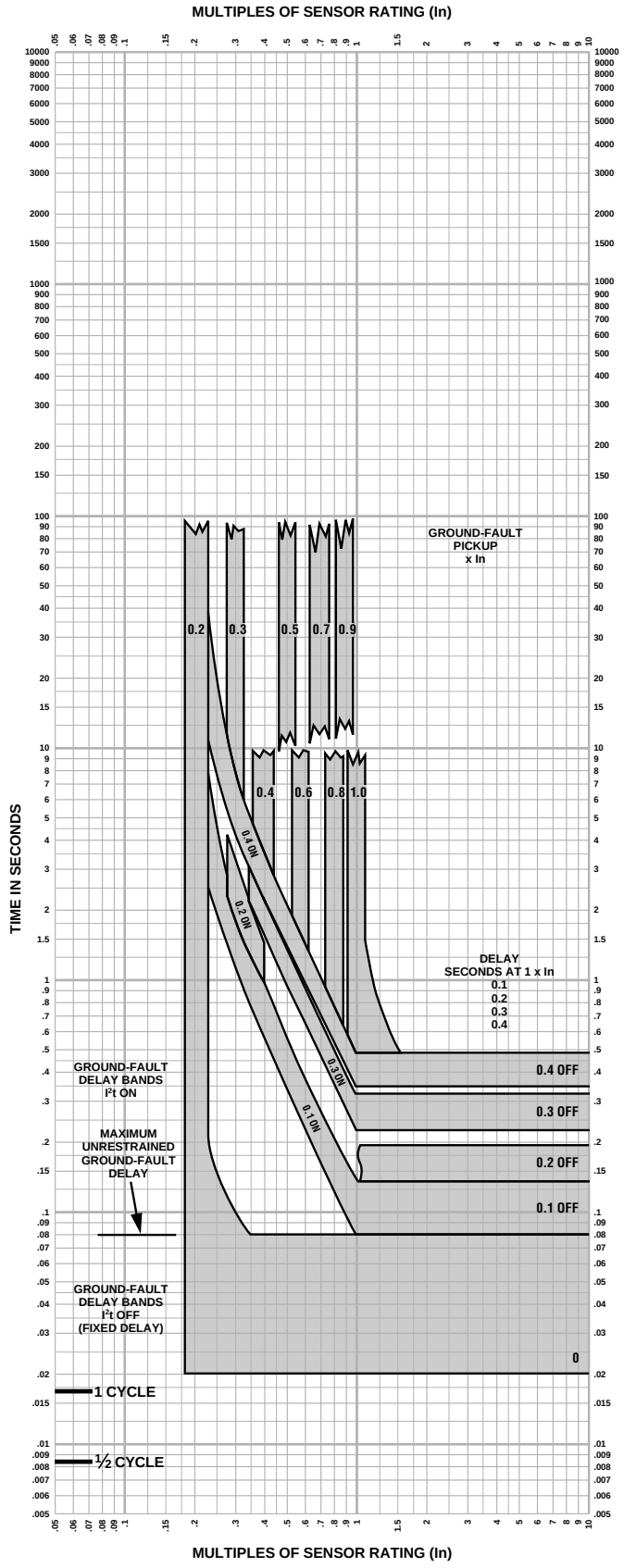


MicroLogic 6.0 A/P/H Trip Units with Adjustable Ground-Fault Pickup and Delay Characteristic Trip Curve No. 613-1
Ground Fault I²t OFF and ON
$I_n \leq 400$ A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

Figure 110 - MicroLogic 6.0 A/P/H Trip Units: 400 A < I_n ≤ 1200 A

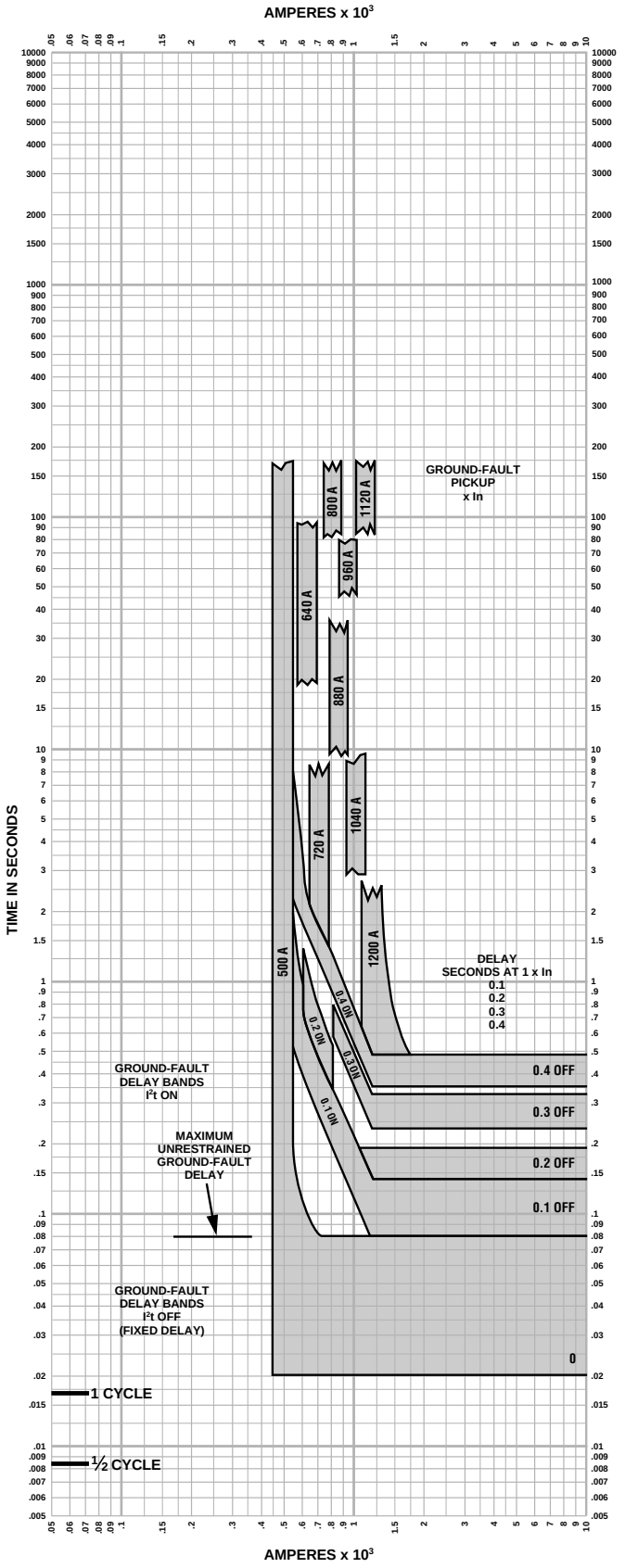


MicroLogic 6.0 A/P/H Trip Units with Adjustable Ground-Fault Pickup and Delay Characteristic Trip Curve No. 613-2
Ground Fault I²t OFF and ON
400 A < I_n ≤ 1200 A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

Figure 111 - MicroLogic 6.0 A/P/H Trip Units: I_n > 1200 A



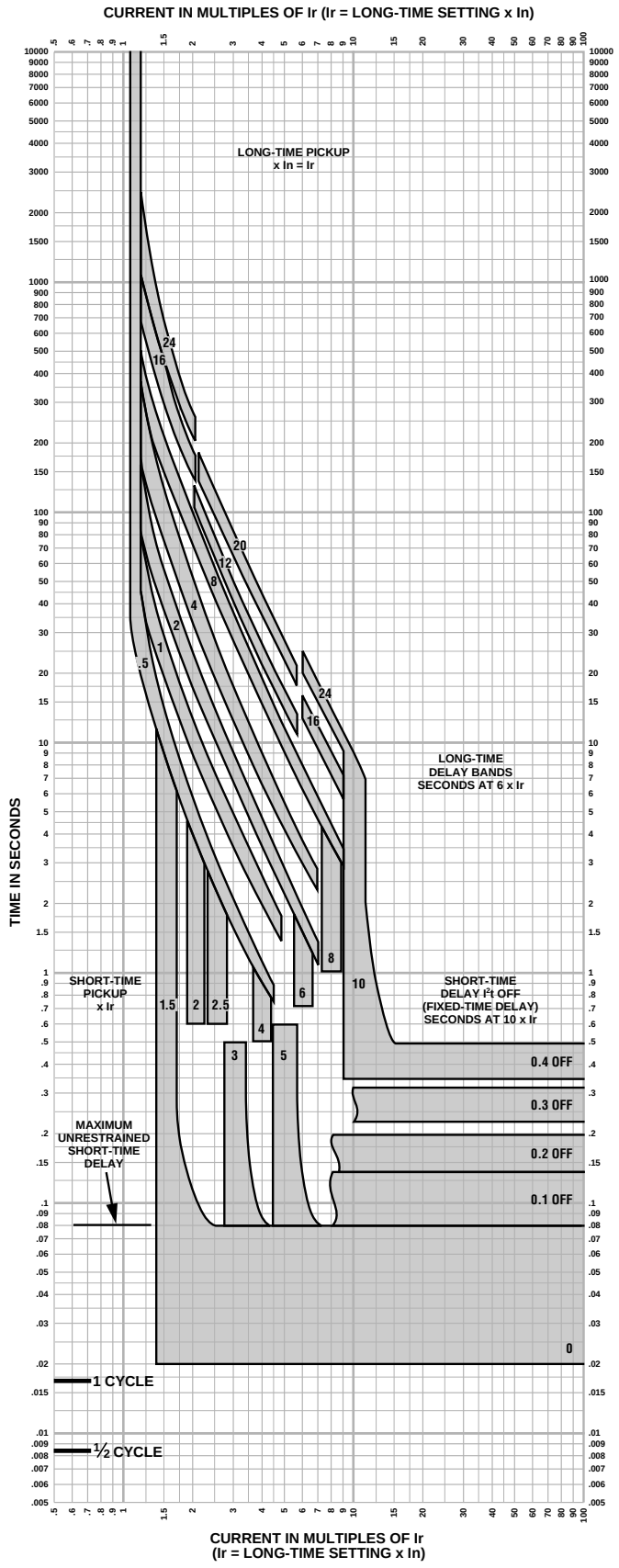
MicroLogic 6.0 A/P/H Trip Units with Adjustable Ground-Fault Pickup and Delay
Characteristic Trip Curve No. 613-3
Ground Fault I²t OFF and ON
I_n > 1200 A

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

MicroLogic 5.0/6.0 A/P/H Trip Unit

Figure 112 - MicroLogic 5.0/6.0 A/P/H Trip Units: Long-Time Pickup and Delay, Short-Time Pickup, and I²t OFF Delay



MicroLogic 5.0/6.0 A/P/H Trip Units
Characteristic Trip Curve No. 613-4
Long-Time Pickup and Delay
Short-Time Pickup and I²t OFF Delay

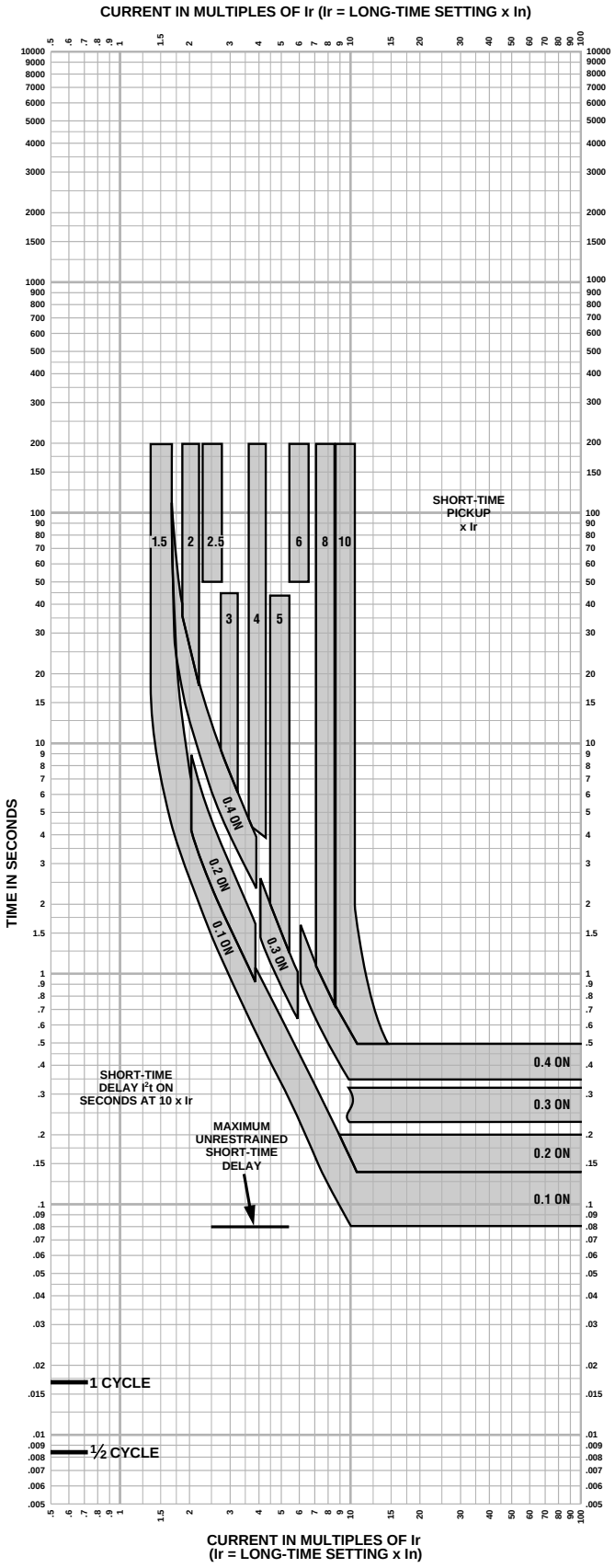
The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of the current.
5. For a withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 for instantaneous trip curve. See trip curve 613-10 for instantaneous override values.
6. Overload indicator illuminates at 100%.

Figure 113 - MicroLogic 5.0/6.0 A/P/H Trip Units: Short-Time Pickup and I²t ON Delay



MicroLogic 5.0/6.0 A/P/H Trip Units
Characteristic Trip Curve No. 613-5
Short-Time Pickup and I²t ON Delay

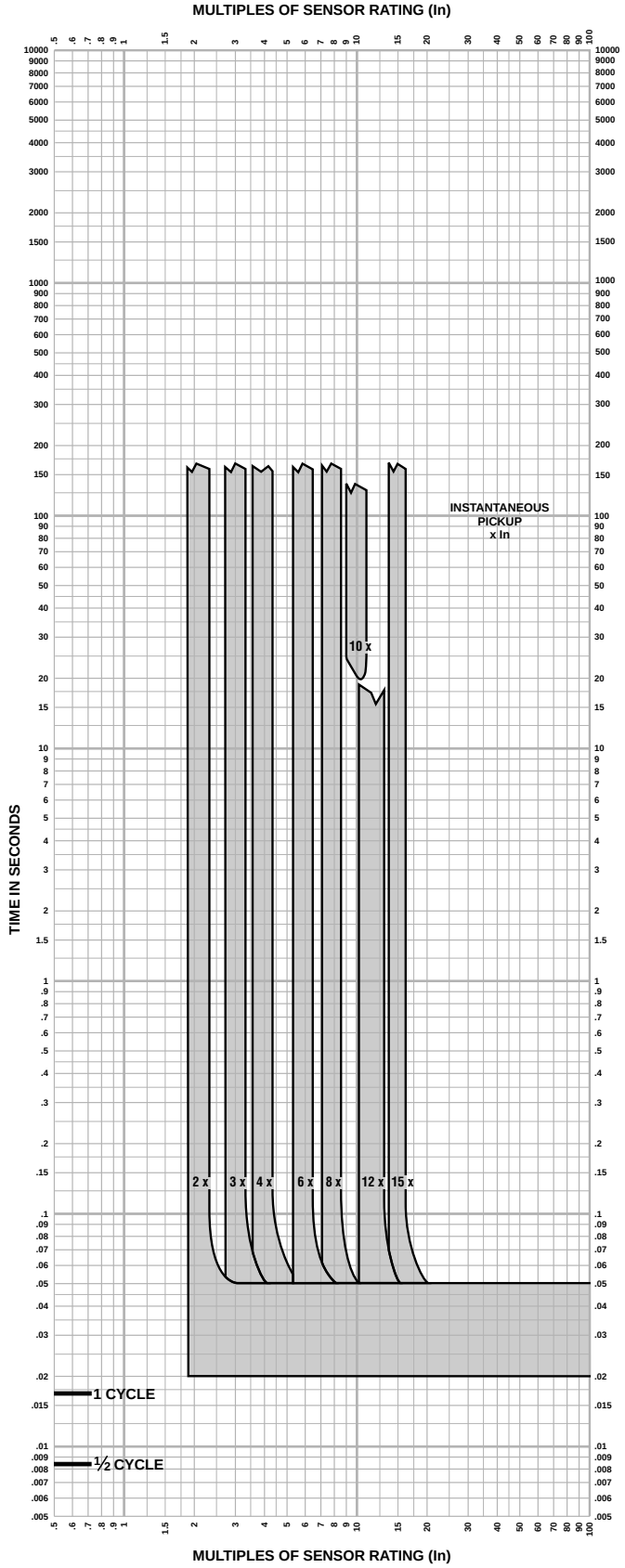
The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the interrupting rating of the circuit breaker.
3. With zone-selective interlocking ON, short-time delay utilized, and no restraining signal, the maximum unrestrained short-time delay time band applies regardless of the setting.
4. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
5. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-7 for instantaneous trip curve. See trip curve 613-10 for instantaneous override values.
6. See trip curve 613-4 for long-time pickup and delay trip curve.

Figure 114 - MicroLogic 5.0/6.0 Trip Units: Instantaneous Pickup, 2x to 15x and OFF



MicroLogic 5.0/6.0 A/P/H Trip Units
Characteristic Trip Curve No. 613-7
Instantaneous Pickup
2x–15x and OFF

The time-current curve information is to be used for application and coordination purposes only.

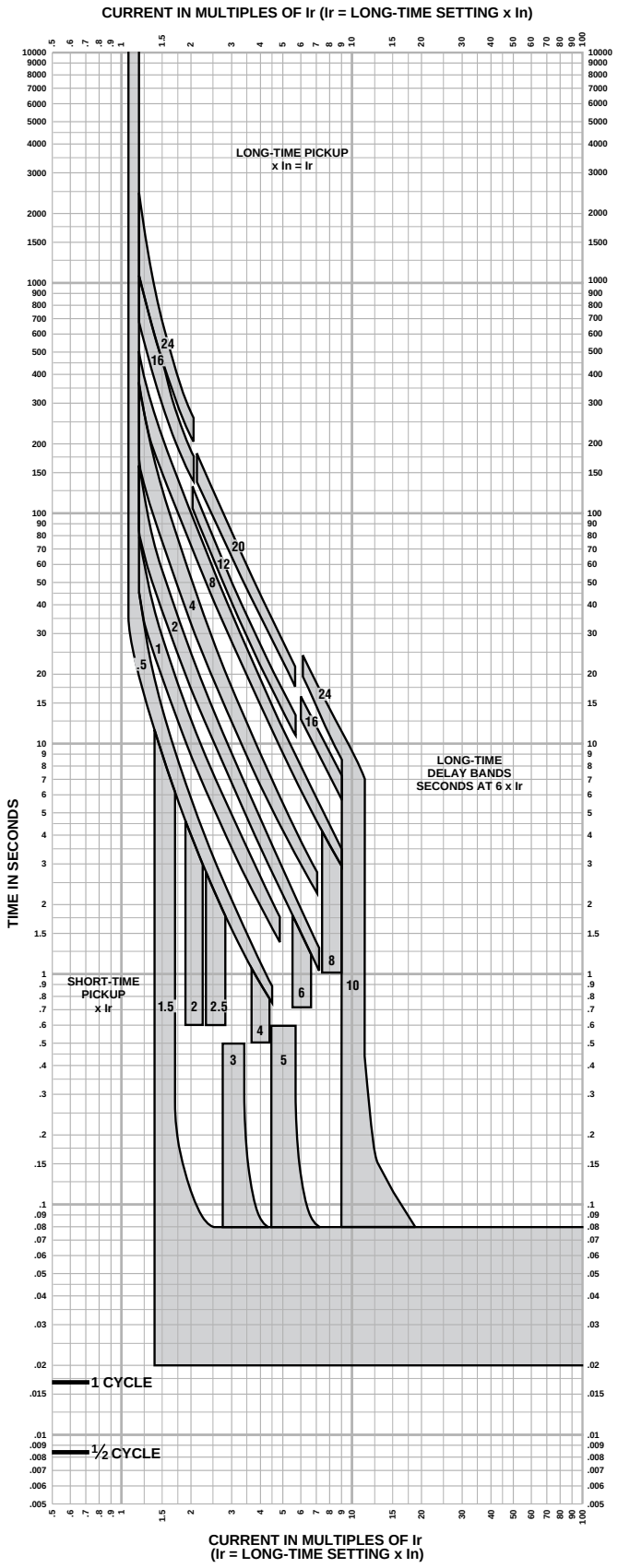
Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

NOTE:

1. The end of the curve is determined by the interrupting rating of the circuit breaker.
2. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
3. The instantaneous region of the trip curve shows maximum total clearing times. Actual clearing times in this region can vary depending on the circuit breaker mechanism design and other factors. The actual clearing time can be considerably faster than indicated. Contact your local Sales Office for additional information.
4. For withstand circuit breaker, instantaneous can be turned OFF. See trip curve 613-10 for instantaneous override values.
5. See trip curve 613-4 and 613-5 for long-time pickup, long-time delay, short-time pickup, and short-time delay trip curve.

MicroLogic 2.0 Trip Units

Figure 115 - MicroLogic 2.0A Trip Unit



MicroLogic 2.0 A Trip Unit
Characteristic Trip Curve No. 613-9
Long-Time Pickup and Delay
Short-Time Pickup with No Delay

The time-current curve information is to be used for application and coordination purposes only.

Curves apply from -25°C to +70°C (-13°F to +158°F) ambient temperature.

NOTE:

1. There is a thermal-imaging effect that can act to shorten the long-time delay. The thermal-imaging effect comes into play if a current above the long-time delay pickup value exists for a time and then is cleared by the tripping of a downstream device or the circuit breaker itself. A subsequent overload will cause the circuit breaker to trip in a shorter time than normal. The amount of time delay reduction is inverse to the amount of time that has elapsed since the previous overload. Approximately twenty minutes is required between overloads to completely reset thermal-imaging.
2. The end of the curve is determined by the short-time setting.
3. Total clearing times shown include the response times of the trip unit, the circuit breaker opening, and the extinction of current.
4. Overload indicator illuminates at 100%.

MicroLogic 2.0/5.0/6.0 A/P/H Trip Unit Instantaneous Override Values

Figure 116 - MicroLogic 2.0/3.0/5.0/6.0 A/P/H Trip Unit Instantaneous Override Values

MasterPact NW/NT

IEC CB Model No.	Inst. Override (kA Peak) +/- 10%
NW08N1	None
NW10N1	None
NW12N1	None
NW16N1	None
NW08H1	None
NW10H1	None
NW12H1	None
NW16H1	None
NW20H1	None
NW25H1	None
NW32H1	None
NW40H1	None
NW40bH1	None
NW50H1	None
NW63H1	None
NW08H2 ★	55
NW08H2	190
NW10H2	190
NW16H2	190
NW20H2	190
NW25H2	190
NW32H2	190
NW40H2	190
NW40bH2	190
NW50H2	270
NW63H2	270
NW20H3	150
NW25H3	150
NW32H3	150
NW40H3	150
NW08L1 ★	55
NW08L1	80
NW10L1	80
NW12L1	80
NW16L1	80
NW20L1	80
NW08H10	None
NW10H10	None
NW12H10	None
NW16H10	None
NW20H10	None
NW25H10	None
NW32H10	None
NW40H10	None
NW08NA	None
NW10NA	None
NW16NA	None

MasterPact NW/NT

IEC CB Model No.	Inst. Override (kA Peak) +/- 10%
NW08HA	None
NW10HA	None
NW12HA	None
NW16HA	None
NW20HA	None
NW25HA	None
NW32HA	None
NW40HA	None
NW40bHA	None
NW50HA	None
NW63HA	None
NW08HF	190
NW10HF	190
NW12HF	190
NW16HF	190
NW20HF	190
NW25HF	190
NW32HF	190
NW40HF	190
NW08HA10	None
NW10HA10	None
NW12HA10	None
NW16HA10	None
NW20HA10	None
NW25HA10	None
NW32HA10	None
NW40HA10	None
NT08H1	None
NT10H1	None
NT12H1	None
NT16H1	None
NT08L1	22
NT08H10	None
NT10H10	None
NT12H10	None
NT16H10	None
NT08HA	None
NT10HA	None
NT12HA	None
NT16HA	None
NT08HA10	None
NT10HA10	None
NT12HA10	None
NT16HA10	None

NOTE: Faults at or above instantaneous override value will be cleared at 25 msec or less.
IEC CB — Text X/R=4.9; divide by 2.1 for nominal RMS

Schneider Electric
800 Federal Street
Andover, MA 01810
USA

888–778–2733

www.se.com

As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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