MicroVersaTrip Plus™ and MicroVersaTrip PM™ Trip Units

for ***Type AKR Low-Voltage Power Circuit Breakers***
Power Break® Insulated-Case Circuit Breakers
Power Break® II Insulated-Case Circuit Breakers
R-Frame Molded-Case Circuit Breakers
Low-Voltage Power Circuit Breaker Conversion Kits

User's Guide

GEH–6273D

WARNINGS, CAUTIONS, AND NOTES AS USED IN THIS PUBLICATION

WARNINGS

Warning notices are used in this publication to emphasize that hazardous voltages, currents, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

Warning notices are also used for situations in which inattention or lack of equipment knowledge could cause either personal injury or damage to equipment.

CAUTIONS

Caution notices are used for situations in which equipment might be damaged if care is not taken.

NOTES

Notes call attention to information that is especially significant to understanding and operating the equipment.

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1-1 Read This First

The MicroVersaTrip Plus™ and MicroVersaTrip PM™ Trip Units described in this publication are used on Power Break® and Power Break® II insulated-case circuit breakers, Type AKR low-voltage power circuit breakers, R-Frame molded-case circuit breakers, and low-voltage power circuit breaker conversion kits.

Spectra RMS™ molded-case circuit breakers use different versions of MicroVersaTrip Plus and MicroVersaTrip PM Trip Units that are not interchangeable with the units described here. Refer to GEH-5934 for information on these Trip Units.

1-2 Product Structure

MicroVersaTrip Trip Units come in two different sizes that are not interchangeable. The larger Trip Unit (series RMS9C) is used on Power Break circuit breakers, Type AKR circuit breakers, and conversion kits. The smaller Trip Unit (series RMS9D) is used only on Power Break II circuit breakers. Each of the two sizes is available in both MicroVersaTrip Plus and MicroVersaTrip PM configurations. The front views of the MicroVersaTrip PM Trip Units are shown in Figures 1 (RMS9C) and 2 (RMS9D).

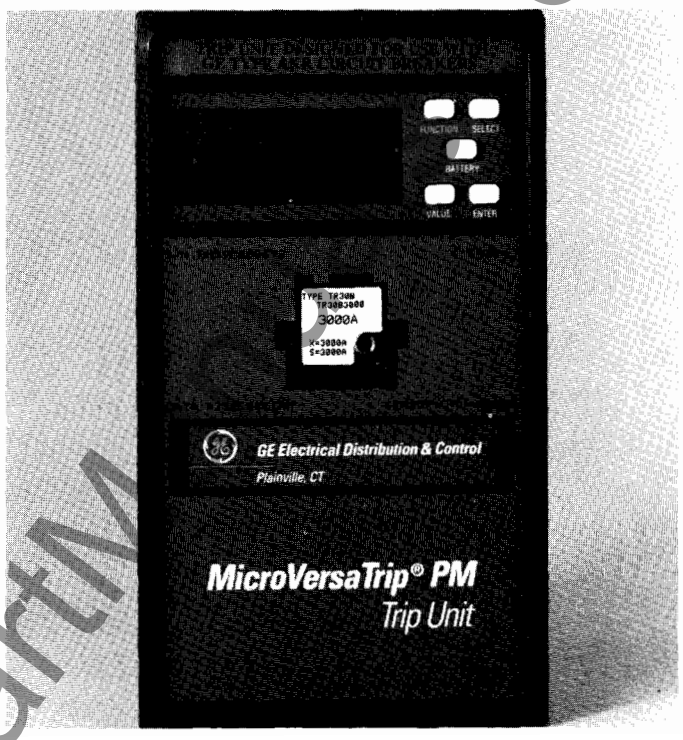


Figure 1. Front view of MicroVersaTrip PM Trip Unit (series RMS9C).

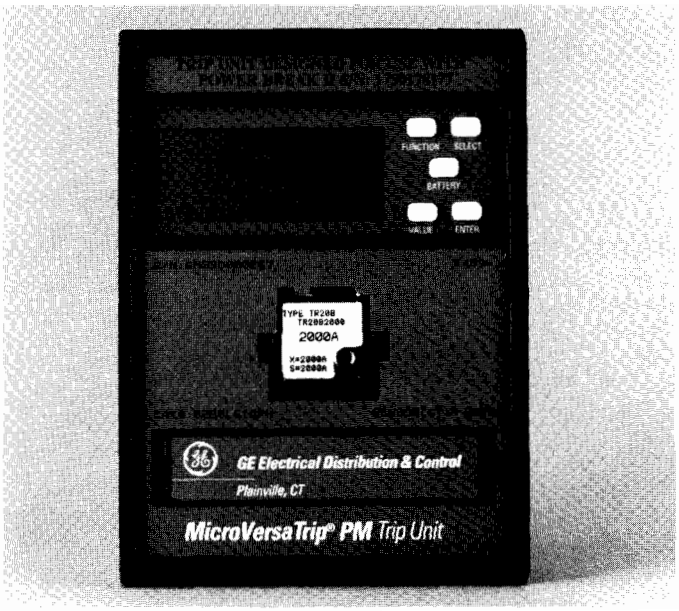


Figure 2. Front view of MicroVersaTrip PM Trip Unit (series RMS9D).

The RMS9C Trip Unit has a 36-pin rear connector, while the RMS9D Trip Unit has a 50-pin rear connector, as shown in Figures 3 and 4. These connectors provide the Trip Units' main connections to the circuit breaker frame and to the equipment control signals.

Both types of Trip Unit have recessed connectors in the front panel to accept interchangeable current rating plugs.

Both types of Trip Unit have a top-mounted 20-pin connector that provides future access to the optional Remote Display accessory. (*Note:* this accessory is not normally used with a Power Break II circuit breaker.) This connector has a removable cover to protect it when not in use.

Series RMS9D Trip Units also have a 6-position DIP switch, not present on series RMS9C Trip Units, that is used to configure the Power Break II integrated accessories. This switch is located on the rear of the unit.

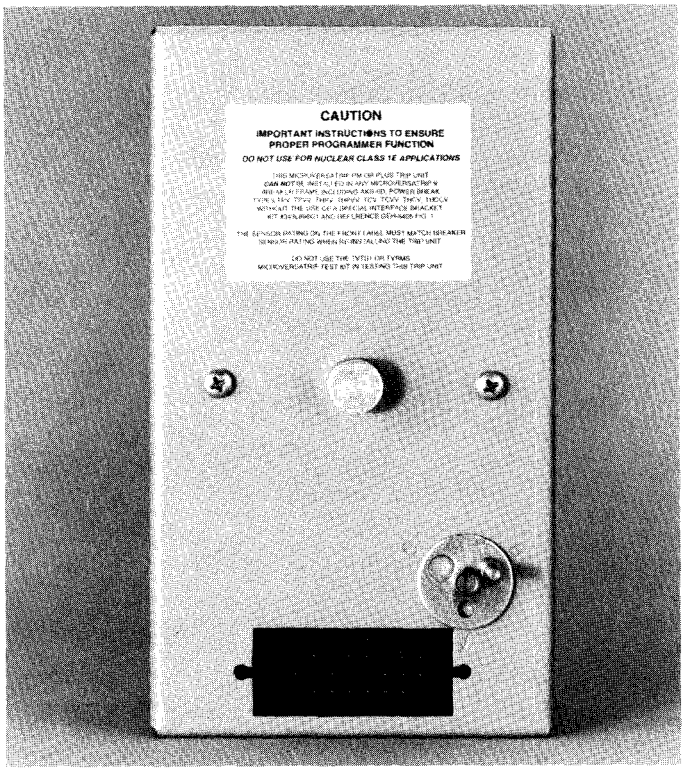


Figure 3. Rear view of MicroVersaTrip PM Trip Unit (series RMS9C).

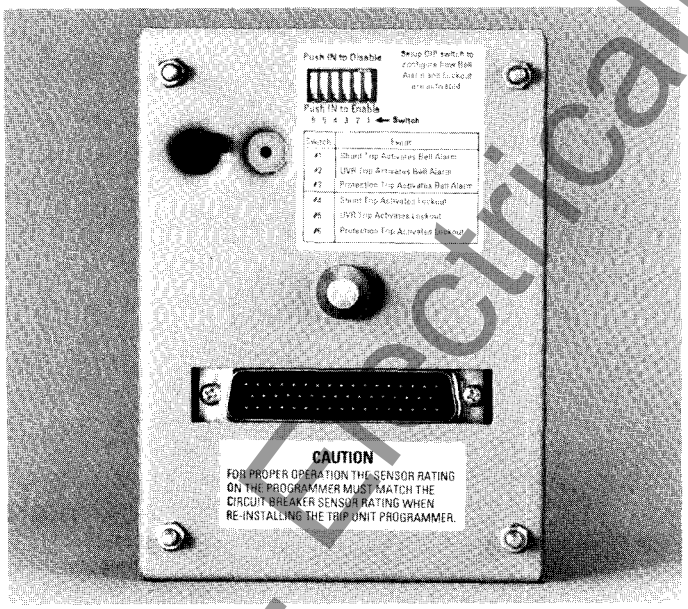


Figure 4. Rear view of MicroVersaTrip PM Trip Unit (series RMS9D).

CAUTION: Removal of a Trip Unit from its breaker must be performed with the breaker in the OPEN or TRIPPED position. Draw-out breakers should be racked out first.

ATTENTION: Pour retirer déclencheur, le disjoncteur doit être en position ouverte ou déclenchée. Les disjoncteurs débrochables doivent être en position débrochée.

CAUTION: Do not attempt to operate the breaker without its assigned Trip Unit. Installation of an incorrect Trip Unit may result in unsafe operation of the breaker.

ATTENTION: Ne pas utiliser le disjoncteur sans son déclencheur. Une mauvaise installation du déclencheur peut être dangereuse.

CAUTION: Removal of the rating plug while the breaker is carrying current reduces the breaker's current-carrying capacity to approximately 25% of the current sensor rating. This may result in undesired tripping.

ATTENTION: Si le calibreur est retiré alors que le disjoncteur est sous tension, le déclencheur se régle automatiquement à approximativement 25% du calibre du transformateur de courant. Ceci peut entrainer un déclenchement indésirable.

NOTE: Trip Units as received may have settings that are undesirable for the specific application. Ensure that settings are appropriately adjusted before energizing.

NOTE: Les disjoncteurs sont livrés avec des réglages standards qui peuvent être inadéquates pour certaines applications. Vérifier ces réglages avant de mettre le disjoncteur sous tension.

1-3 Trip Unit Functions

MicroVersaTrip Plus and MicroVersaTrip PM Trip Units have specific standard and optional functions. All Trip Units share a series of interchangeable rating plugs. The standard functions for both types of Trip Unit are as follows:

- Protection
  - Long-time protection
  - Instantaneous protection
- Status
  - Trip target (trip type)
  - Trip information (magnitude and phase)
  - Trip operations counters
- Metering display
  - Phase current (selectable among phases)

The optional functions available on both types of Trip Unit are as follows:

- High-range (fixed) instantaneous overcurrent protection
- Short-time protection, with or without I^2T
- Ground-fault protection, with or without I^2T
- Defeatable ground fault, with or without I^2T
- Zone-selective interlock, with ground fault only or with both ground fault and short time protection

Additional optional functions available only with MicroVersaTrip PM Trip Units are as follows:

- Available configurations
  - Communication and metering
  - Communication and protective relaying
  - Communication, metering, and protective relaying
- Remote communication with POWER LEADER™ communications network (commnet)
- Metering functions
  - Voltage (V)
  - Energy (kWh/MWh/GWh)
  - Total real power (kW/MW)
  - Total apparent power (kVA/MVA)
  - Demand power (kW/MW)
  - Peak demand power (kW/MW)
  - Frequency (Hz)
- Protective relaying
  - Undervoltage
  - Overvoltage
  - Voltage unbalance
  - Current unbalance
  - Power reversal

NOTE: MicroVersaTrip PM style Trip Units require external +24 Vdc control power.

NOTE: Le déclencheur de type MicroVersaTrip PM necessite l'utilisation d'une alimentation extérieure 24 Vcc.

1-4 Trip Unit Catalog Numbers

A simple catalog-numbering system defines all of the standard and optional Trip Unit functions for each of the two series of Trip Units. Catalog number keys are found in Appendix 1 for AKR breakers, Appendix 2 for RMS9C Trip Units in Power Break® breakers, and in Appendix 3 for RMS9D Trip Units in Power Break® II breakers. A208LIPMR is an example of a valid catalog number.

The first character of each catalog number defines the type of breaker for which it is configured, as listed in Table 1.

Character	Breaker Type	Trip Unit
A	AKR	RMS9C
B	Power Break II	RMS9D
C	Power Break	RMS9C

Table 1. Breaker type referred to by first character of Trip Unit catalog number.

The second character of the catalog number indicates the highest rated phase current transformer (CT) sensor allowed for that breaker frame, as listed in Table 2.

Character	Maximum Allowable CT
2	2000 A
3	2500/3000/3200 A
4	4000 A
5	5000 A

Table 2. Breaker frame size maximum CT referred to by second character of Trip Unit catalog number.

The third and fourth characters of the catalog number indicate the CT that is actually installed in the breaker, as listed in Table 3. The table also indicates whether each CT is available with only RMS9C Trip Units or with both types.

Characters	CT Size	Trip Unit Series
01	150 A	RMS9C
02	200 A	both
03	225 A	RMS9C
04	400 A	both
06	600 A	RMS9C
08	800 A	both
10	1000 A	both
16	1600 A	both
20	2000 A	both
25	2500 A	both
30	3000 A	both
32	3200 A	RMS9C
40	4000 A	both
50	5000 A	RMS9C

Table 3. Installed breaker CT size referred to by third and fourth characters of Trip Unit catalog number.

The fifth character of the catalog number is the letter L, which indicates that all Trip Units come with long-time overcurrent protection. Additional letters are appended to the catalog number to indicate installed protective functions, as in Table 4. These suffixes are valid for both MicroVersaTrip Plus and MicroVersaTrip PM style Trip Units. They are appended from left to right in the order given.

Suffix	Protective Function
S	Short-time overcurrent protection
I	Instantaneous overcurrent protection
H	Fixed high-range instantaneous
K	Fixed high-range instantaneous (AKR-30S only)
G	Ground fault
GD	Defeatable ground fault (not UL listed)
Z1 or Z2	Zone-selective interlock: Z1 – ground fault only Z2 — ground fault and short time
X	Switchable instantaneous/short time and ground fault (AKR only, not UL listed)

Table 4. Trip Unit catalog number suffixes for optional functions.

MicroVersaTrip PM catalog numbers contain an additional one- or two-letter suffix to indicate the communication, metering, and relaying functions installed, as shown in Table 5. MicroVersaTrip Plus catalog numbers do not have this final suffix.

Suffix	Function
(none)	MicroVersaTrip Plus Trip Unit
PM	Metering, relaying, and communication
M	Metering and communication
P	Relaying and communication

Table 5. MicroVersaTrip PM Trip Unit suffixes for communication, metering, and relaying.

Finally, if the Trip Unit is ordered as a replacement, an "R" suffix is appended to the catalog number.

For example, a Trip Unit with catalog number B210LSIGZ1PM has the following functions:

B2 – Trip Unit for Power Break II with maximum CT of 2000 A

10 – breaker current sensor (CT) of 1000 A

L – long-time overcurrent protection

S – short-time overcurrent protection
I – adjustable instantaneous protection

G – ground-fault protection

Z1 – ground-fault zone-selective interlock

PM – MicroVersaTrip PM with metering, relaying, and communication

1-5 Rating Plugs

Interchangeable rating plugs are used to establish or change the current rating of the breaker. Rating plugs for MicroVersaTrip Plus or MicroVersaTrip PM Trip Units in either Power Break®, Power Break® II, or Type AKR breakers are interchangeable within the same sensor rating. Rating plugs for Power Break, Power Break II, and Type AKR breakers cannot be interchanged with Spectra RMS™ MicroVersaTrip Plus and MicroVersaTrip PM Trip Units.

A built-in rejection feature prevents the insertion of a rating plug with an incorrect sensor rating into a Trip Unit. Similarly, a Spectra RMS rating plug can not be inserted into a Power Break, Power Break II, or Type AKR breaker.

Rating plug catalog numbers are listed in Table 6.

Catalog Number	Sensor Rating, Amps	Plug Rating	Breaker Frames
TR1B60	150	60	AKR30
TR1B80		80	AKR30S, AKR30H
TR1B100		100	Conversion Kits
TR1B125		125	
TR1B150		150	
TR2B100	200	100	SSD, SSF, SHD, SHF
TR2B150		150	TP82, THP82
TR2B200		200	TC82, THC82
TR225B100	225	100	Conversion Kits
TR225B150		150	
TR225B225		225	
TR4B150	400	150	SSD, SSF, SHD, SHF
TR4B200		200	AKR30
TR4B225		225	TP84, THP84
TR4B250		250	TC84, THC84
TR4B300		300	AKR30S, AKR30H
TR4B400		400	Conversion Kits
TR6B300	600	300	Conversion Kits
TR6B400		400	
TR6B450		450	
TR6B500		500	
TR6B600		600	
TR8B300	800	300	SSD, SSF, SHD, SHF
TR8B400		400	TP88, THP88
TR8B450		450	TC88, THC88
TR8B500		500	AKR30
TR8B600		600	AKR30S, AKR30H
TR8B700		700	AKR50S, AKR50H
TR8B800		800	
TR10B400	1000	400	SSD, SSF, SHD, SHF
TR10B600		600	TC1610, THC1610
TR10B800		800	TP1610, THP1610
TR10B1000		1000	TC2510, THC2510
			TP2510, THP2510

Catalog Number	Sensor Rating, Amps	Plug Rating	Breaker Frames
TR16B600	1600	600	SSD, SSF, SHD, SHF
TR16B800		800	TC1610, THC1610
TR16B1000		1000	AKR50S, AKR50H
TR16B1100		1100	TP1616, THP1616
TR16B1200		1200	Conversion Kits
TR16B1600		1600	
TR20B750	2000	750	SSD, SSF, SHD, SHF
TR20B800		800	TC2020, THC2020
TR20B1000		1000	TC2520, THC2520
TR20B1200		1200	TP2020, THP2020
TR20B1500		1500	TP2520, THP2520
TR20B1600		1600	AKRT50H
TR20B2000		2000	Conversion Kits
TR25B1600	2500	1600	SSD, SSF, SHD, SHF
TR25B2000		2000	TC2525, THC2525
TR25B2500		2500	TP2525, THP2525
TR30B1200[2]	3000	1200	SSD, SSF, SHD, SHF
TR30B1600[2]		1600	TC3030, THC3030
TR30B2000		2000	TP3030, THP3030
TR30B2500		2500	Conversion Kits
TR30B3000		3000	
TR32B1200	3200	1200	AKR75, AKR75H
TR32B1600		1600	Conversion Kits
TR32B2400		2400	
TR32B3200		3200	
TR40B1600	4000	1600	SSD, SSF, SHD, SHF
TR40B2000		2000	TC4040, THC4040
TR40B2500		2500	TP4040, THP4040
TR40B3000		3000	AKR100
TR40B3600[1]		3600	Conversion Kits
TR40B4000		4000	
TR50B3200	5000	3200	AKR125
TR50B4000		4000	
TR50B5000		5000	

[1] *Not for use with Type AKR breakers.*

[2] *Conversion kits only.*

Table 6. Rating plug catalog numbers.

1-6 Equipment Interfaces

MicroVersaTrip Plus Trip Units

MicroVersaTrip Plus Trip Units do not usually require connections within the equipment, since all wiring is contained within the circuit breaker. The only two connections are for optional zone-selective interlock (Z1 and Z2), made by secondary disconnect, and the neutral sensor, which uses a special dedicated disconnect.

Zone-selective interlocking coordinates breakers, so that the downstream breaker is allowed the first opportunity to clear a disturbance. The two types of available zone-selective interlocking are Z1, which reacts only to ground faults, and Z2, which reacts to both ground faults and short-time overcurrent pick-ups.

Neutral Current Sensors

CAUTION: Neutral current sensors are required for single-phase, three-wire and three-phase, four-wire systems. When the Trip Unit is connected to a three-phase, three-wire system, the neutral sensor terminals of the breaker are left open. Do not short any neutral current sensor terminals in a three-phase, three-wire system, as this could result in damage to, or malfunction of, the electrical system.

ATTENTION: Un transformateur de courant de neutre est nécessaire pour les réseaux 3 phases + neutre. Si le neutre n'est pas distribué, les bornes de neutre du déclencheur doivent être laissées ouvertes. Ne pas les court-circuiter (ceci peut endommager le déclencheur et entrainer un mauvais fonctionnement du système électrique.

MicroVersaTrip PM Trip Units

In addition to the inputs received by MicroVersaTrip Plus Trip Units, MicroVersaTrip PM Trip Units also receive inputs from external voltage conditioners, a +24 Vdc control power supply, and communication connections. External +24 Vdc control power is required for operation.

RMS9C-type MicroVersaTrip PM Trip Units require a connection to an auxiliary switch within the breaker that senses the breaker position. This connection is not required for RMS9D-type MicroVersaTrip PM Trip Units used on Power Break® II breakers.

POWER LEADER™ Communication Network

The POWER LEADER Communication Network (commnet) transmits data and instructions between the Trip Unit and an external intelligent device. The external device may be the POWER LEADER system, the Epic system, or a POWER LEADER Monitor. Devices on commnet may be up to 1000 feet apart without signal repeaters, subject to certain constraints. A maximum of 30 devices can be connected without a signal repeater. Refer to GEH-5943 for installation and operation of the POWER LEADER system.

Commnet connections are made directly to wiring terminations on breaker frames. All commnet connections to the Trip Units are made through the 36-pin or 50-pin plug on the Trip Unit, which mates with a receptacle on the breaker frame. These additional connections are made to the equipment through the secondary disconnects of the breaker.

Voltage Inputs

Voltage inputs are sensed by conventional instrument potential transformers(PTs). PTs have 120 Vac secondaries and must always be used in groups of three; no open-delta connections are permitted. PT primaries are connected either line-to-line or line-to-neutral, as required.

PTs may be used for other monitoring functions, subject to reasonable burden limitations. Note that PTs must be connected in a specific sequence to ensure proper phase relations and power-flow sensing.

Each PT output feeds an individual voltage conditioner that scales the nominal voltage to approximately 1.76 Vac for use by the Trip Unit.

Power Requirements

A small amount of power is necessary to energize the liquid crystal display (LCD) during setup, for viewing breaker status, and for metering displays. MicroVersaTrip PM Trip Units require external +24 Vdc control power for proper operation. The four sources of such power are the following:

- *Flow of current* – Breaker current sensors provide sufficient power to energize the LCD when at least 20% of the sensor's ampere rating is flowing.
- *+24 Vdc control power* – Breakers with MicroVersaTrip PM Trip Units are supplied with external +24 Vdc power that, whenever present, energizes the LCD. Some breaker models that are configured for MicroVersaTrip Plus Trip Units may be optionally equipped to accept an external +24 Vdc supply.
- *Internal Battery Power* – The Trip Unit has an internal battery that powers the unit temporarily when the BATTERY key on the display is pressed. Battery power automatically turns off 30 seconds after the last keypad press. The battery power supply is disabled when any current is sensed through the current sensors.
- *MicroVersaTrip Portable Power Pack* – The MicroVersaTrip Portable Power Pack contains a dc power source and a jack. The LCD is energized when the jack is plugged into the rating plug test receptacle.
- *Power Break® II Undervoltage Release and Shunt Trip Accessories* – When energized, these accessories supply +24 Vdc power to the Trip Unit.

1-7 Trip Unit Information

Trip Unit Label Information

Following are descriptions of the various labels on the front of the Trip Unit, as illustrated in Figure 5.

- *Extreme top* – circuit breaker series and/or serial number of the breaker, unless it is a replacement unit.
- *Upper-left corner* – Trip Unit-series serial number, such as RMS9C000143.

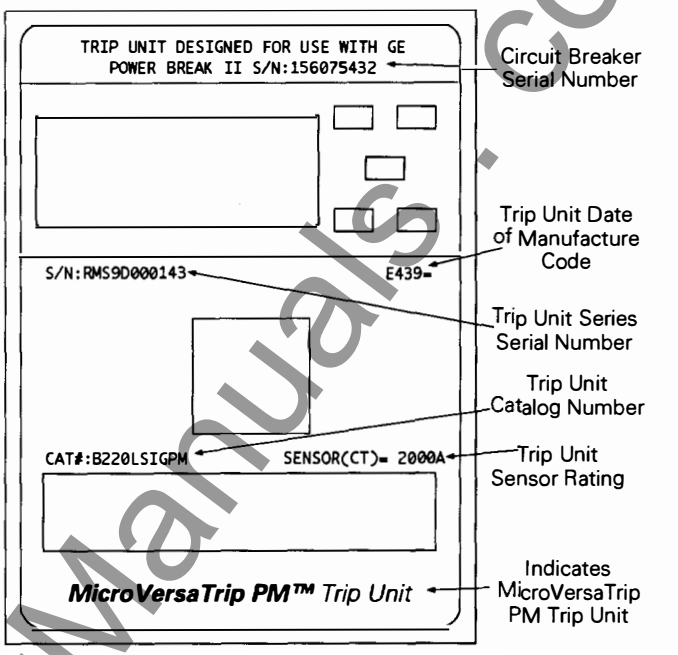


Figure 5. Labels on front of Trip Unit.

- *Upper-right corner* – Trip Unit date of manufacture code, such as E439=.
- *Lower-left corner* – catalog number of the Trip Unit, such as B220LSIGPM.
- *Lower-right corner* – sensor rating of the Trip Unit, such as SENSOR (CT) = 2000A.
- *Below battery cover* – indicates whether the unit is MicroVersaTrip Plus or MicroVersaTrip PM.

There are several other labels on the Trip Unit that are not generally visible when the unit is plugged into a breaker:

- *Under battery cover* – yellow caution label.
- *Side of unit* – bar-coded catalog number and bar-coded serial number of unit.
- *Rear of unit* – yellow caution label. RMS9D-series Trip Units also have a label to indicate which accessory functions are activated by the rear-panel DIP switches.

Function Keys

The Trip Unit has four function keys and a battery enable key. These are marked FUNCTION, SELECT, VALUE, ENTER, and BATTERY, as illustrated in Figure 6. All setup, status, and metering functions and displays are accessed through these keys. As each set point is entered, it is stored in the Trip Unit's nonvolatile

memory, so subsequent loss of power does not result in loss or change of any settings.

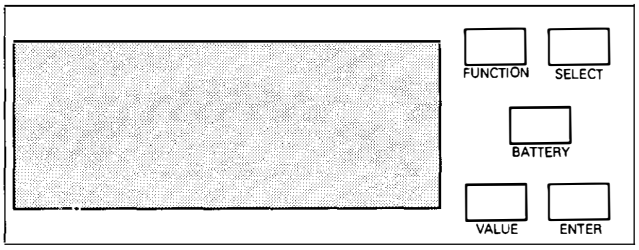


Figure 6. Function key placement on face of Trip Unit.

The functions of the five keys are

- FUNCTION – selects the mode of display.
- SELECT – chooses the next item for display.
- VALUE – selects the phase-to-phase display or allows changing of set points.
- ENTER – stores set points.
- BATTERY – powers the Trip Unit from the internal battery.

Chapter 2 describes the operation of these keys in detail.

Battery Function

Pressing the BATTERY key on the face of the Trip Unit powers the unit from its internal battery. Battery power is maintained for 30 seconds after the last key is pressed. This self-powered mode allows setting up the Trip Unit or viewing trip targets when the breaker is de-energized and external control power is unavailable. All normal setup, meter, and status functions can be performed with battery power.

The battery is intended to power the Trip Unit when it is otherwise unpowered. At low line currents the Trip Unit display is not active. Pressing the BATTERY key under these conditions will not power the Trip Unit.

Note that at temperatures above 40° C, the BATTERY key may have to be held down for up to 5 seconds for the Trip Unit to be powered.

Batteries

The Trip Unit uses a lithium sulfuryl chloride battery with a typical life of two years in a normally energized breaker. Typical usage could include one half-hour of use for first-time cold setup, 10 Trip Unit status checks per year on a de-energized breaker, and one or two configuration changes per year.

The battery is *not* required for proper operation or protection of the breaker. It is not needed nor used to store setpoints, configurations, or trip target information. It provides a source of power to display setpoints and trip information only if no other source of power is available.

Battery Replacement

Replace the battery if it does not power up the Trip Unit or if the low-battery symbol appears in the display when the BATTERY key is pressed. Lift the right-side tab of the battery cover on the front of the Trip Unit to expose the 3.9 V AA lithium cell. A suitable replacement is the Electrochem 3B24–XA, which is available from industrial distributors. The manufacturer's address is listed in Appendix 4.

WARNING: Replace the battery with Electrochem 3B24–XA only. Use of a different battery may present risk of fire, explosion, or damage to equipment. Observe proper battery polarity when installing in the Trip Unit battery compartment.

ATTENTION: Remplacer la batterie avec uniquement des Electrochem 3B24–XA. L'utilisation d'autres batteries peut présenter un risque de feu, d'explosion ou d'endommagement du matériel. Respecter la polarité de la batterie en l'installant dans son logement.

WARNING: The battery may explode if mistreated. Do not recharge, disassemble, or dispose of in fire. Keep the battery away from children and dispose of the used battery promptly.

ATTENTION: La batterie peut exploser en cas de mauvaise utilisation. Ne pas la recharger, l'ouvrir ou la jeter dans un feu. Doit être garder hors de portée des enfants. Une fois usée, la batterie doit être jeté rapidement.

Liquid Crystal Display

Figure 7 illustrates the LCD with all segments illuminated. The various segments are energized in response to conditions sensed by the Trip Unit.

1-8 MicroVersaTrip Plus and MicroVersaTrip PM Accuracies

The accuracy data in Table 7 represent the average expected performance of MicroVersaTrip Plus and MicroVersaTrip PM Trip Units. These data are valid for setup, metering, and status mode displays. These data include the effects of Trip Unit ambient-temperature variation from 0° C to 70° C.

All percentages are based on full-scale values. Full-scale current is *xIn*, the rating of the breaker's rating plug. Full-scale voltage is the potential transformer primary voltage rating. These data do not include the accuracy rating of any measuring instrument.

Refer to the trip-time curves listed in Table 8 for characteristics and accuracies of overcurrent protection.

Value	Full-Scale Accuracy	Resolution
Current (A, kA)	± 2%	± 0.5 digit
Voltage (V)	± 1.5%	± 0.5 digit
Energy (kWh, MWh, GWh)	± 3.5%	± 0.5 digit
Real power (kW, MW)	± 3.5%	± 0.5 digit
Total power (kVA, MVA)	± 3.5%	± 0.5 digit
Frequency (Hz)	± 1 Hz	± 1 Hz
Time delay (sec)	± 1 sec	± 1 sec

Table 7. Protective relay and metering accuracies and resolutions.

Breaker Type	Trip-Time Curves	Ground-Fault Curves
AKR	GES-9910	GES-9911
Power Break® and R-Frame	GES-9909	GES-9911
Power Break® II	GES-9989	GES-9990

Table 8. Trip-time curves for breaker types covered in this guide.

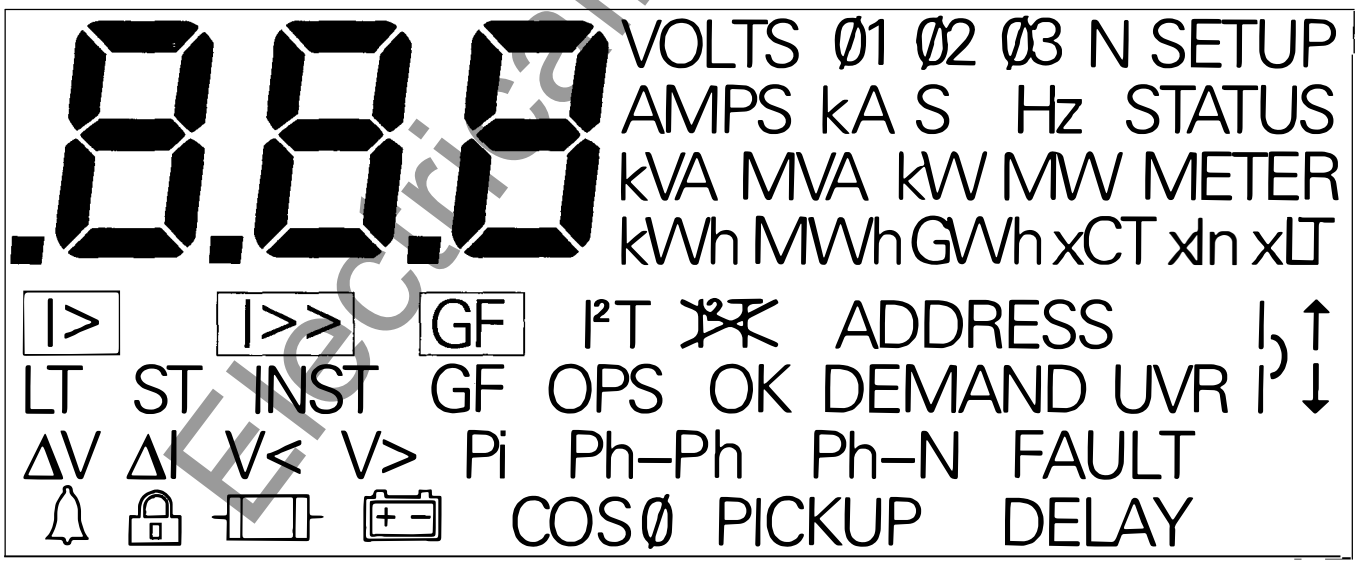


Figure 7. Liquid crystal display segments.

Chapter 2. Setup Mode

2-1 Overview

This chapter describes the operation of the four function keys, set point and time-delay adjustments, and their accuracies. The setup procedures should only be repeated if the Trip Unit or the protection characteristics are changed, requiring different set points and time delays.

These procedures apply to MicroVersaTrip Plus and MicroVersaTrip PM Trip Units. Setup programming must be performed with the rating plug installed.

For Trip Units set up through either the POWER LEADER™ system or the Epic MicroVersaTrip Field Programming Unit, refer to instructions published for those systems.

Table 9 contains a list of abbreviations used throughout the description of the setup procedures.

Abbr.	Description
xIn	Rating plug ampere rating.
xCT	Current sensor ampere rating.
xLT	Long–time (LT) current setting in amperes. Multiply LT set point by rating plug amperes. *xLT* = (LT setpoint multiplier) x (*xIn*)
H	Short-time (ST) withstand rating of breaker in amperes.
F	FUNCTION key on face of Trip Unit.
S	SELECT key on face of Trip Unit.
V	VALUE key on face of Trip Unit.
E	ENTER key on face of Trip Unit.

Table 9. Abbreviations used in setup procedure descriptions.

2-2 Operating Modes

MicroVersaTrip Plus and MicroVersaTrip PM Trip Units have three operating modes: Setup, Metering, and Status. The effects of each of the four function keys in each mode are listed in Table 10.

All the function keys, except for ENTER, automatically step the Trip Unit display to the next available option each time the key is pressed. Continued pressing of a key eventually loops the display back to the initial option for that function. This is illustrated in Figure 8 for the FUNCTION key, which shows that repeatedly pressing this key cycles the mode among Status, Metering, and Setup. Pressing the ENTER key more than once has no effect.

In Setup mode, depressing the VALUE key for about 5 seconds activates a fast scan that rapidly displays each of the available set points or time delays for some of the trip characteristics.

2-3 Setup Mode Operation

The following instructions describe setup procedures for all available Trip Unit functions. These are illustrated in Figure 9. All Trip Units provide long-time overcurrent protection, long-time delay, and some form of instantaneous overcurrent protection when installed in Power Break® circuit breakers. All other functions are optional.

If a specific set of Trip Unit functions, such as relaying or short-time overcurrent protection, has not been ordered, that function will not appear on the Trip Unit display. Ignore setup mode instructions for such functions.

The Trip Unit must be provided with control power during setup. This can come from internal battery power, from a MicroVersaTrip Portable Power Pack, from an external +24 Vdc power supply, or by energizing the breaker to at least 20% of its sensor load.

To begin the process, press the FUNCTION key until SETUP appears in the upper-right corner of the Trip Unit display. Setup mode always begins with long-time pickup. After a choice has been made for this and each subsequent trip function, press SELECT to advance to the next function.

Key	Symbol	Trip Unit Operating Mode		
		Setup	Metering	Status
FUNCTION	F	Select one of three modes: Setup, Metering, Status		
SELECT	S	Select next programming display	Select next metering display	Select next status display
VALUE	V	Display next set point or time-delay value	Display next phase value	No effect
ENTER	E	Store set point or time-delay value into memory	No effect	No effect

Table 10. Actions of function keys in Trip Unit operating modes.

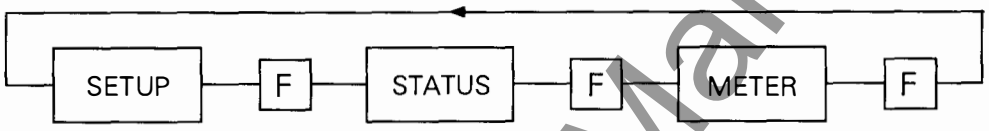


Figure 8. Operation of FUNCTION key, showing progression among Trip Unit operating modes.

Set points are entered into memory in three steps: display, select, and activate, as described below:

1. Press the VALUE key until the desired set point is displayed flashing on the LCD.
2. Press the ENTER key to select this set point. The displayed value stops flashing and the SETUP icon flashes on the LCD. This indicates that the value has been stored in memory but is not yet active. If a new set point is displayed but not selected by pressing the ENTER key (set point value still flashing), then the displayed set point is not entered into memory and the original value is maintained. Multiple set point changes can be made in this fashion without changing the active settings. For each of these changes, the SETUP icon continues to flash.
3. Press the FUNCTION key to activate these settings in the Trip Unit. The SETUP icon no longer flashes, which indicates that any selected settings are also currently active. The FUNCTION key should always be pressed following set point changes to ensure that the active settings match the stored settings.

The set point change steps are summarized as follows:

- Display set point – Press the VALUE key until the desired setting is flashing.
- Select set point – Press the ENTER key; the setting stops flashing and the SETUP icon starts flashing.
- Activate set points – Press the FUNCTION key to activate the settings; the SETUP icon stops flashing.

Always confirm settings on the Trip Unit after making changes by exiting and re-entering Setup mode and rechecking each changed setting.

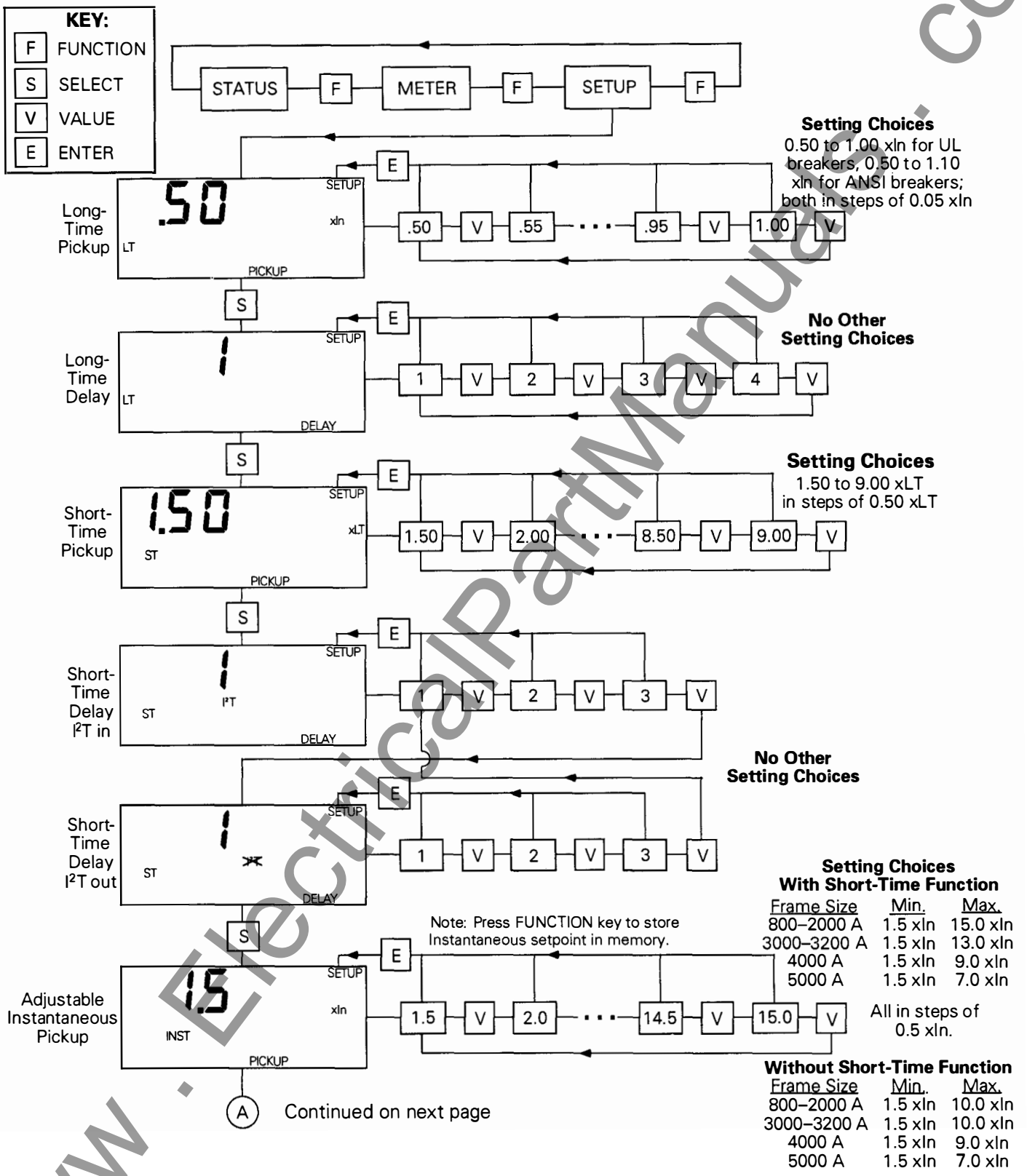


Figure 9. Trip Unit setup mode programming function flow.

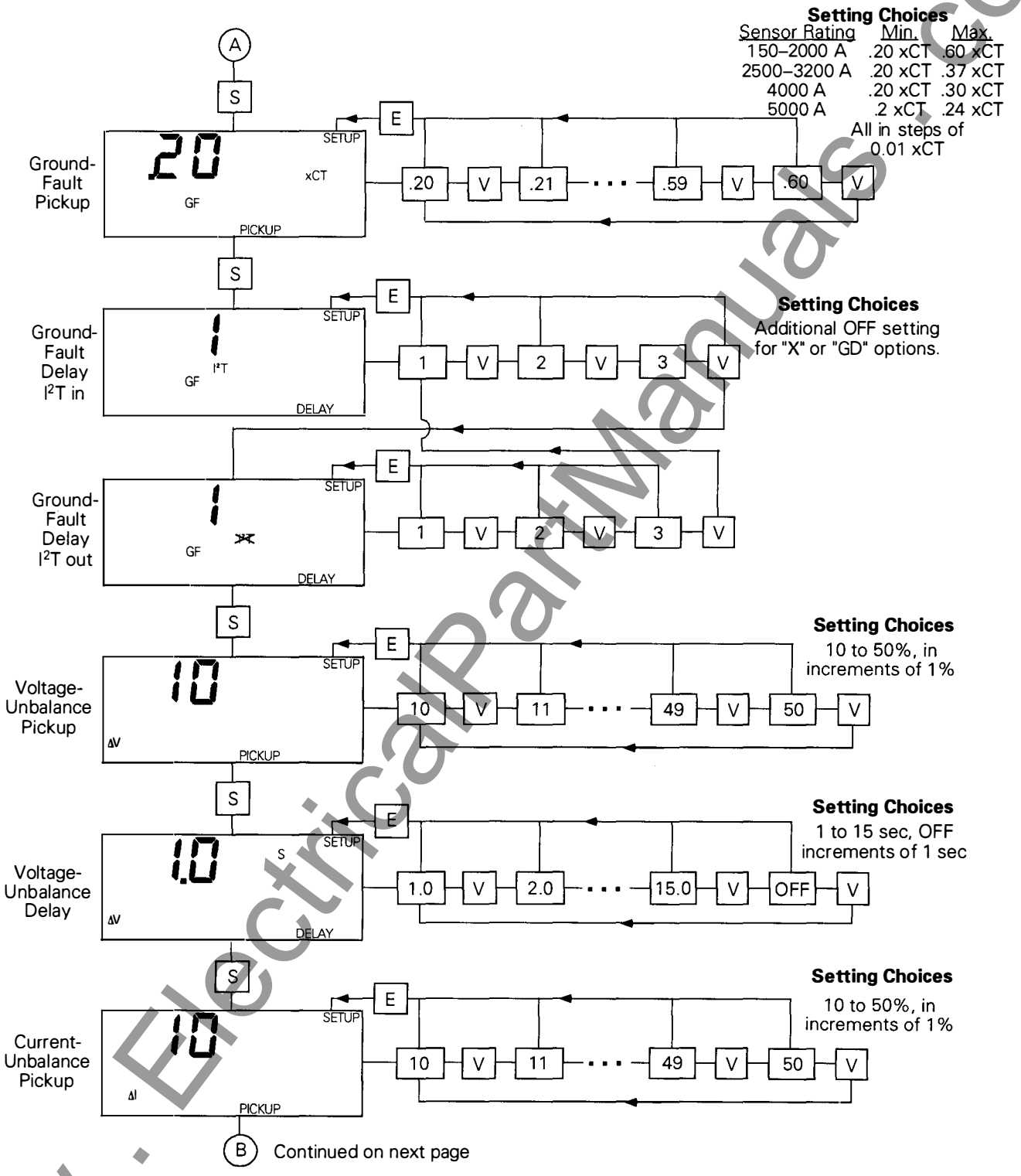


Figure 9. Trip Unit setup mode programming function flow (continued).

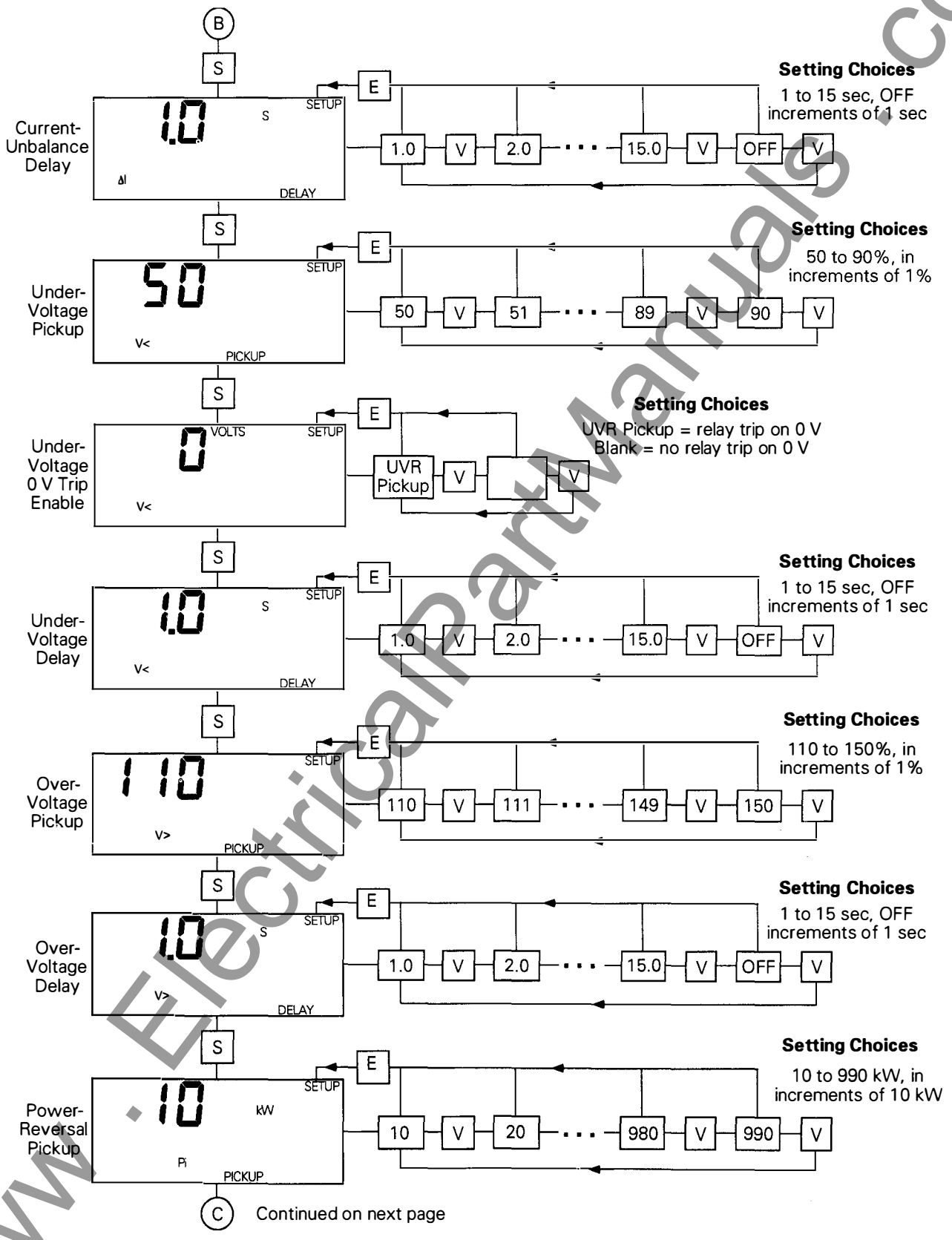


Figure 9. Trip Unit setup mode programming function flow (continued).

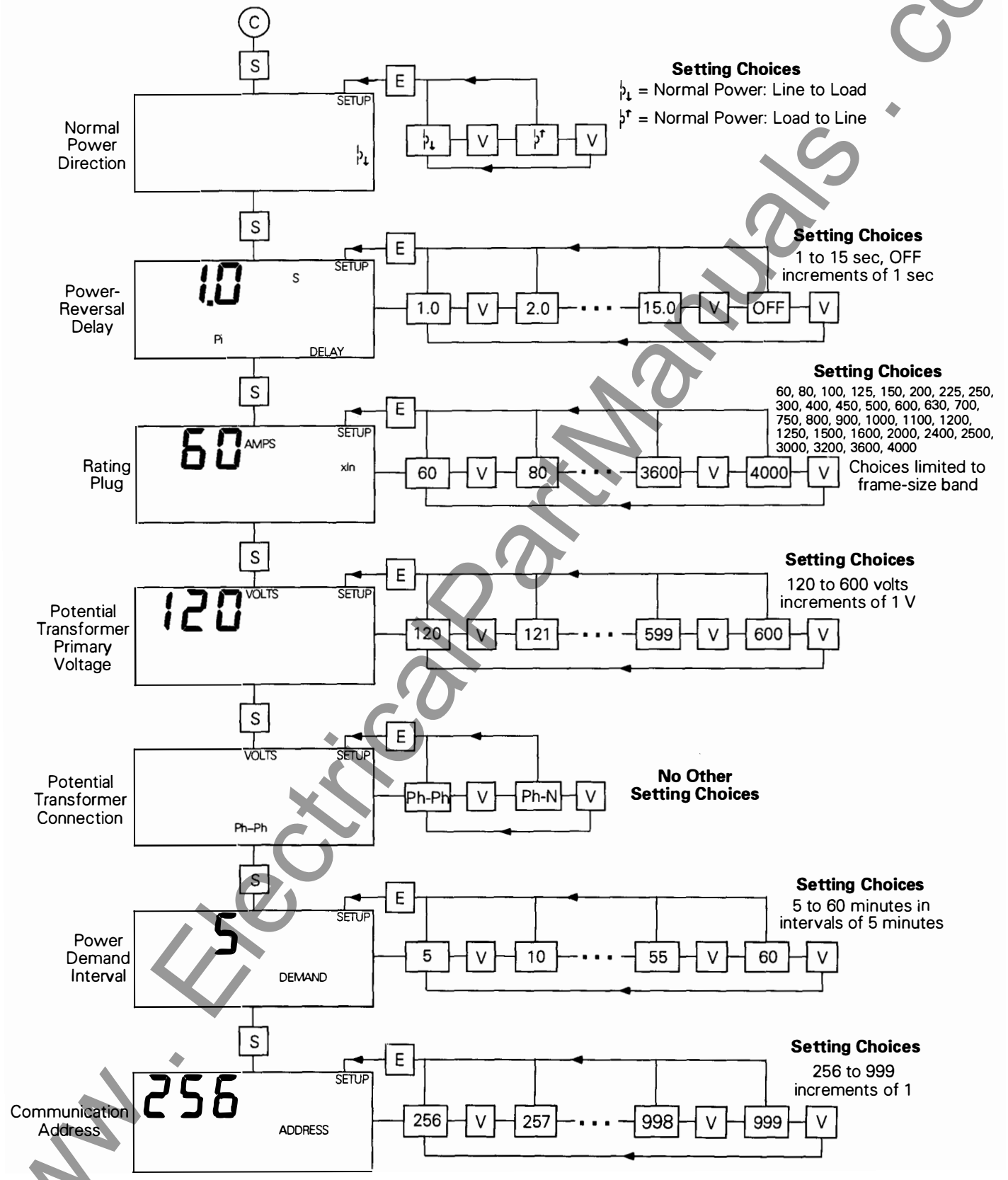


Figure 9. Trip Unit setup mode programming function flow (continued).

Long-Time Pickup

The first setup-mode display is always the long-time pickup setpoint, as illustrated in Figure 10. This set point establishes the breaker's nominal ampere rating, *xLT*, as a fraction of the rating plug value, *xIn* (*xLT* = LT multiplier x *xIn*). Press the VALUE key to scroll through the available choices. Press ENTER to store the desired set point.

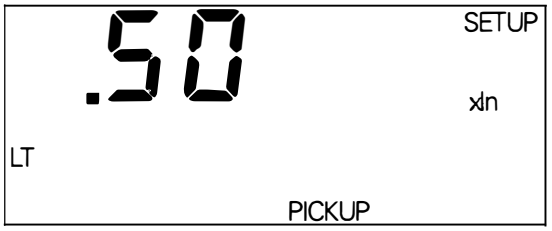


Figure 10. Trip Unit display for long-time pickup.

The choices for UL breakers are 0.50 to 1.00 times *xIn* in steps of 0.05. The pickup value tolerance band is 0% to +20% of the set point.

The choices for ANSI breakers are 0.50 to 1.10 times *xIn*, in steps of 0.05. The pickup value is defined for –10% to +10% of the set point.

Figure 11 illustrates the long-time pickup settings.

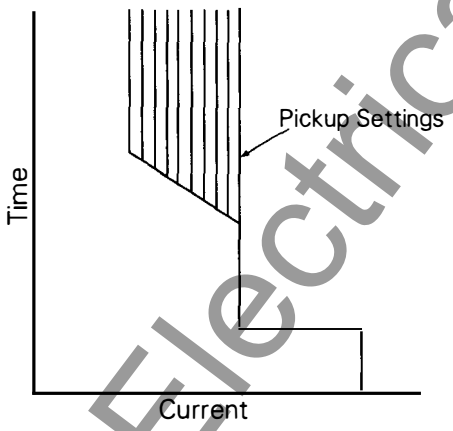


Figure 11. Time-current curve illustrating long-time pickup.

Long-Time Delay

The Trip Unit display for long-time delay is illustrated in Figure 12. This function allows normal momentary overloads without nuisance tripping. The time delays at the lower limit of the bands at 600% of the long-time current setting, *xLT*, are listed in Table 11. Figure 13 illustrates the effect of this delay on trip time. Press the VALUE key to cycle through the four choices of time-delay bands. Press ENTER to store the desired value.

Figure 12. Trip Unit display for long-time delay.

Band	Delay, sec
1	2.4
2	4.9
3	9.8
4	20

Table 11. Lower-limit delays for long-time delay bands.

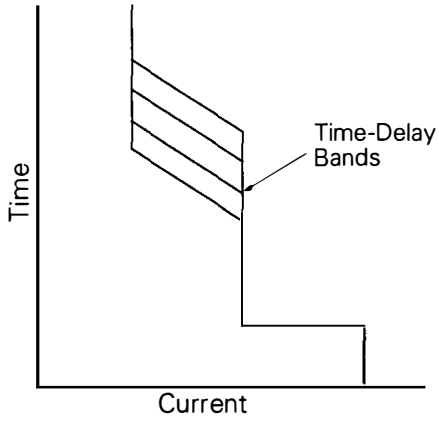


Figure 13. Time-current curve illustrating long-time delay.

Short-Time Pickup

The short-time pickup function establishes the current at which short-time trip is activated. Short-time pickup is coupled with long-time pickup and the choices of pickup settings are from 1.5 to 9.0 times the long-time setting, *xLT*, in steps of 0.5 *xLT*. The Trip Unit display is illustrated in Figure 14.

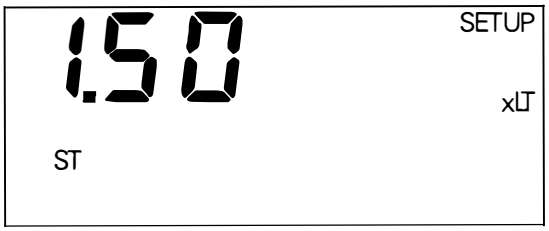


Figure 14. Trip Unit display for short-time pickup coupled with long-time pickup.

The time-current curve for short-time pickup is shown in Figure 15.

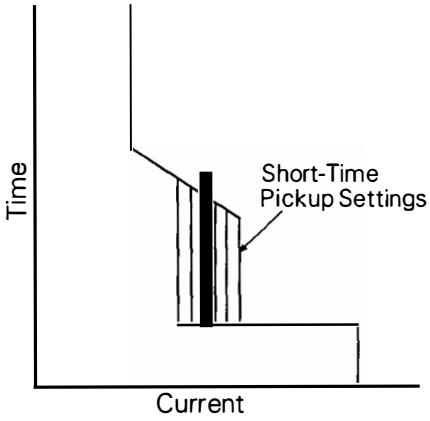


Figure 15. Time-current curve illustrating short-time pickup.

Short-Time Delay

The Trip Unit display for short-time delay is shown in Figure 16. This function delays the breaker trip on a short-time trip. The choices of time-delay bands are listed in Table 12. The delay with I^2T IN is for a current of 600% of *xLT* at the lower limit of the band. The delay with I^2T OUT is for the lower limit of each band.

On ANSI Trip Units ordered with the user-selectable, switchable instantaneous overcurrent and ground-fault option, "X," an additional value of OFF appears at the end of the delay band settings. Choosing OFF disables short-time protection. The short-time OFF band is interlocked with instantaneous pickup, so that only one function can be turned off at a time.

The I^2T OUT function, illustrated in Figure 17, establishes a constant time delay. I^2T IN biases the delay with a constant slope, as shown in Figure 18.

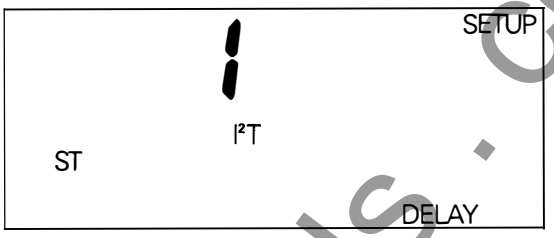


Figure 16. Trip Unit display for short-time delay.

Band	Time Delays, sec
1	0.10
2	0.21
3	0.35

Table 12. Lower-limit delays for I^2T OUT short-time delay bands.

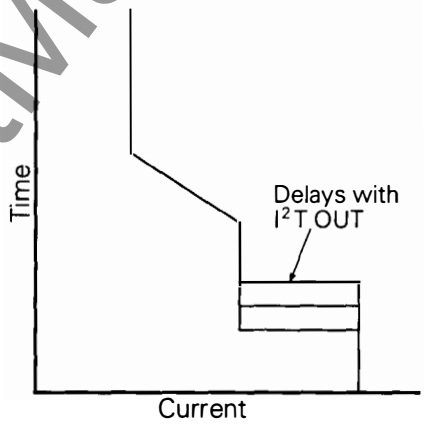


Figure 17. Time-current curve for short-time delay with I^2T OUT.

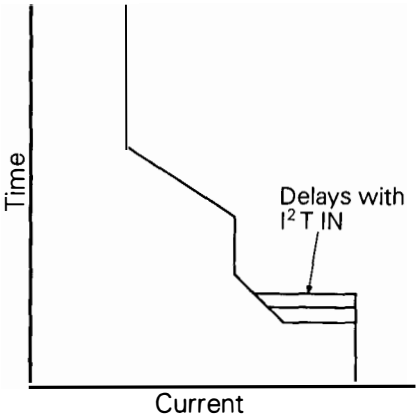


Figure 18. Time-current curve for short-time delay with I^2T IN.

Instantaneous Pickup

Instantaneous overcurrent protection, with Trip Unit display illustrated in Figure 19, causes an immediate breaker trip when the chosen current level is reached. The pickup value may be set in steps of 0.5 *xIn* from 1.5 *xIn* to a maximum dependent on the frame size and the presence of the short-time function, as listed in Table 13.

Note the difference from short-time pickup, which is based on a multiple of *xLT*. The time-current characteristic is shown in Figure 20.

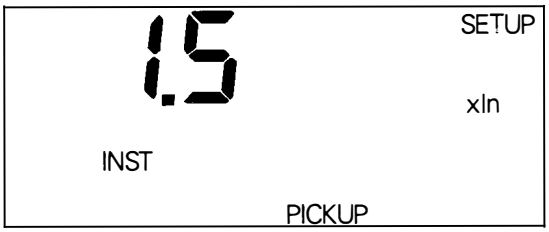


Figure 19. Trip Unit display for instantaneous pickup.

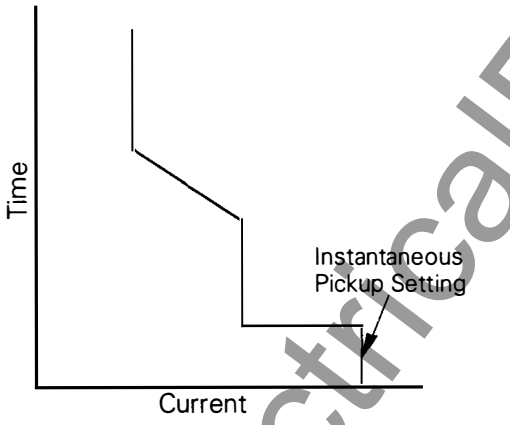


Figure 20. Instantaneous overcurrent protection set point.

Frame Max. Amp Rating	Setpoints Without ST	Setpoints With ST
2000	1.5–10.0 *xIn*	1.5–15.0 *xIn*
3200	1.5–10.0 *xIn*	1.5–13.0 *xIn*
4000	1.5–9.0 *xIn*	1.5–9.0 *xIn*
5000	1.5–7.0 *xIn*	1.5–7.0 *xIn*

Table 13. Instantaneous pickup settings for various frame sizes with and without the short-time function.

On Trip Units with the user-selectable switchable instantaneous overcurrent and ground-fault option, X, an additional value of OFF appears at the end of the listing of numerical values. Choose this setting to disable instantaneous protection. The instantaneous OFF selection is interlocked with short-time pickup, so that only one function can be turned off at a time.

High-Range Instantaneous Overcurrent Protection

High-range instantaneous overcurrent protection has a fixed trip setting equal to the breaker frame's short-time withstand rating, *H*, with pickup tolerance +0%, –20%. When this option is installed, skip programming of instantaneous pickup and go on to the next function by pressing SELECT.

Ground-Fault Pickup

The trip unit display for ground-fault pickup is shown in Figure 21. This function sets the pickup current for ground-fault protection. The available settings are listed in Table 14 as multiples of *xCT* the current sensor rating, in steps of 0.01 *xCT*. The maximum value is limited to 1200 A. Figure 22 illustrates the time-current curve for ground-fault pickup.

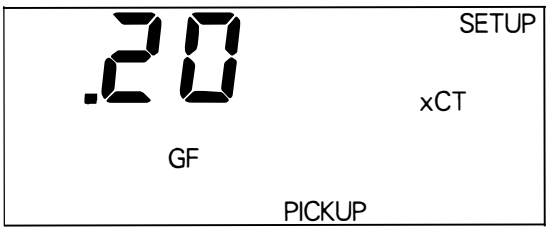


Figure 21. Trip Unit display for ground-fault pickup.

Sensor, A	Set Points
150–2000	0.20–0.60
2500–3200	0.20–0.37
4000	0.20–0.30

Table 14. Ground-fault pickup settings, as a function of sensor rating.

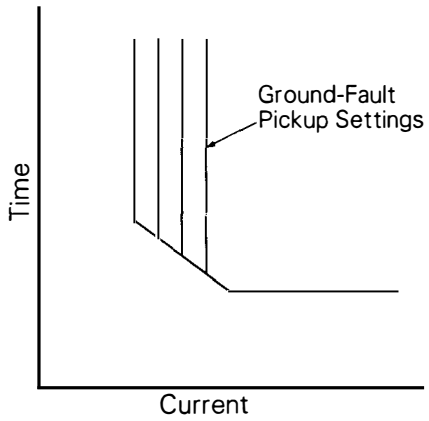


Figure 22. Time-current curve for ground-fault pickup.

Ground-Fault Delay

This function sets the delay before the breaker trips when the ground-fault pickup current has been detected. The Trip Unit display is shown in Figure 23. The choices are listed in Table 15. The delay for I^2T OUT is at the lower limit of each band. The delay for I^2T IN is at 200% of the pickup setting at the lower limit of the band.

The I^2T OUT function establishes a constant time delay, as shown in Figure 24. I^2T IN biases the delay with a constant slope, as shown in Figure 25.

With the X or GD options (switchable ground fault), an OFF selection appears as an additional time-delay set point. Selecting OFF disables ground-fault protection.

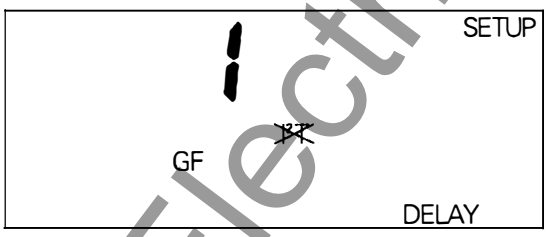


Figure 23. Trip Unit display for ground-fault delay, showing I^2T out.

Band	Time Delay, sec
OFF	Disabled
1	0.10
2	0.21
3	0.35

Table 15. Lower-limit delays for ground-fault delay bands.

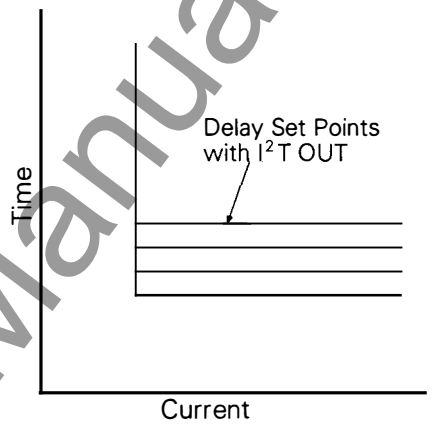


Figure 24. Time-current curve for ground-fault delay with I^2T OUT.

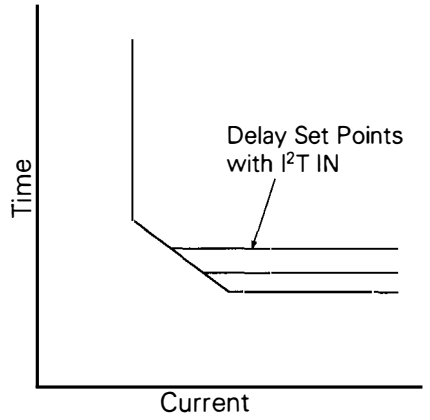


Figure 25. Time-current curve for ground-fault delay with I^2T IN.

Voltage-Unbalance Relay Pickup

This function compares the highest or lowest phase voltage with the average of all three phases and initiates a trip if the difference exceeds the set point. The true rms voltage is computed for each phase. The range of set points is from 10 to 50% of the unbalance, with an increment of 1%. The Trip Unit display is shown in Figure 26.

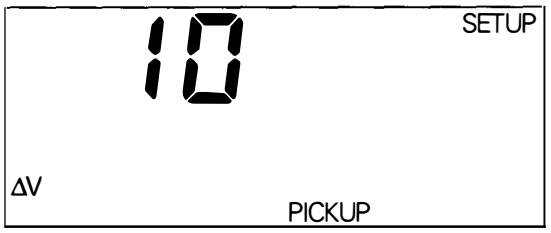


Figure 26. Trip Unit display for voltage-unbalance relay pickup.

Voltage-Unbalance Relay Delay

This function sets the delay time before a voltage-unbalance trip occurs. The range of delays is 1 to 15 seconds, in steps of 1 second. Choosing OFF disables voltage-unbalance protection. The Trip Unit display is shown in Figure 27.

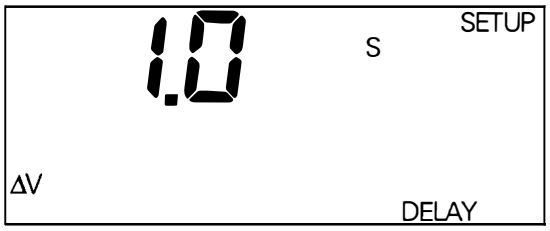


Figure 27. Trip Unit display for voltage-unbalance relay delay.

Current-Unbalance Relay Pickup

This function compares the true RMS current in the highest or lowest phase with the average of all three phases and initiates a trip if the difference exceeds the set point. The range of set points is 10 to 50% of the unbalance, with an increment of 1%. The Trip Unit display is shown in Figure 28.

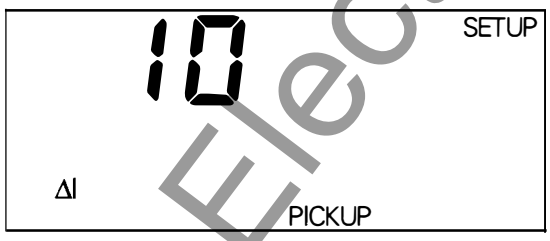


Figure 28. Trip Unit display for current-unbalance relay pickup.

Current-Unbalance Relay Delay

This function sets the delay time before a current-unbalance trip occurs. The range of delays is 1 to 15 seconds, in steps of 1 second. Choosing OFF disables current-unbalance protection. The Trip Unit display is shown in Figure 29.

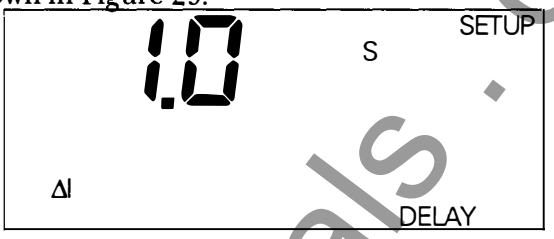


Figure 29. Trip Unit display for current-unbalance relay delay.

Undervoltage Relay Pickup

This function measures the true rms voltage in all phases and initiates a trip if any phase voltage drops below the set point. The range of set points is 50 to 90% of the nominal voltage, with an increment of 1%. The Trip Unit display is shown in Figure 30.

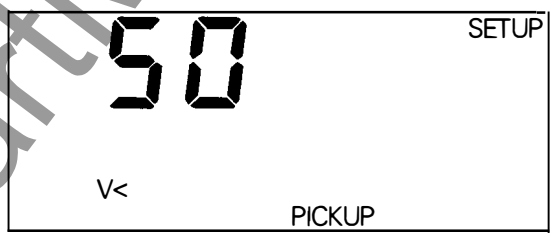


Figure 30. Trip Unit display for undervoltage relay pickup.

Undervoltage Relay Zero-Volt Trip Enable

This function determines if the relay trips when all three phase voltages drop to zero volts. The Trip Unit display for zero-volt trip disabled is shown in Figure 31. The Trip Unit display for zero-volt trip enabled is shown in Figure 32.

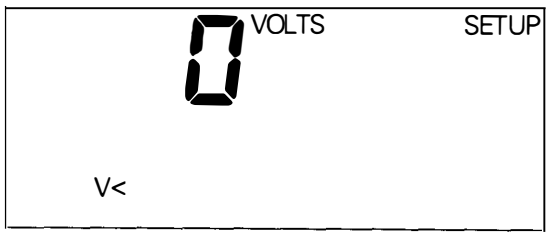


Figure 31. Trip Unit display for undervoltage relay zero-volt trip disabled.

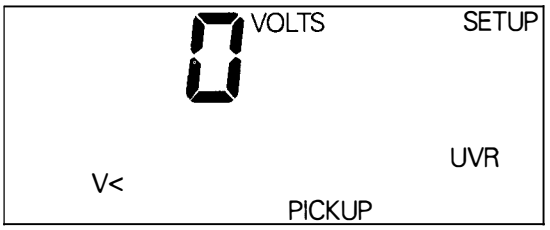


Figure 32. Trip Unit display for undervoltage relay zero-volt trip enabled.

Undervoltage Relay Delay

This function sets the delay time before an undervoltage trip occurs. The range of delays is 1 to 15 seconds, in steps of 1 second. Choosing OFF disables undervoltage protection. The Trip Unit display is shown in Figure 33.

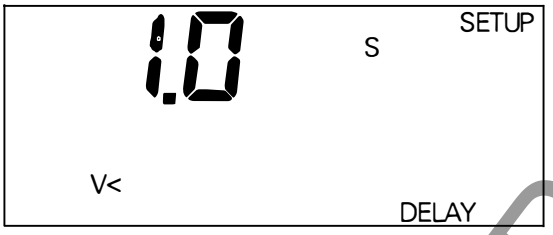


Figure 33. Trip Unit display for undervoltage relay delay.

Overvoltage Relay Pickup

This function measures the true rms voltage in all phases and initiates a trip if any phase voltage exceeds the set point. The range of set points is 110 to 150% of the nominal voltage, with an increment of 1%. The Trip Unit display is shown in Figure 34.

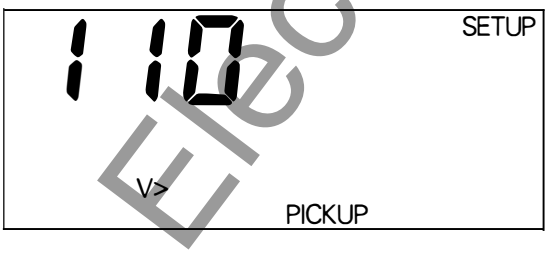


Figure 34. Trip Unit display for overvoltage relay pickup.

Overvoltage Relay Delay

This function sets the delay time before an overvoltage trip occurs. The range of delays is 1 to 15 seconds, in steps of 1 second. Choosing OFF disables overvoltage protection. The Trip Unit display is shown in Figure 35.

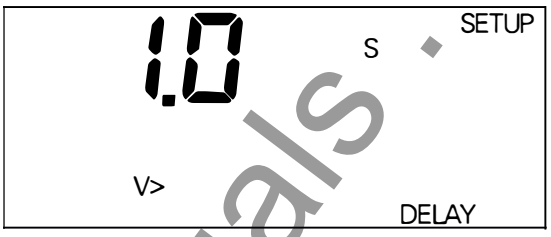


Figure 35. Trip Unit display for overvoltage relay delay.

Power-Reversal Relay Pickup

This function measures the direction of power flow through the breaker and initiates a trip if a sufficient magnitude of reverse power is detected. The range of set points is 10 kW to 990 kW, in steps of 10 kW. The Trip Unit display is shown in Figure 36.

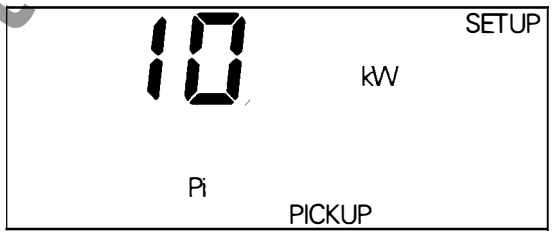


Figure 36. Trip Unit display for power-reversal relay pickup.

Power Direction Setup

This function selects the normal power flow direction for the breaker, either from line to load or from load to line. Figure 37 shows the setup display for normal power flow of line to load. This direction setup also affects the sign of the normal power metering displays.

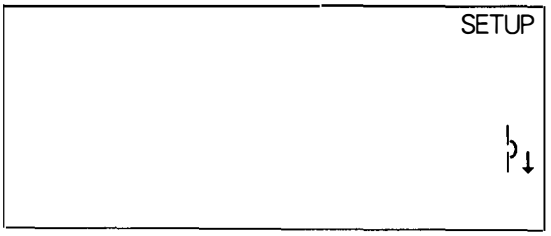


Figure 37. Trip Unit display for power direction setup, showing line to load.

Power-Reversal Relay Delay

This function sets the delay time before a power-reversal trip occurs. The range of delays is 1 to 15 seconds, in steps of 1 second. Choosing OFF disables power-reversal protection. The Trip Unit display is shown in Figure 38.

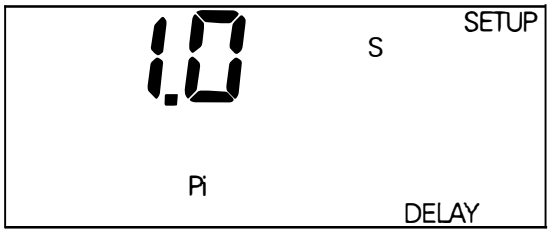


Figure 38. Trip Unit display for power-reversal relay delay.

Rating Plug Current Setting

The Trip Unit display for rating plug setting is shown in Figure 39. Enter the current setting of the rating plug by scrolling through the list with VALUE and pressing ENTER when the correct value is reached. Table 16 lists the available rating plugs for the various Trip Units.

CAUTION: Incorrect storage of this set point will result in incorrect metering values.

ATTENTION: Si une valeur incorrecte est enregistrée pour ce réglage, les mesures seront fausses.

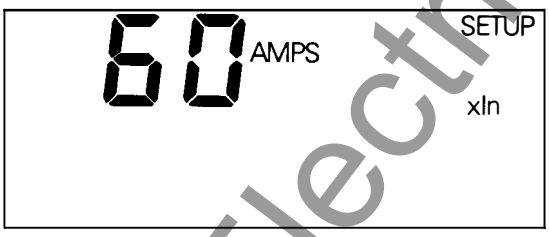


Figure 39. Trip Unit display for rating plug current set point.

Breaker Frame Size	Rating Plug Options, Amps
800–2000 A	60, 80, 100, 125, 150, 200, 225, 250, 300, 400, 450, 500, 600, 630, 700, 750, 800, 900, 1000, 1100, 1200, 1250, 1500, 1600, 2000
2500–3200 A	1200, 1500, 1600, 2000, 2400, 2500, 3000, 3200
4000 A	1600, 2000, 2400, 2500, 3000, 3200, 3600, 4000
5000 A	3200, 4000, 5000

Table 16. Trip Unit rating plug options.

Potential Transformer Primary Voltage

Enter the primary voltage rating of the potential transformer, as illustrated in Figure 40. The range of values is 120 to 600 volts, with an increment of 1 volt.

CAUTION: Incorrect storage of this set point will result in incorrect metering values. Even if this setting is entered remotely, it must be entered again locally.

ATTENTION: Si une valeur incorrecte est enregistrée pour ce réglage, les mesures seront fausses. Cette valeur doit être enregistrée locallement même dans le cas d'une utilisation à distance avec commnet.

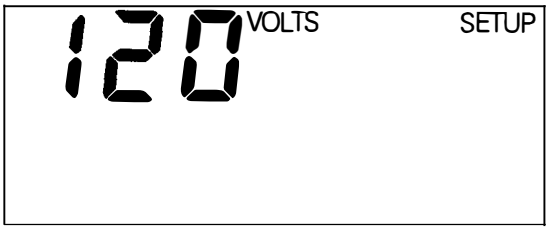


Figure 40. Trip Unit display for potential transformer primary voltage set point.

Potential Transformer Connection

Note that this step applies only to MicroVersaTrip PM Trip Units.

Select the appropriate potential transformer connection, either line-to-line (Ph-Ph) or line-to-neutral (Ph-N), as illustrated in Figure 41.

CAUTION: Incorrect storage of this set point will result in incorrect metering values.

ATTENTION: Si une valeur incorrecte est enregistrée pour ce réglage, les mesures seront fausses.

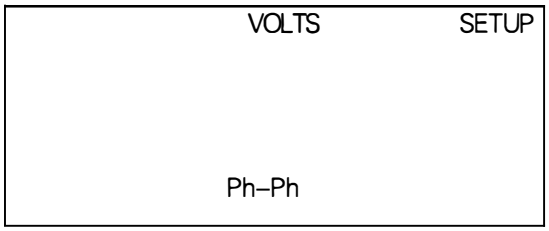


Figure 41. Trip Unit display for potential transformer connection choice.

Power Demand Intervals

This function sets the power demand interval, which can be in the range of 5 to 60 minutes, in steps of 5 minutes. This setpoint specifies the time interval for power demand averaging. The Trip Unit calculates a rolling average of breaker power over this time interval. The Trip Unit display is illustrated in Figure 42.

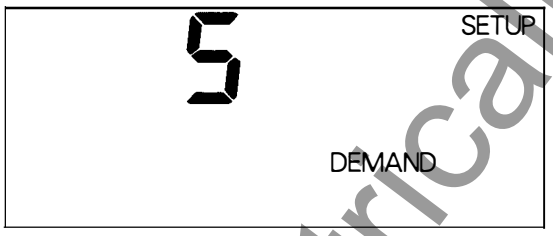


Figure 42. Trip Unit display for power demand interval.

Communication Address

Note that this step applies only to MicroVersaTrip PM Trip Units connected to either POWER LEADER™ or Epic MicroVersaTrip systems.

With POWER LEADER systems, the address is assigned at the breaker. The address options are from 256 to 999, in steps of 1, as illustrated in Figure 43.

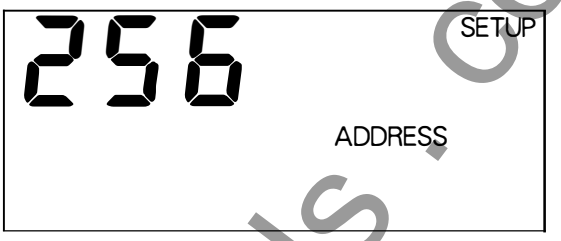


Figure 43. Trip Unit display for setting communication address.

With Epic MicroVersaTrip systems, the Field Programming Unit (FPU) calls for removal of the rating plug. This is not required for addressing a MicroVersaTrip PM Trip Unit. Simply press ENTER to identify the unit to the FPU. *The address shown on the FPU's display must not be changed at the breaker.*

Accessory Configuration Setup (RMS9D Series Trip Units Only)

RMS9D Trip Units have a six-position DIP switch module on the rear of the unit that controls the configuration of the Power Break® II integrated accessories. These switches can be set up to define the types of signals (protection trip, Shunt trip, Shunt Trip with Lockout, or Undervoltage Release trip) that activate the Bell Alarm–Alarm Only and Bell Alarm with Lockout accessories on the Power Break II breaker. Each of the six switches enables or disables a different path to activate these accessories from the different types of trip signals. Figure 44 shows the logic function for the switches.

The Trip Unit DIP switches are illustrated in Figure 45, with the factory settings shown. Table 17 lists the switch functions.

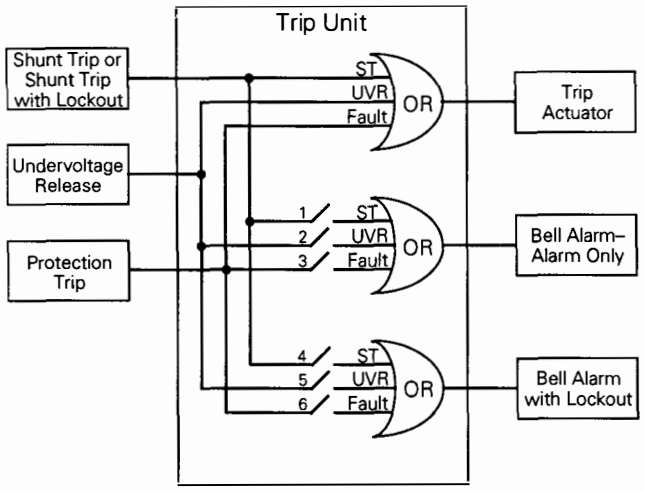


Figure 44. Logic diagram for accessory configurations.

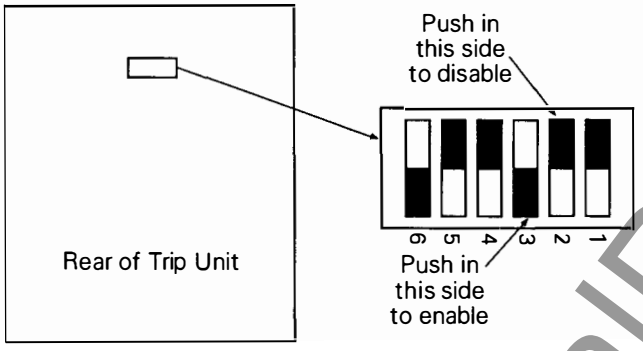


Figure 45. Accessory configuration switch on rear of Trip Unit, showing factory settings (solid part indicates that switch is pushed in on that side).

Description of Switch Settings

Following are descriptions of the effects of each accessory switch when it is *enabled*:

1. When a Shunt Trip or Shunt Trip with Lockout accessory causes the breaker to trip, the contacts of the Bell Alarm–Alarm Only also change state. The factory switch setting is *disabled*.
2. When an Undervoltage Release accessory causes the breaker to trip, the contacts of the Bell Alarm–Alarm Only also change state. The factory switch setting is *disabled*.

Switch	Factory Setting	Function
1	Disabled	Shunt Trip or Shunt Trip with Lockout activates Bell Alarm–Alarm Only
2	Disabled	UVR trip activates Bell Alarm–Alarm Only
3	Enabled	Protection trip activates Bell Alarm–Alarm Only
4	Disabled	Shunt Trip or Shunt Trip with Lockout activates Bell Alarm with Lockout
5	Disabled	UVR trip activates Bell Alarm with Lockout
6	Enabled	Protection trip activates Bell Alarm with Lockout

Table 17. Accessory configuration switch settings, including factory defaults.

3. When a protection trip (long-time, short-time, instantaneous, ground-fault, or protective-relay) occurs, the contacts of the Bell Alarm–Alarm Only also change state. The factory switch setting is *enabled*.
4. When the Shunt Trip or Shunt Trip with Lockout accessory causes the breaker to trip, the contacts of the Bell Alarm with Lockout also change state. The factory switch setting is *disabled*.
5. When the Undervoltage Release accessory causes the breaker to trip, the contacts of the Bell Alarm with Lockout also change state. The factory switch setting is *disabled*.
6. When a protection trip (long-time, short-time, instantaneous, ground-fault, or protective-relay) occurs, the contacts of the Bell Alarm with Lockout also change state. The factory switch setting is *enabled*.

To change switch settings on RMS9D series Trip Units, refer to Chapter 5 to remove the Trip Unit from the breaker. Push in the appropriate Enable or Disable side of the switch to configure the accessories, as shown in Figure 46, and carefully reinstall the Trip Unit. Verify that the new switch settings are correct by testing the breaker responses to Undervoltage Release trips and Shunt trips.

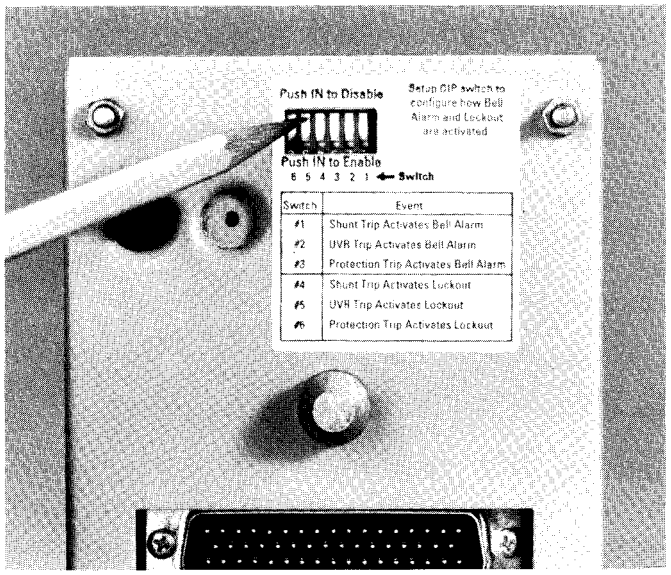


Figure 46. Setting the accessory configuration switches.

3-1 Overview

The metering mode displays parameter values for that part of the electrical system controlled by the breaker's MicroVersaTrip Plus or MicroVersaTrip PM Trip Unit. Both currents and voltages are computed as true rms values. There is no loss of accuracy even in the presence of high levels of harmonics. All metering displays are updated once each second. Accuracies and resolutions are described in Section 1-8 and Table 7.

All values except frequency are displayed to three significant figures. For example, phase currents might be displayed as 60.7 AMPS, 492 AMPS, or 1.22 KA.

The Trip Unit metering displays are appropriate to the actual configuration ordered. All MicroVersaTrip Plus and MicroVersaTrip PM Trip Units include current metering. Two configurations of the MicroVersaTrip PM Trip Units (with PM and M suffixes in their catalog numbers) have the full complement of metering displays.

The Trip Unit must be provided with control power to display metered values. This can come from internal battery power, from a MicroVersaTrip Portable Power pack, from an external +24 Vdc power supply, or by energizing the breaker to at least 20% of its sensor load.

3-2 Metering Mode Operation

Metering mode is reached by pressing FUNCTION until METER appears in the upper-right corner of the display. Metering mode always begins with the phase currents. The sequence in which the metered values appear is illustrated in Figure 47.

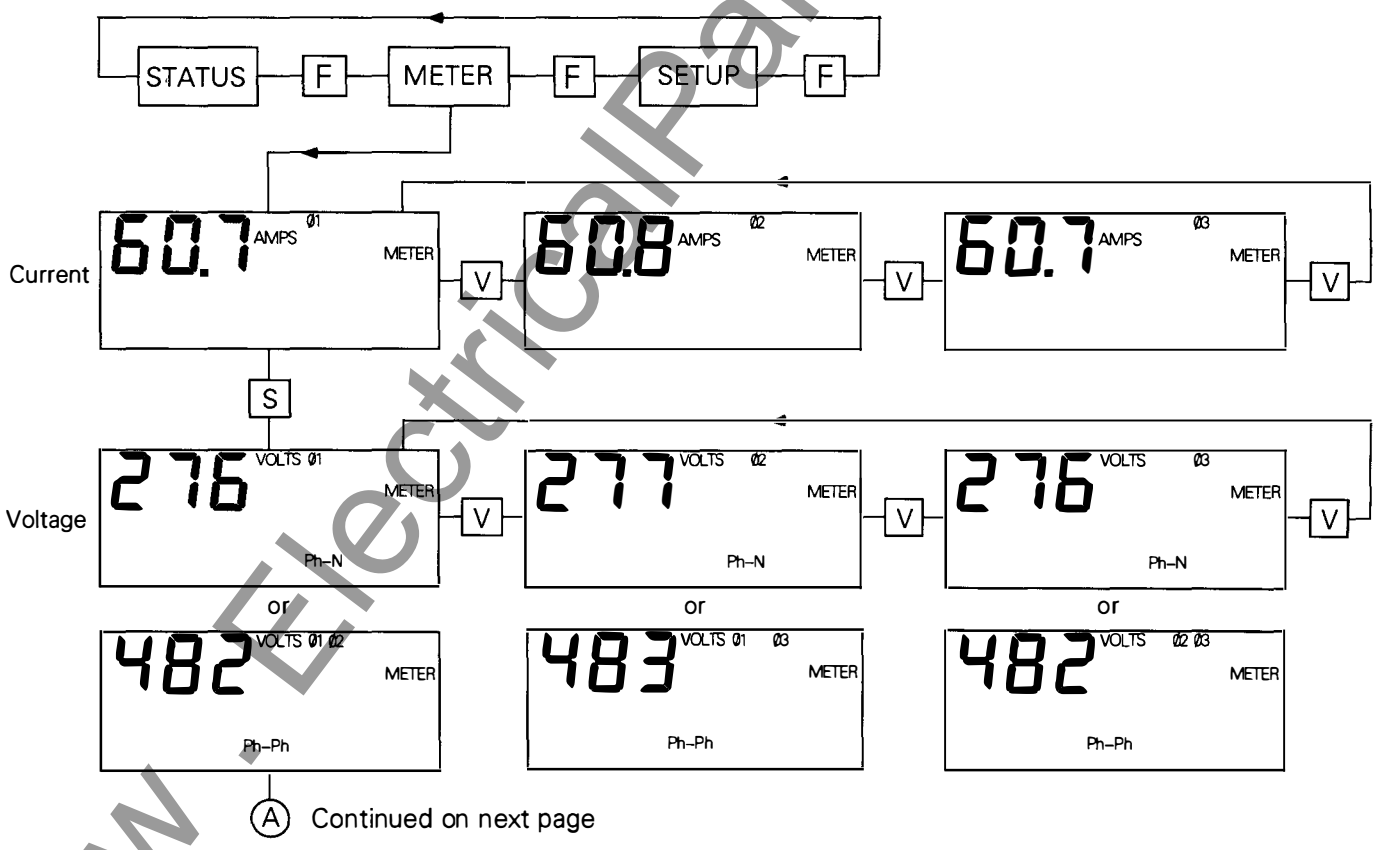


Figure 47. Trip Unit metering mode function flow.

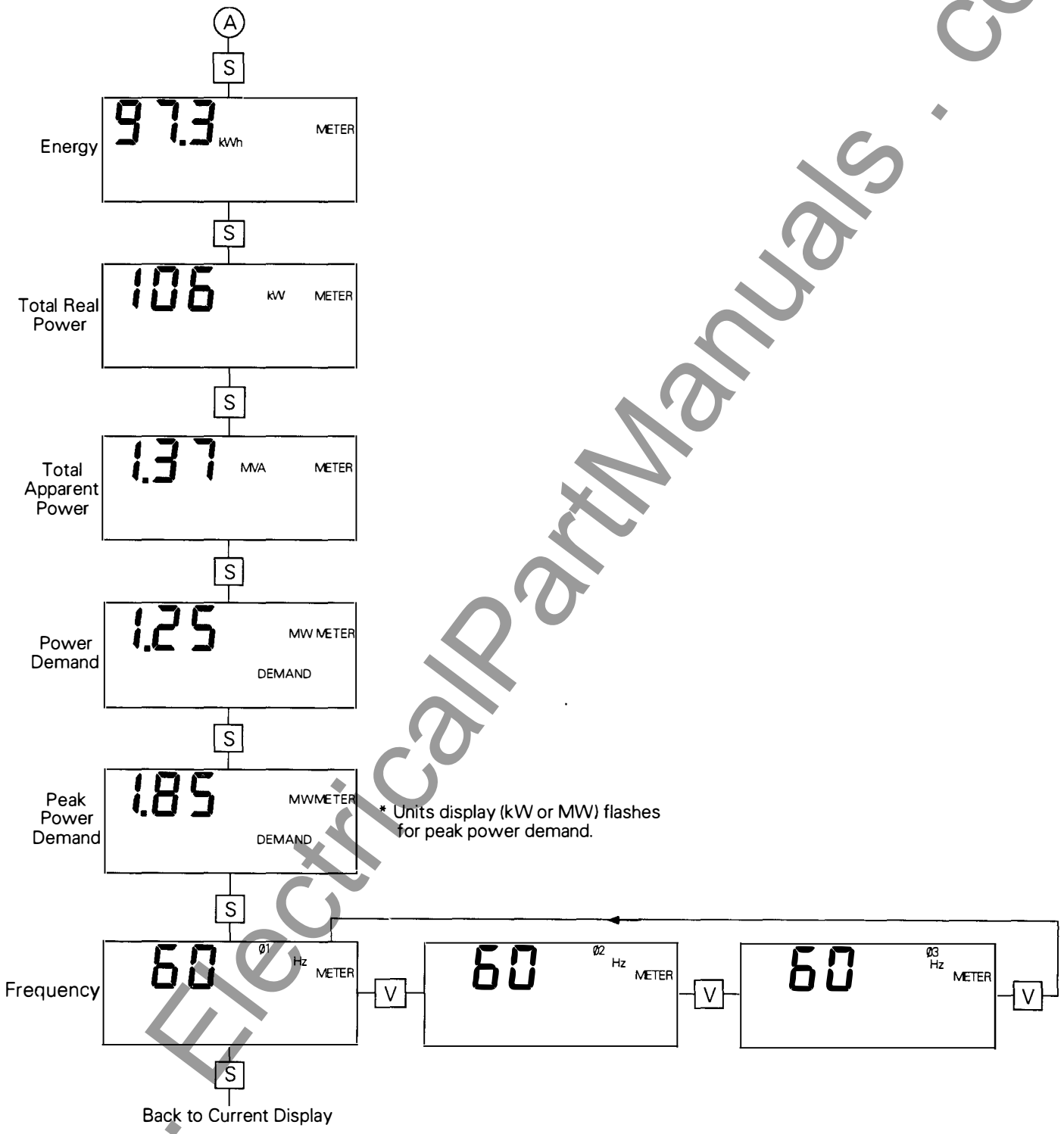


Figure 47. Trip Unit metering mode function flow (continued).

Current

The initial metering display is phase 1 line current, as illustrated in Figure 48. Press VALUE to cycle among the three phases. Current is displayed from 0 to 999 amperes and from 1.00 to a maximum of 999 kA. For current values less than 5% of the current sensor rating, the displayed value is zero.

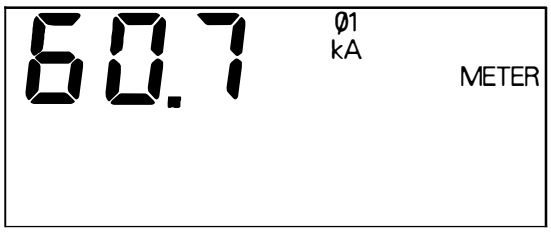


Figure 48. Trip Unit display for current metering.

Voltage

The voltage displayed by this function depends on how the Trip Unit was configured during Setup. If the breaker was configured with phase-to-neutral connections, the display shows individual phase voltages, as in Figure 49. If the breaker was configured with phase-to-phase connections, the display shows voltages between the phases, as in Figure 50. Press VALUE to cycle through the three phase voltages.

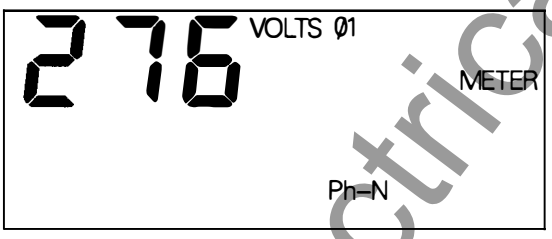


Figure 49. Trip Unit display for line-to-neutral voltages.

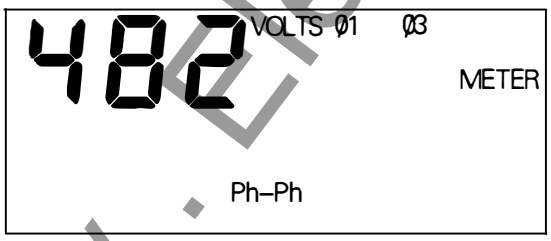


Figure 50. Trip Unit display for line-to-line voltages.

Energy

This display, illustrated in Figure 51, shows the aggregate energy flow through the breaker. The value is displayed from 0 to 999 kWh, then automatically switches units to display 1.00 to 999 Mwh, and then again to display 1.00 to 999 GWh. When 999 GWh is exceeded, the display switches back to 0 kWh. The largest negative energy value displayed is –99 GWh.

Accumulated energy is stored in nonvolatile memory. The value in the display can be reset through the Trip Unit keypad. To reset the energy value, hold down the VALUE key and press the SELECT key. The displayed energy value will reset to zero.

Figure 51. Trip Unit display for aggregate energy.

Total Real Power

The value displayed for total real power, illustrated in Figure 52, represents the aggregate real power in watts flowing through all three phases. The value is displayed from 0 to 999 kW, then automatically switches units to display 1.00 to 999 MW.

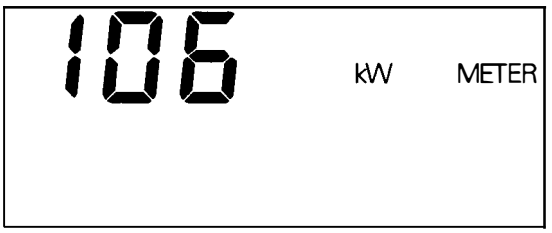


Figure 52. Trip Unit display for aggregate real power.

Total Apparent Power

The value displayed for total apparent power, as illustrated in Figure 53, represents the aggregate total apparent power in volt-amperes flowing through all three phases. The value is displayed from 0 to 999 kVA, then automatically switches units to display 1.00 to 999 MVA.

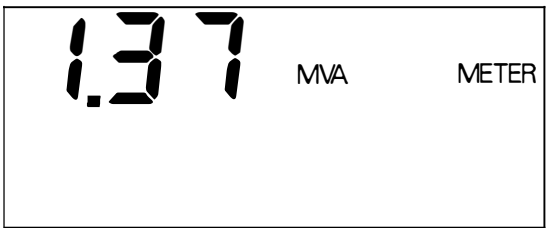


Figure 53. Trip Unit display for aggregate apparent power.

Power Demand

Power demand is the average of total power over the selected interval (5, 10, …, 55, 60 minutes). This display is updated every minute. The power demand display is illustrated in Figure 54.

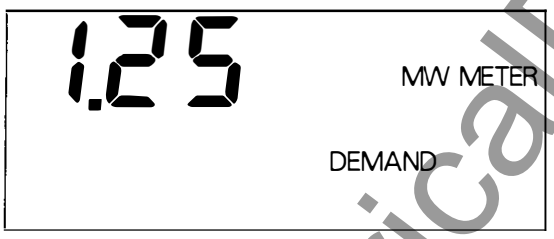


Figure 54. Trip Unit display for power demand.

Peak Power Demand

Peak power demand is stored in nonvolatile memory. Every minute, the power demand is calculated and compared against the stored peak power demand. If the new power demand is greater than the stored peak demand, the Trip Unit stores the new power demand as the peak value. The display of peak power demand is identical to the display illustrated in Figure 54, except that the units segment (in this case, MW) flashes.

Peak demand is stored in nonvolatile memory. The value in the display can be reset through the Trip Unit keypad. To reset the peak demand to the present demand, hold down the VALUE key and press the SELECT key.

Frequency

This display, illustrated in Figure 55, shows the frequency of the line current. Either line voltage or current must be present for this display to appear.

The frequency is calculated from the current and voltage signals. If both are present, the voltage frequency is displayed. If neither are present, this display does not appear.

The frequency is displayed in steps of 1 Hz.

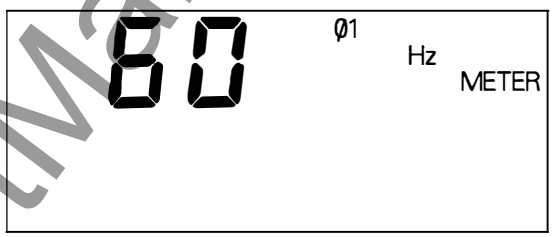


Figure 55. Trip Unit display for frequency.

4-1 Overview

Trip Unit Status mode is selected by pressing the FUNCTION key until STATUS appears on the display. Status mode indicates the present status of the Trip Unit and circuit breaker. It also displays information about trip conditions and the trip history of the breaker. Two categories of information can be displayed: trip information and trip operations counters.

Trip Information

Various trip information parameters are displayed when an overcurrent trip or protective relay trip occurs. Additionally, RMS9D series Trip Units provide target indications if a breaker Undervoltage Release or Shunt Trip accessory trip occurs.

The Status display indicates when a long-time, short-time, or ground-fault trip is imminent (breaker is in pickup). Following a trip, the Trip Unit displays a trip target to indicate the type of trip, the fault current magnitude at trip, and the phase of the fault (where appropriate). For adjustable-instantaneous trips, the Trip Unit displays the instantaneous function setpoint rather than the actual current. Fault magnitude is not displayed for high-range instantaneous trips.

Trip information is stored in the Trip Unit memory and displayed when Trip Unit power is returned or if internal battery power is enabled. Trip information is always available if Trip Unit power is maintained following a fault.

The Status display records trip information only for those options ordered with the Trip Unit. For example, only MicroVersaTrip PM Trip Units can be equipped with protective relays and thus display information about them.

RMS9D series Trip Units only display trip targets for Undervoltage Release and Shunt Trip accessory trips when those accessory modules are installed in the Power Break® II breaker.

Trip Operations Counters

Trip operations counters record the total number of overcurrent trips. Separate internal counters are provided for each of the following types of trips: long-time, short-time, adjustable-instantaneous, and ground-fault. The corresponding counter is incremented after any of these trips. A maximum of 256 trips can be counted for each type of fault, after which the counter rolls over to zero.

4-2 Status Mode Operation

This section describes each of the Status mode displays.

Normal Status Display

When the breaker is closed and its circuit energized, the normal status display appears, as illustrated in Figure 56. This display indicates that the Trip Unit is not in long-time pickup and that all trip targets are cleared.

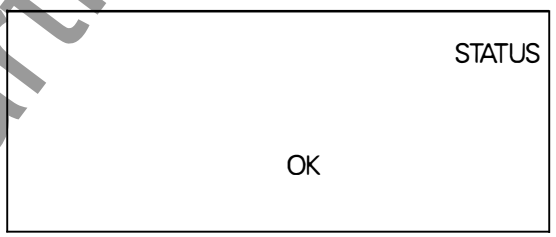


Figure 56. Trip Unit display for normal status.

Long-Time Overcurrent Pickup Display

When the long-time overcurrent function has reached 95% of the Trip Unit's long-time current rating, *xLT*, PICKUP begins to flash on the display, as illustrated in Figure 57. During the transition from 95% to 100% of the set point, the frequency of flashing increases. When the set point is reached, but before the time delay has expired, the flashing stops, indicating that tripping is imminent.

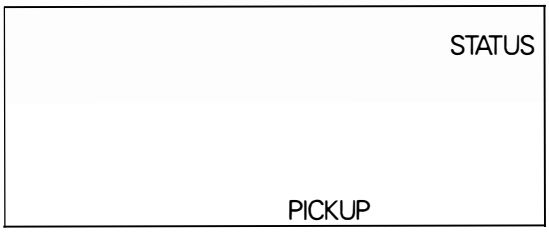


Figure 57. Trip Unit status display for long-time overcurrent pickup.

Trip Target and Fault Displays

When the breaker trips, information about the trip can be displayed in Status mode. Figure 58 illustrates a typical fault display following a trip.

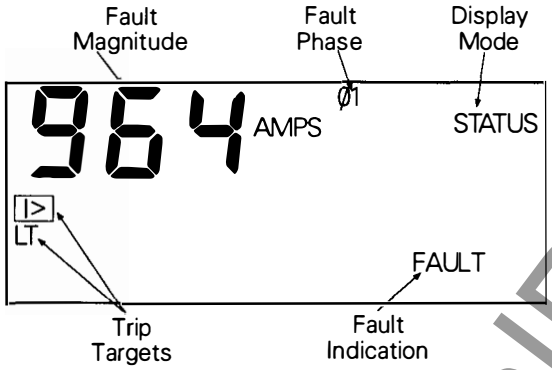


Figure 58. Typical fault display following a breaker trip.

The FAULT segment indicates that the breaker has tripped because of an overcurrent condition or a protective relay. This segment remains visible until it is cleared, including displays in Setup and Meter mode. This provides an indication that trip information is available, even if other screens are being displayed. If the trip was caused by a protective relay, the FAULT segment flashes in Setup or Meter mode. After an overcurrent trip, the FAULT segment and the appropriate overcurrent target are displayed in all modes, without blinking, until cleared.

Long-Time Overcurrent Fault Display

After a long-time overcurrent trip, the trip information display contains the fault current magnitude at trip, the phase on which the fault occurred, and the overload (I>) and long-time (LT) trip targets. This display is illustrated in Figure 59.

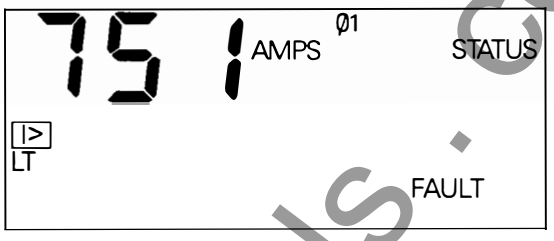


Figure 59. Trip Unit Status display for long-time overcurrent trip.

Short-Time Overcurrent Fault Display

After a short-time trip, the status display appears as in Figure 60. The information presented is similar to that in the long-time overcurrent display, with the short-circuit (I>>) and short-time (ST) targets.

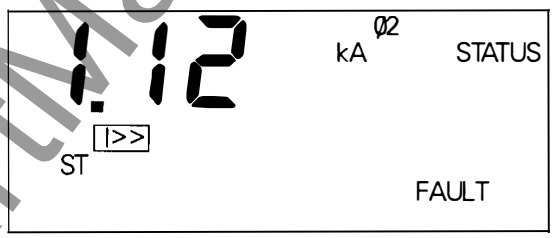


Figure 60. Trip Unit status display for short-time overcurrent trip.

Instantaneous Fault Display

The status display for an adjustable instantaneous trip is illustrated in Figure 61. Because of the fast response of this function, the Trip Unit displays only the threshold current for the fault, not the actual fault current nor the phase on which the fault occurred. For high-range instantaneous trips, the threshold current is also not displayed, only the trip target.

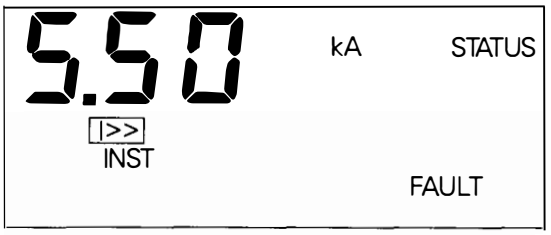


Figure 61. Trip Unit status display for instantaneous overcurrent trip.

Ground-Fault Display

When a ground-fault trip occurs, the display illustrated in Figure 62 appears. The fault current is displayed in units of *xCT*, the breaker CT sensor rating. Multiply the sensor rating of the breaker by the displayed fault current multiplier to obtain the ground-fault current at trip.

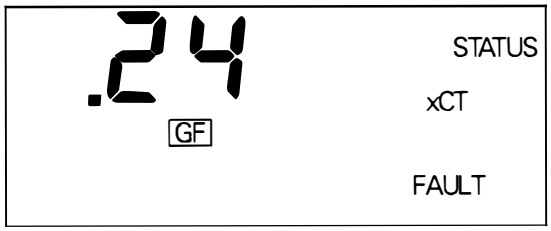


Figure 62. Trip Unit status display for ground-fault trip.

Protective-Relay Fault Display

After a protective-relay trip, the display indicates FAULT with a target for the type of relay that initi ated the trip. This is illustrated in Figure 63 for an overvoltage trip. The targets for the five protective relays are listed in Table 18.

Figure 63. Trip Unit status display for protective-relay trip.

Code	Protective Relay
ΔV	Voltage unbalance
ΔI	Current unbalance
V<	Undervoltage
V>	Overvoltage
↾↑	Power reversal

Table 18. Trip Unit display targets for protective relays.

Shunt Trip and Undervoltage Release Trip Displays (RMS9D Series Trip Units Only)

When a Power Break ®II breaker trips due to the Shunt Trip, Shunt Trip with Lockout, or Undervoltage Release, the display indicates the trip with a flashing target, as illustrated in Figure 64. The indications ST and UVR appear for Shunt Trip and Undervoltage Release trips, respectively. Note that the FAULT segment does not display, since the trip originated external to the breaker and may not represent a true fault condition.

Figure 64. Trip Unit status display for Undervoltage Release trip.

Clearing the Trip Information

Since trip information is stored in nonvolatile memory, the Trip Unit continues displaying the trip information until it is manually cleared or a new trip occurs. After the trip information has been recorded or reviewed, it can be cleared with the keypad. With the Trip Unit in Status mode, hold down the VALUE key and press the SELECT key. The trip information is then cleared and the display reverts to STATUS OK, as in Figure 56.

Trip Operations Counter Display

Trip operations counters record the total number of overcurrent trips. To review any of the trip operations counters while in Status mode, press the SELECT key until the desired count appears. Figure 65 illustrates a typical trip operations counter display. This example indicates that there have been three long-time trips on this breaker since the counter was last reset.

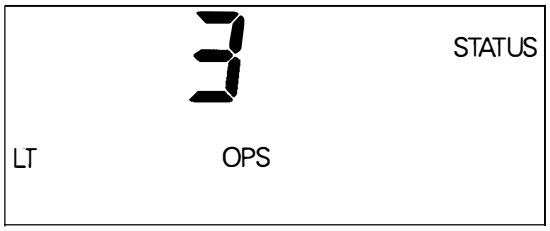


Figure 65. Trip Unit status display for long-time overcurrent trip counter.

Clearing the Trip Operations Counters

Since the trip operations counters are stored in non-volatile memory, the Trip Unit maintains the information indefinitely. To clear a particular counter, first display the corresponding count, then hold down the VALUE key and press the SELECT key. The trip counter is reset to zero.

Rating plugs and MicroVersaTrip Plus and MicroVersaTrip PM Trip Units are factory tested and normally shipped installed in their breaker frame assemblies or as part of a conversion kit. There is no requirement for periodic maintenance of the Trip Units. *There are no user-serviceable components within the Trip Units.*

5-1 Trip Unit Removal and Replacement

Rejection pins are installed on the rear of all Trip Units to prevent installation of an incorrect Trip Unit into a breaker. Do not use excessive force when installing a Trip Unit. Replacement of a Trip Unit always requires repeating the setup procedures, as described in Chapter 2.

Power Break® Insulated-Case Circuit Breakers

Power Break circuit breakers are shipped from the factory with their Trip Units installed. Removal is only necessary for replacement. Refer to GEH-6303 for detailed instructions on replacing Trip Units in Power Break circuit breakers.

WARNING: Before beginning this procedure, turn the breaker off, disconnect it from all voltage sources, and discharge the closing springs.

AVERTISSEMENT: Avant de commencer cette procédure, mettre le disjoncteur en position OFF, le déconnecter de toute tension d'alimentation, et décharger les ressorts de fermeture.

Power Break II Insulated-Case Circuit Breakers

Power Break II circuit breakers are shipped from the factory with their Trip Units installed. Removal is only necessary for replacement or to change the accessory-configuration switches.

To remove the Trip Unit, perform the following procedure:

WARNING: Before beginning this procedure, turn the breaker OFF, disconnect it from all voltage sources, and discharge the closing springs, if they are charged, by closing and then opening the breaker.

AVERTISSEMENT: Avant de commencer cette procédure, mettre le disjoncteur en position OFF, le déconnecter de toute tension d'alimentation, et décharger les ressorts de fermeture.

1. Loosen the four #8-32 screws on the breaker trim-plate assembly and remove the trim plate.
2. Loosen the four #10-32 screws at the corner of the breaker cover. Remove the cover from the breaker face.
3. Pull the Trip Unit locking lever to the right, then hold the Trip Unit near the battery cover and lift it straight out of the breaker.

To reinstall the Trip Unit, perform the following procedure:

1. Pull the Trip Unit locking lever to the right. While holding the lever, carefully align the connector on the rear of the Trip Unit with the connector in the breaker. Press down on the Trip Unit while holding it near the battery cover. When the Trip Unit is fully seated, slide the locking lever back to the left.
2. Reinstall the breaker top cover and tighten the four #10-32 screws to 32 in-lbs.
3. Replace the trim plate and tighten the four #8-32 screws to 20 in-lbs.

Type AKR Low-Voltage Power Circuit Breakers

Type AKR circuit breakers are shipped from the factory with their Trip Units installed. Removal is necessary only for replacement. Trip Units are separately mounted on the breaker structure and are removed by moving the Trip Unit removal bracket. When a Trip Unit is replaced, the locking arm snaps back into place to indicate proper engagement. Refer to GEH-6303 for detailed instructions on replacing Trip Units in in Type AKR circuit breakers.

WARNING: Always de-energize Type AKR circuit breakers before attempting to remove or replace the Trip Unit. Because of the exposed location of the Trip Unit, failure to observe this warning may result in equipment damage or personal injury, including death.

ATTENTION: Deconneter le disjoncteur de type AKR de toute tension avant d'enlever ou remplacer le déclencheur. L'emplacement du déclencheur étant proche de parties sous tension, le non respect de cet avertissement peut entrainer des endommagements du matériel, et des blessures pouvant être mortelles.

5-2 Rating Plug Removal and Replacement

CAUTION: Removal of the rating plug while the breaker is carrying current reduces the breaker's current-carrying capacity to approximately 25% of the current sensor rating.

ATTENTION: Si le calibreur est retiré le disjoncteur et traversé par un courant, le niveau de protection s'ajuste à approximativement 25% du calibre du transformateur d'intensité.

Interchangeable rating plugs are removed with a Rating Plug Extractor, Catalog No. TRTOOL. (Suitable equivalents are commercially available as "integrated circuit (DIP) extractors.") Grasp the rating plug tabs with the extractor and pull the plug out as illustrated in Figure 66. Be sure to grab the tabs and not the front cover of the rating plug, or the plug may be damaged.

Figure 66. Removing the interchangeable rating plug.

Rejection features are provided on all rating plugs to prevent application mismatches. Never force a rating plug into place. Refer to Chapter 1 to find the appropriate rating plugs for each sensor rating and breaker frame.

If a replacement rating plug has a different rating than the plug that was removed, follow the appropriate setup procedure in Chapter 2 to enter the new rating.

Do not attempt to use a rating plug from a Spectra RMS™ breaker or a MicroVersaTrip RMS-9/MVT-4 function trip in a MicroVersaTrip Plus or MicroVersaTrip PM Trip Unit.

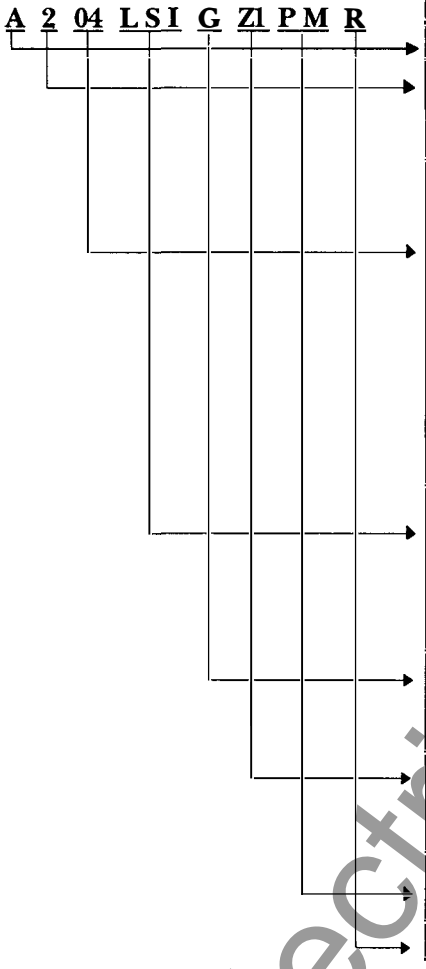
5-3 Trouble-Shooting Guide

The following guide is provided for trouble-shooting and isolating common problems. It does not cover every possible condition. Contact the Customer Support Center at 800-843-3742 if the problem is not resolved by these procedures.

Symptom	Possible Cause	Corrective Action
1. The Trip Unit display is blank.	Line current is below 20% of the breaker sensor rating (MicroVersaTrip Plus).	At least 20% of the current sensor rating, *xCT*, must be flowing through the breaker to activate the display. If not, power the Trip Unit with the internal battery or the Portable Power Pack. The battery power supply is disabled when any current is sensed through the current sensors.
	External +24 Vdc is absent (MicroVersaTrip PM).	Check that the control power supply is present and operational.
2. The Trip Unit display flashes.	Can occur on Plus-style Trip Units when the load current fluctuates near 20% of the breaker sensor rating.	Power the Trip Unit with the internal battery or the Portable Power Pack.
3. The Trip Unit display flashes ERR.	The built-in self test has detected an error.	Replace the Trip Unit.
4. The trip indication target will not clear.	Trip Unit is not in Status mode.	Press FUNCTION until STATUS is displayed. Hold down the VALUE key and press the SELECT key to clear the target.
5. Unit does not communicate with the Monitor, POWER LEADER Distribution Software, or FPU.	The commnet wires are shorted or improperly connected.	Locate and repair the short or the incorrect connection.
	FPU version is lower than 2.0.	Update the FPU to version 2.0 or higher.
	The Trip Unit address is incorrect.	Check that the address assigned to the Trip Unit, as in Chapter 2, agrees with the address at the host.
6. Current readings are incorrect.	The rating plug value was defined incorrectly.	Read the *X* value from the rating plug name plate and enter this as the *xIn* value with the rating plug current set point procedure in Chapter 2. *Do not enter the sensor rating, S.*
7. Voltage readings are incorrect.	The potential transformer (PT) primary voltage was defined incorrectly.	Read the PT primary rating from the PT name plate and enter this value with the PT primary voltage procedure in Chapter 2.
	The PT connection was defined incorrectly.	Follow the PT connection procedure in Chapter 2 to enter Ph-N for a wye-connected PT primary or Ph-Ph for a delta-connected PT.
8. The display is blank or the Low Battery symbol appears when the BATTERY key is pressed.	The battery is discharged.	Replace the battery.
	The battery was stored too long with no power applied to the Trip Unit	Power the Trip Unit with external power or by energizing the breaker for several days to freshen the battery.

Catalog Numbers for RMS9C Trip Units in AKR Circuit Breakers

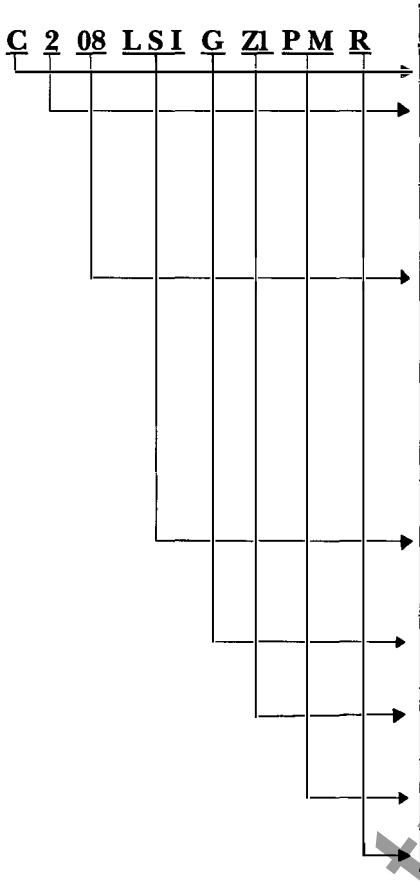
The following table contains the catalog number options for AKR circuit breakers, with an illustration of a valid number and the options that each part of the number refers to.



Code	Description	Function
A	AKR	**Breaker Type**
2	225–2000 A maximum CT	**Breaker Frame (max CT)**
3	3200 A maximum CT	
4	4000 A maximum CT	
01	150 A	**Installed CT**
03	225 A	
04	400 A	
06	600 A	
08	800 A	
16	1600 A	
20	2000 A	
30	3000 A	
32	3200 A	
40	4000 A	
L	Long-time (standard)	**Overcurrent Protection**
S	Short-time	
H	High instantaneous	
I	Instantaneous	
K	Fixed high instantaneous	
G	Ground fault	**Ground-Fault Protection**
GD	Defeatable ground fault (not UL listed)	
W	W curve	
Z1	Ground-fault zone-selective interlock	**Optional Functions**
Z2	Ground-fault and short-time ZSI	
X	Switchable instantaneous short time and ground fault	
P	Relaying and communication	**Communication, Metering, & Relaying**
M	Metering and communication	
R	Replacement trip unit	**Replacement**

Catalog Numbers for RMS9C Trip Units in Power Break® Circuit Breakers

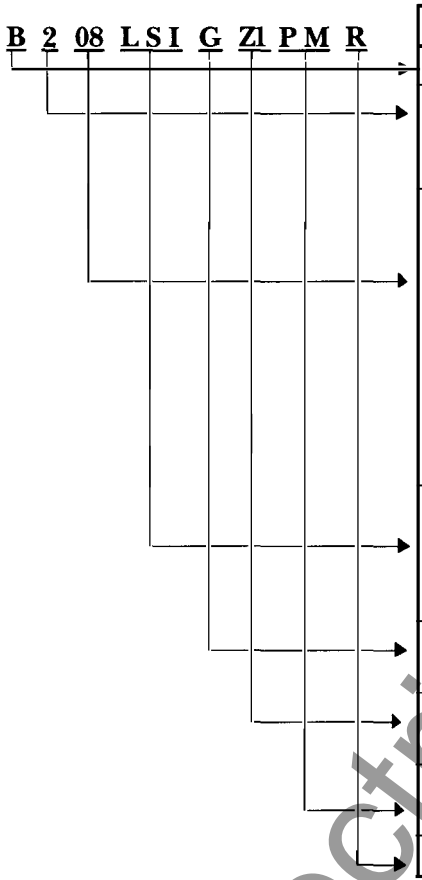
The following table contains the catalog number options for Power Break circuit breakers, with an illustration of a valid number and the options that each part of the number refers to.



Code	Description	Function
C	Power Break	**Breaker Type**
2	800–2000 A maximum CT	**Breaker Frame (max CT)**
3	3000 A maximum CT	
4	4000 A maximum CT	
02	200 A	**Installed CT**
04	400 A	
08	800 A	
10	1000 A	
16	1600 A	
20	2000 A	
25	2500 A	
30	3000 A	
40	4000 A	
L	Long-time (standard)	**Overcurrent Protection**
S	Short-time	
H	High instantaneous	
I	Instantaneous	
G	Ground fault	**Ground-Fault Protection**
GD	Defeatable ground fault (not UL listed)	
Z1	Ground-fault zone-selective interlock	**Optional Functions**
Z2	Ground-fault and short-time ZSI	
P	Relaying and communication	**Communication, Metering, & Relaying**
M	Metering and communication	
R	Replacement trip unit	**Replacement**

Catalog Numbers for RMS9D Trip Units in Power Break® II Circuit Breakers

The following table contains the catalog number options for Power Break II circuit breakers, with an illustration of a valid number and the options that each part of the number refers to.



Code	Description	Function
B	Power Break II	**Breaker Type**
2	2000 A maximum CT	**Breaker Frame (max CT)**
3	3000/3200 A maximum CT	
4	4000 A maximum CT	
02	200 A	**Installed CT**
04	400 A	
08	800 A	
10	1000 A	
16	1600 A	
20	2000 A	
25	2500 A	
30	3000 A	
40	4000 A	
L	Long-time (standard)	**Overcurrent Protection**
S	Short-time	
H	High instantaneous	
I	Instantaneous	
G	Ground fault	**Ground-Fault Protection**
GD	Defeatable ground fault (not UL listed)	
Z1	Ground-fault zone-selective interlock	**Optional Functions**
Z2	Ground-fault and short-time ZSI	
P	Relaying and communication	**Communication, Metering, & Relaying**
M	Metering and communication	
R	Replacement trip unit	**Replacement**

Appendix 4

Trip Unit Battery Suppliers

Supplier	Catalog Number
Wilson Greatbatch Ltd. Electrochem Lithium Batteries 10,000 Wehrle Drive Clarence, NY (716) 759–5428	3B24–XA

Contact the supplier for the nearest distributor.

GE Electrical Distribution & Control

General Electric Company
41 Woodford Ave., Plainville, CT 06062

GEH-6273D 0596