MicroLogic™ 5.0P and 6.0P Electronic Trip Units

Instruction Bulletin

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www.se.com

Legal Information

Table of Contents

Hazard Categories and Special Symbols

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

Failure to follow these instructions can result in injury or equipment damage.

NOTICE

NOTICE is used to address practices not related to physical injury. The safety alert symbol is not used with this signal word.

Failure to follow these instructions can result in equipment damage.

NOTE: Provides additional information to clarify or simplify a procedure.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

General Information

Introduction

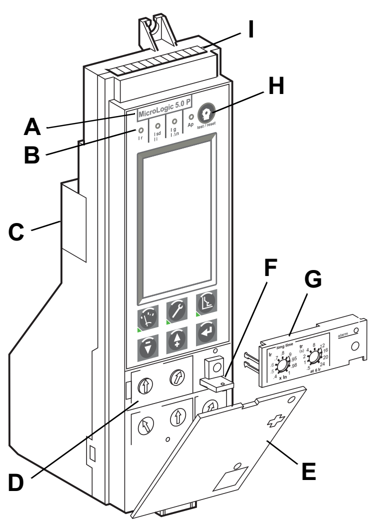
MicroLogic™ trip units provide adjustable tripping functions on electronic trip circuit breakers. The product name (A) specifies the level of protection provided by the trip unit.

MicroLogic 5.0P

- Type of protection
  - 2—Basic IEC protection (LSO)
  - 3—Basic UL protection (LI)
  - 5—Selective protection (LSI)
  - 6—Selective protection plus ground fault protection for equipment (LSIG)
- Trip unit series
  - 0—Indicates the first version
- Type of measurement
  - None—Provides protection only
  - A—Provides protection plus ammeter measurements
  - P—Provides protection plus power measurements
  - H—Provides protection plus harmonic metering

MicroLogic trip units are field replaceable to allow for upgrading of the trip unit in the field. For complete information on available circuit breaker models, frame sizes, interrupting ratings, sensor plugs, rating plugs and trip units, see the product catalog.

Figure 1 - MicroLogic Trip Unit



A	Product Name
B	Trip Indicators
C	Battery Housing
D	Adjustable Switches
E	Switch Cover
F	Sealing Tab
G	Adjustable Rating Plug
H	Reset Button for Battery Status Check and Trip Indicators
I	External Terminal Block Connection

Communications

⚠ WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords at first use to help prevent unauthorized access to device settings, controls and information.
- Disable unused ports/services and default accounts to help minimize pathways for malicious attackers.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection.
- Use cybersecurity best practices (for example, least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, or interruption of services.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

MicroLogic trip units can communicate with other devices via “Modbus” through the Circuit Breaker Communication Module (BCM). For information on the communication feature, see the product catalog and Modbus Communications System Product Data Bulletin 0613DB0702.

Power and Control Settings

Using the graphic display screen and keypad on the trip unit, trip unit options can be set or system measurements checked. See Graphic Display Navigation, page 30 for more information. System measurements can also be checked using the System Manager Software (SMS), Version 3.2 or later, or other network system management software.

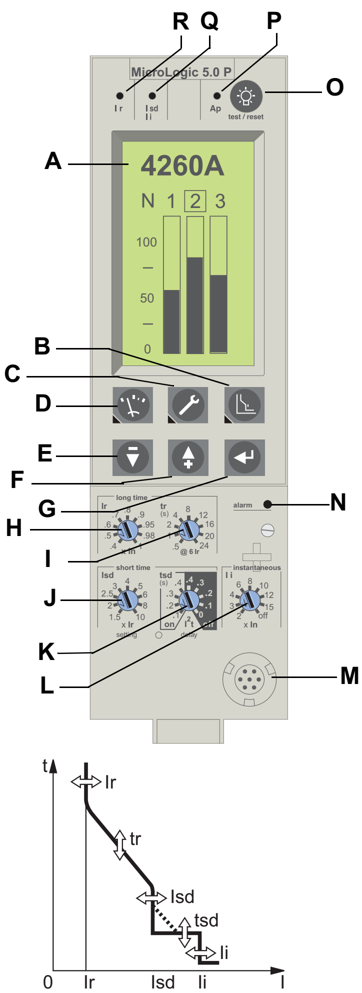
Switch Settings

On the face of the trip unit are adjustable switches to allow changing of the LSI or LSIG trip characteristics of the trip unit. Trip units are shipped with the long-time pickup switch set at 1.0 and all other trip unit switches set at their lowest settings. All advanced protection settings are turned “off.”

Fine switch adjustments can be made with the navigation keys. See Switch Settings Adjustment, page 50.

MicroLogic 5.0P Trip Unit

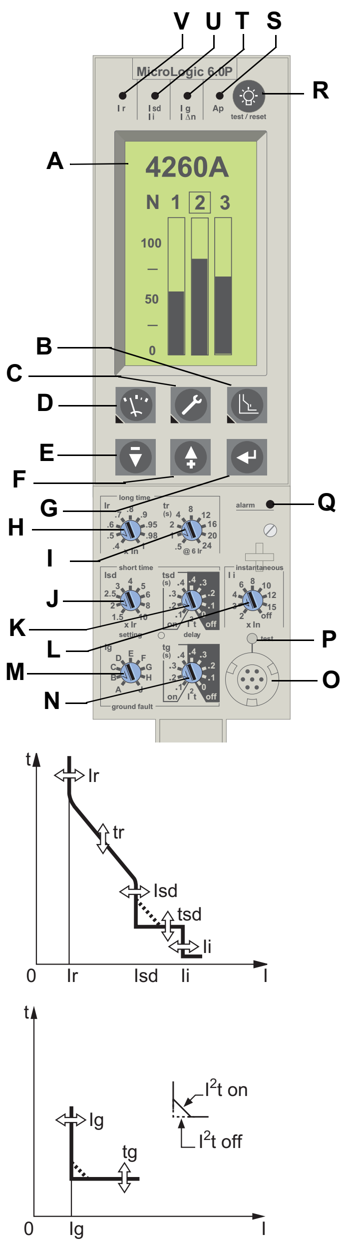
Figure 2 - 5.0P Trip Unit



A	Graphic display screen
B	Protection menu button (Button includes an LED indicating the active menu)
C	Maintenance menu button (Button includes an LED indicating the active menu)
D	Metering menu button
E	Down button
F	Up button
G	Enter button
H	Long-time pickup (Ir) switch
I	Long-time delay (tr) switch
J	Short-time pickup (Isd) switch
K	Short-time delay (tsd) switch
L	Instantaneous pickup (Ii) switch
M	Test plug receptacle
N	Long-time pickup overload indicator light
O	Reset button for battery status check and trip indicator LED
P	Self-protection and advanced-protection indicator light
Q	Short-time or instantaneous trip indicator light
R	Long-time trip indicator light

MicroLogic 6.0P Trip Unit

Figure 3 - 6.0P Trip Unit



A	Graphic display screen
B	Protection menu button (Button includes an LED indicating the active menu)
C	Maintenance menu button (Button includes an LED indicating the active menu)
D	Metering menu button
E	Down button
F	Up button
G	Enter button
H	Long-time pickup (Ir) switch
I	Long-time delay (tr) switch
J	Short-time pickup (Isd) switch
K	Short-time delay (tsd) switch
L	Instantaneous pickup (Ii) switch
M	Ground-fault protection pickup (Ig) switch
N	Ground-fault protection delay (tg) switch
O	Test plug receptacle
P	Ground-fault push-to-trip button
Q	Long-time pickup overload indicator light
R	Reset button for battery status check and trip indicator LED
S	Self-protection and advanced-protection indicator light
T	Ground-fault trip indicator light
U	Short-time or instantaneous trip indicator light
V	Long-time trip indicator light

LSIG Protection

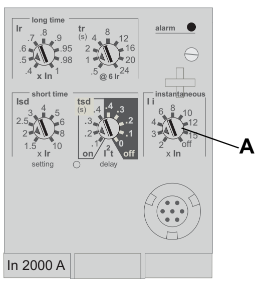
Long-Time Protection

Long-time protection protects equipment against overloads.

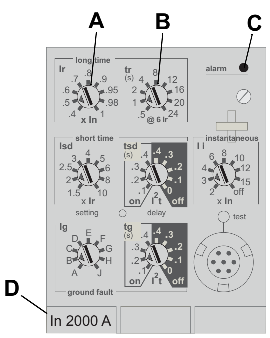
- Long-time protection is standard on all trip units.
- Long-time pickup (Ir) (A) sets the maximum current level based on sensor plug rating (In) which the circuit breaker will carry continuously. If current exceeds this value, circuit breaker will trip after the preset time delay. The long-time pickup (Ir) is adjustable from 0.4–1.0 times the circuit breaker sensor plug rating (In) (D).
- Long-time delay (tr) (B) sets the length of time that the circuit breaker will carry an overcurrent below the short-time or instantaneous pickup current level before tripping. Two options are available:
  - Standard I^2t long-time delay curve. See Long-Time Protection, page 13 for I^2t long-time delay settings.
  - Idmtl (inverse definite minimum time lag) long-time delay curves vary in slope to enhance selectivity.

Figure 4 - Long-Time Protection Switches

MicroLogic 5.0P Trip Unit



MicroLogic 6.0P Trip Unit



Option	Description	Curve
DT	Definite time	Constant
SIT	Standard inverse time	I0.5t
VIT	Very inverse time	It
EIT	Extremely inverse time	I2t
HVF	High-voltage fuse compatible	I4t

- The overload indicator light (C) indicates that the long-time pickup threshold Ir has been exceeded.

NOTE: MicroLogic trip units are powered from the circuit to always provide fault protection. All other functions (display, metering, communications, etc.) require external power. See MicroLogic Setup, page 20 for more information.

Table 1 - MicroLogic Trip Unit I^2t Long-Time Delay Values

Setting[1]	Long-Time Delay in Seconds[2]								
tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600
tr at 6 x Ir	0.5	1	2	4	8	12	16	20	24
tr at 7.2 x Ir	0.34[3]	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6

- For MasterPact™ NT and NW circuit breakers, sensor value (In) can be changed by replacing sensor plug (D) located below the trip unit. For further information, see the instructions packed with the sensor plug replacement kit.
- Neutral protection is not available when Idmtl protection is selected.
- The Idmtl selections do not utilize the same thermal imaging feature as the I^2t long-time protection function. Both the basic long-time protection and Idmtl EIT are I^2t curves, but the different thermal imaging features result in different system performances. For welding applications it is recommended the basic I^2t long-time protection be used to ensure expected system performance.

1. Ir = In x long-time pickup. In = sensor rating. Trip threshold between 1.05 and 1.20 Ir.
2. Time-delay accuracy +0/-20%.
3. When tsd is set to 0.4 off, then tr = 0.5 instead of 0.34.

- Both long-time pickup and long-time delay are located on the field-replaceable adjustable rating plug. To change settings to more precisely match the application, various rating plugs are available. For instructions on replacing the rating plug, see Adjustable Rating Plug Replacement, page 82.
- Long-time protection uses true RMS measurement.

Thermal imaging provides continuous temperature rise status of the wiring, both before and after the device trips. This allows the circuit breaker to respond to a series of overload conditions which could cause conductor overheating, but would go undetected if the long-time circuit was cleared every time the load dropped below the pickup setting or after every tripping event.

NOTE: If checking trip times, wait a minimum of 15 minutes after circuit breaker trips before resetting to allow the thermal imaging to reset completely to zero or use a test kit to inhibit the thermal imaging.

Table 2 - MicroLogic Trip Unit Idmtl Long-Time Delay Values

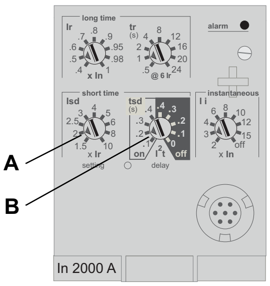
Option	Setting[4]	Long-Time Delay in Seconds									Tolerance
DT	tr at 1.5 x Ir	0.52	1	2	4	8	12	16	20	24	+0/-20%
	tr at 6 x Ir	0.52	1	2	4	8	12	16	20	24	+0/-20%
	tr at 7.2 x Ir	0.52	1	2	4	8	12	16	16.6	16.6	+0/-20%
	tr at 10 x Ir	0.52	1	2	4	8	12	16	16.6	16.6	+0/-20%
SIT	tr at 1.5 x Ir	1.9	3.8	7.6	15.2	30.4	45.5	60.7	75.8	91	+0/-30%
	tr at 6 x Ir	0.7	1	2	4	8	12	16	20	24	+0/-20%
	tr at 7.2 x Ir	0.7	0.88	1.77	3.54	7.08	10.6	14.16	17.7	21.2	+0/-20%
	tr at 10 x Ir	0.7[5]	0.8	1.43	2.86	5.73	8.59	11.46	14.33	17.19	+0/-20%
VIT	tr at 1.5 x Ir	1.9	7.2	14.4	28.8	57.7	86.5	115.4	144.2	173.1	+0/-30%
	tr at 6 x Ir	0.7	1	2	4	8	12	16	20	24	+0/-20%
	tr at 7.2 x Ir	0.7	0.81	1.63	3.26	6.52	9.8	13.1	16.34	19.61	+0/-20%
	tr at 10 x Ir	0.7[5]	0.75	1.14	2.28	4.57	6.86	9.13	11.42	13.70	+0/-20%
EIT	tr at 1.5 x Ir	12.5	25	50	100	200	300	400	500	600	+0/-30%
	tr at 6 x Ir	0.7[6]	1	2	4	8	12	16	20	24	+0/-20%
	tr at 7.2 x Ir	0.7[5]	0.69	1.38	2.7	5.5	8.3	11	13.8	16.6	+0/-20%
	tr at 10 x Ir	0.7[5]	0.7[6]	0.7[6]	1.41	2.82	4.24	5.45	7.06	8.48	+0/-20%
HVF	tr at 1.5 x Ir	164.5	329	658	1316	2632	3950	5265	6581	7900	+0/-30%
	tr at 6 x Ir	0.7[6]	1	2	4	8	12	16	20	24	+0/-20%
	tr at 7.2 x Ir	0.7[5]	0.7[6]	1.1[6]	1.42	3.85	5.78	7.71	9.64	11.57	+0/-20%
	tr at 10 x Ir	0.7[5]	0.7[5]	0.7[6]	0.7[6]	1.02	1.53	2.04	2.56	3.07	+0/-20%

4. Ir = In x long-time pickup. In = sensor rating. Trip threshold between 1.05 and 1.20 Ir.
5. Tolerance = +0/-60%
6. Tolerance = +0/-40%

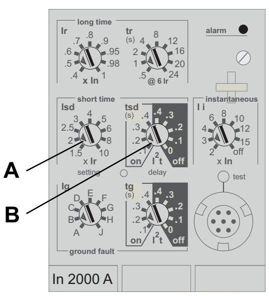
Short-Time Protection

Figure 5 - Short-Time Protection Switches

MicroLogic 5.0P Trip Unit



MicroLogic 6.0P Trip Unit



Short-time protection protects equipment against short circuits.

- Short-time protection is standard on 5.0P and 6.0P trip units.
- The short-time pickup (Isd) (A) sets current level (below instantaneous trip level) at which circuit breaker will trip after the preset time delay.
- The short-time delay (tsd) (B) sets the length of time that the circuit breaker will carry an overcurrent above the short-time pickup current level before tripping.
- The I^2t on/I^2t off option provides improved selectivity with downstream protective devices:
  - With I^2t off selected, fixed time delay is provided.
  - With I^2t on selected, inverse time I^2t protection is provided up to 10 x Ir. Above 10 x Ir, fixed time delay is provided.
- Intermittent currents in the short-time tripping range which do not last sufficiently long to trigger a trip are accumulated and shorten the trip delay appropriately.
- Short-time protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers. Setting tsd to the 0 setting turns off zone-selective interlocking.
- Short-time protection uses true RMS measurement.
- Short-time pickup and delay can be adjusted to provide selectivity with upstream or downstream circuit breakers.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Table 3 - MicroLogic Trip Unit Short-Time Delay Values

Setting	Short-Time Delay				
I^2t off (ms at 10 Ir) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (ms at 10 Ir) (seconds)	–	0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

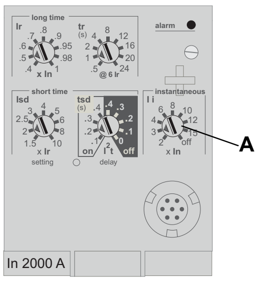
Instantaneous Protection

Instantaneous protection protects equipment against short circuits with no intentional time delay.

- Instantaneous protection (Ii) (A) is standard on all trip units.
- Instantaneous protection is based on the circuit breaker sensor rating (In).
- Circuit breaker open command is issued as soon as threshold current is exceeded.
- Instantaneous protection uses peak current measurement.
- When instantaneous protection switch is set to off, the instantaneous protection is disabled.

Figure 6 - Instantaneous Protection Switches

MicroLogic 5.0P Trip Unit



MicroLogic 6.0P Trip Unit

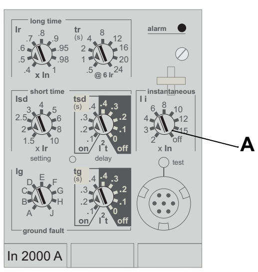


Table 4 - MicroLogic Instantaneous Values

Setting	Interruption Current							
Ii (= In x..)	2	3	4	6	8	10	12	15	off

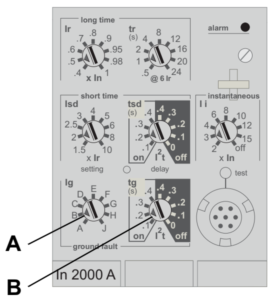
Ii = instantaneous

In = sensor rating

Pickup accuracy ± 10%

Ground-Fault Protection for Equipment

Figure 7 - Ground-Fault Protection Switches



Equipment ground-fault protection protects conductors against overheating and faults from ground-fault currents (≤ 1200 A).

- Equipment ground-fault protection is standard on 6.0P trip units.
- Ground-fault pickup (Ig) (A) sets ground current level where circuit breaker will trip after the preset time delay.
- Ground-fault delay (tg) (B) sets the length of time that the circuit breaker will carry a ground-fault current above the ground-fault pickup current level before tripping.
- Equipment ground-fault protection can be zone-selective interlocked (ZSI) with upstream or downstream circuit breakers. Setting the ground-fault delay (tg) to the 0 setting turns off zone-selective interlocking.
- Neutral protection and equipment ground-fault protection are independent and can operate concurrently.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Table 5 - MicroLogic Trip Unit Ground-Fault Pickup Values

Ig (= In x....)	A	B	C	D	E	F	G	H	J
In ≤ 400 A	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
400 A < In ≤ 1200 A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
In > 1200 A	500 A	640 A	720 A	800 A	880 A	960 A	1040 A	1120 A	1200 A

In = sensor rating.
Ig = ground-fault pickup.

Table 6 - MicroLogic Trip Unit Ground-Fault Delay Values

Setting	Ground-Fault Delay				
I^2t off (ms at In) (seconds)	0	0.1	0.2	0.3	0.4
I^2t on (ms at In) (seconds)	–	0.1	0.2	0.3	0.4
tsd (min. trip) (milliseconds)	20	80	140	230	350
tsd (max. trip) (milliseconds)	80	140	200	320	500

MicroLogic Trip Unit Configuration

Control Power

The P trip unit is designed to be used with an external 24 Vdc power supply. The large LCD display used by the P trip unit requires too much current to be powered by current flow through the circuit breaker.

The P trip unit has a circuit voltage power supply which will power the trip unit when there is approximately 150 Vac or more between two phases. The standard configuration for the voltage probes inside the circuit breaker is at the bottom connections. If the circuit breaker is open in a top fed application, there is no voltage at the bottom of the circuit breaker and the trip unit will not be powered.

The following will be powered and functional even if the trip unit is not externally powered:

- Fault protection for LSIG functions. The P trip unit is fully circuit powered for fault protection.
- LED trip indication (powered by an onboard battery). The battery’s only function is to provide LED indication if all other power is off.
- Ground-fault push-to-trip button works for testing ground fault when the trip unit is powered by the circuit voltage power supply. The ground-fault push-to-trip is also functional if a test kit is powering the trip unit.

The following will be powered and functional with external power:

- All of the above functions which are functional without external power.
- LCD display and backlight are functional. Backlight intensity is not controlled or adjustable, and may be different from one trip unit to another.
- All metering, monitoring, and history logs are functional.
- Communications from the trip unit to M2C and M6C programmable contact modules are powered by a 24 Vdc power supply at F1 and F2. The M6C also required an external 24 Vdc power supply.
- Modbus communciations are functional, using a separate 24 Vdc power supply for the circuit breaker communications module. This separate 24 Vdc power supply is required to maintain the isolation between the trip unit and communications.
- The ground-fault push-to-trip is also functional if a test kit is powering the trip unit.

External Power Supply

⚠ CAUTION

HAZARD OF SHOCK, ARC FLASH OR EQUIPMENT DAMAGE

Trip unit and communication module must use separate power supplies.

Failure to follow these instructions can result in injury or equipment damage.

The trip unit can be powered by:

- 24 Vdc external power supply (recommended).
- Over 150 V on the bottom circuit breaker terminals on two phases.
- Over 150 V on the top circuit breaker terminals with external voltage option.

Table 7 - Power Supply Specifications

Function	Specification
Power for Trip Unit Alone	24 Vdc, 50 mA
Minimum Input-to-Output Isolation	2400 V
Output (Including Max. 1% Ripple)	±5%
Dielectric Withstand (Input/Output)	3 kV rms
Connections	Connections UC3 F1 (-) / F2 (+) — 24 Vdc

Power supply is used for:

Graphic screen display when the circuit breaker is open and top fed.

Option of linking an alarm to a relay output.

To maintain date and time when the circuit breaker is open.

MicroLogic Setup

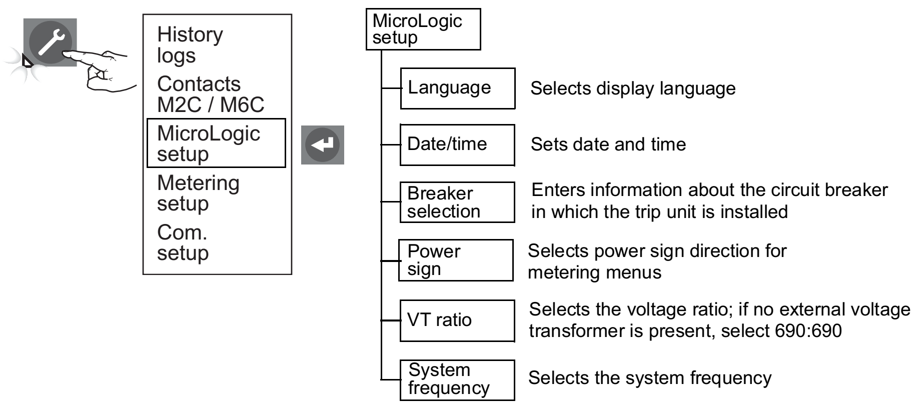
Use the Maintenance Menu by pressing the wrench key.

> **NOTE:** If trip unit is connected to a communication network which provides date and time synchronization, date/time cannot be set from trip unit.

See MicroLogic Trip Unit Setup, page 41 for step-by-step instructions to set up the MicroLogic trip unit.

See Trip Unit Configuration, page 38 for other trip unit configurations instructions.

Figure 8 - MicroLogic Setup



Advanced Protection

Neutral Protection

Neutral protection protects neutral conductors against overheating.

- For a three-pole circuit breaker, neutral protection is possible if a neutral current transformer is used.
  - Adjust the neutral using the trip unit keypad.
  - Possible settings are OFF, N/2, N, or 1.6N.
  - Factory setting is OFF.
  - Oversize neutral protection (1.6N) requires use of the appropriate oversize neutral current transformer.

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

If a four-pole circuit breaker neutral pole switch is set to 4P3D setting, the current in the neutral must not exceed the rated current of the circuit breaker. For a three-pole circuit breaker with oversize neutral protection (1.6N), select the appropriate oversize neutral current transformer.

Failure to follow these instructions can result in injury or equipment damage.

- For a four-pole circuit breaker, set system type using the circuit breaker neutral selector dial Neutral Protection, page 20.
  - Make fine adjustments using the trip unit keypad, with the circuit breaker dial setting providing the upper limit for adjustment.
  - Factory setting is 4P4D.
- Neutral protection conductor type has four possible settings:
  - Off—Neutral protection is turned off.
  - N/2—Neutral conductor capacity is one-half that of the line conductors.
  - N—Neutral conductor capacity is the same as that of the line conductors.
  - 1.6N—Neutral conductor capacity is 1.6 times that of the line conductors. (Three-pole circuit breaker only.)

Figure 9 - Four-Pole Circuit Breaker Neutral Selector Dial

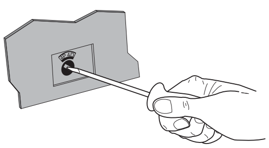


Table 8 - Neutral Protection Settings for Four-Pole Circuit Breaker

Circuit Breaker Selector Dial	Available Keypad Setting
4P 3D	Off, N/2, N
3P N/2	N/2
4P 4D	N/2,N

Table 9 - MicroLogic Trip Unit Conductor Type

Setting	Long-Time Pickup		Short-Tme Pickup		Instantaneous		Ground-Fault Pickup	
	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral	Trip Unit	Neutral
OFF	Ir	None	Isd	None	Ii	None	Ig	None
N/2	Ir	1/2 Ir	Isd	1/2 Isd	Ii	Ii	Ig	Ig
N	Ir	Ir	Isd	Isd	Ii	Ii	Ig	Ig
1.6N	Ir	1.6 x Ir	Isd	1.6 x Isd[7]	Ii	Ii	Ig	Ig

Alarms

Alarms can be enabled or disabled for protection or load shedding.

- When an alarm occurs, an entry is made in the alarm log.
- For a trip unit to activate an alarm, both the pickup level and time delay must be exceeded. Therefore for LSIG protection and advanced protection programmed to trip the circuit breaker, the trip unit will not activate the alarm until the circuit breaker trips. (For example, if a relay is programmed for the long-time pickup Ir, the trip unit will not signal an alarm when the long-time overload indicator lights. The trip unit will only activate the alarm once the long-time overload exceeds the time delay and trips the circuit breaker.)
- Link alarms to a visual or audible signal by programming the optional M2C or M6C module contacts, when an external 24 V power supply is used on the trip unit.
- View alarms by:
  - History logs menu
  - The network system management software

7. In order to limit the range, limited to 10 x In

- M2C/M6C contact characteristics:
  - Minimum load of 100 mA/24 V
  - Breaking capacity at a 0.7 power factor

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

- When several alarms are activated, screen response/refresh time will be slower.

See Appendix B—Default Settings and Tolerances, page 90 for default and range values.

Table 10 - Trip Unit Alarms

Alarm	Menu	Symbol	Alarm	Trip
Long-time pickup	Current protection	Ir	X	X
Short-time pickup	Current protection	Isd	X	X
Instantaneous pickup	Current protection	Ii	X	X
Ground-fault current	Current protection	I⏚	X	X
Ground-fault alarm	Current protection	Al⏚	X	X
Current unbalance	Current protection	Iunbal	X	X
Phase A maximum demand current	Current protection	$\overline{\text{Ia}}$ max	X	X
Phase B maximum demand current	Current protection	$\overline{\text{Ib}}$ max	X	X
Phase C maximum demand current	Current protection	$\overline{\text{Ic}}$ max	X	X
Neutral maximum demand current	Current protection	$\overline{\text{In}}$ max	X	X
Minimum voltage (undervoltage)	Voltage protection	Vmin	X	X
Maximum voltage (overvoltage)	Voltage protection	Vmax	X	X
Voltage unbalance	Voltage protection	Vunbal	X	X
Reverse power	Other protection	rPmax	X	X
Minimum frequency (underfrequency)	Other protection	Fmin	X	X
Maximum frequency (overfrequency)	Other protection	Fmax	X	X
Phase rotation	Other protection	Φ rotation	X	–
Current load shedding	Load shedding I	Ished	X	–
Power load shedding	Load shedding P	Pshed	X	–

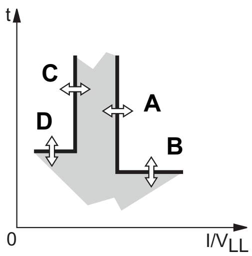
Minimum (Under) and Maximum (Over) Demand Current and Voltage Protection

Provides pickup and dropout values for alarm, contacts or tripping for current and voltage values. (There is no minimum for current.)

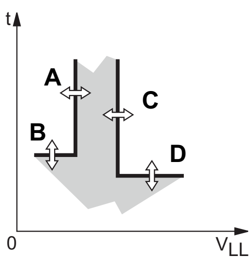
- Pickup value (A) is set to activate an alarm or trip.
- Pickup time delay (B) is set to start timing once the pickup value has been passed.
- Dropout value (C) is set to deactivate the alarm and/or contact.
- Dropout time delay (D) is set to start timing once the dropout value has been passed.
- Minimum (under) voltage protection (V_{min}) is activated when any line-line voltage is below the minimum voltage setting.
- Maximum (over) voltage protection (V_{max}) is activated when any line-line voltage is above the maximum voltage setting.
- V_{min} has a dropout value ≥ pickup value.
- V_{max} has a dropout value ≤ pickup value.
- If current or voltage protection trips the circuit breaker, the circuit breaker cannot be reset until the current or voltage problem which caused the trip is corrected.
- Ground-fault alarm on the 5.0P and 6.0P trip unit is based on true rms value of the ground current.
- Do not set undervoltage protection below 80%.[8]

Figure 10 - Minimum/Maximum Protection Curves

Maximum Protection



Minimum Protection

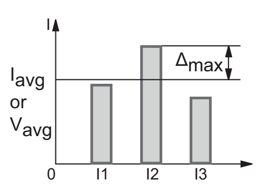


Current or Voltage Unbalance Protection

This protection applies to unbalanced values for the three-phase currents and voltages.

- Unbalance values are based on the true RMS values of the three-phase currents.
- Do not set V_{unbal} above 20%.[8]
- Do not use voltage unbalance protection to determine the loss of multiple phases.[8]

Figure 11 - Current or Voltage Unbalance Protection



$$I_{avg} = \frac{I_a + I_b +}{I_c} \qquad V_{avg} = \frac{V_a + V_b +}{V_c}$$

$$I_{unbal} = \frac{|\Delta max|}{I_{avg}} \qquad V_{unbal} = \frac{|\Delta max|}{V_{avg}}$$

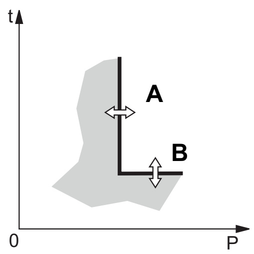
8. For an explanation of system protection behavior, see Appendix D—Trip Unit Voltage Supply Architecture, page 113.

Reverse Power Protection (rPmax)

Reverse power protection protects alternators against absorption of the total actual power over all three phases in the event that a drive motor fails.

- Reverse power protection applies a trip curve based on the total actual power value (A) over all three phases.
- A time delay (B) starts timing if the total actual power of the three phases is not flowing in the defined direction and if it exceeds a reverse power threshold.
- The power direction is defined during trip unit setup.

Figure 12 - Reverse Power Protection

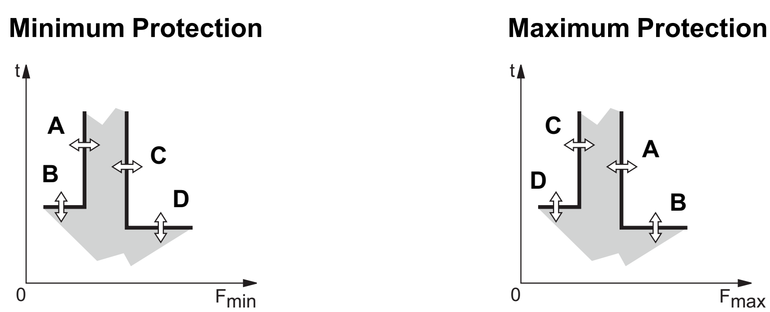


Minimum (Under) and Maximum (Over) Frequency Protection

Provides pickup and dropout values for frequency.

- Pickup value (A) is set to activate an alarm or trip.
- Pickup time delay (B) is set to start timing once the pickup value has been passed.
- Dropout value (C) is set to deactivate the alarm and/or contact.
- Dropout time delay (D) is set to start timing once the dropout value has been passed.
- F_{min} has a dropout value ≥ pickup value.
- F_{max} has a dropout value ≤ pickup value.
- When system frequency is set to 400 Hz, the frequency protection is disabled.

Figure 13 - Minimum/Maximum Frequency Curves



Load Shedding

Load shedding does not trip the circuit breaker, but may be used to activate an alarm linked to an M2C or M6C contact (controlling non-priority network loads).

- Load shedding is defined by a threshold and time delay:

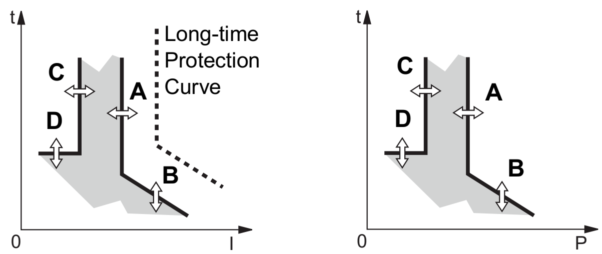
  A—Activation threshold

  B—Activation time delay

  C—Dropout threshold

  D—Dropout time delay
- Power load shedding depends on the flow direction set during trip unit setup.
- Current load shedding is connected to the I^2t or Idmtl long-time delay values.
- Current load shedding cannot be activated if “Long-time OFF” rating plug is installed.

Figure 14 - Load Shedding



Phase Rotation Protection

Protects the circuit when two of the three phases are reversed.

- If one of the phases is down, this protection is inactive.
- Options are ABC or ACB.
- When system frequency is set to 400 Hz, phase rotation protection is disabled.
- Do not use phase rotation protection to determine the loss of multiple phases in delta connected systems.

M2C and M6C Programmable Contact Kits

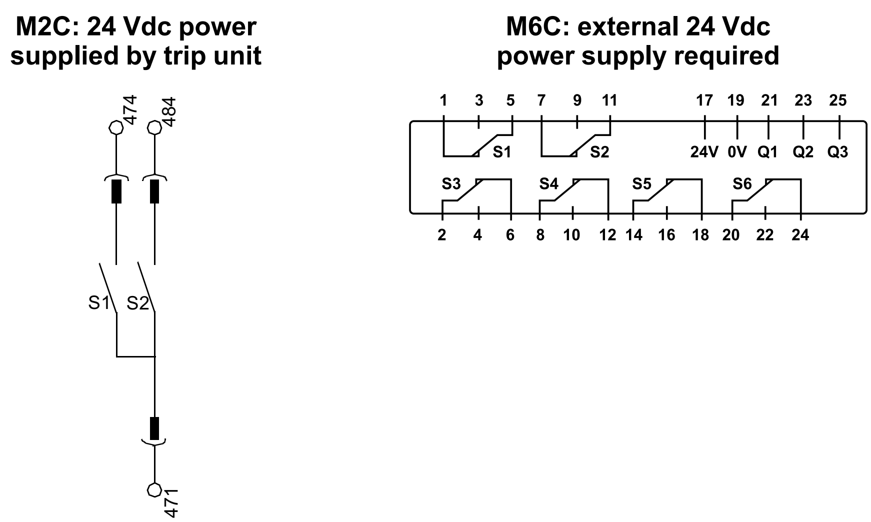
One or more alarms can be activated using an optional M2C or M6C programmable contact kit. The M2C contact kit provides two form A contacts with common neutral. The M6C contact kit provides six form C contacts. Each contact can be programmed through the trip unit for one alarm condition.

A 24 Vdc, 5 W auxiliary power supply is required for operation of trip unit/M2C or M6C contact kit combination.

> **NOTE:** Trip unit and communication modules (BCM and CCM) must use separate power supplies. The M2C and M6C contact kits can share the trip unit auxiliary power supply.

Characteristics for M2C/M6C Programmable Contacts	V	A
Minimum Load	24 Vdc	100 mA
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

Figure 15 - M2C/M6C Wiring Diagrams



Zone-selective Interlocking

Short-time and ground-fault protection can be interlocked to provide zone-selective interlocking.

Control wiring links several trip units in the distribution network and in the event of a fault, a trip unit will obey the set delay time only if receiving a signal from a downstream trip unit.

If the trip unit does not receive a signal, tripping will be instantaneous (with no intentional delay).

- The fault is cleared instantaneously by the nearest upstream circuit breaker.
- Thermal stresses (I^2t) in the network are minimized without any effect on the correct time delay coordination of the installation.

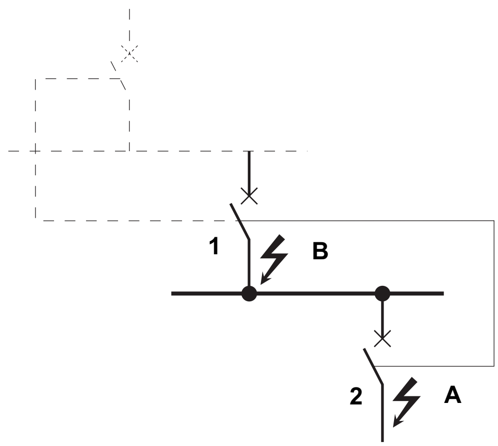
Figure 16 shows circuit breakers 1 and 2 zone-selective interlocked.

- A fault at A is seen by circuit breakers 1 and 2. Circuit breaker 2 trips instantaneously and also informs circuit breaker 1 to obey set delay times. Thus, circuit breaker 2 trips and clears the fault. Circuit breaker 1 does not trip.
- A fault at B is seen by circuit breaker 1. Circuit breaker 1 trips instantaneously since it did not receive a signal from the downstream circuit breaker 2. Circuit breaker 1 trips and clears the fault. Circuit breaker 2 does not trip.

NOTE: Use I^2t off with ZSI for proper coordination. Using I^2t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

NOTE: Setting short-time delay (tsd) or ground-fault delay (tg) to the 0 setting will eliminate selectivity for that circuit breaker.

Figure 16 - Zone-selective Interlocking



Metering

The MicroLogic P trip unit provides continuous metering of system values. Metered values can be checked using the graphic display screen or network system management software.

Trip Unit Testing

Trip unit LSIG functions can be tested using primary injection testing or secondary injection testing. Test trip unit using the appropriate test kit. (See Trip Unit Installation Check, page 80 for more information.)

Operation Counter

The circuit breaker communication module is required to display the total number of times the circuit breaker has opened since initial installation and since the last reset and the day/time of last reset.

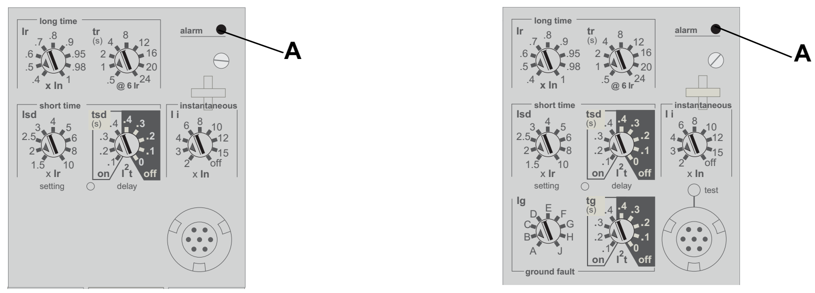
Indicator Lights

Overload Indicator Light

The overload indicator light (A) lights when the Ir long-time pickup level has been exceeded.

Figure 17 - Overload Indicator Light

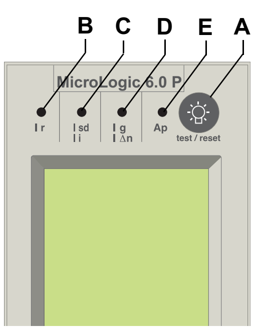
MicroLogic 5.0P Trip Unit **MicroLogic 6.0P Trip Unit**



Trip Indicator Lights

A trip indicator light on the trip unit will light when the circuit breaker trips. If the trip unit has auxiliary power connected, the trip unit will display information about the trip.

Figure 18 - Trip Indicator Lights



The trip indicator light will remain lit until it is reset by pressing the reset button (A). Cause of trip should be corrected before resetting.

Ir trip indicator light (B) lights when long-time pickup (Ir) signals the circuit breaker to trip.

Isd/Ii trip indicator light (C) lights when short-time pickup (Isd) or instantaneous pickup (Ii) signals the circuit breaker to trip.

Ig trip indicator light (D) lights when ground-fault pickup (Ig) signals the circuit breaker to trip.

Ap self-protection/advanced-protection indicator light (E) lights when the advanced protection features cause a trip to occur, the trip unit overheats, the instantaneous override value is exceeded or a trip unit power supply failure occurs.

NOTICE

HAZARD OF EQUIPMENT DAMAGE

If the circuit breaker remains closed and the Ap light remains lit after the reset, open the circuit breaker and contact the sales office.

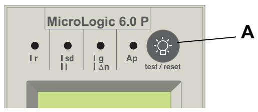
Failure to follow these instructions can result in equipment damage.

NOTE: In cases where a number of causes may result in tripping, the LED signalling the last cause is the only one to remain on.

Test/Reset Button

The test/reset button (A) must be pressed after a trip to reset the fault information on the graphic display and clear the trip indicator light.

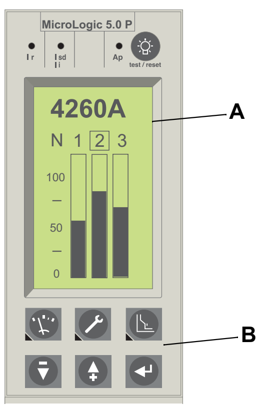
Figure 19 - Reset Button



Graphic Display Screen

The graphic display screen (A) shows the trip unit settings and information. Navigation buttons (B) are used to display and modify items on the screen. Default display shows current levels.

Figure 20 - Graphic Display Screen



Trip unit must be powered for graphic display screen to operate. The trip unit is powered if:

- circuit breaker is on and has more than 150 V of load voltage on two phases (circuit breaker is closed or bottom fed).
- the test kit is connected and on.
- the 24 Vdc external power supply is connected.
- an external voltage tap is installed and voltage of more than 150 V is present on two phases.

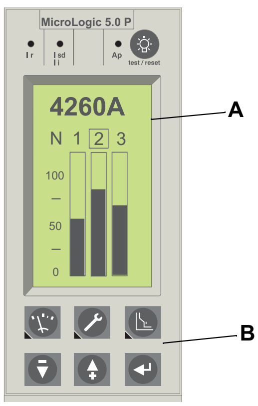
Contact Wear Indicator

The trip unit keeps track of the circuit breaker contact wear when a MasterPact circuit breaker type is selected. The amount of wear on the circuit breaker contacts can be transferred when a trip unit is replaced. (External trip unit power supply is required.)

Graphic Display Navigation

Graphic Display Navigation Buttons

Figure 21 - Graphic Display Screen



Display

The graphic display (A) functions if the trip unit is connected to a 24 Vdc external power supply or there is 150 V on at least two phases. Current alone (from primary injection test set or electrical system) will power the LSIG protection functions, but will not power the display.

Navigation buttons (B):

Metering Menu Button—Provides access to metering menus

Maintenance Menu Button—Provides access to maintenance menus

Protection Menu Button—Provides access to protection menus

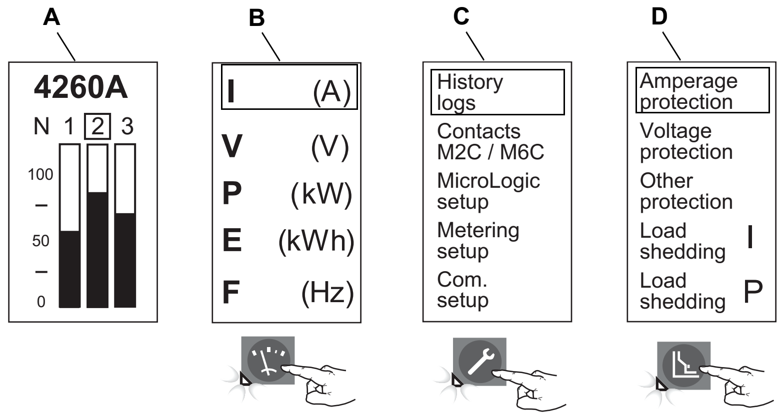
Down Button—Moves cursor downward or decreases setting value

Up Button—Moves cursor upward or increases setting value

Enter Button—Selects an option from a list or enters the set values

Bar Graph Display and Menus

Figure 22 - Menus



The MicroLogic P trip unit has a default bar graph display of currents and three different menus which can be accessed using navigation buttons:

A	Bar Graph Display—Provides real-time bar graph display of line currents and measurement of line current and neutral current (if applicable) (default display)
B	Metering Menu—Provides access to metered values of current, voltage, power, energy and frequency
C	Maintenance Menu—Allows user to change the trip unit configuration and provides access to history logs
D	Protection Menu—Allows precision adjustments to basic and advanced protection

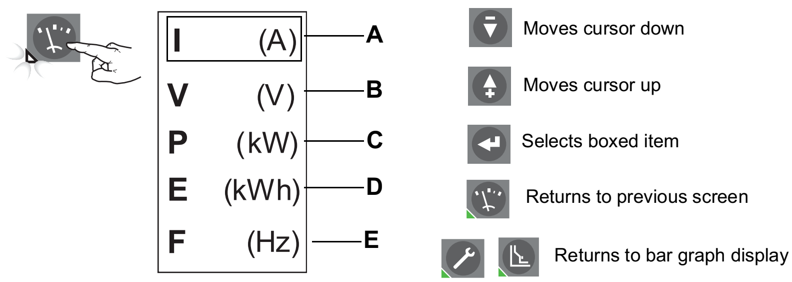
When the switch cover is closed, the trip unit will return to the bar graph (default) display after 3.5 minutes of no input. (If the switch cover is open, the display stays at the window selected.) To access another menu, press the button that corresponds to the desired menu. The menu appears on the display and the green LED below the menu button lights up.

Metering Menu

Use the metering button to access the metered values of:

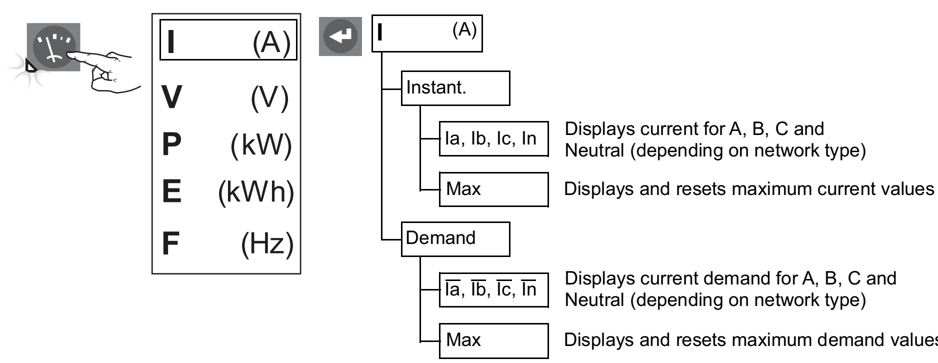
- A Current
- B Voltage
- C Power
- D Energy
- E Frequency

Figure 23 - Metering Menu



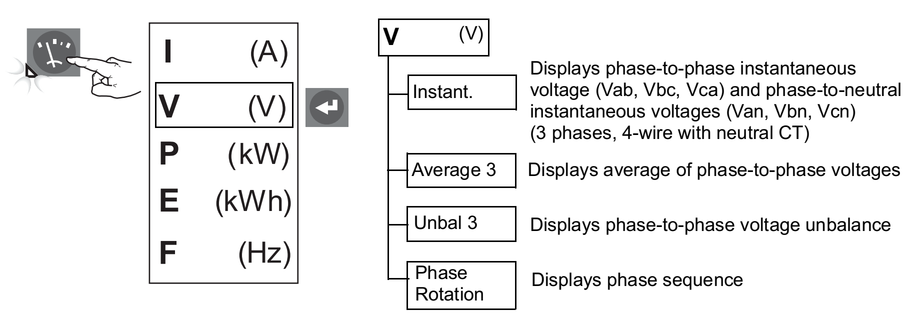
Current

Figure 24 - Current Levels



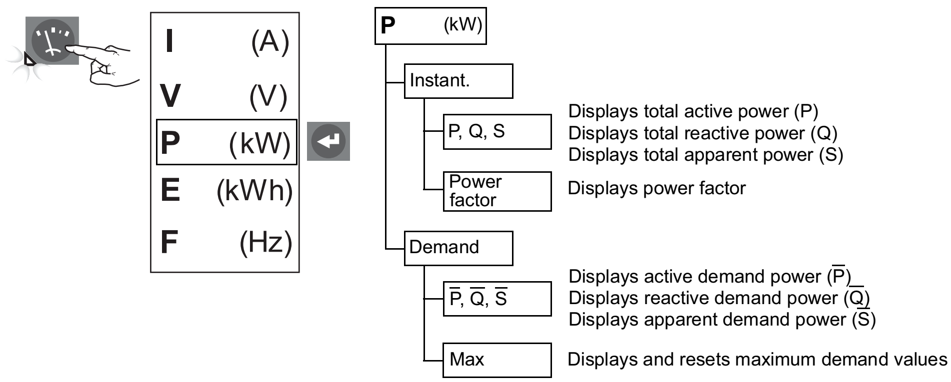
Voltage

Figure 25 - Voltage Levels



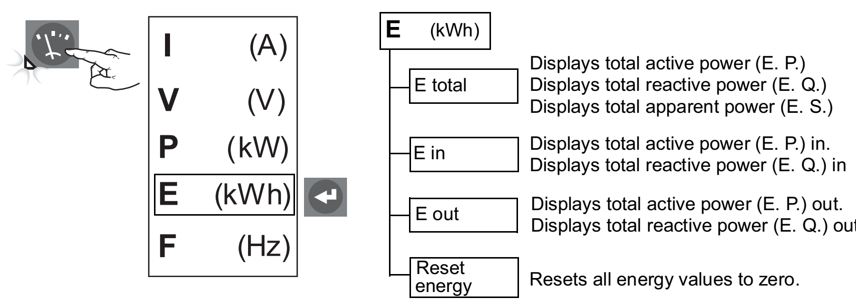
Power

Figure 26 - Power Levels



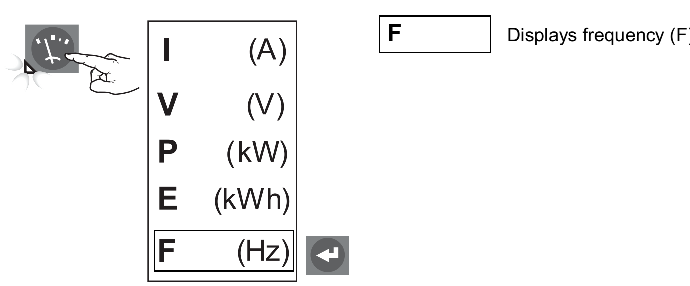
Energy

Figure 27 - Energy Levels



Frequency

Figure 28 - Frequency Levels



Maintenance Menu

Use the maintenance button to access the maintenance menu.

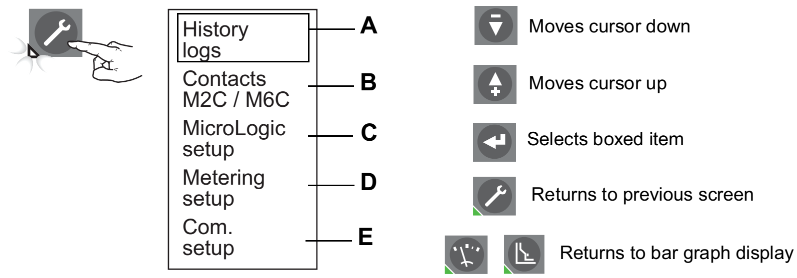
A To access the history log

B To set up the M2C/M6C contacts

C To set up the MicroLogic trip unit

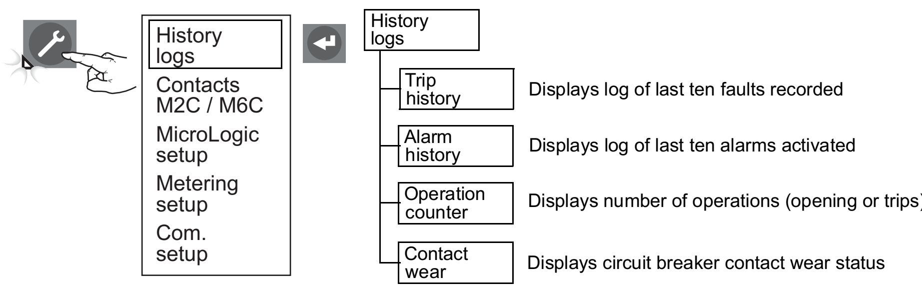
D	To set up the metering parameters
E	To set up the communication module

Figure 29 - Maintenance Menu



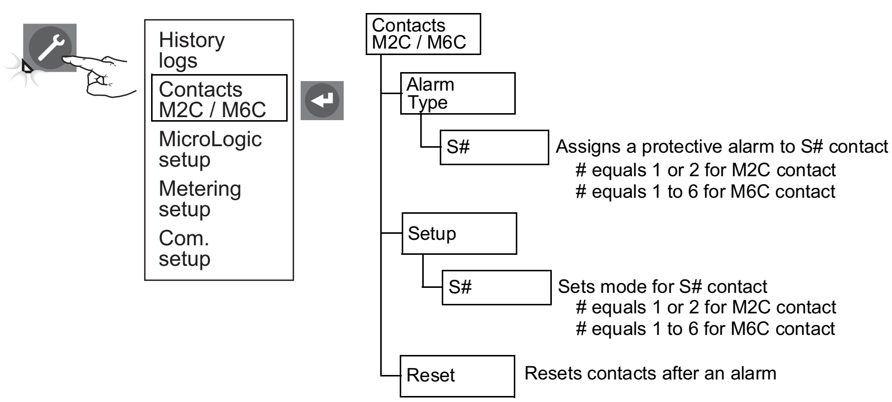
History Logs

Figure 30 - History Logs



M2C/M6C Programmable Contacts

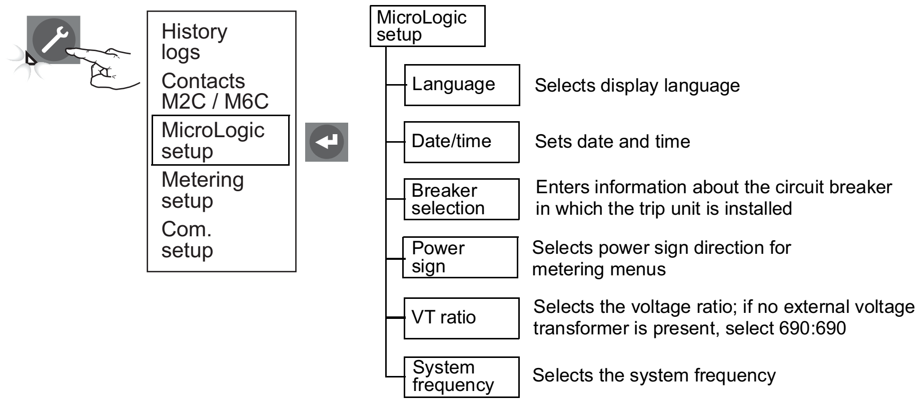
Figure 31 - M2C/M6C Contacts Setup



- Available only if M2C/M6C contacts are installed.
- One alarm per contact.
- Can select those set up as “alarm” or “trip” under protection menu.

MicroLogic Setup

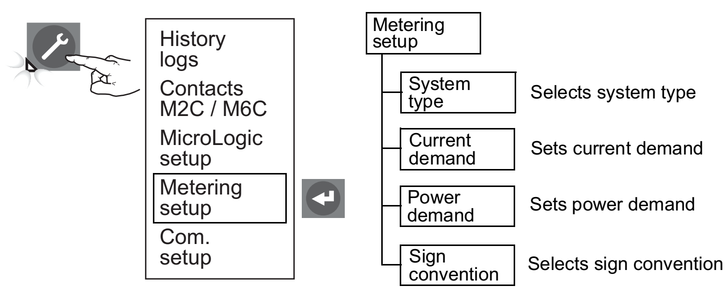
Figure 32 - MicroLogic Setup



NOTE: If trip unit is connected to a communication network which provides date and time synchronization, date/time cannot be set from trip unit.

Metering Setup

Figure 33 - Metering Setup



Communication Setup

Use the metering button to access the metered values of:

A Current

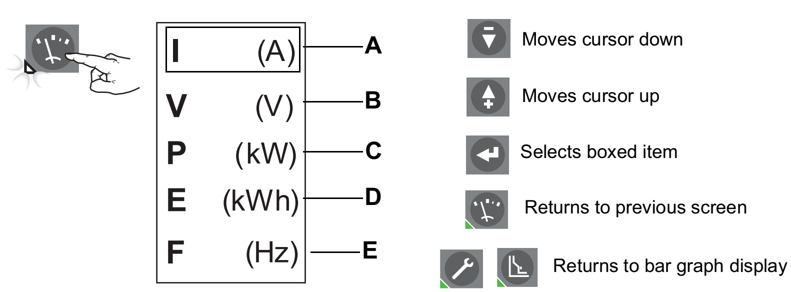
B Voltage

C Power

D Energy

E Frequency

Figure 34 - Metering Menu



Protection Menu

Use the protection button to access the menus.

A To display and adjust current protection

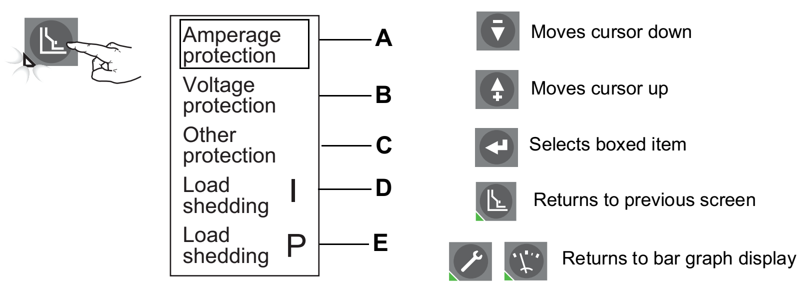
B To display and adjust voltage protection

C To display and adjust other protection

D To set current load shedding

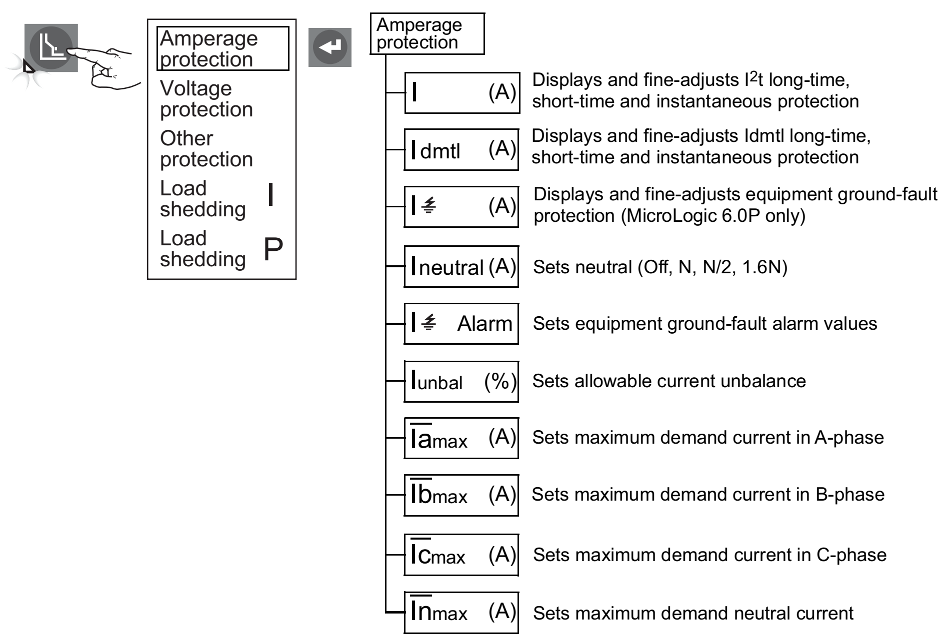
E To set power load shedding

Figure 35 - Protection Menu



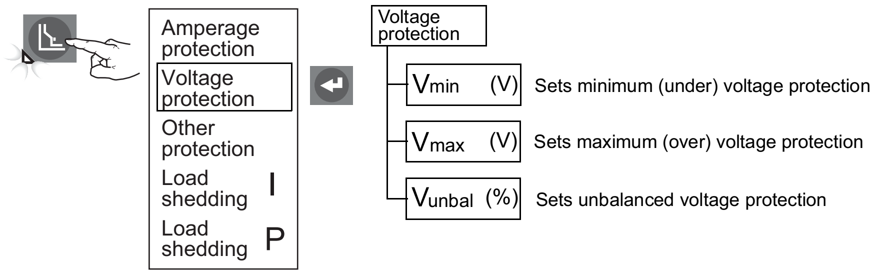
Amperage Protection

Figure 36 - Amperage Protection



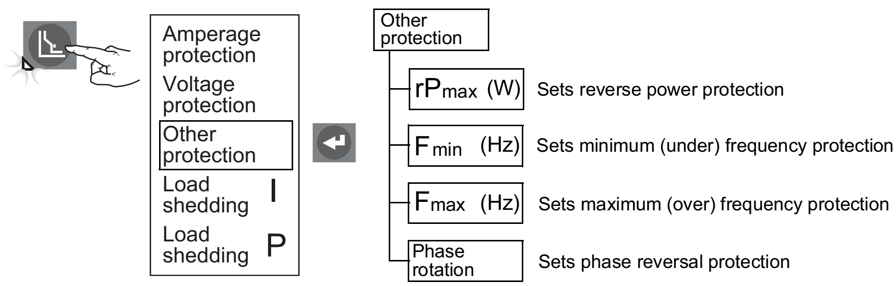
Voltage Protection

Figure 37 - Voltage Protection



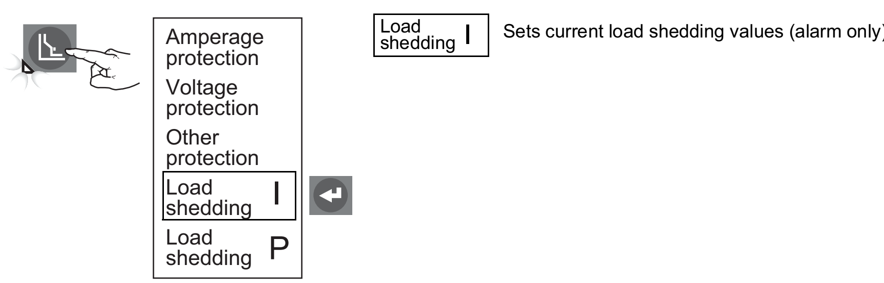
Other Protection

Figure 38 - Other Protection



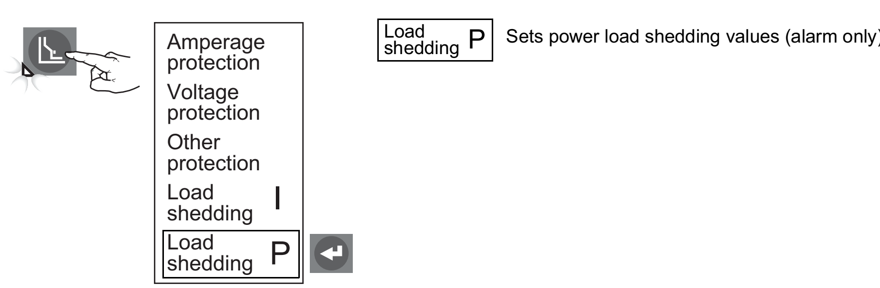
Current Load Shedding

Figure 39 - Current Load Shedding



Power Load Shedding

Figure 40 - Power Load Shedding



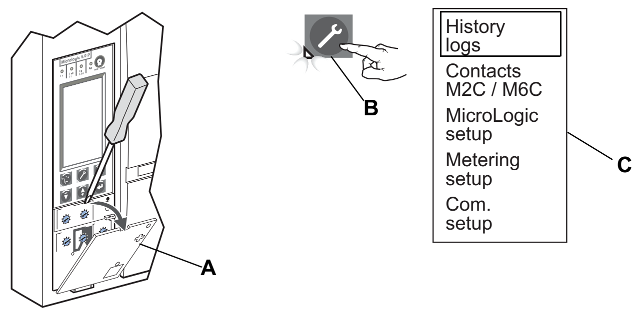
Trip Unit Configuration

Trip Unit Parameters Adjustment

NOTE: The protection menu settings cannot be adjusted unless the switch cover is open. When settings have been adjusted, press one of the menus buttons to save the new values.

1. Open switch cover (A).
2. Press maintenance button (B) to bring up maintenance menu (C).

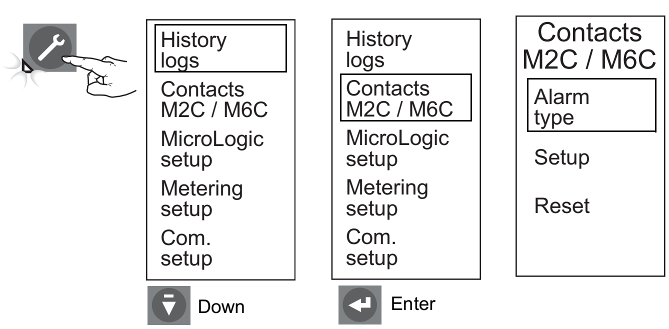
Figure 41 - Maintenance Menu



M2C/M6C Programmable Contacts

If M2C or M6C contact kit is installed, use “Contacts M2C/M6C” menu to set alarm type and operational mode. The M2C kit has S1 and S2 contacts. The M6C kit has S1, S2, S3, S4, S5 and S6 contacts.

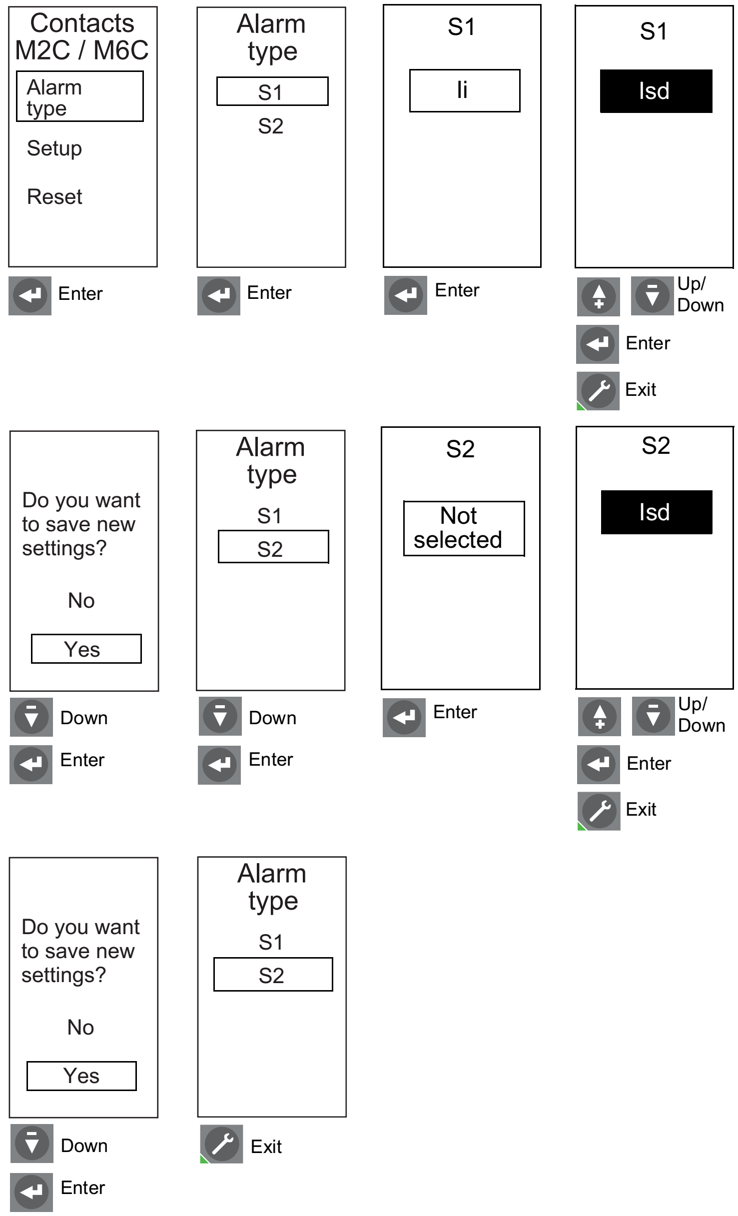
Figure 42 - M2C/M6C Contact Kits Setup



1. Enter M2C/M6C contacts alarm type into trip unit memory. Available alarms are:

Ir	Long-time pickup
Ii	Instantaneous pickup
Isd	Short-time pickup
I⏚	Ground-fault current
Al⏚	Ground-fault alarm
Iunbal	Current unbalanced
Iamax	Phase A demand overcurrent
Ibmax	Phase B demand overcurrent
Icmax	Phase C demand overcurrent
Inmax	Neutral demand overcurrent
Vmin	Voltage is below set minimum
Vmax	Voltage is above set maximum
Vunbal	Voltage unbalanced
rPmax	Reversed power
Fmin	Frequency is below set minimum
Fmax	Frequency is above set maximum
ΦF rot	Phase rotation
Ished	Current shedding
Pshed	Power shedding
Not Selected	No alarms selected

Figure 43 - Set M2C/M6C Contact Alarm Type



2. Set up M2C/M6C contact alarm mode. Contact modes available are:
   - Latching contact—Stays latched until reset
   - Nonlatching contact—Drops out after fault is removed.
   - Time Delay—Delay placed on contacts

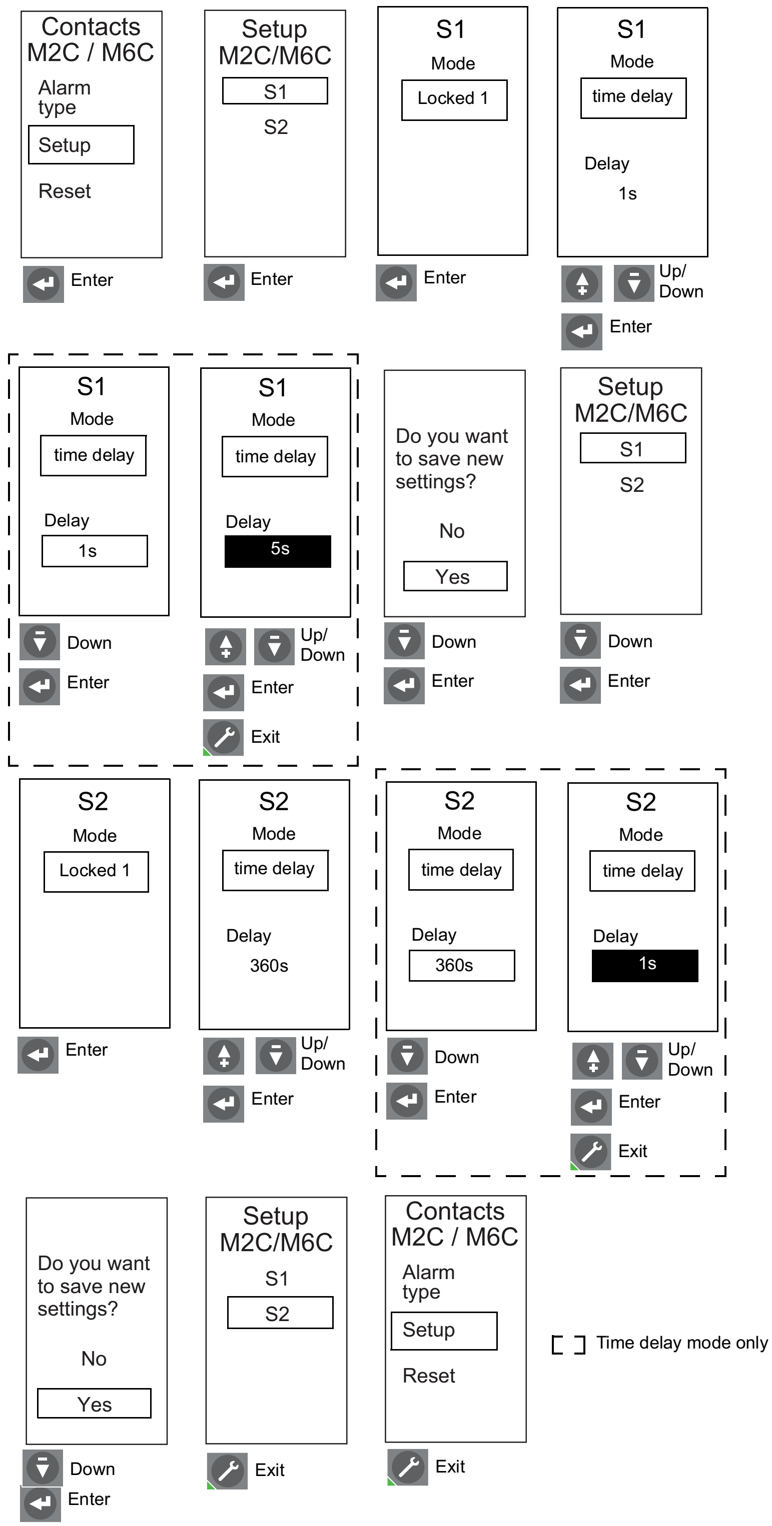
   For troubleshooting purposes only the following modes are available:
   - Locked 0—Contacts are locked open
   - Locked 1—Contacts are locked closed

   For short-time, instantaneous and ground fault (SIG) alarms only:
   - Each alarm occurrence will activate the relay and will signal and continue to signal an alarm until the trip unit test/reset button is pressed.
   - This “latching behavior occurs regardless of whether “latching” or “nonlatching” contact mode was used during alarm setup.

3. Reset displays states of relays and allows them to be reset.

   NOTE: Select reset option under the M2C/M6C menu to reset all alarms. The test/reset button on the trip unit will reset the trip unit so that it will stop activating the alarm, but does not reset the M2C/M6C contact.

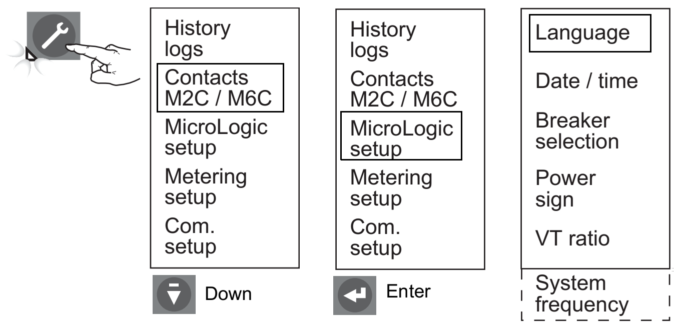
Figure 44 - Set M2C/M6C Contact Alarm Mode



MicroLogic Trip Unit Setup

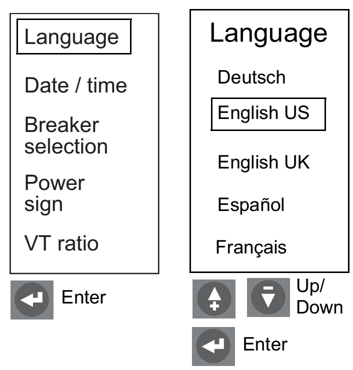
Use “MicroLogic setup” menu to set display language, date and time, circuit breaker information, power sign, VT ratio and system frequency.

Figure 45 - MicroLogic Trip Unit Setup



1. Set display language.

Figure 46 - Set Language



2. Set trip unit date and time.

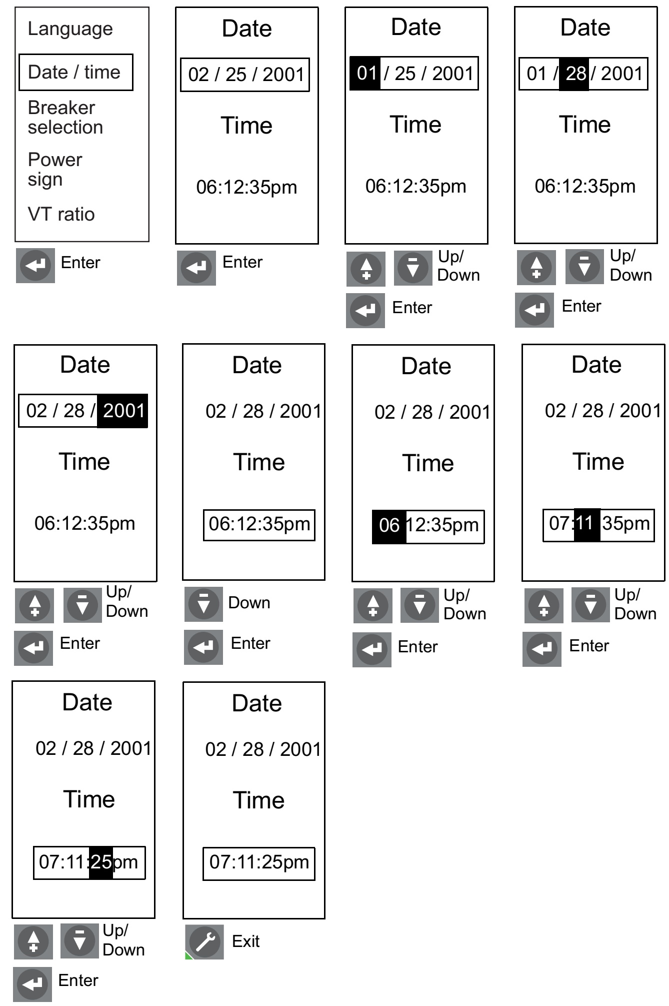
   NOTE: If trip unit is connected to a communication network which provides date and time synchronization, date/time cannot be set from trip unit. If trip unit is not connected to a communication network which provides data and time synchronization, date and time will need to be re-entered every time trip unit power is lost.)

   NOTE: In US English the date format is month/day/year. In all other languages the date format is day/month/year.

After using the test kit to do secondary injection testing, thermal imaging inhibit, ZSI testing or ground-fault inhibit, the time will need to be reset if the trip unit is not connected to a communication network providing date and time synchronization.

   NOTE: If time is not synchronized by a supervisor using the network system management software, reset time semi-annually, or more often if needed.

Figure 47 - Set Date and Time



3. Enter circuit breaker information into trip unit memory. The following information must be entered to properly identify the circuit breaker over the communication network:

   Standard—ANSI, UL, IEC or IEC/GB

   Circuit Breaker Family—MasterPact (ANSI, UL, IEC or IEC/GB), PowerPact (UL or IEC) or ComPact NS (IEC)

   Circuit Breaker Type—Found on the circuit breaker faceplate

   Circuit Breaker Contact Wear Code–Only modified when replacing an existing trip unit with contact wear information

   NOTE: The contact wear meter is active only when circuit breaker type is MasterPact.

   To maintain contact wear indicator information when replacing an existing trip unit:

   a. Read code on trip unit to be replaced. (The code is a hexadecimal number.)

   b. Remove old trip unit and install new trip unit in circuit breaker.

   c. Enter code from old trip unit in new trip unit.

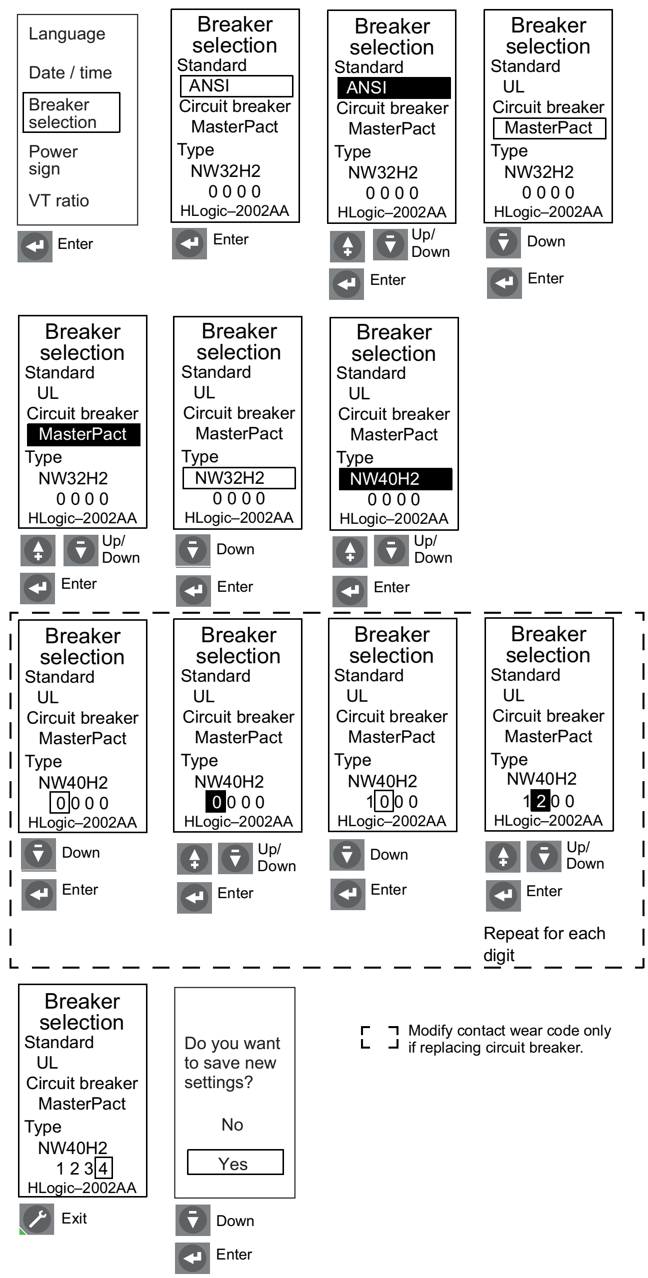
⚠WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

Change default passwords at first use to help prevent unauthorized access to device settings, controls and information.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Figure 48 - Set Circuit Breaker Information



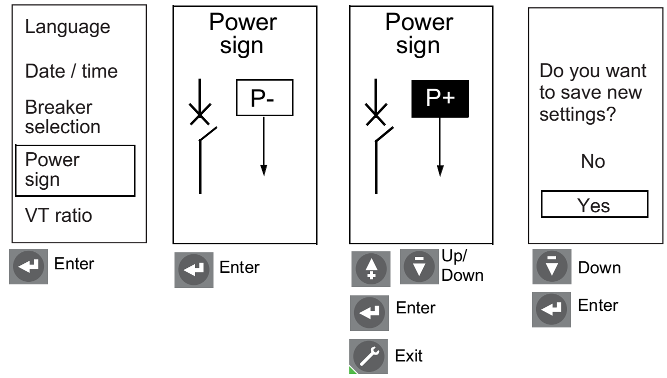
4. Select power sign.

   Choose the signing convention to be used for power metering, energy metering and load shedding:

   - P+: Power absorbed from upstream to downstream (top fed)
   - P-: Power absorbed from downstream to upstream (bottom fed)

   Default value is P+

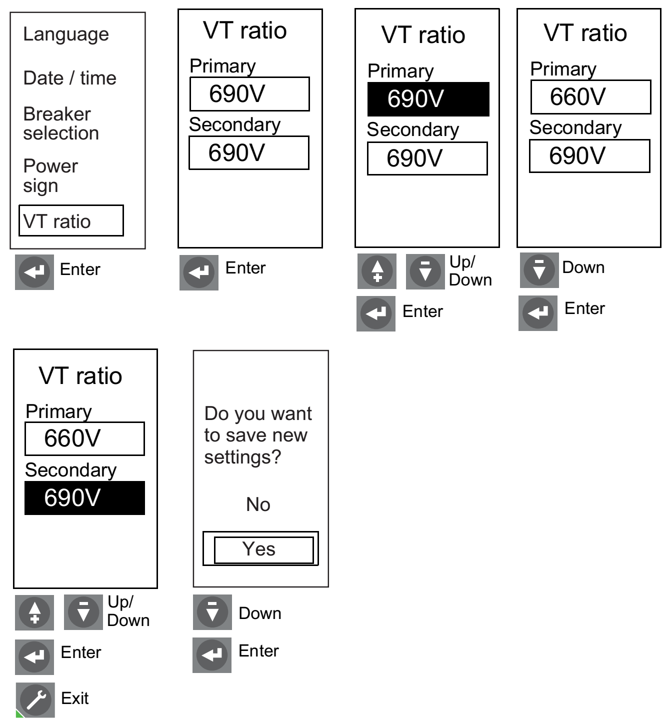
Figure 49 - Set Power Sign



5. Enter VT ratio of external voltage transformer into trip unit memory. If no external voltage transformer is present, set both primary value and secondary value to 690 V.

   If supply voltage for the trip unit exceeds 690 V, an external voltage transformer is required.

Figure 50 - Set VT Ratio

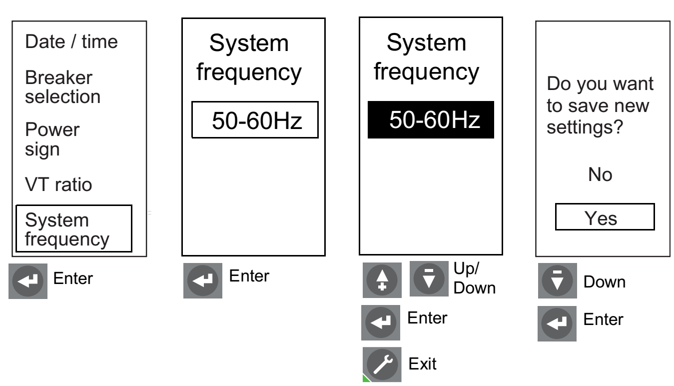


6. Enter system frequency into trip unit memory.

   NOTE: When system frequency is set to 400 Hz:

   - Reactive power absolute value will be correct, but sign will be wrong.
   - PF absolute value will be correct, but sign will be wrong.
   - Frequency value may not be accurate.
   - Frequency protection is disabled.
   - Phase rotation protection is disabled.

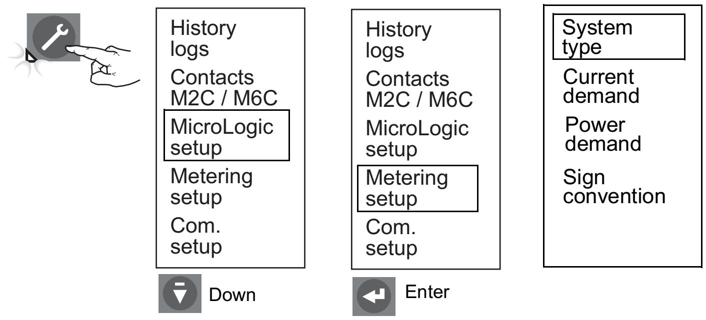
Figure 51 - Set System Frequency



Metering Setup

Use “Metering setup” menu to set parameters for metering system current and power.

Figure 52 - Metering Setup



1. Select system type.

   Three measurement options are available:

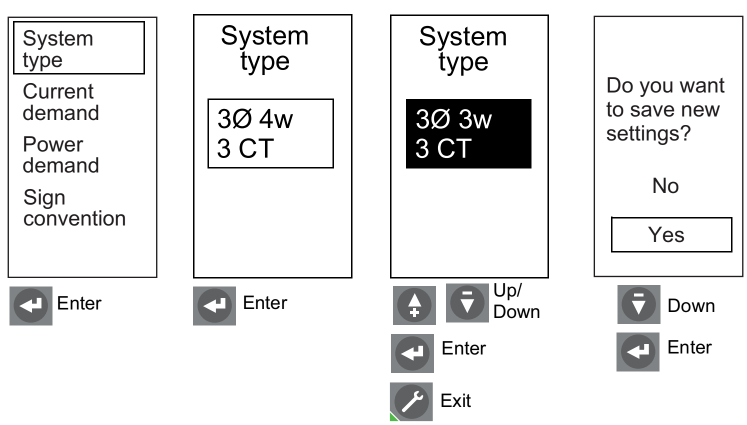
Network Type	Neutral	Phase Current
3-phase, 3-wire, 3 CT (Uses 2 wattmeters)	No	I_a, I_b and I_c measured
3-phase, 4-wire, 4 CT[9] (Uses 3 wattmeters)	Yes	I_a, I_b, I_c and I_n measured
3-phase, 4-wire, 3 CT (Uses 3 wattmeters)	No	I_a, I_b and I_c measured

NOTE: In the case of a four-pole circuit breaker, the ability to set the neutral is limited by the setting of the neutral type switch on the circuit breaker.

I_n measurement is not available for “3phase, 4-wire, 3 CT” network types and V_{an}, V_{bn} and V_{cn} simple voltage measurements are not available for “3phase, 3-wire, 3 CT” network types.

If these measurements are desired, and if the connected system is a wye (4-wire) system, select “3-phase, 4-wire, 4 CT’ and connect to neutral (V_n) voltage terminal on the neutral CT.

Figure 53 - Set System Type



9. Do not use “3-phase, 4-wire, 4 CT” type unless neutral is effectively connected to the trip device (neutral voltage connection is external to the 3-pole circuit breaker). (See neutral CT instruction bulletin.)

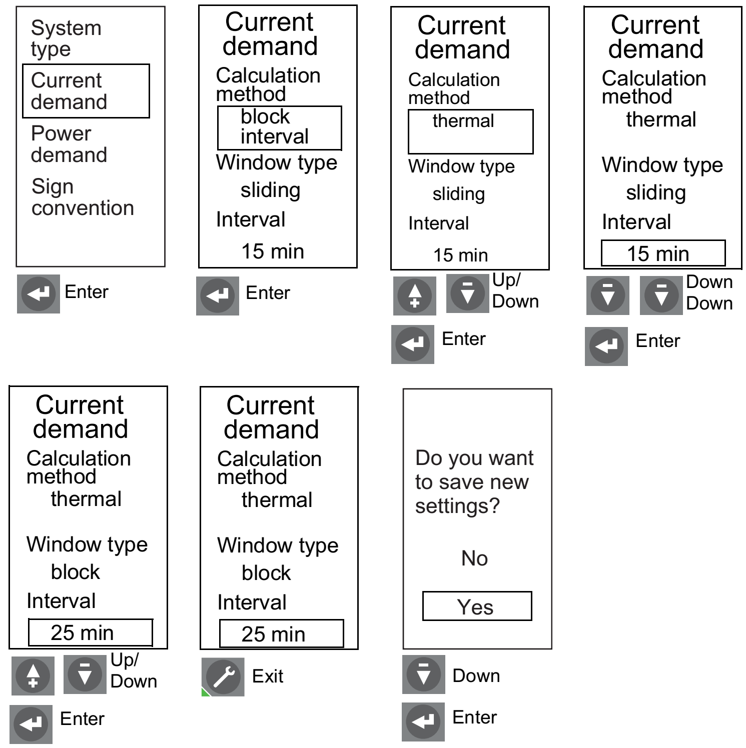
2. Set current calculation method and interval.

   The calculation method can be block interval or thermal calculation.

   The window type is factory set as a sliding window.

   The time interval can be set from five to 60 minutes in one minute increments.

Figure 54 - Set Current Demand



3. Set power calculation method and interval.

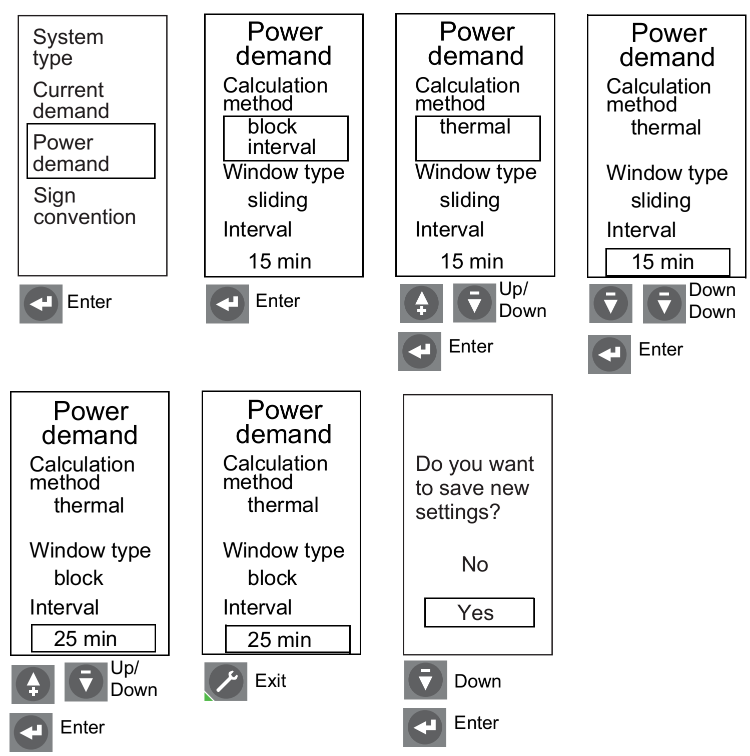
   The calculation method can be block interval, thermal calculation or sync. to comms.

   NOTE: The sync to comms method is available only with the communication option. This function determines demand power based on a signal from the communication module.

   The default window type is sliding.

   The time interval can be set from five to 60 minutes in one minute increments.

Figure 55 - Set Power Demand



4. Select sign convention.

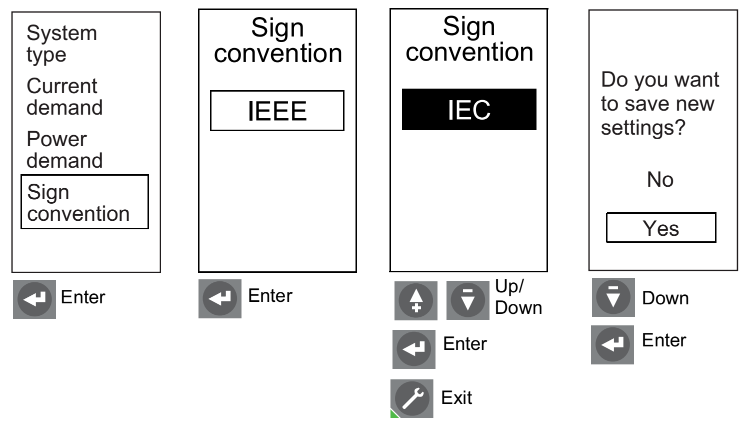
   Choose the signing convention to be used for reactive power (VARS) and reactive energy (VARhrs) and power factor measurements:

   IEEE

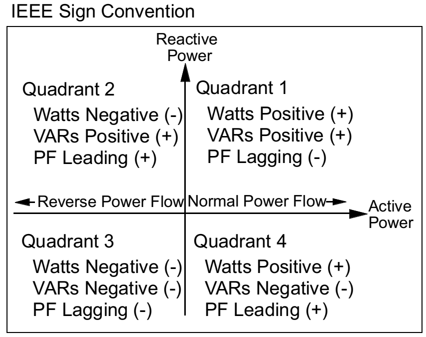
   IEC

   IEEE alt

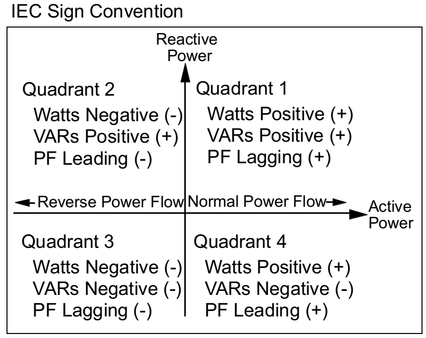
Figure 56 - Set Sign Convention



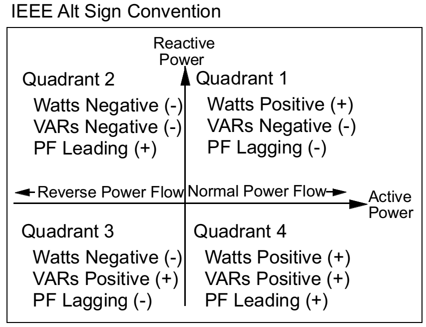
IEEE Sign Convention



IEC Sign Convention



IEEE Alt Sign Convention

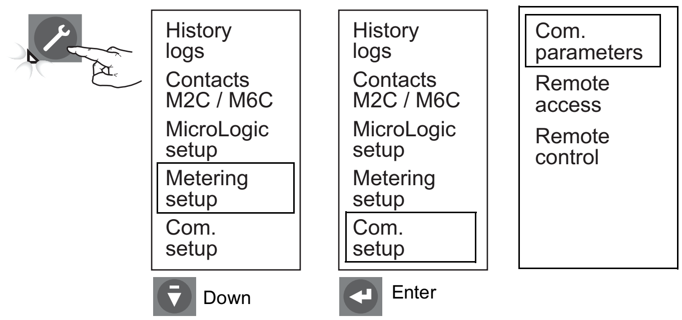


Communication Module Setup

Use “Com. setup” menu to set communication module setup.

NOTE: Com. setup parameters can only be entered if a circuit breaker communication module (BCM) is installed.

Figure 57 - Communication Module Setup



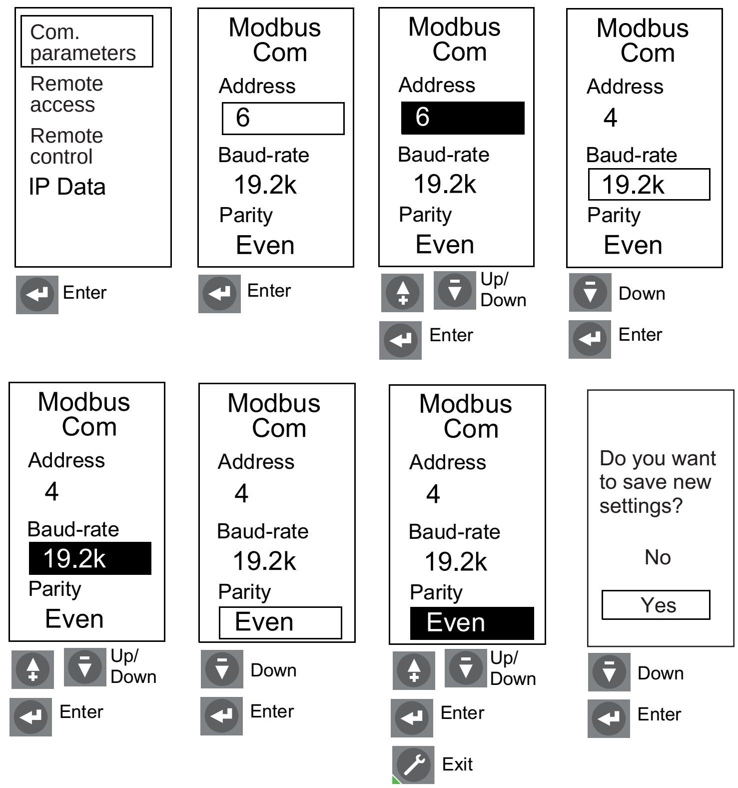
1. Set communication parameters. Default values are:

   Address = 47

   Baud-rate = 19.2k

   Parity = even

Figure 58 - Set Modbus Com Values



⚠ WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

Change default passwords at first use to help prevent unauthorized access to device settings, controls and information.

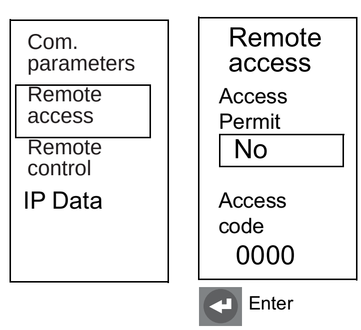
Failure to follow these instructions can result in death, serious injury, or equipment damage.

2. Remote access.

   Remote access is factory set and does not require adjustment.

   NOTE: Remote access setting can be changed to allow protection settings to be changed via the communication network. Contact the local sales office about the availability of software to utilize this feature.

Figure 59 - Check Remote Access



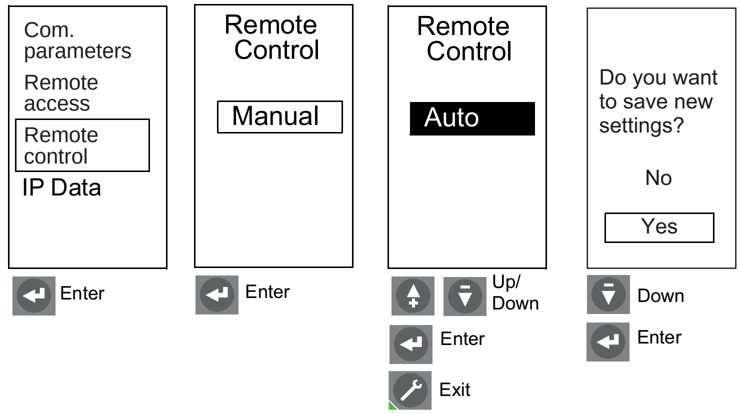
3. Set remote control.

   Manual: The circuit breaker cannot be opened or closed via the network system management software.

   Auto: The circuit breaker can be opened or closed via the network system management software.

   NOTE: For remote operation of the circuit breaker, the BCM must be set to enable opening and/or closing and circuit breaker must have communicating shunt coils with wire harness installed.

Figure 60 - Set Remote Control



Switch Settings Adjustment

NOTICE

HAZARD OF EQUIPMENT DAMAGE

- Using the switches to set trip unit values will override settings made using the keypad.
- Changing the switch setting for overload, short-time or instantaneous, or changing the neutral protection selector on a four-pole circuit breaker, will delete all fine adjustments previously made using the keypad for overload, short-time and instantaneous protection.
- Changing the switch setting for ground-fault will delete all fine adjustments made with the keypad for ground-fault protection.
- If cover pin located on back of the protective cover is missing, contact sales office for a replacement cover.

Failure to follow these instructions can result in equipment damage.

1. Open switch cover (A).
2. Confirm that cover pin (B) is on back of the protective cover. This pin is necessary to lock trip unit settings when they are set to trip.
3. Adjust the appropriate switches (C) to desired values. Display screen (D) automatically shows appropriate setting curve (E). The set value is displayed as a boxed value in amperes or seconds.

4. Make fine adjustments using navigation keys (F) or network system management software. All fine adjustments are stored in non-volatile memory.

   NOTE: Fine adjustments can only be made for values less than those set with the switches. Using switches to set values after making fine adjustments using the keypad will override the keypad adjustments.

   Fine switch settings are in the following increments:

   Long-time pickup = 1 A

   Long-time delay = 0.5 sec.

   Short-time pickup = 10 A

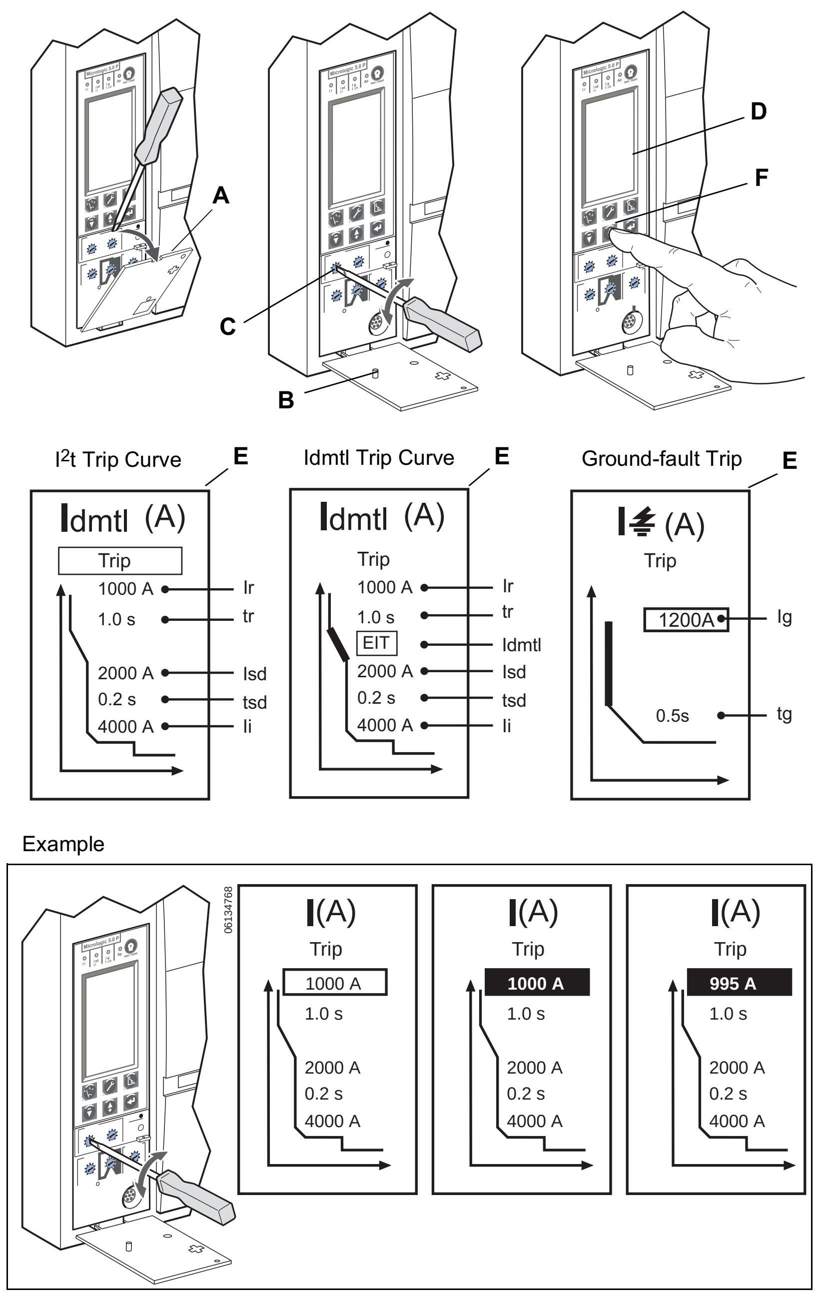
   Short-time delay = 0.1 sec.

   Instantaneous pickup = 10 A

   Ground-fault pickup = 1 A

   Ground-fault delay = 0.1 sec.

Figure 61 - Adjust Switch Settings

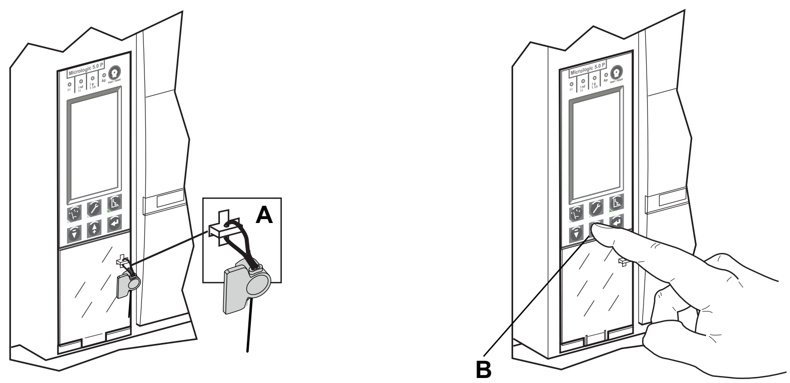


5. Replace switch cover. Use a lead seal (A), not supplied, to provide tamper evidence if necessary.

   NOTE: When the cover is closed, the navigation keys can no longer be used to make adjustments to the trip unit settings if they are set to trip.

6. Check settings using keypad (B) and graphic display or the network system management software.

Figure 62 - Check Switch Settings



Examples

MicroLogic 5.0P Trip Unit

1. Set switches:

   A—Long-time pickup (Ir)

   B—Long-time delay (tr)

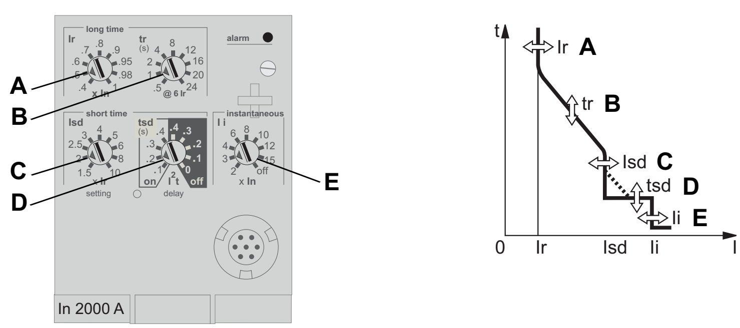
   C—Short-time pickup (Isd)

   D—Short-time delay (tsd)

   E—Instantaneous pickup (Ii)

2. Fine-tune adjust using keypad and graphic display screen or the network system management software.

Figure 63 - Set Pickup Levels



MicroLogic 6.0P Trip Unit

1. Set switches:

   A—Long-time pickup (Ir)

   B—Long-time delay (tr)

   C—Short-time pickup (Isd)

   D—Short-time delay (tsd)

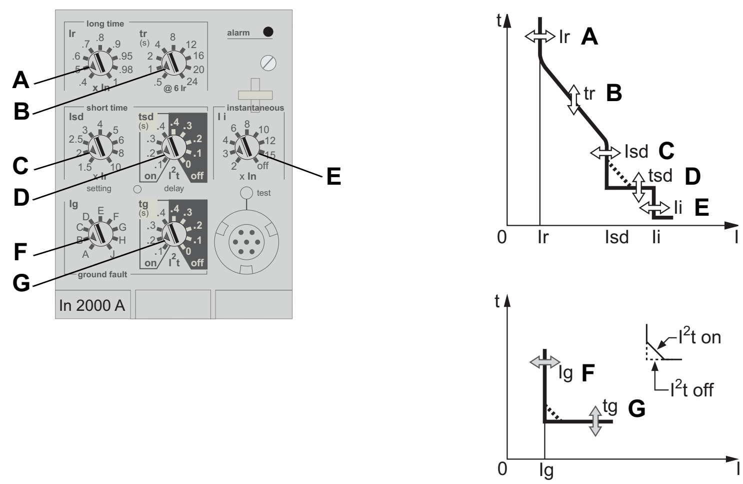
   E—Instantaneous pickup (Ii)

   F—Ground-fault pickup (Ig)

   G—Ground-fault delay (tg)

2. Fine-tune adjust using keypad and graphic display screen or the network system management software.

Figure 64 - Set Pickup Levels



Zone-Selective Interlocking (ZSI)

The number of devices which can be interlocked are shown in Zone-Selective Interlocking (ZSI), page 54.

Table 11 - ZSI Combinations

Downstream Device (sends output to RIM)	Upstream Device (receives input from RIM) →					
	MicroLogic #.0x Trip Units	Square D MicroLogic Series B Trip Units	Square D GC-100 Ground-Fault Relay for Equipment Protection	Square D GC-200 Ground-Fault Relay for Equipment Protection	Merlin Gerin STR58 Trip Units	Federal Pioneer USRC and USRCM Trip Units
MicroLogic #.0x Trip Units	15	R	R	15	15	R
Square D MicroLogic Series B Trip Units	R	26	R	R	R	15
Square D GC-100 Ground-Fault Relay for Equipment Protection	R	R	7	R	R	R
Square D GC-200 Ground-Fault Relay for Equipment Protection	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

Wire circuit breakers for zone-selective interlocking.

Circuit breaker terminals are shipped with terminals Z3, Z4 and Z5 jumpered to self-restrain the short-time and ground-fault functions. Remove the jumpers when activating zone-selective interlocking.

NOTE: Use I²t off with ZSI for proper coordination. Using I²t on with ZSI is not recommended as the delay in the upstream device receiving a restraint signal could result in the trip unit tripping in a time shorter than the published trip curve.

Figure 65 - Jumpered Terminals

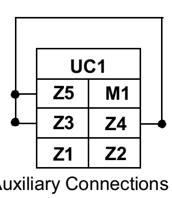
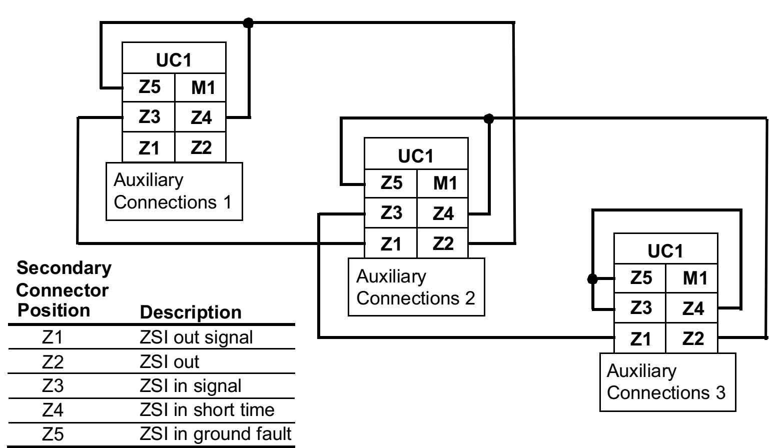


Figure 66 - ZSI Wiring Example



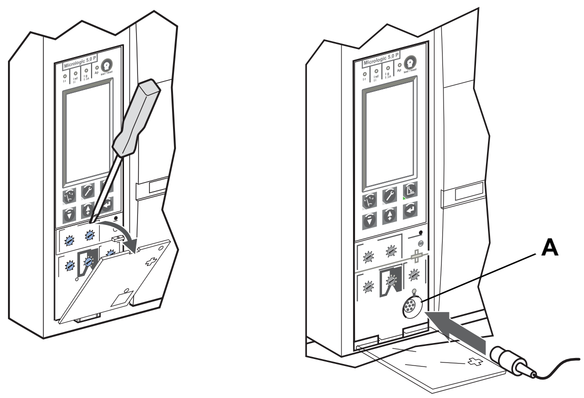
Secondary Connector Position	Description
Z1	ZSI out signal
Z2	ZSI out
Z3	ZSI in signal
Z4	ZSI in short time
Z5	ZSI in ground fault

Trip Unit Operation Verification

Use a test kit connected to the trip unit test plug receptacle (A) to verify trip unit is functioning as desired. See instructions shipped with test kit to perform verification tests.

> **NOTE:** To verify operation of the circuit breaker and trip unit, use primary injection testing. (See Trip Unit Installation Check, page 80 for more information.)

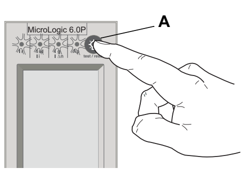
Figure 67 - Verify Trip Unit Operation



Trip Unit Resetting

When the circuit breaker trips, the fault indicator will remain lit until the trip unit is reset.

Figure 68 - Reset Trip Unit



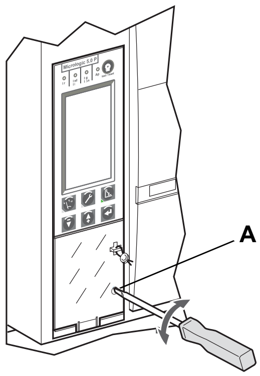
Do not return circuit breaker to service until cause of trip is determined. For more information, refer to the circuit breaker installation instructions shipped with the circuit breaker.

Press the reset/test button (A) to reset the trip unit after trip.

Equipment Ground-Fault Trip Functions Testing

Paragraph 230-95 (c) of the National Electrical Code requires that all equipment ground-fault protection systems be tested when first installed.

Figure 69 - Test Equipment Ground-Fault Trip Function



With the trip unit powered and the circuit breaker closed, test the equipment ground-fault (MicroLogic 6.0P trip unit) trip function.

The trip unit is powered if:

- circuit breaker is on and has more than 150 V of load voltage on two phases (circuit breaker is closed or bottom fed).
- the test kit is connected and on.
- the 24 Vdc external power supply is connected.
- an external voltage tap is installed and voltage of more than 150 V is present on two phases.

For instructions on how to close circuit breaker, refer to the circuit breaker installation instructions shipped with the circuit breaker.

To test trip function, press the ground-fault test button (A). Circuit breaker should trip.

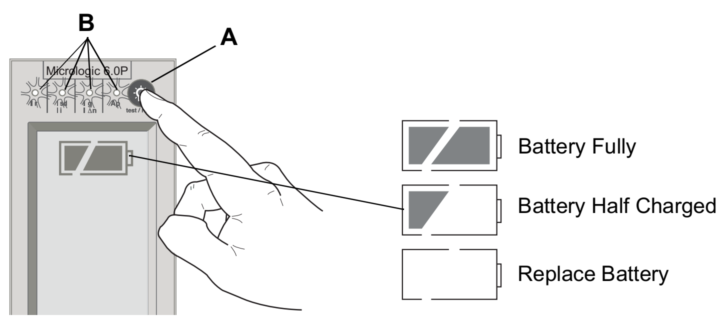
If circuit breaker does not trip, contact the local field office.

Trip Unit Status Check

Check trip unit battery and trip indicators.

1. Make sure trip unit is powered. The trip unit is powered if:
   - circuit breaker is on and has more than 150 V of load voltage on two phases (circuit breaker is closed or bottom fed).
   - the test kit is connected and on.
   - the 24 Vdc external power supply is connected.
   - the external voltage tap is installed and voltage of more than 150 V is present on two phases.
2. Press test/reset button (A).
   - All trip indicators (B) will light up
   - Battery status will be displayed
   - The battery bar graph reading is valid after the reset button has been released

Figure 70 - Check Trip Unit Status



3. If the battery bar graph shows the battery needs to be changed, use Square D battery catalog number S33593:
   - lithium battery
   - 1.2AA, 3.6 V, 800 ma/h

For instructions on replacing battery, see Battery Replacement, page 84.

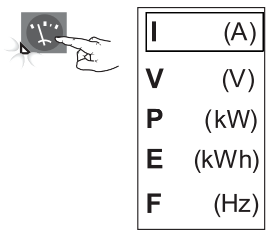
Operation

Metered Values

Use the metering menus to monitor circuit breaker current (**I**), voltage (V), power (P), energy (E) and frequency (F).

NOTE: System measurements can also be checked remotely using System Manager Software (SMS) (version 3.3 or later) or other network system management software.

Figure 71 - Metering Menu

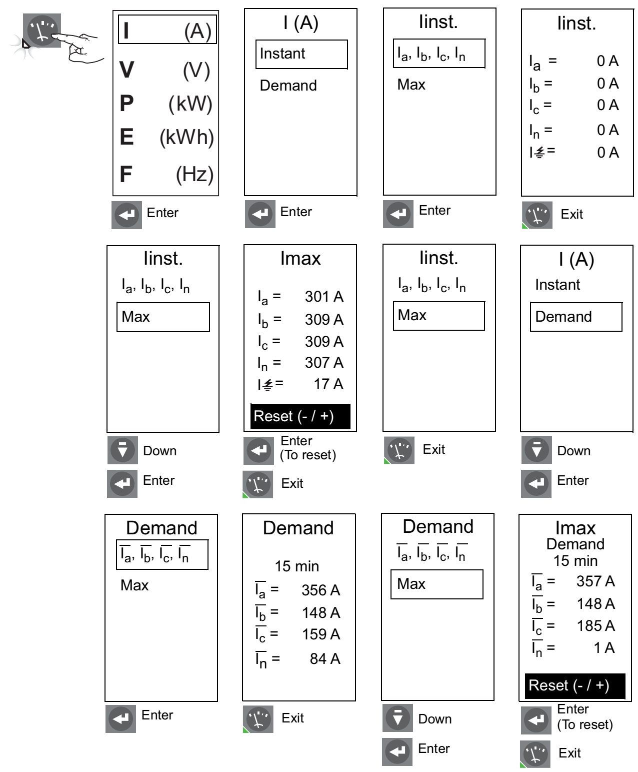


Current Levels

I_a	Instantaneous A phase current
I_b	Instantaneous B phase current
I_c	Instantaneous C phase current
I_n	Instantaneous neutral current
I⏚	Instantaneous ground current
$I_a$max	Maximum instantaneous A phase current
$I_b$max	Maximum instantaneous B phase current
$I_c$max	Maximum instantaneous C phase current
$I_n$max	Maximum instantaneous neutral current
I⏚max	Maximum instantaneous ground current
$\overline{I}a$	Voltage is above set maximum
$\overline{I}b$	Demand B phase current
$\overline{I}c$	Demand C phase current
$\overline{I}n$	Demand neutral current
$\overline{I}a$ max	Maximum demand A phase current
$\overline{I}b$ max	Maximum demand B phase current
$\overline{I}c$ max	Maximum demand C phase current
$\overline{I}n$ max	Maximum demand neutral current

Maximum measurements can also be reset to zero.

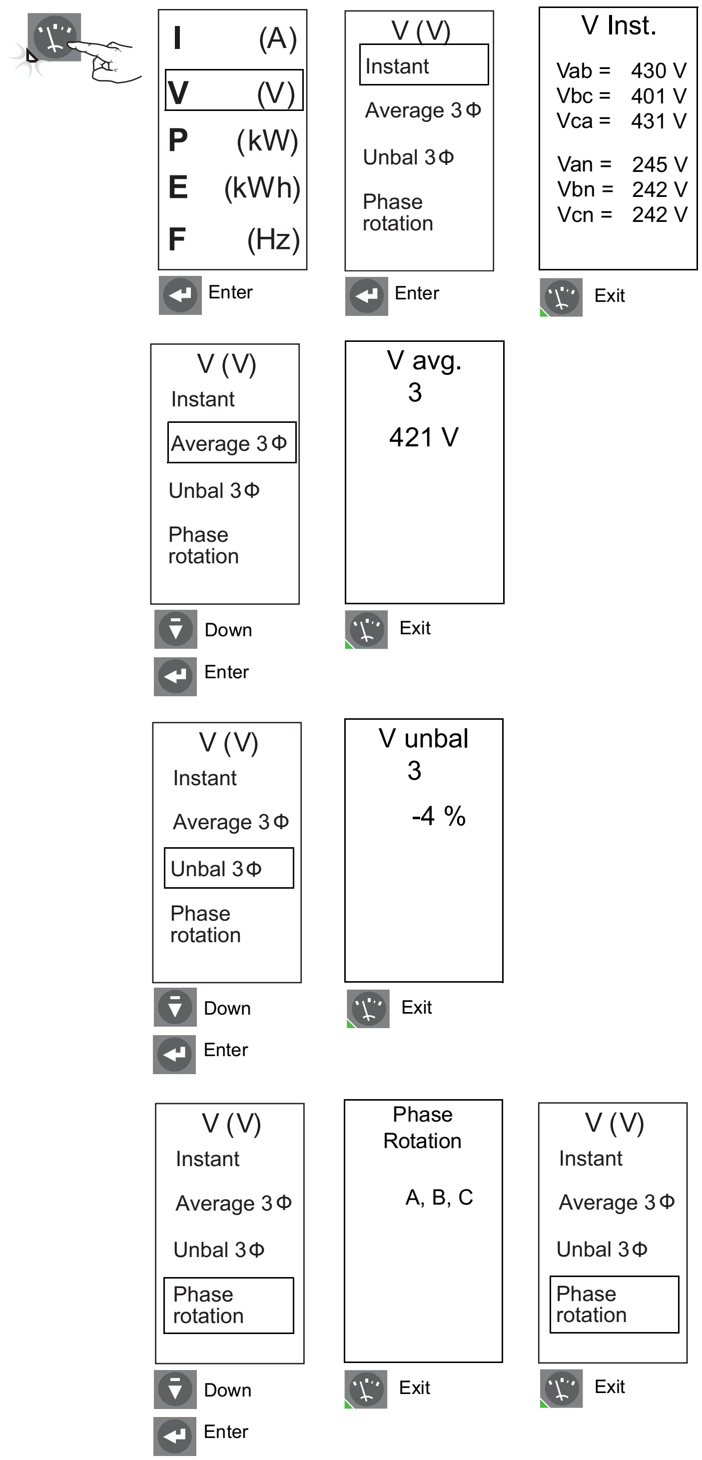
Figure 72 - Check Current Levels



Voltage Levels

Vab	Instantaneous voltage between A and B phases
Vbc	Instantaneous voltage between B and C phases
Vca	Instantaneous voltage between C and A phases
Van	Instantaneous voltage between A phase and neutral
Vbn	Instantaneous voltage between B phase and neutral
Vcn	Instantaneous voltage between C phase and neutral

Figure 73 - Check Voltage Levels



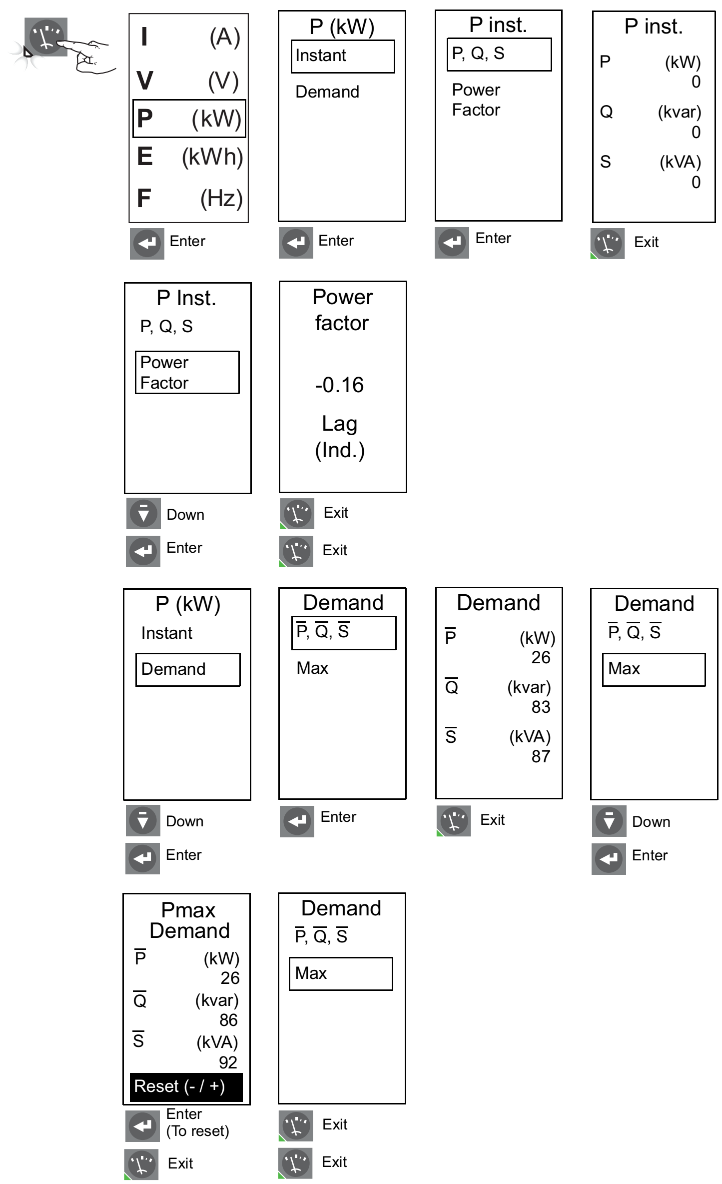
Power Levels

P	Instantaneous active power
Q	Instantaneous reactive power
S	Instantaneous apparent power
Power Factor	Instantaneous power factor
$\overline{P}$	Demand active power
$\overline{Q}$	Demand reactive power
$\overline{S}$	Demand apparent power
$\overline{P}$max	Maximum demand active power
$\overline{Q}$max	Maximum demand reactive power
$\overline{S}$max	Maximum demand apparent power

Maximum measurements can also be reset to zero.

NOTE: To ensure reliable power and power factor measurements, Set Power Sign, page 44, and Set Sign Convention, page 47.

Figure 74 - Check Power Levels



Energy Levels

Total active energy (P)

Total reactive energy (Q)

Total apparent energy (S)

Active energy in (E.P.)

Reactive energy in (E.Q.)

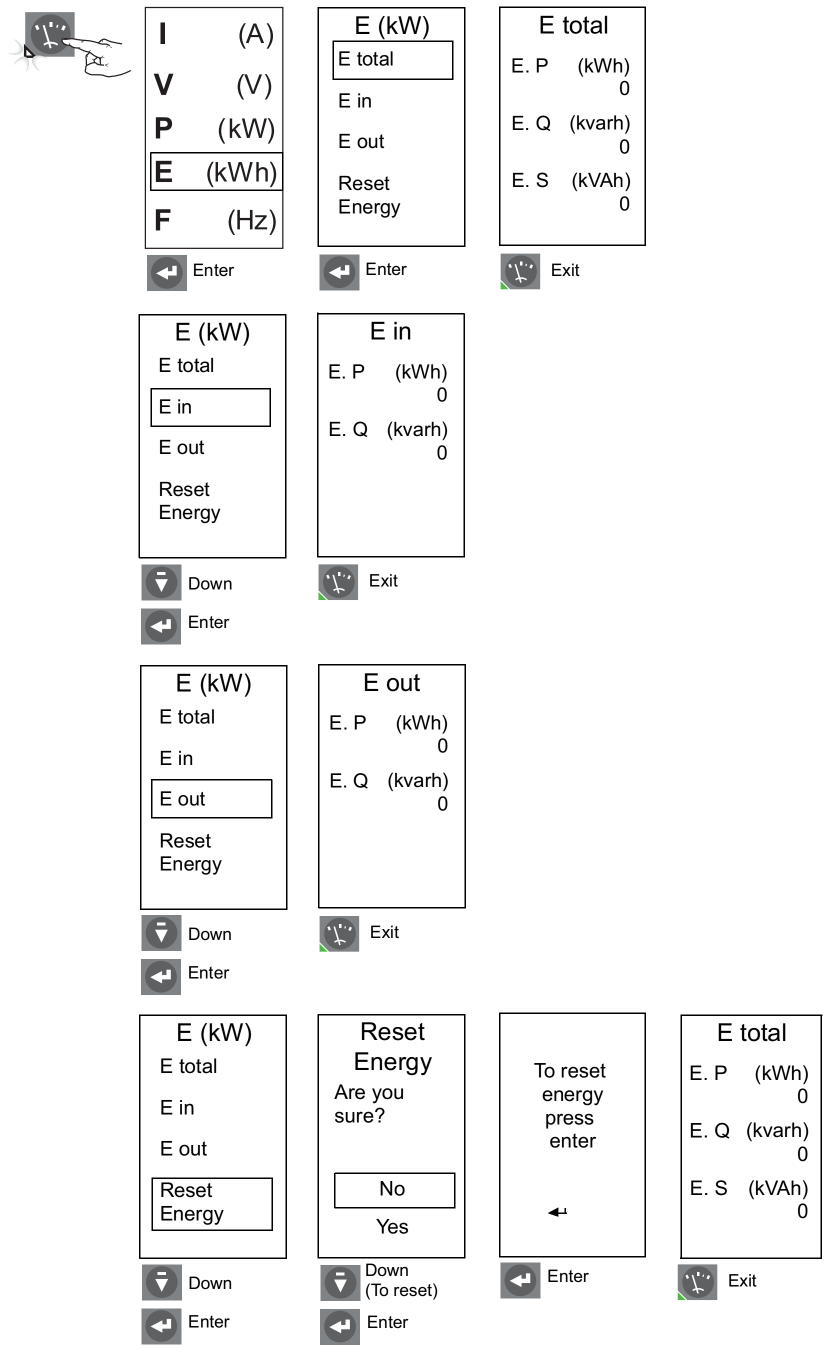
Active energy out (E.P.)

Reactive energy out (E.Q.)

Energy measurements can also be reset to zero.

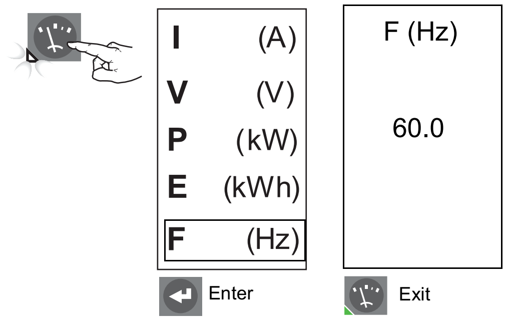
NOTE: To ensure reliable energy measurements, Set Power Sign, page 44, and Set Sign Convention, page 47.

Figure 75 - Check Energy Levels



Frequency

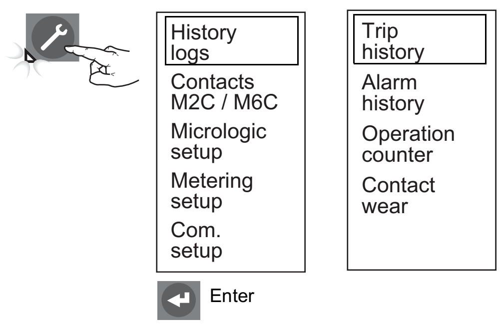
Figure 76 - Check Frequency



Trip Unit History

Use the maintenance menu to review the trip unit history stored in the history logs.

Figure 77 - History Log Menu



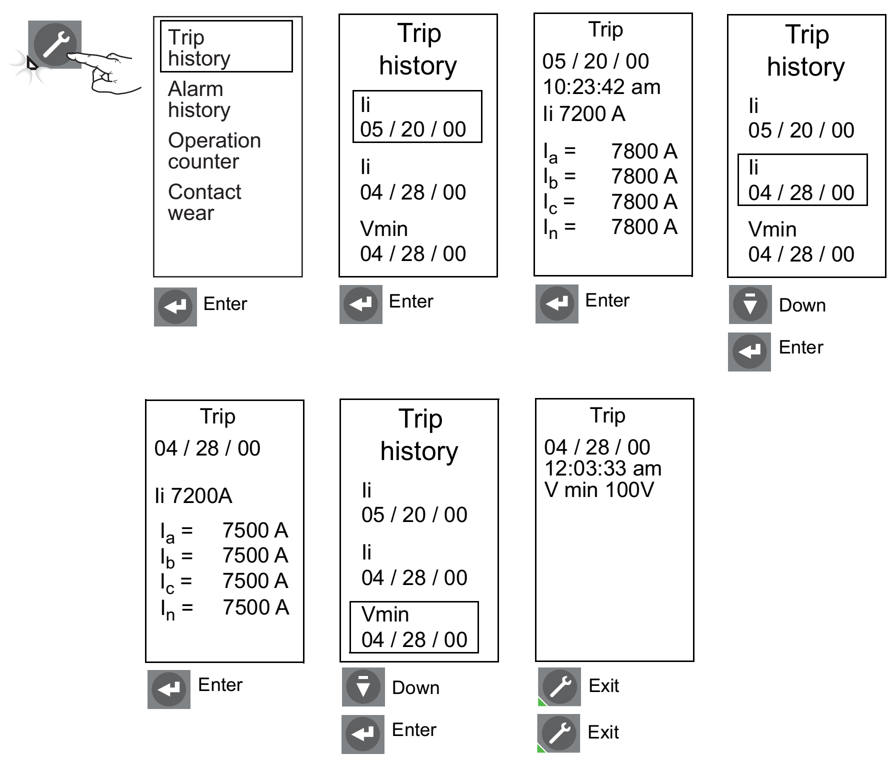
Trip History

The trip unit stores information about the LSIG fault causing the last ten trips. For each fault the following are stored:

- Current values of Ir, Isd, Ii, and Ig
- Pickup setpoint for voltage and other protection
- Date
- Time (hour, minute and second)

NOTE: Trips from use of a test kit are not recorded in the trip history log.

Figure 78 - Check Trip History

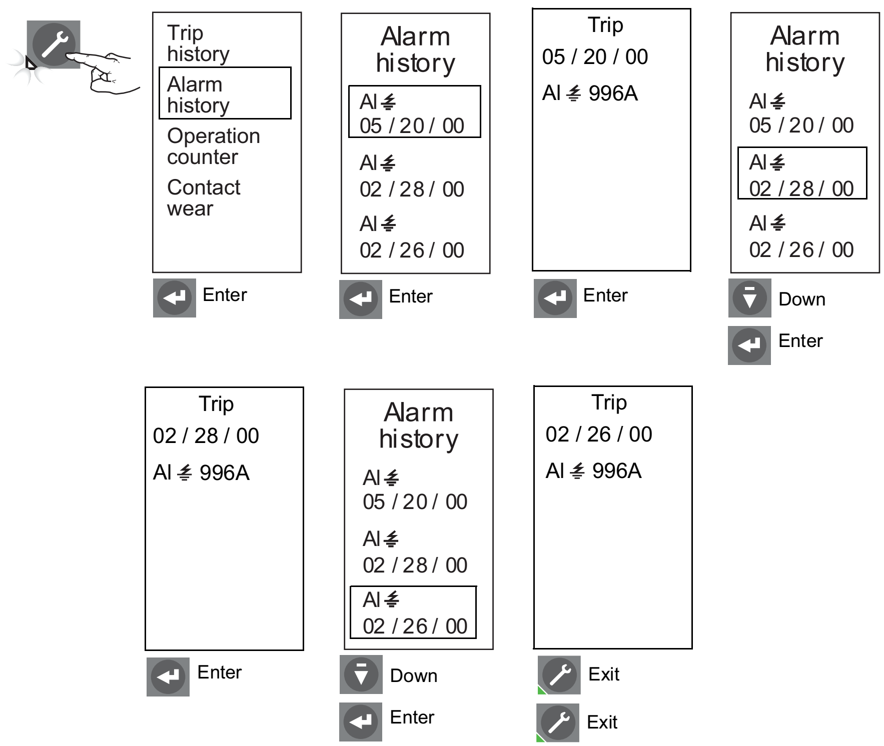


Alarm History

The trip unit records measurement at each of the last ten alarms activated. For each alarm the following are stored:

- Indication and value of the alarm setting
- Date
- Time (hour, minute and second)

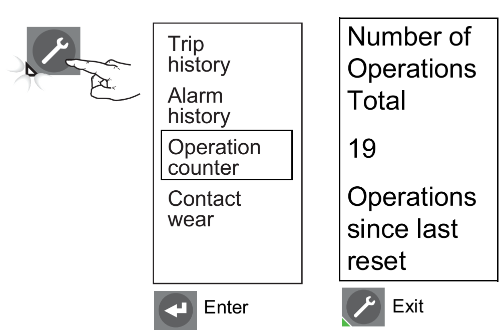
Figure 79 - Check Alarm History



Operation Counter

This displays the maximum number of operations (trip or circuit breaker openings) since the circuit breaker was installed. The number is obtained from the circuit breaker communication module (BCM).

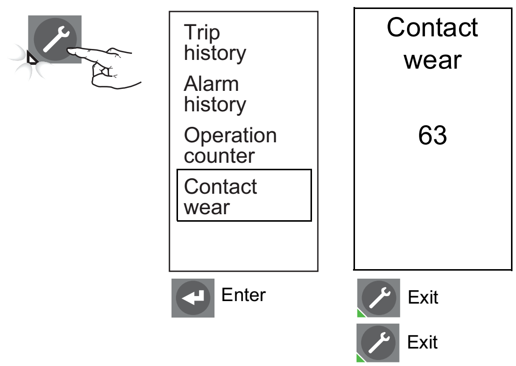
Figure 80 - Check Operation Counter



Contact Wear

This displays the amount of contact wear on the contact with the greatest wear. When this number reaches 100, it is recommended that a visual inspection of the contacts be done. This function works only on MasterPact® NT and NW circuit breakers.

Figure 81 - Check Contact Wear

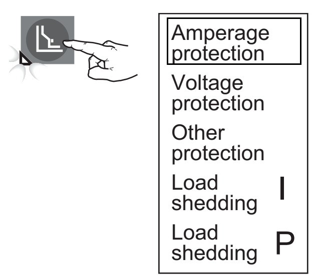


Protection Setup

Use the protection menus to check protection setup for amperage protection, voltage protection, other protection, current load shedding and power load shedding.

Refer to Appendix B for default settings and setting ranges.

Figure 82 - Protection Menu



Amperage Protection

The “Change Idmtl (A) setting with I(A)” screen will only appear if long-time, short-time and/or instantaneous adjustments have been previously made under the Idmtl (A) menu screen. If the user responds Yes, the Idmtl (A) settings will be lost when the menu goes to the I(A) adjustment screen. If no adjustments have been made under the Idmtl (A) menu screen, the menu goes directly to the I(A) adjustment screen.

The “Change I (A) setting with Idmtl(A)” screen will only appear if long-time, short-time and/or instantaneous adjustments have been previously made under the I(A) menu screen. If the user responds Yes, the I(A) settings will be lost when the menu goes to the Idmtl(A) adjustment screen. If no adjustments have been made under the Idmtl(A) menu screen, the menu goes directly to the I(A) adjustment screen.

NOTE: Neutral protection is disabled if Idmtl protection is selected.

Figure 83 - Check Amperage Protection

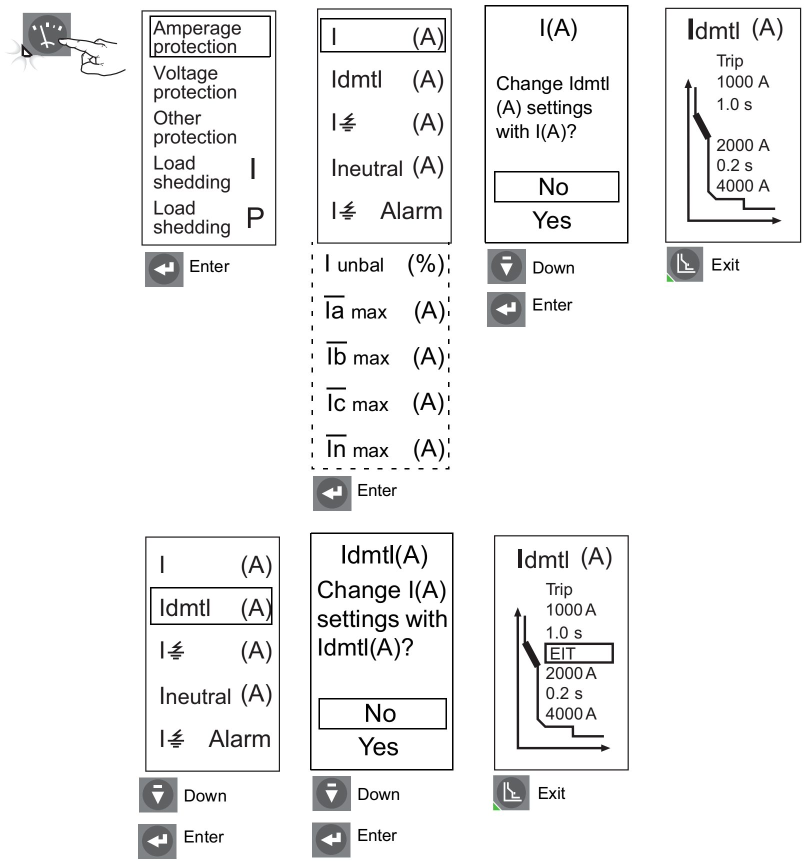
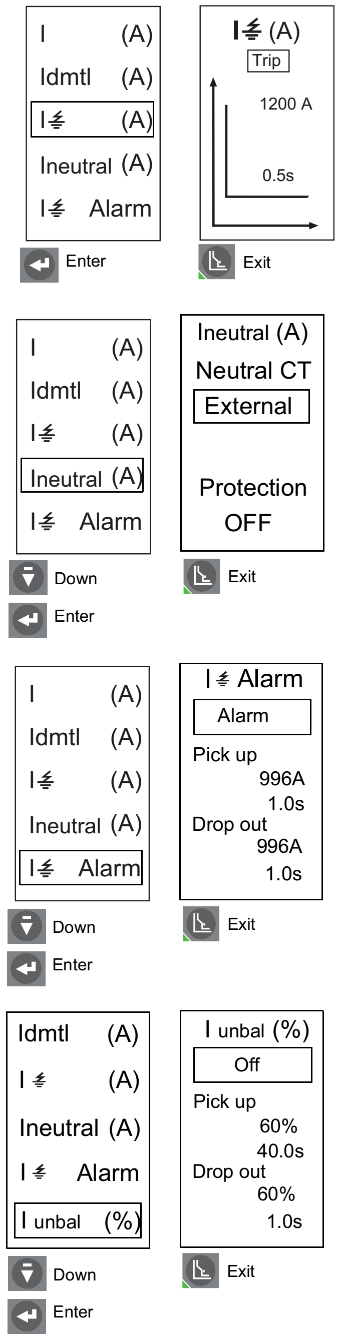


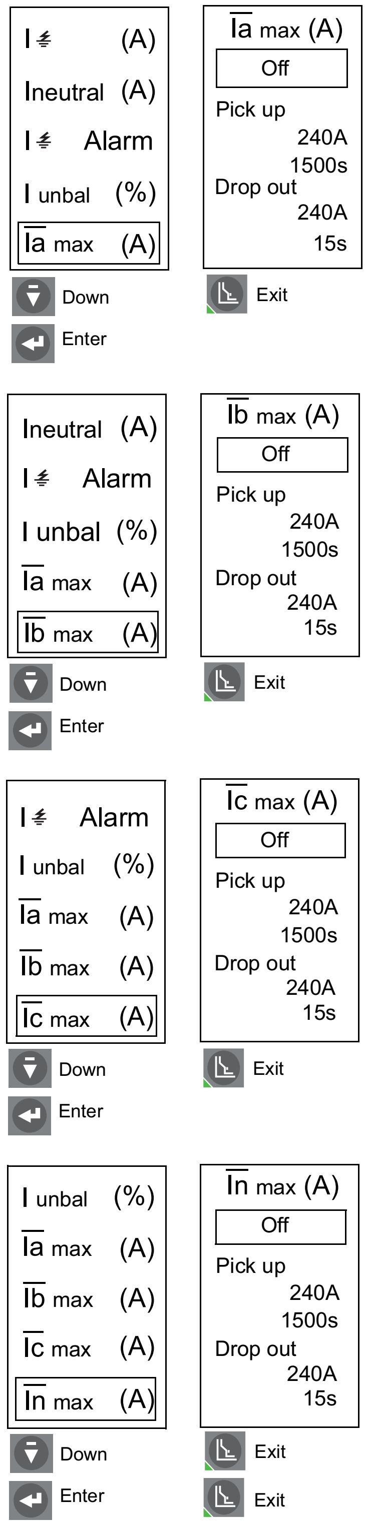
Figure 84 - Check Amperage Protection



NOTE: Selection of the CT type determines the Ineutral protection in the Protection menu.

Circuit Breaker	Neutral CT Type	Protection Choices
All	none	disabled
Four-pole	internal	OFF: no neutral protection
		N/2: half neutral protection
		N: full neutral protection
Three-pole	external	OFF: no neutral protection
		N/2: half neutral protection
		N: full neutral protection
		1.6N: oversized neutral protection

Figure 85 - Check Amperage Protection



NOTE: To set Inmax, the neutral CT must be set to external or internal under MicroLogic setup under the maintenance menu.

Voltage Protection

NOTICE

HAZARD OF EQUIPMENT DAMAGE

Setting undervoltage protection (Vmin) below 80% or voltage unbalance (Vunbal) above 20% can cause the trip unit to not perform as expected.

Failure to follow these instructions can result in equipment damage.

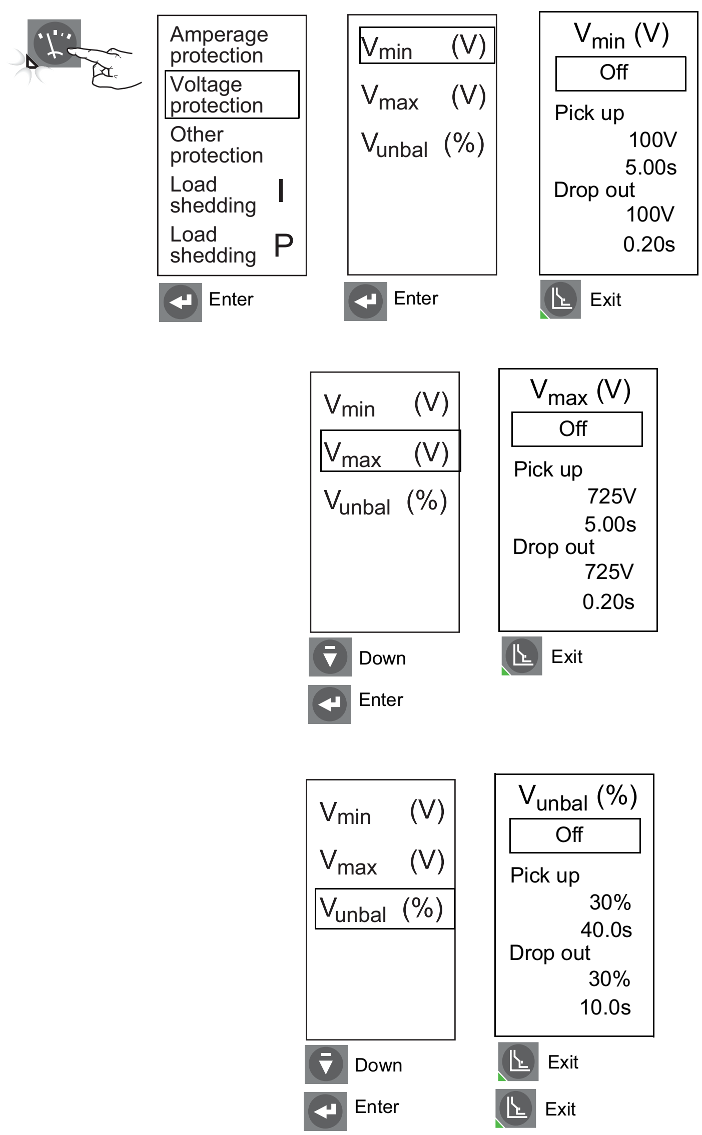
Voltage protection pickup settings are phase-to-phase values.

Unbalance values are based on the true RMS values of the three-phase currents.

Undervoltage alarm drops out upon the loss of the second phase.

> **NOTE:** Do not set undervoltage protection below 80%. Do not set Vunbal above 20%[10]

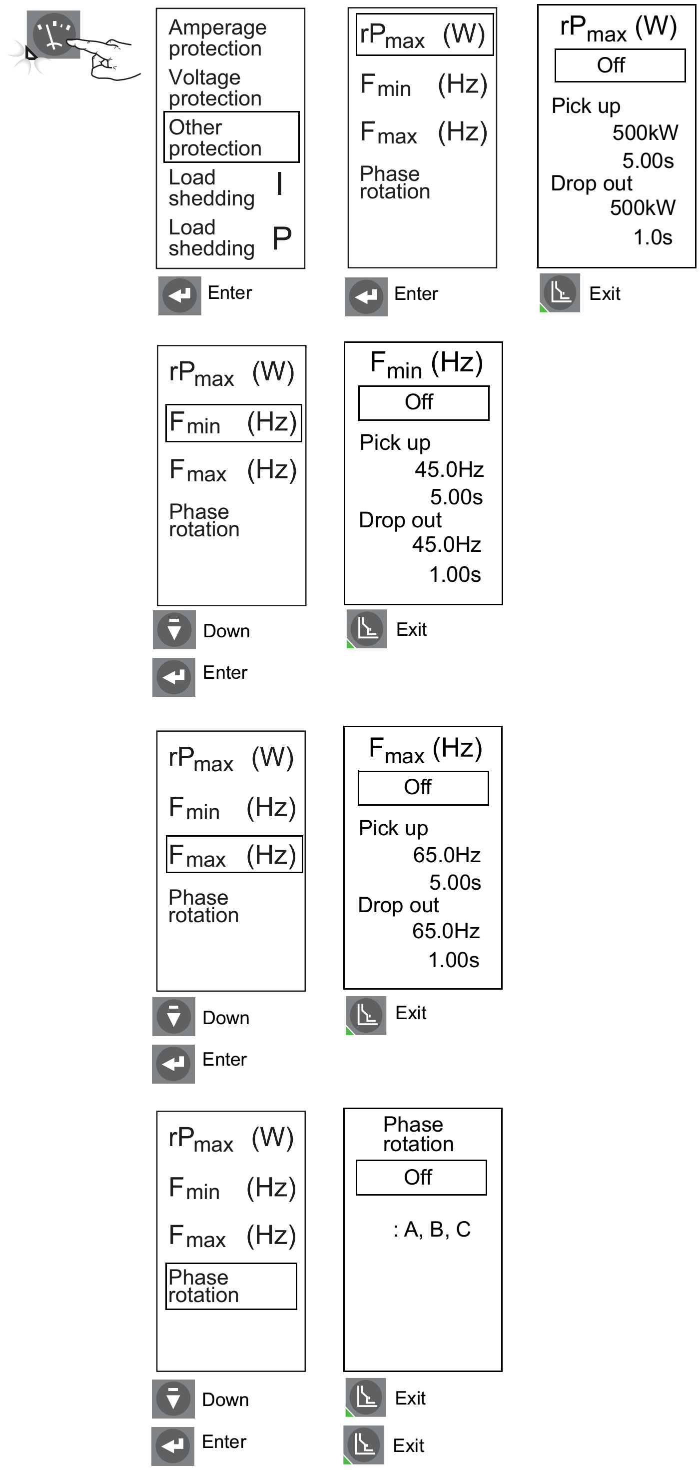
Figure 86 - Check Voltage Protection



10. For an explanation of system protection behavior, refer to Appendix D

Other Protection

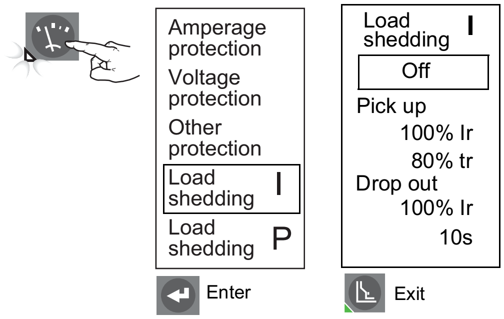
Figure 87 - Check Other Protection



Current Load Shedding

Current load shedding can be configured for alarm only. It cannot be used to trip the circuit breaker.

Figure 88 - Check Current Load Shedding

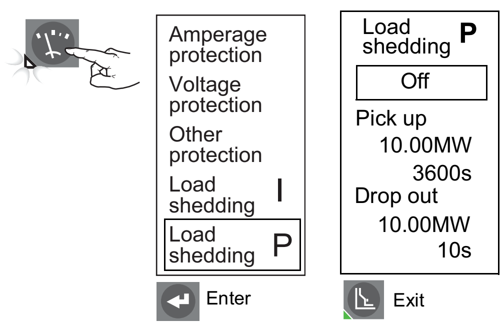


Power Load Shedding

Power load shedding can be configured for alarm only. It cannot be used to trip the circuit breaker.

NOTE: Press Protection button to view Protection Menu.

Figure 89 - Check Power Load Shedding



Trip Unit Replacement

Trip unit replacement must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.

Before replacing trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.

Read this entire section before starting the replacement procedure.

If trip unit being replaced is a MicroLogic 2.0, 3.0 or 5.0 trip unit, order connector block S33101 and circuit breaker or cradle wiring harness if necessary.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Failure to follow these instructions for installation, trip test and primary injection testing may result in the failure of some or all protective function.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, NOM 029-STPS or local equivalent.
- Replacement/upgrading of a trip unit in the field must be done by qualified persons, as defined by the National Electric Code, who are familiar with the installation and maintenance of power circuit breakers.
- Before replacing/upgrading trip unit, confirm that the circuit breaker is in good working condition. If the condition of the circuit breaker is unknown, do not proceed. For assistance in evaluating the condition of the circuit breaker, call Technical Support.
- If the circuit breaker fails to function properly in any manner upon completion of the trip unit installation, immediately remove the circuit breaker from service and call Field Services.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow these instructions will result in death or serious injury.

Required Tools

- Torque-controlled screwdriver, set at 7 in-lbs (0.8 N•m) ± 10% (Lindstrom torque driver MAL500-2 or equivalent)
- The appropriate MicroLogic test kit found in Section 7 of The Digest (Reference 0100CT1901).[11]

11. See test kit user guide for compatibility and test function coverage.

Preparation

Record Switch Settings

Record all trip unit switch and advanced protection settings for later use.

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker. The circuit breaker must be completely isolated. (For a drawout circuit breaker, place circuit breaker in the disconnected position. For a fixed-mounted circuit breaker, all voltage sources, including auxiliary power, must be disconnected.)

Circuit Breaker Accessory Cover Removal

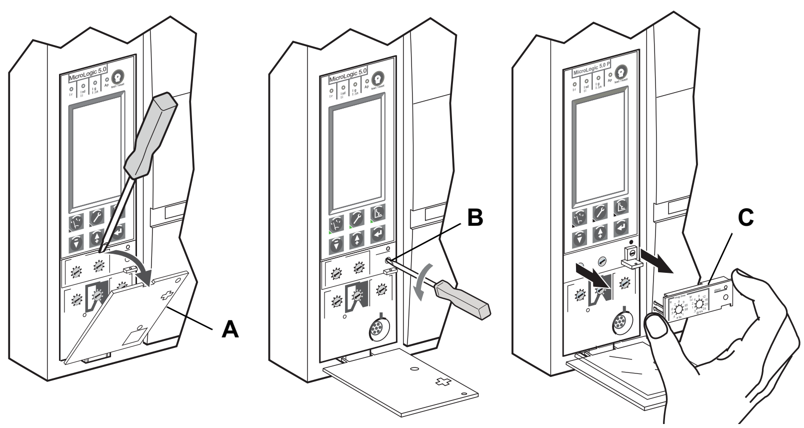
Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Rating Plug Removal

A small Phillips screwdriver is needed to remove the adjustable rating plug.

- Open switch cover (A).
- Unscrew adjustable rating plug mounting screw (B).
- Remove adjustable rating plug (C). Save for installation in replacement trip unit.

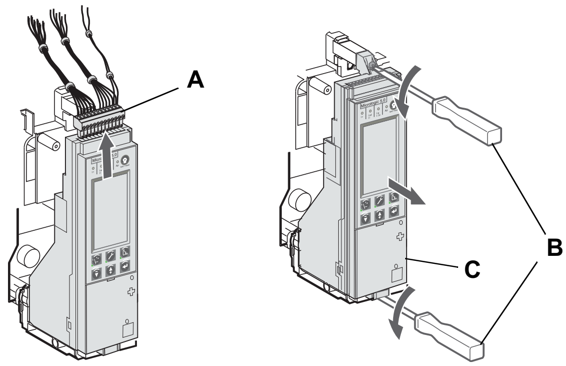
Figure 90 - Remove Adjustable Rating Plug



Trip Unit Removal

1. Remove connector block (A) from top of trip unit, if present.
2. Loosen two trip unit screws (B).
3. Slide out trip unit (C).

Figure 91 - Remove Existing Trip Unit



Trip Unit Replacement

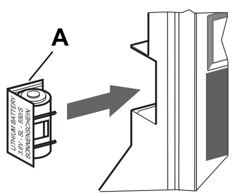
Battery Installation

If a new trip unit is being installed, install the trip unit battery.

Install battery holder with battery (A) in trip unit, observing the correct polarity as indicated on the battery compartment.

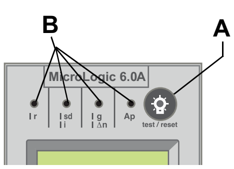
> **NOTE:** Battery holder with battery is located under the side flap in the cardboard box the trip unit is shipped in.

Figure 92 - Install Battery



Press test/reset button (A). All four indicator lights (B) should light. If they do not light, check polarity of battery and retest. If indicator lights still do not light up when test/reset button is pressed, stop installation and contact the local sales office for factory authorized service

Figure 93 - Trip Indicator Lights



Trip Unit Installation

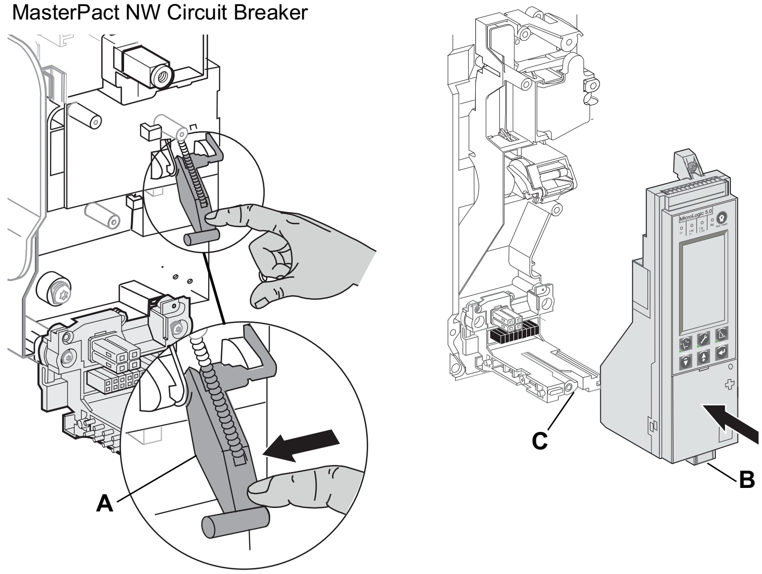
1. Inspect trip unit connector pins and surfaces. If there is any damage, misaligned pins, or contamination, stop installation and contact the local sales office for factory authorized service.
2. Inspect trip unit mounting base on the circuit breaker. Clear any debris from area and check that all accessory wiring is properly routed for the trip unit being installed. If there is any damage or contamination, stop installation and contact the local sales office for factory authorized service.
3. For MasterPact NW circuit breaker only: Manually depress trip unit interlock (A) and hold it in place during steps 4–6 below.

4. Align guide rail (B) on bottom of trip unit with guide rail slot (C) on trip unit mounting base in circuit breaker and gently slide the trip unit in until it stops.

   NOTE: The MasterPact NT and NW trip unit mounting bases are shock mounted and therefore can flex slightly.

Figure 94 - Install Trip Unit

MasterPact NW Circuit Breaker



⚠CAUTION
HAZARD OF EQUIPMENT DAMAGE Check installation of trip unit to assure proper connections and seating. **Failure to follow these instructions can result in injury or equipment damage.**

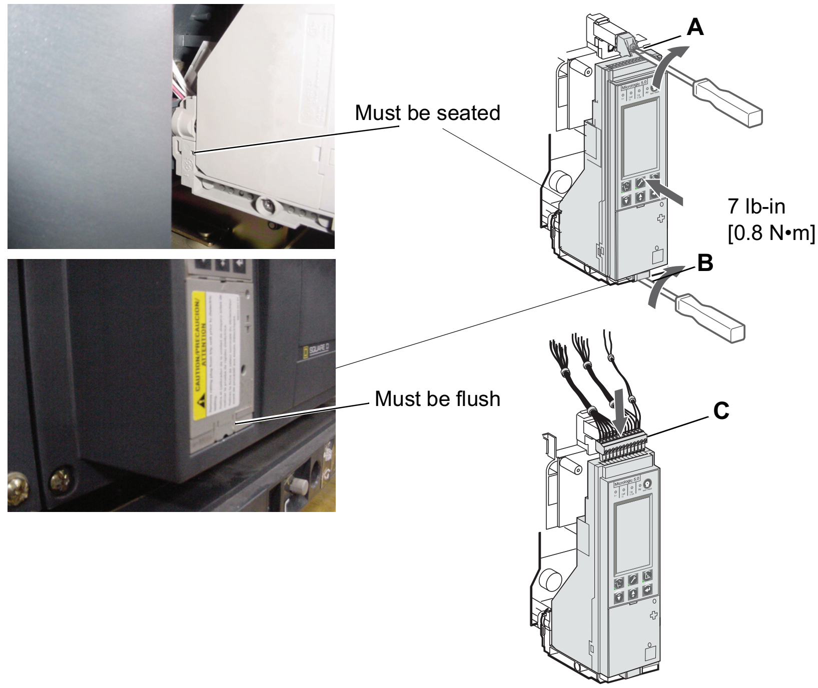
5. Align the trip unit so top mounting screw (A) aligns with the top threaded insert and start the screw by turning the screw two full rotations.
6. Use a torque-controlled screwdriver to drive the bottom screw (B) to 7 in-lbs (0.8 N•m) ± 10%. The back of the trip unit must be flush with the trip unit mounting base.
7. Use a torque-controlled screwdriver to drive the top screw to 7 in-lbs (0.8 N•m) ± 10%. Mounting tab must be flush with the mounting standoff and sensor plug.

   NOTE: The face of the closed switch cover must be flush with adjoining mounting base surfaces. If these surfaces are not flush, stop installation and contact the local sales office for factory authorized service.

   NOTE: If you are upgrading from a MicroLogic 2.0, 3.0 or 5.0 trip unit, the connector block must be ordered separately (Part Number S33101). See instructions shipped with the connector block for installation into circuit breaker.

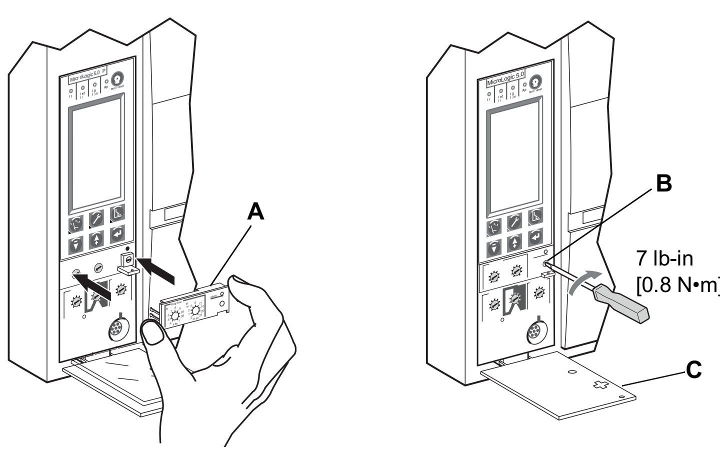
8. Install connector block (C) into top of trip unit.

Figure 95 - Secure Trip Unit



9. Install adjustable rating plug into the trip unit.
   a. Open switch cover (A) on new trip unit.
   b. Inspect mounting area for debris and contamination.
   c. Gently push adjustable rating plug (B) into new trip unit.
   d. Tighten adjustable rating plug mounting screw (C). The plug will be drawn into position flush with front face as screw is tightened.
10. Set trip unit switches and advanced protection settings to values recorded above or per coordination study results.
11. Close switch cover (A).

Figure 96 - Install Adjustable Rating Plug



Circuit Breaker Accessory Cover Replacement

Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Trip Unit Installation Check

Secondary Injection Testing

Field installation of a trip unit requires secondary injection testing with an appropriate test kit. This will ensure that the newly-installed trip unit is functioning properly. The test will require opening and closing the circuit breaker. Follow the procedures outlined in the instruction bulletins shipped with the circuit breaker and the test kit.

1. Make sure the circuit breaker is isolated from all upstream and downstream devices.
2. Perform secondary injection testing as outlined in the instruction bulletin shipped with the test kit. Verify that all applicable trip unit functions are operating properly.
3. If any test fails, do not put the circuit breaker into service and contact the local sales office for factory authorization service.

Primary Injection Testing

Primary injection testing is recommended to ensure that all trip system connections have been correctly made. Perform primary injection testing per the instructions in the *Field Testing and Maintenance Guide*, bulletin 48049-900-xx, where xx is 02 or higher.

Check Accessory Operation

1. Installed accessories – Validate the proper operation of all installed accessories. See the corresponding accessory instruction bulletins for operational testing procedures.
2. Programmable contact module – If circuit breaker has an M2C or M6C programmable contact module installed, validate its proper operation. See the corresponding accessory instruction bulletins for operational testing procedures.
3. Zone selective interlocking – If the circuit breaker is part of a ZSI system, follow the zone selectiveinterlocking test procedures as outlined in the appropriate test kit instruction bulletin.
4. Communications – If communication modules exist, confirm circuit breaker has re-established communications with the supervisor.

Trip Unit Setup

1. If an auxiliary power supply is being used for the MicroLogic trip unit, reconnect the auxiliary power supply.
2. Reset the trip unit switches and advanced protection settings to original values, as recorded at the beginning of this section.

Circuit Breaker Reconnection

Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Adjustable Rating Plug Replacement

NOTE: To select correct replacement rating plug, see the product catalog.

NOTE: Adjustable rating plug must be removed when doing hi-pot testing. Adjustable rating plug must be installed for voltage measurement. If adjustable rating plug is removed, the circuit breaker will default to a long-time pickup rating of 0.4 x sensor size (In) and a long-time delay of whatever setting was selected before the rating plug was removed.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

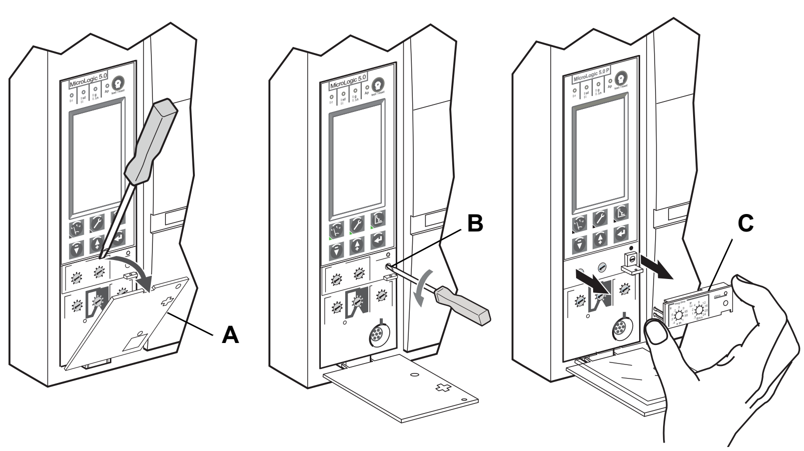
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, NOM 029-STPS or local equivalent.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

Failure to follow these instructions will result in death or serious injury.

Remove Rating Plug

1. Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.
2. Open switch cover (A).
3. Record switch settings in Appendix E (switch settings and those set with graphic screen, if applicable).
4. Unscrew plug mounting screw (B).
5. Remove adjustable rating plug (C).

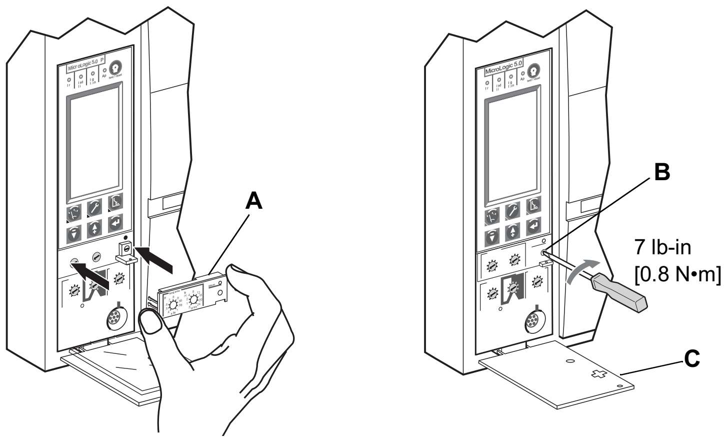
Figure 97 - Remove Adjustable Rating Plug



Install New Rating Plug

1. Inspect mounting area for debris and contamination.
2. Gently push in new rating plug (A).
3. Tighten adjustable rating plug mounting screw (B).
4. Set trip unit settings to values recorded in Appendix E or per coordination study results.
5. Close switch cover (C).

Figure 98 - Install New Adjustable Rating Plug



Battery Replacement

Circuit Breaker Disconnection

Disconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Accessory Cover Removal

Remove circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, CSA Z462, NOM 029-STPS or local equivalent.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment. Follow instructions shipped with circuit breaker to disconnect and reconnect circuit breaker.
- Replace all devices, doors and covers before returning equipment to service.

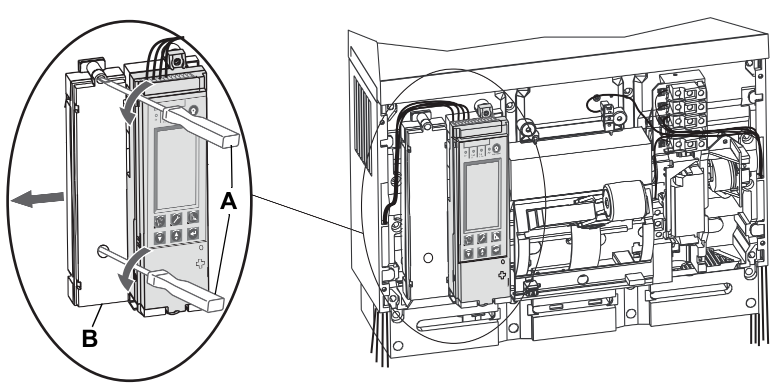
Failure to follow these instructions will result in death or serious injury.

Withstand Module Shifting

NOTE: R-frame and NS1600b–NS3200 circuit breakers only.

Loosen screws (A) securing withstand module (B). Swing module to side to access trip unit battery cover. Do not remove withstand module connector.

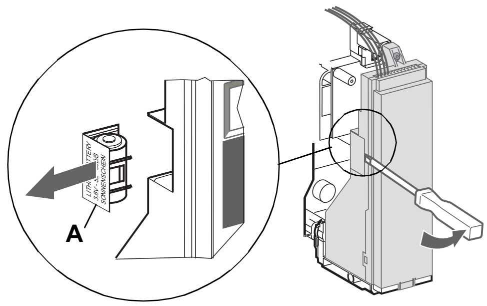
Figure 99 - Shift Withstand Module



Battery Replacement

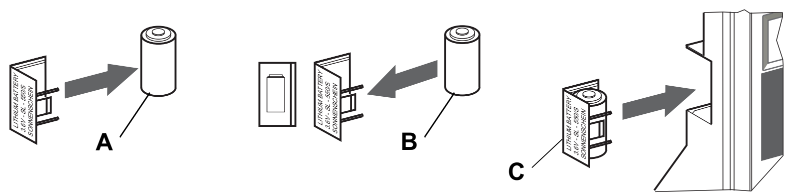
1. Insert small screwdriver blade into battery housing cover notch and rotate to slide battery housing cover (A) out of trip unit.

Figure 100 - Remove Battery Cover



2. Remove battery (A).
3. Insert new battery (B). Make sure that the polarity is correct.
4. Replace battery housing cover (C).

Figure 101 - Replace Battery

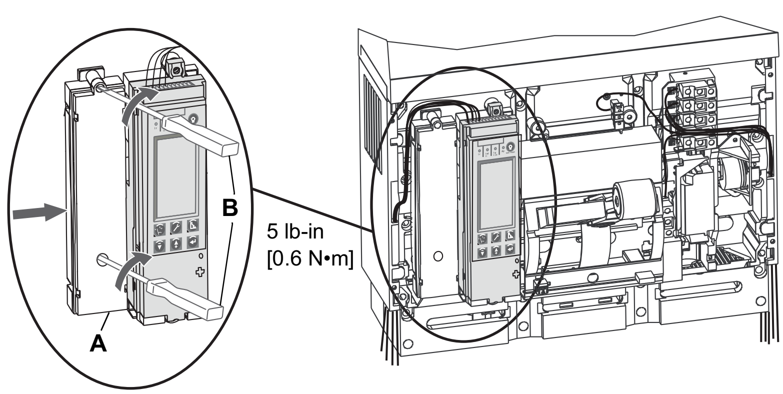


Withstand Module Replacement

NOTE: R-frame and NS1600b–NS3200 circuit breakers only.

Replace withstand module (A). Tighten screws (B) securing withstand module.

Figure 102 - Replace Withstand Module



Accessory Cover Replacement

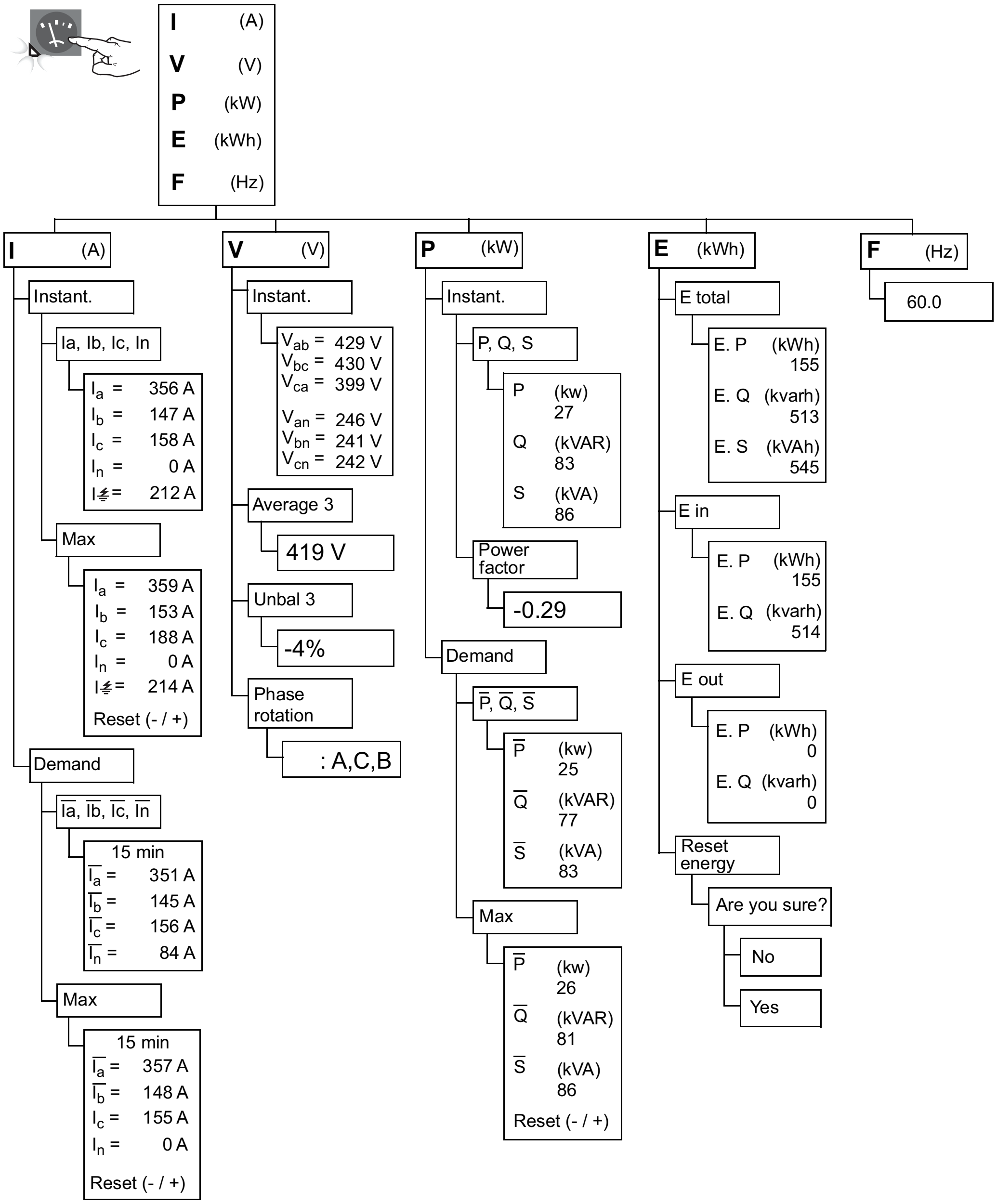
Replace circuit breaker accessory cover as directed in the Install Accessories section of the circuit breaker instruction bulletin shipped with the circuit breaker.

Circuit Breaker Reconnection

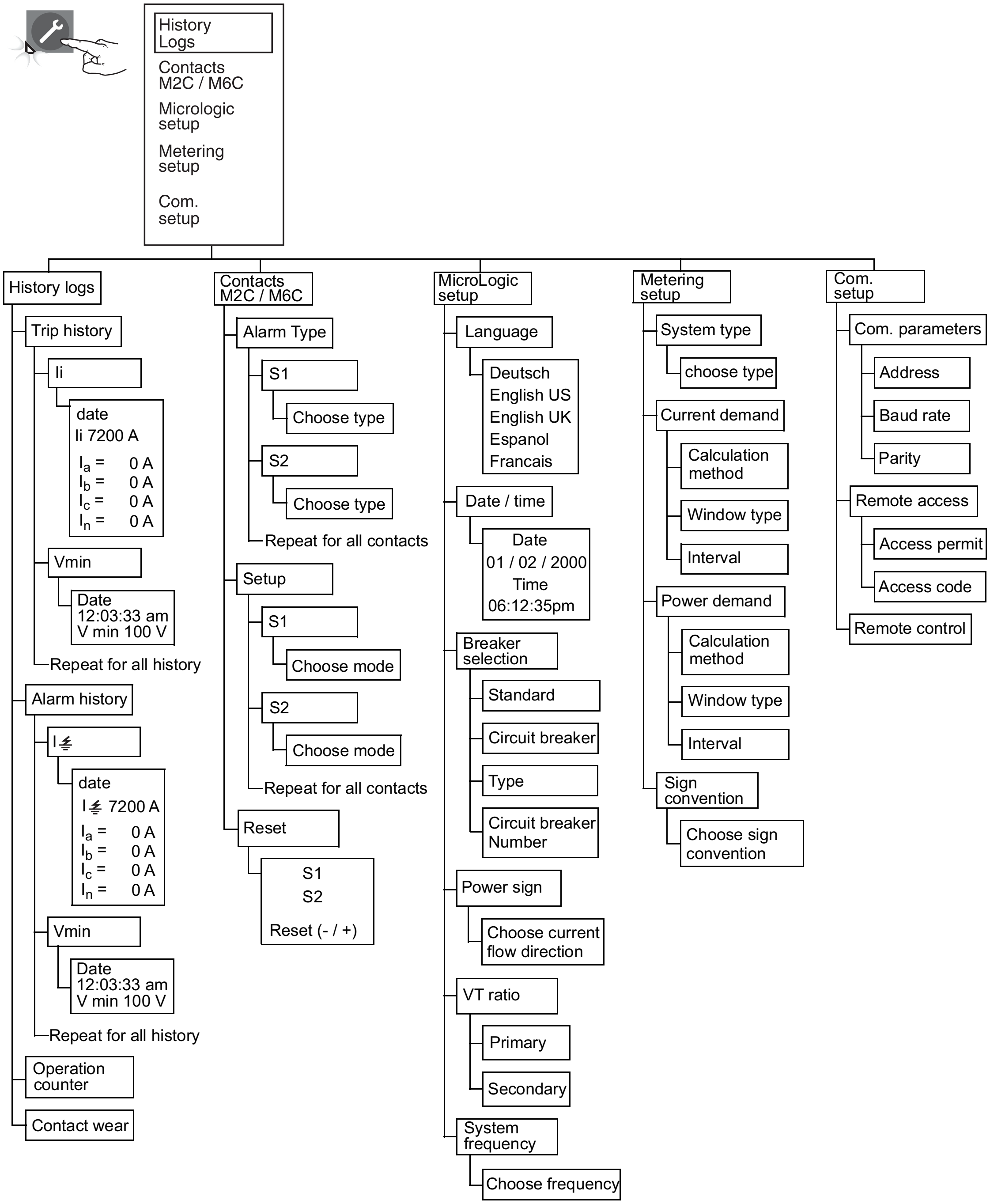
Reconnect circuit breaker as directed in the circuit breaker instruction bulletin shipped with the circuit breaker.

Appendix A—Graphic Display Flowcharts

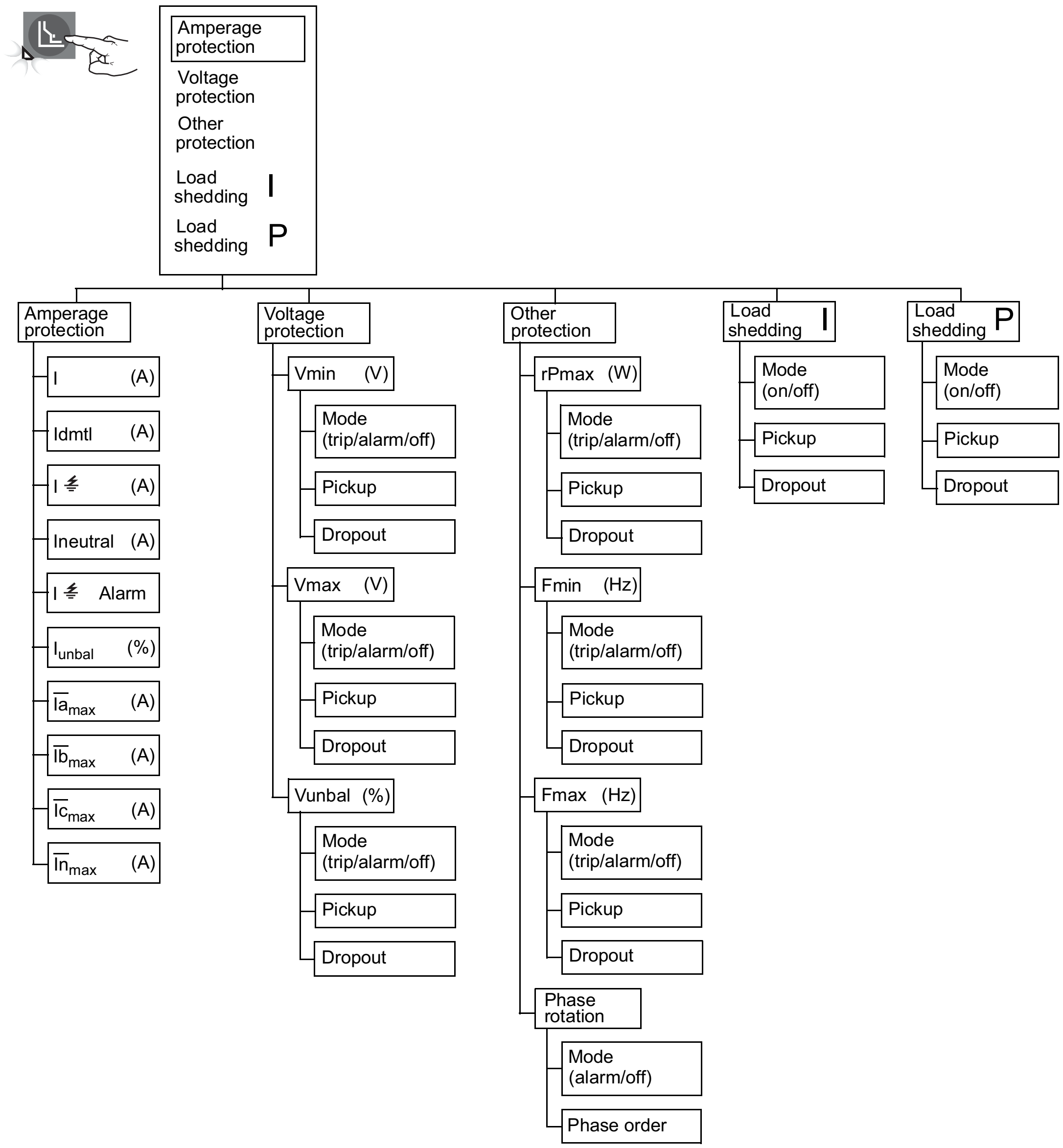
Metering Menu Flowchart



Maintenance Menu Flowchart



Protection Menu Flowchart



Appendix B—Default Settings and Tolerances

Default Settings

Table 12 - Default Settings—Switches

Description	Symbol	Default Value
Long-time pickup	Ir	Maximum
Long-time delay	tr	Minimum
Short-time pickup	Isd	Minimum
Short-time delay	tsd	Minimum
Ground-fault pickup	Ig	Minimum
Ground-fault delay	tg	Minimum
Instantaneous	Ii	Minimum

Table 13 - Default Settings—Maintenance

Submenu	Description	Line Item	Default Value	Setting Range
M2C/M6C contacts	Alarm type	S#	Not selected	Not selected, Isd, Ir, Iunbal (See Trip Unit Alarms, page 22)
	Setup	S#	Latching	Latching contact, time delay, non-latching contact, Locked 0, Locked 1
MicroLogic setup	Language	—	English US	Deutsch, English US, English UK, Espanol, Francais
	Date/Time	—	—	—
	Breaker selection	Standard	NA	Not def, ANSI, IEC, UL, IEC/GB
		Circuit breaker	NA	—
		Type	NA	—
		Circuit breaker number	0	0000–FFFF
	Power sign	—	P+	P+, P-
	VT ratio	Primary	690	000–690
		Secondary	690	000–690
	System frequency	—	50-60 Hz	50-60 Hz, 400 Hz
Metering setup	System type	—	3Φ 4 w 4 CT	3Φ 4w 4CT, 3Φ 4w 3CT, 3Φ 3w 3CT
	Current demand	Interval	15 min.	5–60 min
	Power demand	Window type	Sliding	Sliding, block
		Interval	15 min.	5–60 min
	Sign convention	—	IEEE	IEEE, IEEE alt, IEC
Com setup	Com parameter	—	—	—
	Remote access	—	No	Yes, no
	Remote control	—	Auto	Auto, manual

Table 14 - Default Settings—Protection

Submenu	Description	Symbol	Line Item	Default Value	Setting Range	Tolerance
Amperage protection	Long-time pickup	Ir	—	Maximum	—	±10%
	Long-time delay	tr	—	Minimum	—	-20%, +0%
	Short-time pickup	Isd	—	Minimum	—	±10%
	Short-time delay	tsd	—	Minimum	—	
	Instantaneous	Ii	—	Minimum	—	±10%
	Ground-fault alarm (5.0P trip unit)	I⏚	No protection	—	—	—
	Ground-fault (6.0P trip unit)	I⏚	Mode	Trip	Trip	—
			Pickup	Switch setting	In £ 400 A: 30%–100% In 400 < In £ 1200 A: 20%–100% In 1200 A < In: 500 A–1200 A	±10%
			Pickup delay	Switch setting	1–40 sec.	-20%, +0%
	Neutral current	Ineutral	—	Off	Off, N/2, N, 1.6N	—
	Ground-fault alarm	I⏚ alarm	Mode	Off	Alarm, off	—
			Pickup	1200 A	20 x In–1200 A	±15%
			Pickup delay	10.0 sec.	1.0–10.0 sec.	-20%, +0%
			Dropout	1200 A	20 A–pickup	±15%
			Dropout delay	1.0 sec.	1.0–10.0 sec.	-20%, +0%
	Current unbalance	Iunbal	Mode	Off	Alarm, trip, off	—
			Pickup %	60%	5–60%	-10%, +0%
			Pickup delay	40 sec.	1–40 sec.	-20%, +0%
			Dropout %	Iunbal pickup %	5%–pickup %	-10%, +0%
			Dropout delay	10 sec.	10–360 sec.	-20%, +0%
	Max. phase A demand current	$\overline{Ia}$ max	Mode	Off	Alarm, trip, off	—
			Pickup	In	0.2 x In– In	±6.6%
			Pickup delay	1500 sec.	15–1500 sec.	-20%, +0%
			Dropout	Iamax pickup	0.2 x In–pickup	±6.6%
			Dropout delay	15 sec.	15–3000 sec.	-20%, +0%
	Max. phase B demand current	$\overline{Ib}$ max	Mode	Off	Alarm, trip, off	—
			Pickup	In	0.2 x In–In	±6.6%
			Pickup delay	1500 sec.	15–1500 sec.	-20%, +0%
			Dropout	Ibmax Pickup	0.2 x In–pickup	±6.6%
			Dropout delay	15 sec.	15–3000 sec.	-20%, +0%
	Max. phase C demand current	$\overline{Ic}$ max	Mode	Off	Alarm, trip, off	—
			Pickup	In	0.2 x In–In	±6.6%
			Pickup delay	1500 sec.	15–1500 sec.	-20%, +0%

Table 14 - Default Settings—Protection (Continued)

Submenu	Description	Symbol	Line Item	Default Value	Setting Range	Tolerance
			Dropout	Icmax pickup	0.2 x In–pickup	±6.6%
			Dropout delay	15 sec.	15–3000 sec.	-20%, +0%
	Max. neutral demand current	$\overline{In}$ max	Mode	Off	Alarm, trip, off	—
			Pickup	In	0.2 x In–In	±6.6%
			Pickup delay	1500 sec.	15–1500 sec.	-20%, +0%
			Dropout	Inmax pickup	0.2 x In–pickup	±6.6%
			Dropout delay	15 sec.	15–3000 sec.	-20%, +0%
Voltage protection	Minimum (under) voltage	Vmin	Mode	Off	Alarm, trip, off	—
			Pickup	100 V	100 V–Vmax pickup	-5%, +0%
			Pickup delay	5 sec.	1.2–5 sec.	-0%, +20%
			Dropout	Vmin pickup	Vmin pickup–1200 A	-5%, +0%
			Dropout delay	1.2 sec.	1.2–36 sec.	-0%, +20%
	Maximum (over) voltage	Vmax	Mode	Off	Alarm, trip, off	—
			Pickup	725 V	Vmin–1200 A	-0%, +5%
			Pickup delay	5 sec.	1.2–5 sec.	-0%, +20%
			Dropout	Vmax pickup	100–Vmax pickup	-0%, +5%
			Dropout delay	1.2 sec.	1.2–36 sec.	-0%, +20%
	Voltage unbalance	Vunbal	Mode	Off	Alarm, trip, off	—
			Pickup	20%	2–20%[12]	-10%, +0%
			Pickup delay	40 sec.	1–40 sec.	-20%, +0%
			Dropout	Vunbal pickup	2%–Vunbal pickup	-10%, +0%
			Dropout delay	10 sec.	10–360 sec.	-20%, +0%
Other protection	Reverse power	rP	Mode	Off	Alarm, trip, off	—
			Pickup	500 kW	5–500kW	± 2.5%
			Pickup delay	20 sec.	0.2–20 sec.	-0%, +20%
			Dropout	rP pickup	5kW–rP pickup	± 2.5%
			Dropout delay	1 sec.	1–360 sec.	-0%, +20%
	Minimum (under) frequency	Fmin	Mode	Off	Alarm, trip, off	—
			Pickup	45 Hz	45 Hz–Fmax pickup	± 0.5 Hz
			Pickup delay	5 sec.	0.2–5 sec.	-0%, +20%
			Dropout	Fmin pickup	Fmin Pickup–440 Hz	± 0.5 Hz
			Dropout delay	1 sec.	1–36 sec.	-0%, +20%
	Maximum (over) frequency	Fmax	Mode	Off	Alarm, trip, off	—
			Pickup	65 Hz	Fmin Pickup–440 Hz	± 0.5 Hz
			Pickup delay	5 sec.	0.2–5 sec.	-0%, +20%
			Dropout	Fmax pickup	45 Hz–Fmax pickup	± 0.5 Hz
			Dropout delay	1 sec.	1–36 sec.	-0%, +20%

12. Do not adjust above 20%.

Table 14 - Default Settings—Protection (Continued)

Submenu	Description	Symbol	Line Item	Default Value	Setting Range	Tolerance
Phase rotation	Phase rotation	—	Sequence	Phase A, phase C, phase B direction	Phase A, phase B, phase C direction or phase A, phase C, phase B direction	—
			Mode	Off	Off, alarm	—
Load shedding I	Load shedding I	—	Mode	Off	Off, on	—
			Pickup %	100% Ir	50% Ir–100% Ir	±6%
			Pickup delay %	80% tr	20–80% tr	-20%, +0%
			Dropout %	Load shedding I pickup	30%–Load shedding I pickup %	±6%
			Dropout delay	10 sec.	10–600 sec.	-20%, +0%
Load shedding P	Load shedding P	—	Mode	Off	Off, On	—
			Pickup	10,000 kW	200–10,000 kW	± 2.5%
			Pickup delay	3600 sec.	10–3600 sec.	-20%, +0%
			Dropout	Load shedding P pickup	100 kW–Load shedding P pickup %	± 2.5%
			Dropout delay	10 sec.	10–3600 sec.	-20%, +0%

Metering Range and Accuracy

Table 15 - Metering Range and Accuracy

Item	Description	Symbol	Range	Tolerance
Instantaneous Current	Instantaneous current in A phase	Ia	0–32 kA	±1.5%
	Instantaneous current in B phase	Ib	0–32 kA	±1.5%
	Instantaneous current in C phase	Ic	0–32 kA	±1.5%
	Instantaneous current in neutral	In	0–32 kA	±1.5%
	Instantaneous current in ground	I⏚	0–32 kA	±1.5%
	Max. instantaneous current in A phase	$I_a$max	0–32 kA	±1.5%
	Max. instantaneous current in B phase	$I_b$max	0–32 kA	±1.5%
	Max. instantaneous current in C phase	$I_c$max	0–32 kA	±1.5%
	Max. instantaneous current in neutral	$I_n$max	0–32 kA	±1.5%
	Max. instantaneous current in ground	I⏚max	0–32 kA	±1.5%
Demand Current	Demand current in A phase	$\overline{Ia}$	0–32 kA	±1.5%
	Demand current in B phase	$\overline{Ib}$	0–32 kA	±1.5%
	Demand current in C phase	$\overline{Ic}$	0–32 kA	±1.5%
	Demand current in neutral	$\overline{In}$	0–32 kA	±1.5%
	Max. demand current in A phase	$\overline{Ia}$ max	0–32 kA	±1.5%
	Max. demand current in B phase	$\overline{Ib}$ max	0–32 kA	±1.5%
	Max. demand current in C phase	$\overline{Ic}$ max	0–32 kA	±1.5%
	Max. demand current in neutral	$\overline{In}$ max	0–32 kA	±1.5%
Voltage	Phase-to-phase instantaneous voltage between A and B phase	V_{ab}	0–1200 V	±0.5%
	Phase-to-phase instantaneous voltage between B and C phase	V_{bc}	0–1200 V	±0.5%
	Phase-to-phase instantaneous voltage between C and A phase	V_{ca}	0–1200 V	±0.5%
	Phase-to-phase instantaneous voltage between A and neutral phase	V_{an}	0–1200 V	±0.5%
	Phase-to-phase instantaneous voltage between B and neutral phase	V_{bn}	0–1200 V	±0.5%
	Phase-to-phase instantaneous voltage between C and neutral phase	V_{cn}	0–1200 V	±0.5%
	Average phase-to-phase voltage	V avg 3Φ	0–1200 V	±0.5%
	Voltage unbalance	V unbal 3Φ	0–100 V	±0.5%
Instantaneous Power	Instantaneous active power	P	0–32 MW	±2%
	Instantaneous reactive power	Q	0–32 Mvar	±2%
	Instantaneous apparent power	S	0–32 MVA	±2%

Table 15 - Metering Range and Accuracy (Continued)

Item	Description	Symbol	Range	Tolerance
Power Factor	Power factor	PF	-1–1	±0.01%
Demand Power	Active demand power	P	0–32 MW	±2%
	Reactive demand power	Q	0–32 Mvar	±2%
	Apparent demand power	S	0–32 MVA	±2%
	Max. active demand power since last reset	$\overline{P}max$	0–32 MW	±2%
	Max. reactive demand power since last reset	$\overline{Q}max$	0–32 Mvar	±2%
	Max. apparent demand power since last reset	$\overline{S}max$	0–32 MVA	±2%
Energy Total	Total active power	E. P	-10^{10}–10^{10} Kwh	±2%
	Total reactive power	E. Q	-10^{10}–10^{10} Kvarh	±2%
	Total apparent power	E. S	-10^{10}–10^{10} KVAh	±2%
Energy In	Total active power in	E. P	-10^{10} –10^{10} Kwh	±2%
	Total reactive power in	E. Q	-10^{10}–10^{10} Kvarh	±2%
Energy Out	Total active power out	E. P	-10^{10}–10^{10} Kwh	±2%
	Total reactive power out	E. Q	-10^{10}–10^{10} Kvarh	±2%
Frequency	System frequency	F	45–440 Hz	±0.1 Hz

Appendix C—Network/Com Access

Remotely Readable Values

The communication option can be used to remotely access the MicroLogic trip unit, using System Manager Software (SMS) (version 3.3 or later) or other network system management software. See the product catalog for more information on the SMS software.

Table 16 - Remotely Readable Values

Item	Description	Symbol
Current	Instantaneous current in A phase	I_a
	Instantaneous current in B phase	I_b
	Instantaneous current in C phase	I_c
	Instantaneous current in neutral	I_n
	Instantaneous current in ground	I⏚
	Average instantaneous current in A phase	$I_a$avg
	Average instantaneous current in B phase	$I_b$avg
	Average instantaneous current in C phase	$I_c$avg
	Average instantaneous current in neutral	$I_n$avg
	Average instantaneous current in ground	I⏚avg
	Maximum instantaneous current in A phase	$I_a$max
	Maximum instantaneous current in B phase	$I_b$max
	Maximum instantaneous current in C phase	$I_c$max
	Maximum instantaneous current in neutral	$I_n$max
	Maximum instantaneous current in ground	I⏚max
	Instantaneous current unbalance in A phase	$I_a$unbal
	Instantaneous current unbalance in B phase	$I_b$unbal
	Instantaneous current unbalance in C phase	$I_c$unbal
	Instantaneous current unbalance in neutral	$I_n$unbal
	Instantaneous current unbalance in ground	I⏚unbal
	Max. instantaneous current unbalance in A phase	$I_a$unbal max
	Max. instantaneous current unbalance in B phase	$I_b$unbal max
	Max. instantaneous current unbalance in C phase	$I_c$unbal max
	Max. instantaneous current unbalance in neutral	$I_n$unbal max
	Max. instantaneous current unbalance in ground	I⏚unbalmax

Table 16 - Remotely Readable Values (Continued)

Item	Description	Symbol
Demand Currents	Demand current in A phase	I_a
	Demand current in B phase	I_b
	Demand current in C phase	I_c
	Demand current in neutral	I_n
	Max. demand current since last reset in A phase	$I_a$max
	Max. demand current since last reset in B phase	$I_b$max
	Max. demand current since last reset in C phase	$I_c$max
	Max. demand current since last reset in neutral	$I_n$max
	Recommended demand current in A phase	
	Recommended demand current in B phase	
	Recommended demand current in C phase	
	Recommended demand current in neutral	
	Time stamping of demand current max.	
Voltage	Instantaneous voltage between A and B phase	V inst V_{ab}
	Instantaneous voltage between B and C phase	V inst V_{bc}
	Instantaneous voltage between C and A phase	V inst V_{ca}
	Instantaneous voltage between A and neutral phase	V inst V_{an}
	Instantaneous voltage between B and neutral phase	V inst V_{bn}
	Instantaneous voltage between C and neutral phase	V inst V_{cn}
	Average phase-to-phase voltage between A and B phase	V avg V_{ab}
	Average phase-to-phase voltage between B and C phase	V avg V_{bc}
	Average phase-to-phase voltage between C and A phase	V avg V_{ca}
	Average phase-to-phase voltage between A phase and neutral	V avg V_{an}
	Average phase-to-phase voltage between B phase and neutral	V avg V_{bn}
	Average phase-to-phase voltage between C phase and neutral	V avg V_{cn}
	Voltage unbalance between V_{ab} and mean	V unbal V_{ab}
	Voltage unbalance between V_{bc} and mean	V unbal V_{bc}
	Voltage unbalance between V_{ca} and mean	V unbal V_{ca}
	Voltage unbalance between V_{an} and mean	V unbal V_{an}
	Voltage unbalance between V_{bn} and mean	V unbal V_{bn}
	Voltage unbalance between V_{cn} and mean	V unbal V_{cn}
	Max. voltage unbalance between V_{ab} and mean	
	Max. voltage unbalance between V_{bc} and mean	
	Max. voltage unbalance between V_{ca} and mean	
	Max. voltage unbalance between V_{an} and mean	
	Max. voltage unbalance between V_{bn} and mean	
	Max. voltage unbalance between V_{cn} and mean	
Active Power	Instantaneous active power per phase	P

Table 16 - Remotely Readable Values (Continued)

Item	Description	Symbol
Demand Power	Active demand power	P
	Reactive demand power	Q
	Apparent demand power	S
	Max. active demand power since last reset	$\overline{P}max$
	Max. reactive demand power since last reset	$\overline{Q}max$
	Max. apparent demand power since last reset	$\overline{S}max$
	Max. predicted active demand power	
	Max. predicted reactive demand power	
	Max. predicted apparent demand power	
	Time stamping of demand power max.	
Energy	Total active energy	E
	Active energy in	
	Active energy out	
Fault values	Fault type	
	Interrupted current values	
Frequency	System frequency	F
Update dates	Interval between last update of real-time values and the current table	
	Update date of demand currents, demand power and energy	
History	Trip history	
	Alarm history	
	Event history	
Counters	Contact wear	
	Operation counter since last reset	
	Date/time of last operation counter reset	
	Operation counter total (lifetime)	

Table 16 - Remotely Readable Values (Continued)

Item	Description	Symbol
Setup	Setting of date and time	
	Password	
	Trip unit ID code	
	Trip unit ID name	
	Measurement calculation algorithm	
	Sign convention	
	Total-energy measurement mode	
	Scale factors	
	Demand-current calculation window interval	
	Power quality indication	
	Demand-power calculation mode	
	Demand-power calculation window interval	
	Battery-charge indication	
	Programmable contact assignments	
	Programmable contact setup	
	Waveform capture	
Protection	Circuit breaker rated current	
	Type of neutral protection	
	Long-time protection settings	
	Short-time protection settings	
	Instantanaeous protection settings	
	Ground-fault protection settings	
	Current-unbalance protection settings	
	I⏚ alarm settings	
	Maximum-current protection settings	
	Voltage protection settings	
	Other protective functions settings	

List of Registers

The quantities are listed in alphabetical order according to the SMS topic name.

NOTE: A system scan rate of 500 ms or greater is recommended to minimize communications timeout issues.

To access available registers, the following address scheme applies

Module	Module Name	Equation	Address Range
BCM	Circuit Breaker Communication Module	—	1–47
CCM	Cradle Communication Module	BCM + 50	51–97
PM	Protection Module (Internal to trip unit)	BCM + 100	101–147
MM	Meter Module (Internal to trip unit)	BCM + 200	201–247

Table 17 - List of Registers

SMS Topic Name	User Description	Number of Registers[13]	Register[13]	Module[13]	Units[13]	Scale[13]
810D_LDPU	Breaker LDPU in Progress	1	8862	PM		Scaling N/A
810DBrkrStatus	Breaker Status	1	661	BCM		Bit 0; ON = closed; OFF = open
810DBrkrTripStat	Breaker Trip Unit Status	1	661	BCM		Bit 2; ON = tripped; OFF = not tripped
BCM_SN	BCM Serial Number	4	516	BCM		ASCII text
BkrPos	Breaker Position	1	661	CCM		Bit 8 = disconnected Bit 9 = connected Bit 10 = test position
CFVAB	Crest Factor Voltage A-B	1	1119	MM	No Units	Hundredths
CFVAN	Crest Factor Voltage A-N	1	1122	MM	No Units	Hundredths
CFVBC	Crest Factor Voltage B-C	1	1120	MM	No Units	Hundredths
CFVBN	Crest Factor Voltage B-N	1	1123	MM	No Units	Hundredths
CFVCA	Crest Factor Voltage C-A	1	1121	MM	No Units	Hundredths
CFVCN	Crest Factor Voltage C-N	1	1124	MM	No Units	Hundredths
DT_3Regs	Device Clock Date/Time	4	679	BCM		3-register date/time format[14]
DTLastTrip	D/T of Last Trip	3	693	BCM		3-register date/time format[14]
DTPkIAD	D/T Peak Demand Current A	3	3005	MM		3-register date/time format[14]
DTPkIBD	D/T Peak Demand Current B	3	3008	MM		3-register date/time format[14]
DTPkICD	D/T Peak Demand Current C	3	3011	MM		3-register date/time format[14]
DTPkIND	D/T Peak Demand Current N	3	3014	MM		3-register date/time format[14]
DTPkKFDA	D/T K-Factor Dmd Peak A	3	3041	MM	No Units	3-register date/time format[14]
DTPkKFDB	D/T K-Factor Dmd Peak B	3	3044	MM	No Units	3-register date/time format[14]
DTPkKFDC	D/T K-Factor Dmd Peak C	3	3047	MM	No Units	3-register date/time format[14]

13. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
14. 3-register date/time format: register 1: month (byte 1) = 1–12; day (byte 2) = 1–31; register 2: year (byte 1) = 0–199 (add to 1900 to determine the actual year); hour (byte 2) = 0–23; register 3: minutes (byte 1) = 0–59; seconds (byte 2) = 0–59 **Note:** Bits 14 and 15 of the month/day register must be masked.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis- ters[15]	Regis- ter[15]	Module[15]	Units[15]	Scale[15]
DTPkKFDN	D/T K-Factor Dmd Peak N	3	3050	MM	No Units	3-register date/time format[16]
DTPkkVAD	D/T Peak Demand Apparent Power	3	3023	MM		3-register date/time format[16]
DTPkkVARD	D/T Peak Demand Reactive Power	3	3020	MM		3-register date/time format[16]
DTPkkWD	D/T Peak Demand Active Power	3	3017	MM		3-register date/time format[16]
DTResetEnergy	D/T Last Reset Accum. Energies	3	3038	MM		3-register date/time format[16]
DTResetMinMax	D/T Last Reset Min/Max	3	3032	MM		3-register date/time format[16]
DTResetPkID	D/T Last Reset Peak Dmd Currents	3	3026	MM		3-register date/time format[16]
DTResetPkkWD	D/T Last Reset Peak Dmd Power	3	3029	MM		3-register date/time format[16]
EnableCloseBkr	Remote Closing Enabled	1	669	BCM		Bit 2; ON = enabled, OFF = not enabled
EnableOpenBkr	Remote Opening Enabled	1	669	BCM		Bit 1; ON = enabled; OFF = not enabled
EnableRemCtrl	Remote Control Enabled	1	669	BCM		Bit 3; ON = auto (enabled); OFF = manual (not enabled)
fkVAA	Fundamental Apparent Power A	1	1084	MM	kVA	Scale E
fkVAB	Fundamental Apparent Power B	1	1085	MM	kVA	Scale E
fkVAC	Fundamental Apparent Power C	1	1086	MM	kVA	Scale E
fkVATtl	Fundamental Apparent Power Total	1	1087	MM	kVA	Scale E
fVAngA	Fundamental Voltage Ang A-B/A-N	1	1133	MM	Deg	Tenths
fVAngB	Fundamental Voltage Ang B-C/B-N	1	1134	MM	Deg	Tenths
fVAngC	Fundamental Voltage Ang C-A/C-N	1	1135	MM	Deg	Tenths
GFAlarmStatus	GF Alarm Status	1	8860	PM		Bit 0; ON = active; OFF = inactive
GFPreAlarmStatus	GF Alarm Pre-Alarm Status	1	8864	PM		Bit 0; ON = active; OFF = inactive
Hz	Frequency	1	1054	MM	Hz	Scale F
IA	Current A	1	1016	MM	A	Scale A - Phase Current
IA_PCT	Current A % Load	1	8837	PM	%	Unity
IAD	Demand Current A	1	2200	MM	A	Scale A
IAppA	Current Apparent A	1	1023	MM	A	Scale A
IAppB	Current Apparent B	1	1024	MM	A	Scale A
IAppC	Current Apparent C	1	1025	MM	A	Scale A

15. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
16. 3-register date/time format: register 1: month (byte 1) = 1–12; day (byte 2) = 1–31; register 2: year (byte 1) = 0–199 (add to 1900 to determine the actual year); hour (byte 2) = 0–23; register 3: minutes (byte 1) = 0–59; seconds (byte 2) = 0–59 **Note:** Bits 14 and 15 of the month/day register must be masked.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Registers[17]	Register[17]	Module[17]	Units[17]	Scale[17]
IAppN	Current Apparent N	1	1026	MM	A	Scale B
IAvg	Current Avg	1	1027	MM	A	Scale A - Phase Current
IB	Current B	1	1017	MM	A	Scale A - Phase Current
IB_PCT	Current B % Load	1	8838	PM	%	Unity
IBD	Demand Current B	1	2201	MM	A	Scale A
IC	Current C	1	1018	MM	A	Scale A - Phase Current
IC_PCT	Current C % Load	1	8839	PM	%	Unity
ICD	Demand Current C	1	2202	MM	A	Scale A
IDatPkKFD_A	Current Demand at Peak K-Factor Demand A	1	2270	MM	A	Scale A
IDatPkKFD_B	Current Demand at Peak K-Factor Demand B	1	2271	MM	A	Scale A
IDatPkKFD_C	Current Demand at Peak K-Factor Demand C	1	2272	MM	A	Scale A
IDatPkKFD_N	Current Demand at Peak K-Factor Demand N	1	2273	MM	A	Scale B
IG	Current G	1	1021	MM	A	Scale C
IG_PCT	Current G % Load	1	8841	PM	%	Unity
IG_PCT_VIGI	Current G (VIGI) % Load	1	8842	PM	%	Hundredths
IG_VIGI	Current G (VIGI)	1	8826	PM	A	Thousandths
IMax	Current Max Present	1	1020	MM	A	Scale A - Phase Current
IN	Current N	1	1019	MM	A	Scale B - Neutral Current
IN_PCT	Current N % Load	1	8840	PM	%	Unity
IND	Demand Current N	1	2203	MM	A	Scale B
IUnbalA	Current Unbalance A	1	1028	MM	%	Tenths
IUnbalAlrm	Current Unbalance Alarm Status	1	8859	PM		Bit 0; ON = active; OFF = inactive
IUnbalB	Current Unbalance B	1	1029	MM	%	Tenths
IUnbalC	Current Unbalance C	1	1030	MM	%	Tenths
IUnbalPreAlrm	Current Unbalance Pre-Alarm Status	1	8863	PM		Bit 0; ON = active, OFF = inactive
IUnbalW	Current Unbalance Worst	1	1032	MM	%	Tenths
KFDatPkID_A	K-Factor Demand at Peak Demand Current A	1	2254	MM	No Units	Tenths
KFDatPkID_B	K-Factor Demand at Peak Demand Current B	1	2255	MM	No Units	Tenths
KFDatPkID_C	K-Factor Demand at Peak Demand Current C	1	2256	MM	No Units	Tenths
KFDatPkID_N	K-Factor Demand at Peak Demand Current N	1	2257	MM	No Units	Tenths
KFDN	K-Factor Demand N	1	2215	MM	No Units	Tenths
KFN	K-Factor N	1	1118	MM	No Units	Tenths

17. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[18]	Regis-ter[18]	Module[18]	Units[18]	Scale[18]
kVAA	Apparent Power A	1	1042	MM	kVA	Scale E
kVAB	Apparent Power B	1	1043	MM	kVA	Scale E
kVAC	Apparent Power C	1	1044	MM	kVA	Scale E
kVAD	Demand Apparent Power	1	2236	MM	kVA	Scale D
kVAD_PkkVARD	KVA Dmd Coincident w/ Peak KVAR Dmd	1	2235	MM	kVA	Scale D
kVAD_PkkWD	KVA Dmd Coincident w/ Peak KW Dmd	1	2229	MM	kVA	Scale D
kVAHr	Apparent Energy	4	2024	MM	kVAH	Unity
kVARA	Reactive Power A	1	1038	MM	kVAR	Scale E
kVARB	Reactive Power B	1	1039	MM	kVAR	Scale E
kVARC	Reactive Power C	1	1040	MM	kVAR	Scale E
kVARD	Demand Reactive Power	1	2230	MM	kVAR	Scale D
kVARD_PkkVAD	KVAR Dmd Coincident w/ Peak KVA Dmd	1	2241	MM	kVAR	Scale D
kVARD_PkkWD	KVAR Dmd Coincident w/ Peak KW Dmd	1	2228	MM	kVAR	Scale D
kVARHr	Reactive Energy	4	2004	MM	kVARH	Unity
kVARHr_I	Reactive Energy Into the Load	4	2016	MM	kVARH	Unity
kVARHr_O	Reactive Energy Out of the Load	4	2020	MM	kVARH	Unity
kVARTtl	Reactive Power Total	1	1041	MM	kVAR	Scale E
kVATtl	Apparent Power Total	1	1045	MM	kVA	Scale E
kWA	Active Power A	1	1034	MM	kW	Scale E
kWB	Active Power B	1	1035	MM	kW	Scale E
kWC	Active Power C	1	1036	MM	kW	Scale E
kWD	Demand Active Power	1	2224	MM	kW	Scale D
kWD_PkkVAD	KW Dmd Coincident w/ Peak KVA Dmd	1	2240	MM	kW	Scale D
kWD_PkkVARD	KW Dmd Coincident w/ Peak KVAR Dmd	1	2234	MM	kW	Scale D
kWHr	Real Energy	4	2000	MM	kWH	Unity
kWHr_I	Real Energy Into the Load	4	2008	MM	kWH	Unity
kWHr_O	Real Energy Out of the Load	4	2012	MM	kWH	Unity
kWTtl	Active Power Total	1	1037	MM	kW	Scale E
LDPUValue	Long Delay Pickup Value	2	8756	PM	A	Unity
LSCurrAlrm	Load Shed Current Alarm Status	1	8859	PM		Bit 13; ON = active; OFF = inactive
LSCurrPreAlrm	Load Shed Current Pre-Alarm Status	1	8863	PM		Bit 13; ON = active; OFF = inactive

18. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[19]	Regis-ter[19]	Module[19]	Units[19]	Scale[19]
LSPwrAlrm	Load Shed Power Alarm Status	1	8859	PM		Bit 14; ON = active; OFF = inactive
LSPwrPreAlrm	Load Shed Power Pre-Alarm Status	1	8863	PM		Bit 14; ON = active; OFF = inactive
M2C_M6CR1Status	Relay Module R1 Status	1	8857	PM		Bit 0; ON = on; OFF = off
M2C_M6CR2Status	Relay Module R2 Status	1	8857	PM		Bit 1; ON = on; OFF = off
M2C_M6CR3Status	Relay Module R3 Status	1	8857	PM		Bit 2; ON = on; OFF = off
M2C_M6CR4Status	Relay Module R4 Status	1	8857	PM		Bit 3; ON = on; OFF = off
M2C_M6CR5Status	Relay Module R5 Status	1	8857	PM		Bit 4; ON = on; OFF = off
M2C_M6CR6Status	Relay Module R6 Status	1	8857	PM		Bit 5; ON = on; OFF = off
MaxCFVAB	Maximum Crest Factor Voltage A-B	1	1719	MM	No Units	Hundredths
MaxCFVAN	Maximum Crest Factor Voltage A-N	1	1722	MM	No Units	Hundredths
MaxCFVBC	Maximum Crest Factor Voltage B-C	1	1720	MM	No Units	Hundredths
MaxCFVBN	Maximum Crest Factor Voltage B-N	1	1723	MM	No Units	Hundredths
MaxCFVCA	Maximum Crest Factor Voltage C-A	1	1721	MM	No Units	Hundredths
MaxCFVCN	Maximum Crest Factor Voltage C-N	1	1724	MM	No Units	Hundredths
MaxfkVAA	Maximum Fundamental Apparent Power A	1	1684	MM	kVA	Scale E
MaxfkVAB	Maximum Fundamental Apparent Power B	1	1685	MM	kVA	Scale E
MaxfkVAC	Maximum Fundamental Apparent Power C	1	1686	MM	kVA	Scale E
MaxfkVATtl	Maximum Fundamental Apparent Power Total	1	1687	MM	kVA	Scale E
MaxfVMagAB	Maximum Fundamental Voltage Mag A-B	1	1656	MM	V	Scale D
MaxfVMagAN	Maximum Fundamental Voltage Mag A-N	1	1659	MM	V	Scale D
MaxfVMagBC	Maximum Fundamental Voltage Mag B-C	1	1657	MM	V	Scale D
MaxfVMagBN	Maximum Fundamental Voltage Mag B-N	1	1660	MM	V	Scale D
MaxfVMagCA	Maximum Fundamental Voltage Mag C-A	1	1658	MM	V	Scale D
MaxfVMagCN	Maximum Fundamental Voltage Mag C-N	1	1661	MM	V	Scale D
MaxHz	Max Frequency	1	1654	MM	Hz	Scale F
MaxIA	Max Current A	1	1616	MM	A	Scale A - Phase Current

19. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[20]	Regis-ter[20]	Module[20]	Units[20]	Scale[20]
MaxIAppA	Maximum Current Apparent A	1	1623	MM	A	Scale A
MaxIAppB	Maximum Current Apparent B	1	1624	MM	A	Scale A
MaxIAppC	Maximum Current Apparent C	1	1625	MM	A	Scale A
MaxIAppN	Maximum Current Apparent N	1	1626	MM	A	Scale B
MaxIAvg	Max Current Avg	1	1627	MM	A	Scale A - Phase Current
MaxIB	Max Current B	1	1617	MM	A	Scale A - Phase Current
MaxIC	Max Current C	1	1618	MM	A	Scale A - Phase Current
MaxIG	Max Current G	1	1621	MM	A	Scale C
MaxIG_VIGI	Max Current G (VIGI)	1	8832	PM	A	Thousandths
MaxIN	Max Current N	1	1619	MM	A	Scale B - Neutral Current
MaxIUnbalA	Max Current Unbalance A	1	1628	MM	%	Tenths
MaxIUnbalB	Max Current Unbalance B	1	1629	MM	%	Tenths
MaxIUnbalC	Max Current Unbalance C	1	1630	MM	%	Tenths
MaxIUnbalW	Max Current Unbalance Worst	1	1632	MM	%	Tenths
MaxKFN	Maximum K-Factor N	1	1718	MM	No Units	Tenths
MaxkVAA	Max Apparent Power A	1	1642	MM	kVA	Scale E
MaxkVAB	Max Apparent Power B	1	1643	MM	kVA	Scale E
MaxkVAC	Max Apparent Power C	1	1644	MM	kVA	Scale E
MaxkVARA	Max Reactive Power A	1	1638	MM	kVAR	Scale E
MaxkVARB	Max Reactive Power B	1	1639	MM	kVAR	Scale E
MaxkVARC	Max Reactive Power C	1	1640	MM	kVAR	Scale E
MaxkVARTtl	Max Reactive Power Total	1	1641	MM	kVAR	Scale E
MaxkVATtl	Max Apparent Power Total	1	1645	MM	kVA	Scale E
MaxkWA	Max Active Power A	1	1634	MM	kW	Scale E
MaxkWB	Max Active Power B	1	1635	MM	kW	Scale E
MaxkWC	Max Active Power C	1	1636	MM	kW	Scale E
MaxkWTtl	Max Active Power Total	1	1637	MM	kW	Scale E
MaxPFA	Max Power Factor A	3	1646	MM		PF format[21]
MaxPFB	Max Power Factor B	3	1647	MM		PF format[21]
MaxPFC	Max Power Factor C	3	1648	MM		PF format[21]
MaxPFTtl	Max Power Factor Total	3	1649	MM		PF format[21]
MaxVAB	Max Voltage A-B	1	1600	MM	V	Scale D - Voltage
MaxVAN	Max Voltage A-N	1	1603	MM	V	Scale D - Voltage
MaxVBC	Max Voltage B-C	1	1601	MM	V	Scale D - Voltage

20. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
21. Power factor format: –1 to –999 for lagging power factors, 1000 for unity power factor 1.000, and 1 to 999 for leading power factors.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Registers[22]	Register[22]	Module[22]	Units[22]	Scale[22]
MaxVBN	Max Voltage B-N	1	1604	MM	V	Scale D - Voltage
MaxVCA	Max Voltage C-A	1	1602	MM	V	Scale D - Voltage
MaxVCN	Max Voltage C-N	1	1605	MM	V	Scale D - Voltage
MaxVLLAvg	Max Voltage L-L Avg	1	1606	MM	V	Scale D - Voltage
MaxVLNAvg	Max Voltage L-N Avg	1	1607	MM	V	Scale D - Voltage
MaxVUnbalAB	Max Voltage Unbalance A-B	1	1608	MM	%	Tenths
MaxVUnbalAN	Max Voltage Unbalance A-N	1	1611	MM	%	Tenths
MaxVUnbalBC	Max Voltage Unbalance B-C	1	1609	MM	%	Tenths
MaxVUnbalBN	Max Voltage Unbalance B-N	1	1612	MM	%	Tenths
MaxVUnbalCA	Max Voltage Unbalance C-A	1	1610	MM	%	Tenths
MaxVUnbalCN	Max Voltage Unbalance C-N	1	1613	MM	%	Tenths
MaxVUnbalLLW	Max Voltage Unbalance L-L Worst	1	1614	MM	%	Tenths
MaxVUnbalLNW	Max Voltage Unbalance L-N Worst	1	1615	MM	%	Tenths
MinCFVAB	Minimum Crest Factor Voltage A-B	1	1419	MM	No Units	Hundredths
MinCFVAN	Minimum Crest Factor Voltage A-N	1	1422	MM	No Units	Hundredths
MinCFVBC	Minimum Crest Factor Voltage B-C	1	1420	MM	No Units	Hundredths
MinCFVBN	Minimum Crest Factor Voltage B-N	1	1423	MM	No Units	Hundredths
MinCFVCA	Minimum Crest Factor Voltage C-A	1	1421	MM	No Units	Hundredths
MinCFVCN	Minimum Crest Factor Voltage C-N	1	1424	MM	No Units	Hundredths
MinfkVAA	Minimum Fundamental Apparent Power A	1	1384	MM	kVA	Scale E
MinfkVAB	Minimum Fundamental Apparent Power B	1	1385	MM	kVA	Scale E
MinfkVAC	Minimum Fundamental Apparent Power C	1	1386	MM	kVA	Scale E
MinfkVATtl	Minimum Fundamental Apparent Power Total	1	1387	MM	kVA	Scale E
MinfVMagAB	Minimum Fundamental Voltage Mag A-B	1	1356	MM	V	Scale D
MinfVMagAN	Minimum Fundamental Voltage Mag A-N	1	1359	MM	V	Scale D
MinfVMagBC	Minimum Fundamental Voltage Mag B-C	1	1357	MM	V	Scale D

22. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[23]	Regis-ter[23]	Module[23]	Units[23]	Scale[23]
MinfVMagBN	Minimum Fundamental Voltage Mag B-N	1	1360	MM	V	Scale D
MinfVMagCA	Minimum Fundamental Voltage Mag C-A	1	1358	MM	V	Scale D
MinfVMagCN	Minimum Fundamental Voltage Mag C-N	1	1361	MM	V	Scale D
MinHz	Min Frequency	1	1354	MM	Hz	Scale F
MinIA	Min Current A	1	1316	MM	A	Scale A - Phase Current
MinIAppA	Minimum Current Apparent A	1	1323	MM	A	Scale A
MinIAppB	Minimum Current Apparent B	1	1324	MM	A	Scale A
MinIAppC	Minimum Current Apparent C	1	1325	MM	A	Scale A
MinIAppN	Minimum Current Apparent N	1	1326	MM	A	Scale B
MinIAvg	Min Current Avg	1	1327	MM	A	Scale A - Phase Current
MinIB	Min Current B	1	1317	MM	A	Scale A - Phase Current
MinIC	Min Current C	1	1318	MM	A	Scale A - Phase Current
MinIN	Min Current N	1	1319	MM	A	Scale B - Neutral Current
MinIUnbalA	Min Current Unbalance A	1	1328	MM	%	Tenths
MinIUnbalB	Min Current Unbalance B	1	1329	MM	%	Tenths
MinIUnbalC	Min Current Unbalance C	1	1330	MM	%	Tenths
MinIUnbalW	Min Current Unbalance Worst	1	1332	MM	%	Tenths
MinKFN	Minimum K-Factor N	1	1418	MM	No Units	Tenths
MinkVAA	Min Apparent Power A	1	1342	MM	kVA	Scale E
MinkVAB	Min Apparent Power B	1	1343	MM	kVA	Scale E
MinkVAC	Min Apparent Power C	1	1344	MM	kVA	Scale E
MinkVARA	Min Reactive Power A	1	1338	MM	kVAR	Scale E
MinkVARB	Min Reactive Power B	1	1339	MM	kVAR	Scale E
MinkVARC	Min Reactive Power C	1	1340	MM	kVAR	Scale E
MinkVARTtl	Min Reactive Power Total	1	1341	MM	kVAR	Scale E
MinkVATtl	Min Apparent Power Total	1	1345	MM	kVA	Scale E
MinkWA	Min Active Power A	1	1334	MM	kW	Scale E
MinkWB	Min Active Power B	1	1335	MM	kW	Scale E
MinkWC	Min Active Power C	1	1336	MM	kW	Scale E
MinkWTtl	Min Active Power Total	1	1337	MM	kW	Scale E
MinPFA	Min Power Factor A	3	1346	MM		PF format[24]
MinPFB	Min Power Factor B	3	1347	MM		PF format[24]
MinPFC	Min Power Factor C	3	1348	MM		PF format[24]

23. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
24. Power factor format: –1 to –999 for lagging power factors, 1000 for unity power factor 1.000, and 1 to 999 for leading power factors.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[25]	Regis-ter[25]	Module[25]	Units[25]	Scale[25]
MinPFTtl	Min Power Factor Total	3	1349	MM		PF format[26]
MinVAB	Min Voltage A-B	1	1300	MM	V	Scale D - Voltage
MinVAN	Min Voltage A-N	1	1303	MM	V	Scale D - Voltage
MinVBC	Min Voltage B-C	1	1301	MM	V	Scale D - Voltage
MinVBN	Min Voltage B-N	1	1304	MM	V	Scale D - Voltage
MinVCA	Min Voltage C-A	1	1302	MM	V	Scale D - Voltage
MinVCN	Min Voltage C-N	1	1305	MM	V	Scale D - Voltage
MinVLLAvg	Min Voltage L-L Avg	1	1306	MM	V	Scale D - Voltage
MinVLNAvg	Min Voltage L-N Avg	1	1307	MM	V	Scale D - Voltage
MinVUnbalAB	Min Voltage Unbalance A-B	1	1308	MM	%	Tenths
MinVUnbalAN	Min Voltage Unbalance A-N	1	1311	MM	%	Tenths
MinVUnbalBC	Min Voltage Unbalance B-C	1	1309	MM	%	Tenths
MinVUnbalBN	Min Voltage Unbalance B-N	1	1312	MM	%	Tenths
MinVUnbalCA	Min Voltage Unbalance C-A	1	1310	MM	%	Tenths
MinVUnbalCN	Min Voltage Unbalance C-N	1	1313	MM	%	Tenths
MinVUnbalLLW	Min Voltage Unbalance L-L Worst	1	1314	MM	%	Tenths
MinVUnbalLNW	Min Voltage Unbalance L-N Worst	1	1315	MM	%	Tenths
NominalCurrent	Breaker Nominal Current	1	8750	PM	A	Unity
OverFreqAlrm	Over Frequency Alarm Status	1	8859	PM		Bit 11; ON = active, OFF = inactive
OverFreqPreAlrm	Over Frequency Pre-Alarm Status	1	8863	PM		Bit 11; ON = active, OFF = inactive
OverIAAlrm	Over IA Demand Alarm Status	1	8859	PM		Bit 1; ON = active, OFF = inactive
OverIAPreAlrm	Over IA Demand Pre-Alarm Status	1	8863	PM		Bit 1; ON = active, OFF = inactive
OverIBAlrm	Over IB Demand Alarm Status	1	8859	PM		Bit 2; ON = active, OFF = inactive
OverIBPreAlrm	Over IB Demand Pre-Alarm Status	1	8863	PM		Bit 2; ON = active, OFF = inactive
OverICAlrm	Over IC Demand Alarm Status	1	8859	PM		Bit 3; ON = active, OFF = inactive
OverICPreAlrm	Over IC Demand Pre-Alarm Status	1	8863	PM		Bit 3; ON = active, OFF = inactive
OverINAlrm	Over IN Demand Alarm Status	1	8859	PM		Bit 4; ON = active, OFF = inactive
OverINPreAlrm	Over IN Demand Pre-Alarm Status	1	8863	PM		Bit 4; ON = active, OFF = inactive
OverVoltAlrm	Over Voltage Alarm Status	1	8859	PM		Bit 6; ON = active, OFF = inactive
OverVoltPreAlrm	Over Voltage Pre-Alarm Status	1	8863	PM		Bit 6; ON = active, OFF = inactive

25. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
26. Power factor format: –1 to –999 for lagging power factors, 1000 for unity power factor 1.000, and 1 to 999 for leading power factors.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Regis-ters[27]	Regis-ter[27]	Module[27]	Units[27]	Scale[27]
PF_PkkVAD	PF Coincident w/Peak KVA Demand	3	2239	MM		Thousandths
PF_PkkVARD	PF Coincident w/Peak KVAR Demand	3	2233	MM		Thousandths
PF_PkkWD	PF Coincident w/Peak KW Demand	3	2227	MM		Thousandths
PFA	Power Factor A	3	1046	MM		PF format[28]
PFB	Power Factor B	3	1047	MM		PF format[28]
PFC	Power Factor C	3	1048	MM		PF format[28]
PFTtl	Power Factor Total	3	1049	MM		PF format[28]
PhaRotAlrm	Phase Rotation Alarm Status	1	8859	PM		Bit 12; ON = active, OFF = inactive
PkIAD	Peak Demand Current A	1	2204	MM	A	Scale A
PkIBD	Peak Demand Current B	1	2205	MM	A	Scale A
PkICD	Peak Demand Current C	1	2206	MM	A	Scale A
PkIND	Peak Demand Current N	1	2207	MM	A	Scale A
PkKFDA	Peak K-Factor Demand A	1	2216	MM	No Units	Tenths
PkKFDB	Peak K-Factor Demand B	1	2217	MM	No Units	Tenths
PkKFDC	Peak K-Factor Demand C	1	2218	MM	No Units	Tenths
PkKFDN	Peak K-Factor Demand N	1	2219	MM	No Units	Tenths
PkkVAD	Peak Demand Apparent Power	1	2237	MM	kVA	Scale A
PkkVARD	Peak Demand Reactive Power	1	2231	MM	kVAR	Scale A
PkkWD	Peak Demand Active Power	1	2225	MM	kW	Scale A
PredIAD	Predicted Demand Current A	1	2208	MM	A	Scale A
PredIBD	Predicted Demand Current B	1	2209	MM	A	Scale A
PredICD	Predicted Demand Current C	1	2210	MM	A	Scale A
PredIND	Predicted Demand Current N	1	2211	MM	A	Scale A
PredKFDA	Predicted K-Factor Demand A	1	2220	MM	No Units	Tenths
PredKFDB	Predicted K-Factor Demand B	1	2221	MM	No Units	Tenths
PredKFDC	Predicted K-Factor Demand C	1	2222	MM	No Units	Tenths
PredKFDN	Predicted K-Factor Demand N	1	2223	MM	No Units	Tenths
PredkVAD	Predicted KVA Demand	1	2238	MM	kVA	Scale A
PredkVARD	Predicted KVAR Demand	1	2232	MM	kVAR	Scale A
PredkWD	Predicted KW Demand	1	2226	MM	kW	Scale A

27. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.
28. Power factor format: –1 to –999 for lagging power factors, 1000 for unity power factor 1.000, and 1 to 999 for leading power factors.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Registers[29]	Register[29]	Module[29]	Units[29]	Scale[29]
R1OpsCounter	Relay 1 Operations Counter	1	9081	PM		Unity
R2OpsCounter	Relay 2 Operations Counter	1	9082	PM		Unity
R3OpsCounter	Relay 3 Operations Counter	1	9083	PM		Unity
R4OpsCounter	Relay 4 Operations Counter	1	9084	PM		Unity
R5OpsCounter	Relay 5 Operations Counter	1	9085	PM		Unity
R6OpsCounter	Relay 6 Operations Counter	1	9086	PM		Unity
ReadyToClose	Breaker Ready to Close	1	661	BCM		Bit 5; ON = yes, OFF = no
RevPwrAlrm	Reverse Power Alarm Status	1	8859	PM		Bit 9; ON = active; OFF = inactive
RevPwrPreAlrm	Reverse Power Pre-Alarm Status	1	8863	PM		Bit 9; ON = active; OFF = inactive
TimeToTrip	Time Remaining to LT Trip	2	8865	PM		Tenths
TU_BATT_PCT	Trip Unit % Battery	1	8843	PM	%	Unity
TU_SN	Trip Unit Serial Number	4	8700	PM		ASCII text
TUCommStatus	Trip Unit Internal Comms Status	1	552	BCM		Bit 11; ON = not responding; OFF = OK
UnderFreqAlrm	Under Frequency Alarm Status	1	8859	PM		Bit 10; ON = active; OFF = inactive
UnderFreqPreAlrm	Under Frequency Pre-Alarm Status	1	8863	PM		Bit 10; ON = active; OFF = inactive
UnderVoltAlrm	Under Voltage Alarm Status	1	8859	PM		Bit 5; ON = active; OFF = inactive
UnderVoltPreAlrm	Under Voltage Pre-Alarm Status	1	8863	PM		Bit 5; ON = active; OFF = inactive
VAB	Voltage A-B	1	1000	MM	V	Scale D - Voltage
VAN	Voltage A-N	1	1003	MM	V	Scale D - Voltage
VBC	Voltage B-C	1	1001	MM	V	Scale D - Voltage
VBN	Voltage B-N	1	1004	MM	V	Scale D - Voltage
VCA	Voltage C-A	1	1002	MM	V	Scale D - Voltage
VCN	Voltage C-N	1	1005	MM	V	Scale D - Voltage
VigiAlarm	Vigi Alarm Status	1	8860	PM		Bit 1; ON = active; OFF = inactive
VigiPreAlrm	Vigi Pre-Alarm Status	1	8864	PM		Bit 1; ON = active; OFF = inactive
VLLAvg	Voltage L-L Avg	1	1006	MM	V	Scale D - Voltage
VLNAvg	Voltage L-N Avg	1	1007	MM	V	Scale D - Voltage
VUnbalAB	Voltage Unbalance A-B	1	1008	MM	%	Tenths
VUnbalAlrm	Voltage Unbalance Alarm Status	1	8859	PM		Bit 7; ON = active, OFF = inactive
VUnbalAN	Voltage Unbalance A-N	1	1011	MM	%	Tenths
VUnbalBC	Voltage Unbalance B-C	1	1009	MM	%	Tenths
VUnbalBN	Voltage Unbalance B-N	1	1012	MM	%	Tenths

29. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Table 17 - List of Registers (Continued)

SMS Topic Name	User Description	Number of Registers[30]	Register[30]	Module[30]	Units[30]	Scale[30]
VUnbalCA	Voltage Unbalance C-A	1	1010	MM	%	Tenths
VUnbalCN	Voltage Unbalance C-N	1	1013	MM	%	Tenths
VUnbalLLW	Voltage Unbalance L-L Worst	1	1014	MM	%	Tenths
VUnbalLNW	Voltage Unbalance L-N Worst	1	1015	MM	%	Tenths
VUnbalPreAlrm	Voltage Unbalance Pre-Alarm Status	1	8863	PM		Bit 7; ON = active, OFF = inactive

30. For register entries that are not listed, please refer to the MicroLogic device type register list. Contact your local sales representative.

Appendix D—Trip Unit Voltage Supply Architecture

The trip unit has an integral internal three-phase voltage power supply which appears as a three-phase delta configured load to the system (Integral Internal Three-phase Power Supply, page 113). This power supply is a three-phase load by itself and will inject voltage on an open phase (Open Phase on Three-phase Power Supply, page 114). The impact of a three-phase delta configured load on the voltage-based protection functions is as follows:

> ## *NOTICE*
>
> **HAZARD OF EQUIPMENT DAMAGE**
>
> Setting undervoltage protection (Vmin) below 80% or voltage unbalance (Vunbal) above 20% can cause the trip unit to not perform as expected.
>
> **Failure to follow these instructions can result in equipment damage.**

Minimum Voltage Protection

The minimum (under) voltage protection function is based on phase-to-phase voltage measurement.

For circuit configuration 1 (Circuit Configuration 1, page 114), 2 (Circuit Configuration 2, page 115) or 3 (Circuit Configuration 3, page 115), if a fuse opens the trip unit will inject voltage on the open phase. Therefore the trip unit will meter the voltage being injected on the open phase accurately. The phase-to-phase voltage (V_{LL}) measurement will be higher than when the open phase is at zero volts. The trip unit will also accurately meter the phase-to-neutral voltage (V_{LN}) injected on the open phase and display a value greater than zero.

For circuit configuration 4 (Circuit Configuration 4, page 115), the trip unit has a return path through the transformer and the injected voltage on the open phase will be zero. In this configuration the trip unit will accurately meter zero volts on V_{LN}.

To ensure the MicroLogic trip system will perform as expected regardless of system configuration the user should limit the undervoltage pickup range to 80%–100% of the nominal phase-to-phase system voltage.

Figure 103 - Integral Internal Three-phase Power Supply

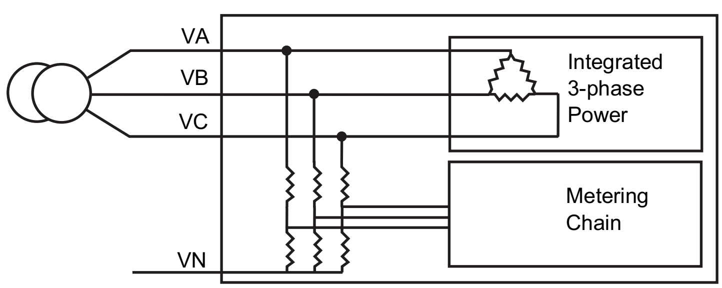


Figure 104 - Open Phase on Three-phase Power Supply

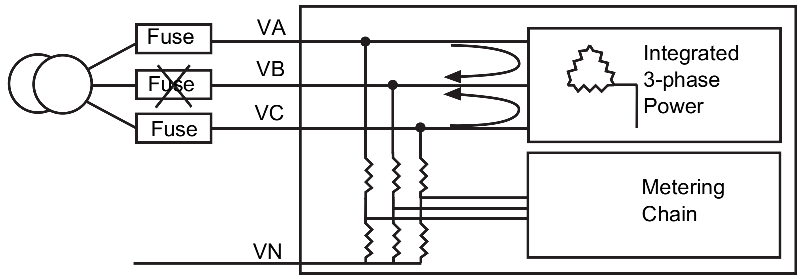
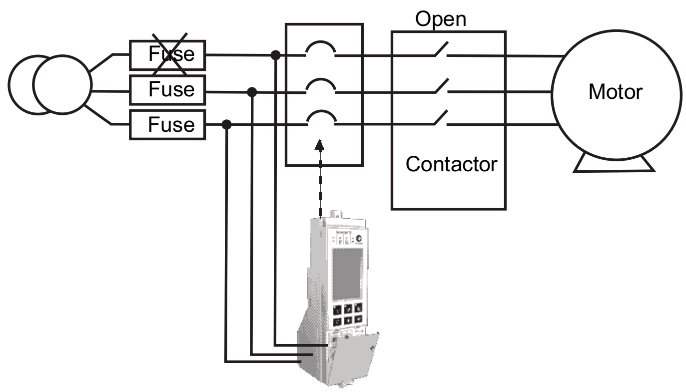


Figure 105 - Circuit Configuration 1



Voltage Unbalance Protection

The voltage unbalance protection function is based on phase-to-phase voltage measurement.

For circuit configuration 1 (Circuit Configuration 1, page 114), 2 (Circuit Configuration 2, page 115) or 3 (Circuit Configuration 3, page 115), if a fuse opens the trip unit will inject voltage on the open phase. Therefore the trip unit will meter the voltage being injected on the open phase accurately.

The phase-to-phase voltage (V_{LL}) measurement will be higher than when the open phase is at zero volts. The trip unit will also accurately meter the phase-to-neutral voltage (V_{LN}) injected on the open phase and display a value greater than zero.

For circuit configuration 4 (Circuit Configuration 4, page 115), the trip unit has a return path through the transformer and the injected voltage on the open phase will be zero. In this configuration the trip unit will accurately meter zero volts on V_{LN}.

To ensure the MicroLogic trip system will perform as expected regardless of system configuration the user should limit the voltage unbalance protection settings to 0–20%.

Figure 106 - Circuit Configuration 2

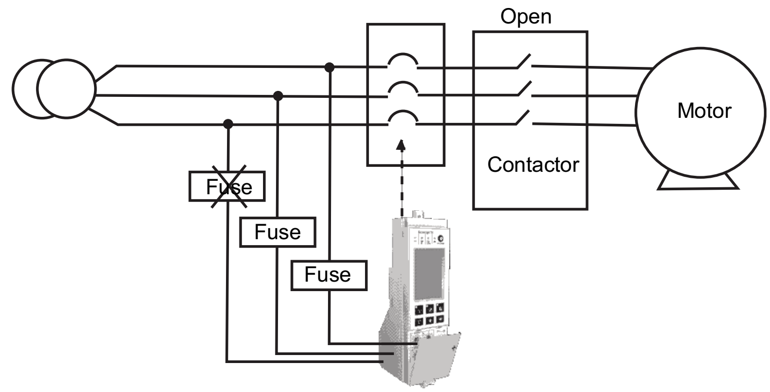


Figure 107 - Circuit Configuration 3

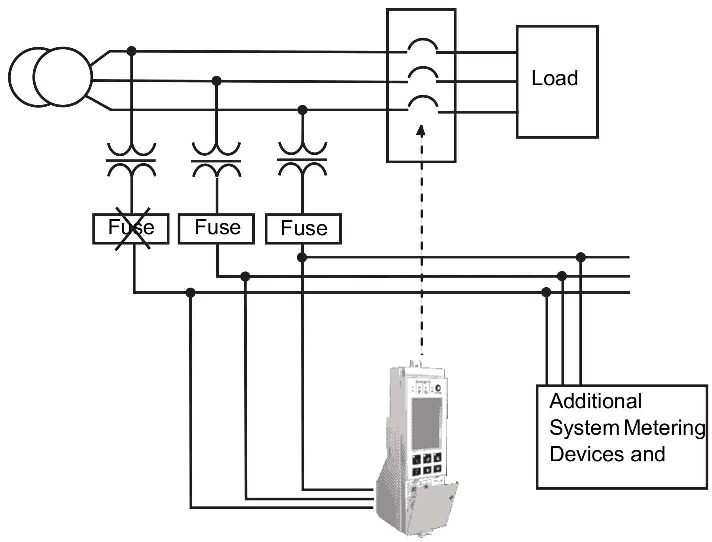
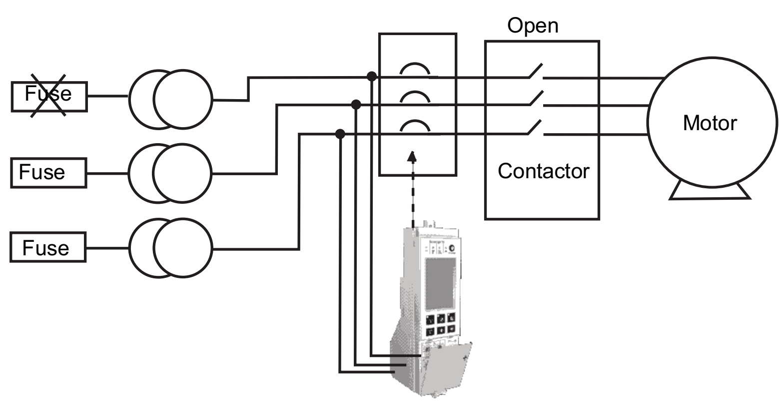


Figure 108 - Circuit Configuration 4



Loss of Multiple Phases

Do not use either minimum voltage protection or voltage unbalance protection to determine the loss of multiple phases.

- The internal voltage power supply requires voltage of two phases to operate. (The voltage power supply has an operating range from 100 V to 690 V.)
- In circuit configurations 1 (Figure 103), 2 (Figure 104) and 3 (Figure 105), when multiple phases are lost the trip unit will measure the system voltage of the remaining phase on all three phases. For example, if two phases are lost on a 480 V three-phase delta system, the trip unit will meter 480 V_{LL} on all three phases.

Appendix E—Trip Unit Settings

Enter setting values in settings tables.

Table 18 - Settings–Switches

Description	Symbol	Settings
Long-time pickup	Ir	
Long-time delay	tr	
Short-time pickup	Isd	
Short-time delay	tsd	
Ground-fault pickup	Ig	
Ground-fault delay	tg	

Table 19 - Settings—Maintenance Menu

Submenu	Description	Line Item	Trip Unit Setting
M2C/M6C contacts	Alarm type	S#	
	Setup	S#	
MicroLogic setup	Language	—	
	Date/Time	—	
	Breaker selection	Standard	
		Circuit breaker	
		Type	
		Circuit breaker number	
	Neutral CT	—	
	VT ratio	Primary	
		Secondary	
	System frequency	—	
Metering setup	System type	—	
	Current demand	Interval	
	Power demand	Window type	
		Interval	
	Power sign	—	
	Sign convention	—	
Com setup	Com parameter	—	
	Remote access	—	
	Remote control	—	

Table 20 - Settings—Protection Menu

Submenu	Description	Symbol	Line Item	Trip Unit Setting
Amperage protection	Long-time pickup	Ir		

Table 20 - Settings—Protection Menu (Continued)

Submenu	Description	Symbol	Line Item	Trip Unit Setting
	Long-time delay	tr		
	Short-time pickup	Isd		
	Short-time delay	tsd		
	Instantaneous	Ii		
	Idmtl Long-time pickup	Idmtl Ir		
	Idmtl Long-time delay	Idmtl tr		
	Idmtl Mode			
	Idmtl Short-time pickup	Idmtl Isd		
	Idmtl Short-time delay	Idmtl tsd		
	Idmtl Instantaneous	Idmtl Ii		
	Ground-fault (6.0P trip unit)	I⏚	Mode	
			Pickup	
			Pickup delay	
	Neutral current	Ineutral		
	Ground-fault alarm	I⏚ alarm	Mode	
			Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Current unbalance	Iunbal	Mode	
			Pickup %	
			Pickup delay	
			Dropout %	
			Dropout delay	
	Max. phase A demand current	$\overline{Ia}$ max	Mode	
			Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Max. phase B demand current	$\overline{Ib}$ max	Mode	
			Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Max. phase C demand current	$\overline{Ic}$ max	Mode	
			Pickup	
			Pickup delay	
			Dropout	

Table 20 - Settings—Protection Menu (Continued)

Submenu	Description	Symbol	Line Item	Trip Unit Setting
			Dropout delay	
	Max. neutral demand current	$\overline{\text{In}}$ max	Mode	
			Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
Voltage protection	Minimum (under) voltage	Vmin	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Maximum (over) voltage	Vmax	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Voltage unbalance	Vunbal	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
Other protection	Reverse power	rP	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Maximum (over) frequency	Fmax	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Minimum (under) frequency	Fmin	Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	
	Phase rotation	—	Mode	
			Sequence	
Load shedding I	Load shedding I	—	Mode	
			Pickup %	
			Pickup delay %	
			Dropout %	
			Dropout delay	
Load shedding P	Load shedding P	—	Mode	

Table 20 - Settings—Protection Menu (Continued)

Submenu	Description	Symbol	Line Item	Trip Unit Setting
			Pickup	
			Pickup delay	
			Dropout	
			Dropout delay	

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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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