SIEMENS

Sentron™ Systems Breaker

Energy Communicating Trip Unit
Information and Instruction Guide

Bulletin IPIM-2208B

⚠ DANGER

Hazardous voltage. Will cause death or serious injury.

Turn off and lock out all power supplying the device prior to cover(s) removal or while cover(s) are removed and when installing any internal or external accessory.

Replace the cover(s) and shield(s) before power supplying this device is turned on.

IMPORTANT

The information contained herein is general in nature and not intended for specific application purposes. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. The successful and safe operation of this equipment is dependent upon proper handling, installation, operation, and maintenance.

Siemens reserves the right to make changes at any time without notice or obligations. Should a conflict arise between the general information contained in this publication and the contents of drawings or supplementary material, or both, the latter shall take precedence.

Qualified Person

For the purposes of this manual, a qualified person is one who is familiar with the installation, construction, or operation of the equipment and the hazards involved. In addition, this person has the following qualifications:

(a) **is trained and authorized** to de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.

(b) **is trained** in the proper care and use of protective equipment such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established safety procedures.

(c) **is trained** in rendering first aid.

Danger

For the purpose of this manual and product labels, **DANGER** indicates an imminently hazardous situation which, if not avoided will result in death or serious injury.

Warning

For the purpose of this manual and product labels, **WARNING** indicates a potentially hazardous situation which, if not avoided could result in death or serious injury.

Caution

For the purpose of this manual and product labels, **CAUTION** indicates a potentially hazardous situation which, if not avoided may result in minor or moderate injury.

SB Energy-Comm Trip Unit

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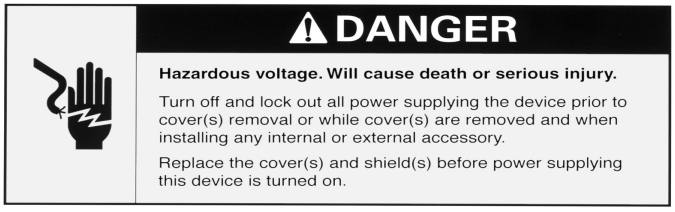
Note

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.

The contents of the instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

1 Introduction



1.1 Product Overview

The Sentron™ Systems Breaker Energy Communicating Trip Unit (SB Energy-Comm) is a microprocessor controlled protection and metering device for application with Siemens' state-of-the-art family of SB Encased Systems Breakers. In addition to the basic overcurrent protection functions, SB Energy-Comm trip units have a full complement of standard and optional features. Included in these features are serial communications, energy monitoring, and additional protective relaying functions. This full-featured capability, together with programmable flexibility, allows for easy adaptation to new and changing protection requirements. The SB Energy-Comm trip unit, shown in **Figure 1.1,** is a high performance device, integrating metering and ACCESS communication capabilities with overcurrent protective functions.

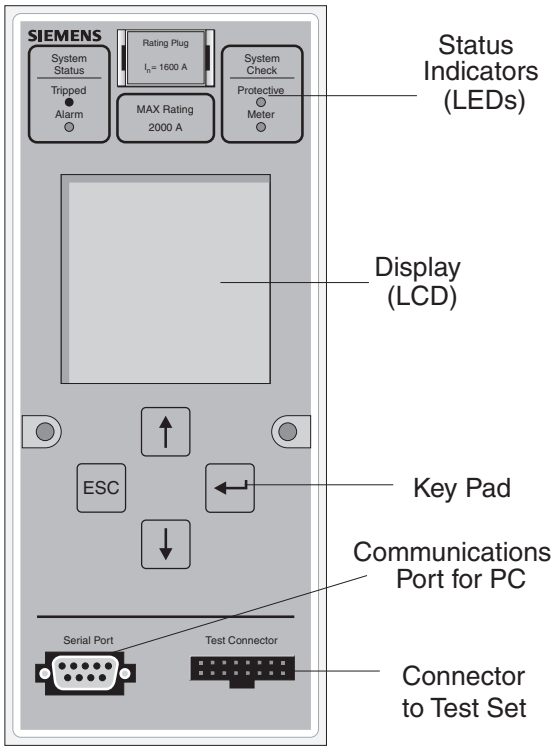


Figure 1.1 SB Energy-Comm Trip Unit

Four models of the SB Energy-Comm are available. They are:

SBxxTP01	Basic protection and power measurement
SBxxTP01G	Basic plus ground fault protection
SBxxTP02	Advanced protection, power measurement and harmonics
SBxxTP02G	Advanced plus ground fault protection

The "xx" in the model number denotes the breaker's current transformer rating (MAX rating). **Table 1.4** on page 6 describes the functions included with each model.

The programmability of the SB Energy-Comm trip unit allows the user to easily accommodate load changes and other protective requirements while still ensuring optimum coordination. In addition to the programmable protective functions, the trip unit is designed to use field interchangeable rating plugs. These rating plugs allow the ampere rating of the circuit breaker to be changed to meet specific applications.

For ease of installation and interchangeability in the field, the trip unit has been designed as a plug-in unit to mount directly into an SB circuit breaker frame.

Current transformers within the SB circuit breaker provide signal currents and operating power for the circuit protection function of the trip unit. When the circuit breaker is closed and current is flowing, the trip unit requires no external connections or control power to perform its circuit protection functions. External control power is required for metering, communications, and protective relaying functions, as well as setting adjustments and viewing the display.

A standard feature on all Siemens trip units is RMS current sensing. As opposed to peak-current sensing, RMS sensing measures the true heating potential of the current waveform. This allows for more accurate overcurrent protection and eliminates nuisance tripping due to harmonic distortion of the current waveform.

1.2 Principles of Operation

The SB Energy-Comm trip unit uses a microprocessor to execute the numerous logic functions and calculations programmed in the device. The keypad and display on the trip unit's front panel allow the user to select what numerical values are to be used by the microprocessor in performing its functions. These settings allow the trip unit to be tailored to a customer's application. The overall functional diagram is shown in **Figure 1.2** on page 2.

Current data is derived from current transformers (CTs) mounted in the Siemens SB circuit breaker. As passive devices, they provide high reliability with minimum signal error, while also providing power for the trip unit's circuit protection functions. The current signals from the CTs are converted to digital values in the trip unit. These values are then stored in memory and are used by the microprocessor to detect and process overcurrent conditions. This operation is illustrated in **Figure 1.3** on page 3.

The microprocessor reads the stored current values and compares these with the set of values that correspond to the user-selected settings. When it detects an overcurrent condition, the microprocessor's software begins to process the appropriate protection function. During this processing, the microprocessor continues to monitor the incoming current level data. If the overcurrent

condition continues until the processing is completed, and the appropriate delay time has elapsed, the microprocessor issues a tripping command.

Issuance of the tripping command from the microprocessor sends a signal from the trip unit to the low-energy, high-speed magnetic latch in the circuit breaker. The signal in the trip unit counteracts the permanent magnet in the latch, allowing the latch to trip the breaker.

Beyond the basic tripping function, the SB Energy-Comm trip unit also collects real-time data that can be reported via the Siemens ACCESS System or directly to a personal computer through its serial port. For any of several functions, the SB Energy-Comm trip unit can also send an alarm to a remote indicator.

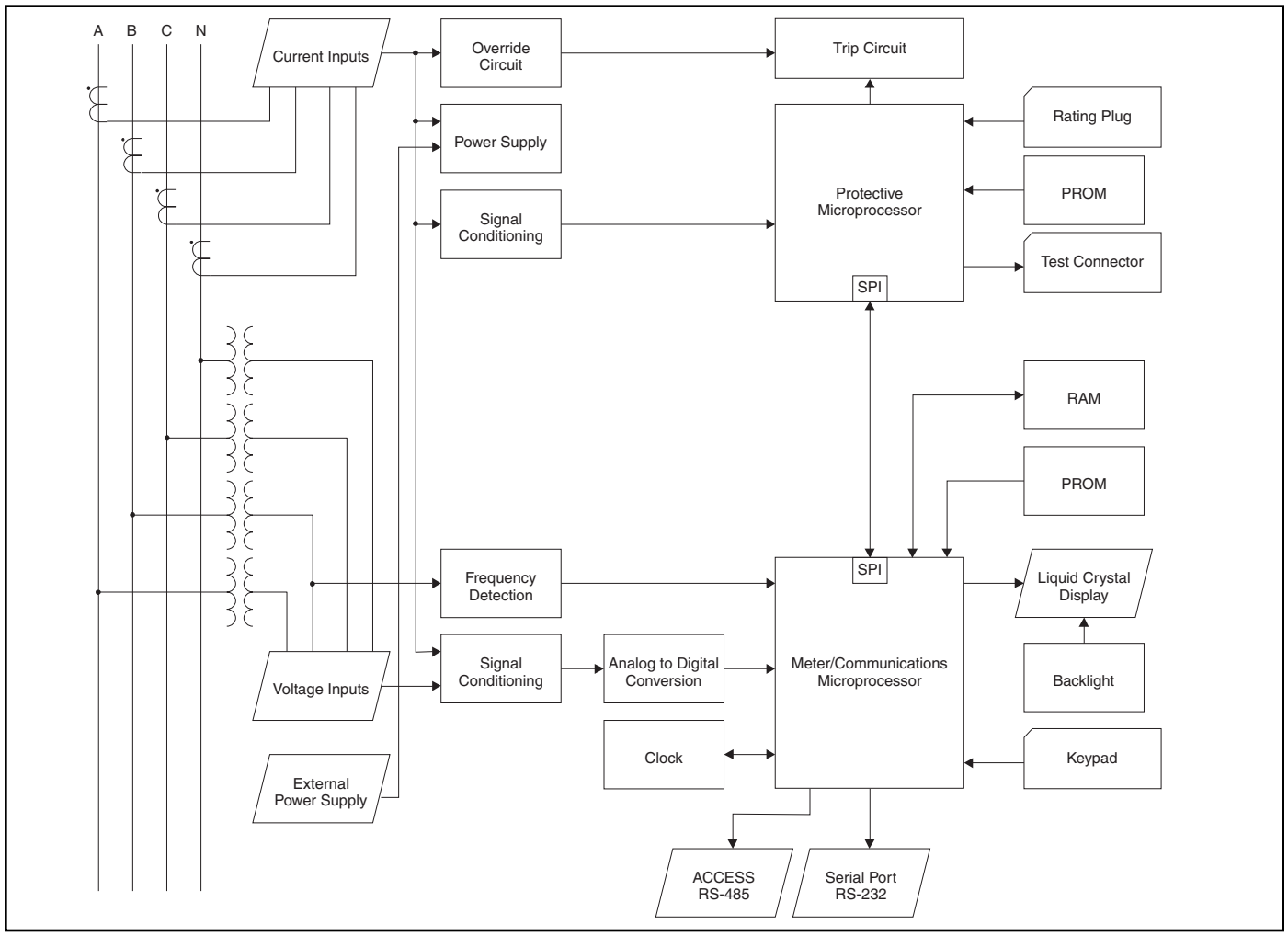


Figure 1.2 Functional Block Diagram

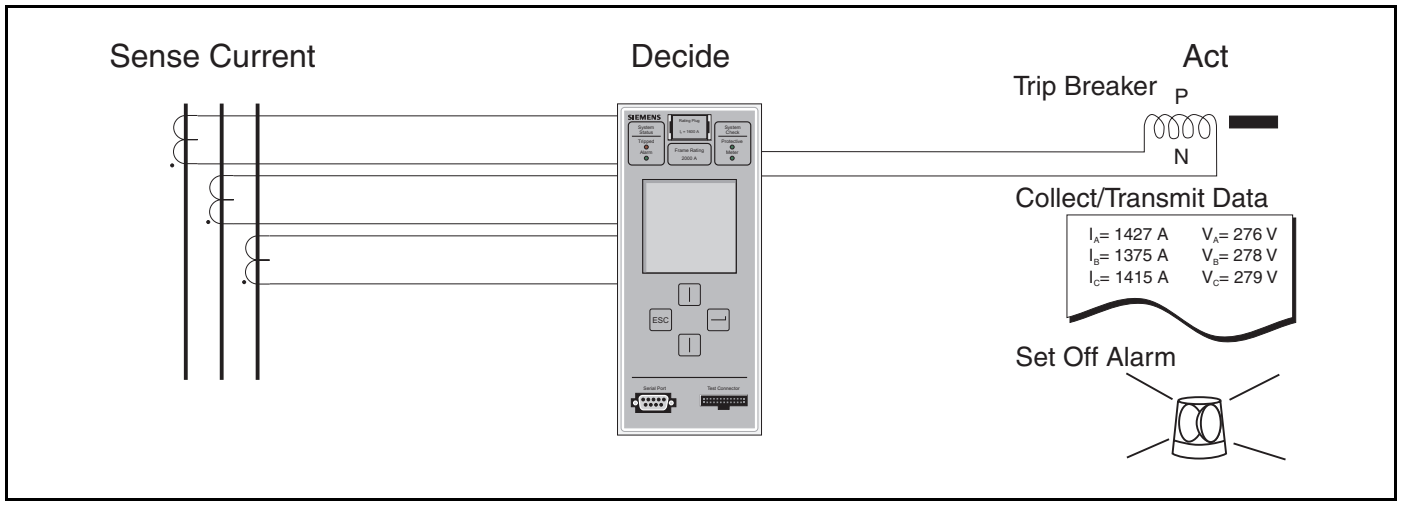


Figure 1.3 Operational Overview

1.3 SB Encased Systems Breaker

Siemens SB Encased Systems Breakers come in four (4) principal frame sizes with MAX Ratings ranging from 400 to 5000 amperes. The rating is determined by the current transformers within the frame. All frames are rated for 100% continuous operation. Rated trip units are available for all SB Encased Systems Breakers.

Trip units are fully field installable by authorized personnel. A special rejection scheme is built into the frames and trip units to prevent the installation of a trip unit into a frame for which it is not intended.

The combinations of frame sizes and frame ampere ratings are illustrated in **Table 1.1**.

Field interchangeable rating plugs are used to set the continuous current rating of the circuit breaker. For a list of available rating plugs, refer to **Table 2.2** on page 13.

The interrupting rating of the SB breaker is specified on the front cover label and is further identified by the use of a “color bar” at the top left of the breaker label.

Several short circuit interrupting ratings are available to meet specific applications. The interrupting ratings and short time ratings are given in **Table 1.2** on page 4**.** The trip unit that may be used with a specific circuit breaker is identified on the front cover label of the breaker.

Table 1.1 Breaker Frame Size and Rating Combinations

Breaker Frame Size(A)	Breaker Frame Ampere Rating
1200	400, 800, 1200
2000	1200, 1600, 2000
3200	2500, 3200
5000	2500, 3200, 4000, 5000

Table 1.2 UL 489 Symmetrical RMS Amperes Interrupting Rating (kA)

Optional Ratings and Application Voltage	Breaker Frame Size			
	1200A	2000A	3200A	5000A
Alternate A.I.R. (kA): Blue Label "SBA"				
@ 240V AC	65	85	N/A	N/A
@ 480V AC	65	65	N/A	N/A
@ 600V AC	42	50	N/A	N/A
Standard A.I.R. (kA): Black Label "SBS"				
@ 240V AC	100	100	150	150
@ 480V AC	100	100	100	100
@ 600V AC	50	65	85	85
High A.I.R. (kA): Red Label "SBH"				
@ 240V AC	200	200	200	200
@ 480V AC	150	150	150	150
@ 600V AC	100	100	100	100
Short Time Delay Rating (kA) t=0.5 sec.	25	35	50	65

Table 1.3 IEC 947-2 Rating–Standard SBS

Interrupting Ratings Symmetrical RMS Kiloamperes 50/60 Hz.	AC Voltage		Breaker Frame Size			
			1200A	2000A	3200A	5000A
	415	I_{cu} I_{cs} I_{cw}	100 100 25	100 100 35	100 100 50	100kA 100kA 65kA
	690	I_{cu} I_{cs} I_{cw}	65 65 25	65 65 35	65 65 50	65kA 65kA 65kA

1.4 Front Panel Interface

Each SB Energy-Comm trip unit features a rating plug (purchased separately), front panel keypad, liquid crystal display (LCD), and a EIA-232 communications port for use with a PC or laptop. The trip unit's integral front panel keypad and LCD provide the user with direct access to device data and settings. Through detailed menus and graphical displays, the user may view and modify the system configuration and communication parameters, as well as protective and metering function settings. Both real-time and accumulated data are available, in addition to current and voltage waveforms. The user may also view information in the trip log associated with the five most recent trips.

1.4.1 Keypad

The front panel provides the user with four keypad buttons for easy touch-control interface which uses no switches or knobs for making adjustments to this trip unit. The keypad buttons permit navigation through the displays to allow the local programming of settings and viewing of those settings.

The Up [↑] and Down [↓] arrow keys are used for scrolling through a menu of choices displayed on the LCD. The Enter [↵] key is used to select a choice or move between two selections. The Escape [ESC] key is used to exit from a given menu to the next higher level.

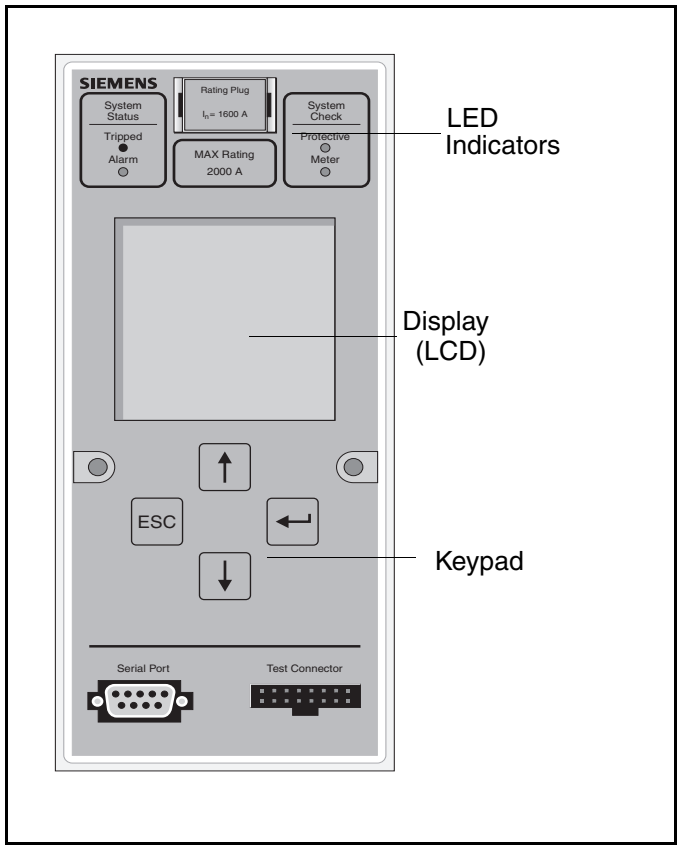


Figure 1.4 Display and Keypad on Front Panel

1.4.2 LCD

The LCD displays the menu of options and the status of the device. The menu allows the user to request configuration settings and protective or metered data, as well as time-stamped information stored in the various logs. Pickup and delay settings for alarm and protective relay functions can also be viewed and modified.

1.4.3 LED Indicators

Two green status LEDs indicate the proper operation of the metering and protective functions. A separate yellow LED indicates an alarm condition. A red LED indicates that a trip has occured.

1.5 Overcurrent Protective Functions

Like the standard electronic trip unit for SB Encased Systems breakers, the SB Energy-Comm trip unit provides configurable long time, short time, and instantaneous over-current protection. Trip units with integral ground fault protection are available as an option.

The pickup and delay settings for each protective function are user-configurable through the integral keypad and LCD screen, as well as through communications. In addition, short time and instantaneous protection may be disabled, although not at the same time.

1.6 Alarm Setpoints

The SB Energy-Comm trip unit's full-featured model offers the ten alarm functions listed below:

- Overcurrent
- Ground Overcurrent
- Overcurrent Demand
- Total Harmonic Distortion (THD)
- Over Real Power (kW)
- Over Power Demand (kW Demand)
- Over Reactive Power (kVAR)
- Over Apparent Power (kVA)
- Under Power Factor (PF) Leading
- Under Power Factor (PF) Lagging

Each alarm function is configured separately to include its enable/disable status and associated pickup and delay. When enabled, a function causes the trip unit's relay contact to close if its alarm limit (pickup) is exceeded for the time specified by the delay. Assuming that no other alarm conditions exist, a time-stamped entry is also made to the event log at this time. (Restrictions are discussed in **Section 1.10.2**.) If the alarm condition ends, the relay contact is opened, assuming that no other alarm conditions are causing it to remain closed. All alarm settings are stored in nonvolatile memory.

The full-featured models (SBxxTP02 and SBxxTP02G) offer more alarm functions than the base models (SBxxTP01 and SBxxTP01G).

1.7 Extended Protective Relaying

In addition to the ten alarm functions described earlier, the SB Energy-Comm trip unit also provides the following optional programmable protective relay functions:

- Neutral Overcurrent
- Current Unbalance
- Undervoltage
- Voltage Unbalance
- Overvoltage
- Over Reverse Power (kW)
- Over Frequency
- Under Frequency

Software allows the user to configure each of these functions individually for alarm and trip, alarm only, or neither. Separate pickup and delay settings are assigned for alarming and for tripping actions. In this way, an alarm can be activated to warn of a potential trip.

When enabled for alarm activity, a particular function will close the relay contact if its alarm pickup setting is exceeded for the specified delay. When also enabled for tripping, the function controls the breaker tripping actuator to trip the breaker if the separate trip pickup is exceeded for the trip delay time. An event log records

alarm activity, while the trip log stores tripping information. All protective relay settings are stored in nonvolatile memory.

1.8 Metering Functions

The SB Energy-Comm trip unit measures and stores several types of metered data for evaluation or monitoring. The metering includes real-time measurement of current, voltage and power values, and demand measurements. It also includes additional options, including programmable protective relay and alarm functions, harmonic distortion analysis, and separate logs to record event and min/max data.

1.9 Features By Model Number

Table 1.4 summarizes the features available with each of the four trip unit models. The full-featured models (SBxxTP02 and SBxxTP02G) offer more alarm functions; the extended protective relay functions, and harmonic analysis that the base models (SBxxTP01 and SBxxTP01G) do not. Models with Ground Fault protection have that additional protective function available. This manual describes all these functions. Your particular model may or may not have all the features discussed in this manual.

Table 1.4 Features by Model Number

Features	Models			
	SBxxTP01	SBxxTP01G	SBxxTP02	SBxxTP02G
Integral Keypad and Display Voltage/Current Waveform Displays	✓	✓	✓	✓
Protective Functions Long Time, Short Time, Instantaneous	✓	✓	✓	✓
Metering Functions Volts, Amps, PF, Frequency, Watts, VARs, VA, Crest Factor, Ampand Watt Demand, Voltage and Current Waveforms, Voltage and Current Unbalance	✓	✓	✓	✓
Communications PC (RS-232), ACCESS (RS-485)	✓	✓	✓	✓
Counters Breaker Test (Trip/No Trip), Mechanical Counter, Interruption Level Fault Counter	✓	✓	✓	✓
Security Password Protection	✓	✓	✓	✓
Event Log Time-Stamped –10 Most Recent Events	✓	✓	✓	✓
Trip Log Time-Stamped – 5 Most Recent Trips	✓	✓	✓	✓
Alarms (Alarm Only) Overcurrent, Gnd. Overcurrent, Over Amp Demand, Over kW, Over kW Demand, Over KVAR, Over KVA, Under/Over PF	✓	✓	✓	✓
Advanced Alarms Total Harmonics			✓	✓
Min./Max. Logs Volt/Amp., Power, PF, Frequency, %THD			✓	✓
Harmonic Analysis Up to 19th Per Phase, THD			✓	✓
Protective Relay Functions **(Alarm and/or Trip)** Neutral Overcurrent, Current Balance, Under/Over Voltage, Voltage Unbalance, Reverse Power, Under/Over Frequency			✓	✓
Ground Fault Protection Residual or Ground Return		✓		✓

1.10 Logs

The SB Energy-Comm trip unit maintains three logs: a trip log in nonvolatile memory to document up to five of the most recent trips, an event log to document up to ten of the most recent alarms, and a min/max log containing minimum and maximum metered values.

1.10.1 Trip Log

All SB Energy-Comm trip unit models maintain a trip log in nonvolatile memory to store information for up to five of the most recent device trips. Each log entry records the trip's cause, its date and time, and the measured quantities associated with the tripping action. The trip log may be viewed and cleared through the trip unit's LCD menu or through communications.

1.10.2 Event Log

All SB Energy-Comm trip unit models provide an event log to store the ten most recent alarms. Each entry includes a sequential event number (used by the ACCESS master), an alarm ID indicating the alarm type, the start and stop time stamps, and up to five parameters associated with the alarm.

The ten alarm functions are prioritized (that is, overcurrent alarm is highest priority, total harmonic distortion alarm is lowest). This is done to insure that only one alarm will be recorded in the event log at a time. If two alarm functions become active simultaneously, the higher priority alarm (Alarm #1) will be written to the event log. The lower priority alarm (Alarm #2) will not be recorded until Alarm #1 conditions have ended. If Alarm #2 conditions cease before those associated with Alarm #1, Alarm #2 will not appear in the event log.

Like the trip log, the event log may be viewed and cleared locally using the trip unit's keypad and LCD menu or through EIA-232 or EIA-485 communications. However, because the event log resides only in RAM, it is lost if control power is removed.

1.10.3 Min/Max Log

The SB Energy-Comm trip unit's full-featured model also maintains a min/max log for metered quantities. This includes the minimum and/or maximum values detected for currents, voltages, leading and lagging power factors, instantaneous VA and VARs, crest factors, frequency, kW and amp demand, as well as total harmonic distortion. Like the trip log, the min/max log may be viewed and cleared at the trip unit or through communications. The min/max log resides only in RAM and is lost if control power is removed. These logs are described in detail in **Chapter 10, Logs.**

1.11 Communications

1.11.1 ACCESS Communications

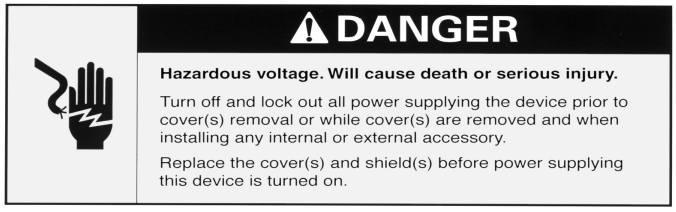
The EIA-485 communications port is located on the back of the SB Energy-Comm trip unit. This port allows the trip unit to be connected as a slave device in an ACCESS master/slave network. Data is transmitted serially between the trip unit and a remote ACCESS master (e.g., Power Monitor) using a shielded, twisted-pair EIA-485 cable. The EIA-485 communications standard is superior to EIA-232 for industrial applications, providing better noise rejection and faster transmission rates over greater distances.

With few exceptions, the device information available locally at the trip unit is accessible to the ACCESS bus master (for example, configuration parameters, function settings, and real-time data). Although the ACCESS master may request information from the trip unit at any time, it is prevented from making device changes while an operator is using the trip unit's keypad to locally view/modify device information. In fact, a local operator at the keypad is given priority over both EIA-485 and EIA-232 communications to ensure against data access violations.

1.11.2 Serial Communications

The EIA-232 serial port on the face of the SB Energy-Comm trip unit allows a PC or laptop running custom software to view and/or modify device information in much the same way as the ACCESS host. Settings can be easily downloaded to the trip unit, providing a faster, more convenient means for device configuration than the manual keypad method. EIA-232 communications can occur with, and are independent of, EIA-485 ACCESS communications.

2 Installation



2.1 Quick Reference Guide

This section summarizes the required procedures to install the trip unit before energizing the breaker. Follow the steps listed below to install the SB Energy-Comm trip unit.

1. Unpack and inspect the trip unit as described in **Section 2.2, Unpacking and Inspection.**
2. Select a power source for the trip unit. See **Section 2.3, Selecting a Power Source**.
3. Select and install the proper potential transformer (PT) for your system. See **Section 2.4, Selecting a PT**.
4. Wire the trip unit as described in **Section 2.5, Wiring**.
5. Install the trip unit into the breaker. The step-by-step procedure is described in **Section 2.6, Installing the Trip Unit in a Systems Breaker**.
6. Select and install the rating plug. See **Section 2.7, Inserting and Removing the Rating Plug**. Be sure the plug has the proper rating.
7. Read **Section 3, User Interface** to familiarize yourself with the front panel controls and display.
8. Configure the trip unit's system parameters, including frequency, wiring configuration, PT rating, short circuit protection type, and neutral CT. Instructions on setting these parameters are listed in **Section 4.2, Setting System Configuration Parameters**.
9. Configure the trip unit's overcurrent protection. Instructions on setting these parameters are listed in **Section 5, Overcurrent Protection Configuration**.

These are the minimum configuration requirements before energizing the breaker. Additional configuration parameters are described in **Section 4.3, Setting Other Device Parameters** and in **Sections 6** through **10** inclusive.

2.2 Unpacking and Inspection

When unpacking the SB Energy-Comm trip unit, inspect the device for any damage and report any problems to your local Siemens representative.

The SB Energy-Comm trip unit has been factory tested to stringent requirements. The Siemens factory that produced this trip unit has a quality system that is certified to an ISO 9000 international standard.

All settings are factory preset to the minimum values.

2.3 Selecting a Power Source

The SB Energy-Comm trip unit depends either on power from the current transformers (CTs) or independent control power. The protective functions use the power from the CTs; the metering and communications require separate control power from an external power supply. This requirement allows communication with the trip unit during all load current conditions, even with the circuit breaker switched off.

The ratings for the power supply are:

- Input: 110V AC = SBEPS Catalog Number
  24V DC = SBEPS24 Catalog Number
- Output: +5V DC @ 4A,
  +12V DC @ 0.3A, -12V DC @ 0.3A

2.4 Selecting a PT

A potential transformer (PT) module is required to provide voltage signals to the trip unit for metering functions and provides isolation from the primary circuits. Class CC IA 600V fuses can be added during installation to protect against internal PT module faults. The PT modules are encapsulated in polymeric material to protect the transformer windings and withstand mechanical vibration. The PT module's primary inputs are from the three phases plus neutral. For three-wire systems, the neutral conductor input is not used. To choose a PT module, select the one rated closest to, but higher than the rated voltage:

Table 2.1 PT Module Selection

For System Voltage of:	Select This PT Module:
120/208V, 120/240V, 220V	SBPTM240
277/480V, 415V	SBPTM480
575V	SBPTM600

2.5 Wiring

Before operation, the SB Energy-Comm trip unit must be properly wired to the external power supply and the PT module. Panelboards manufactured by Siemens are shipped with all required wiring. Retrofit applications require a retrofit kit, which includes instructions for mounting and wiring the power supply and PT module. **Figure 2.1** shows the proper wiring connections.

If you are connecting the SB Energy-Comm trip unit to an ACCESS Host device, you must also connect the SEAbus RS-485 cabling to the secondary disconnects or terminal blocks as shown in **Figure 2.1**.

Refer to the **Individual Instruction Sheets** for wiring the various accessories, the PT module, and the trip unit power supply.

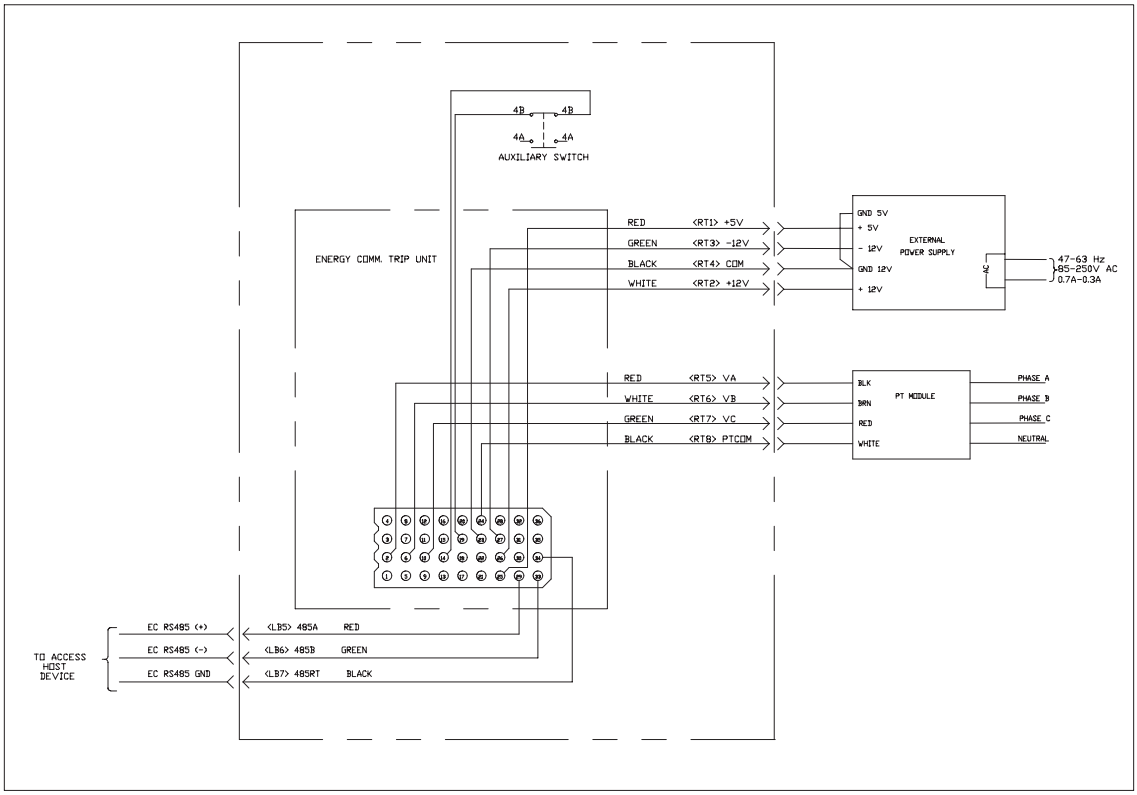


Figure 2.1 SB Energy-Comm Wiring to External Power Supply, PT Module, and ACCESS System

2.6 Installing the Trip Unit in a Systems Breaker

⚠ DANGER

Hazardous voltage. Will cause death or serious injury.

Turn off and lock out all power supplying the device prior to cover(s) removal or while cover(s) are removed and when installing any internal or external accessory.

Replace the cover(s) and shield(s) before power supplying this device is turned on.

⚠ CAUTION

Spring under compression.
May cause personal injury, or may damage equipment.
Make certain that the breaker has the spring discharged and contacts open.

The Siemens SB circuit breaker has a built-in interlock device that prevents the circuit breaker from being closed when there is not an installed trip unit. This same interlock device trips the circuit breaker when the trip unit is removed.

Before installing the trip unit, make sure that the indicators in the top center of the front of the breaker show that the spring is discharged and the contacts are open. Refer to the breaker's information and instruction guide for the proper operating procedure.

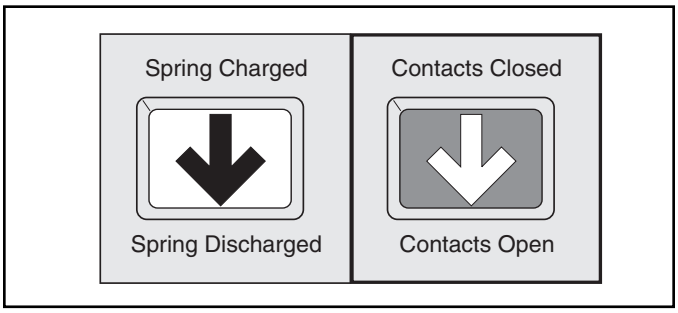
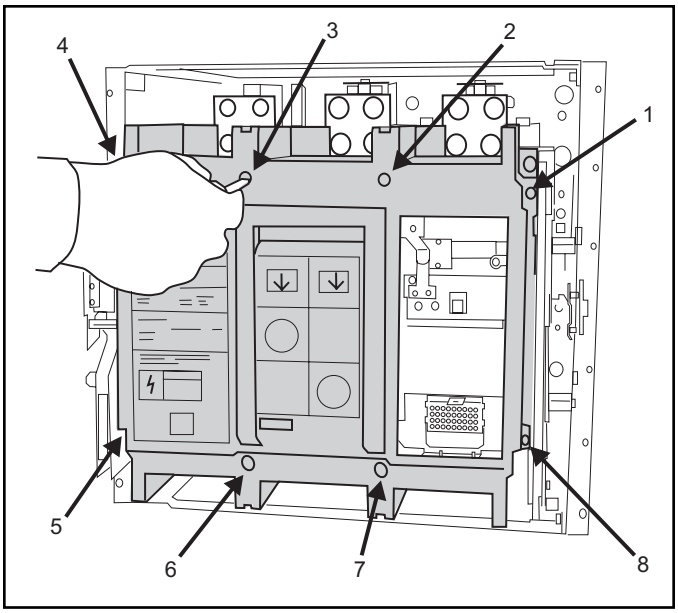


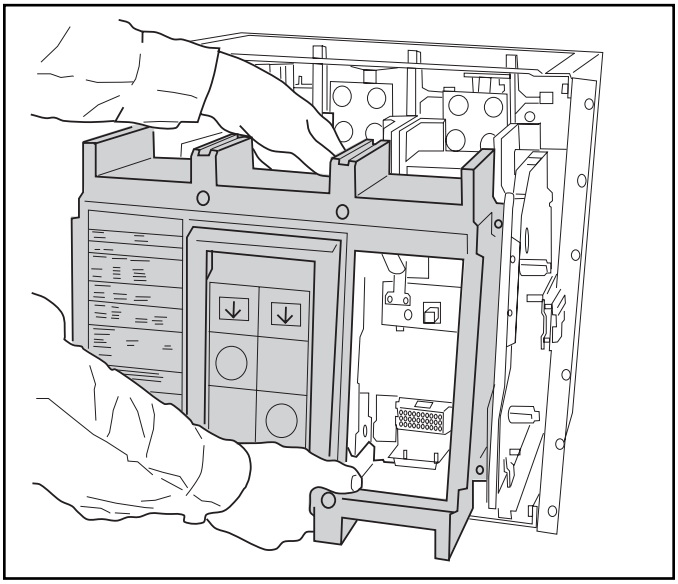
Figure 2.4 Breaker Indicators

Follow these steps to install the trip unit into an SB circuit breaker.

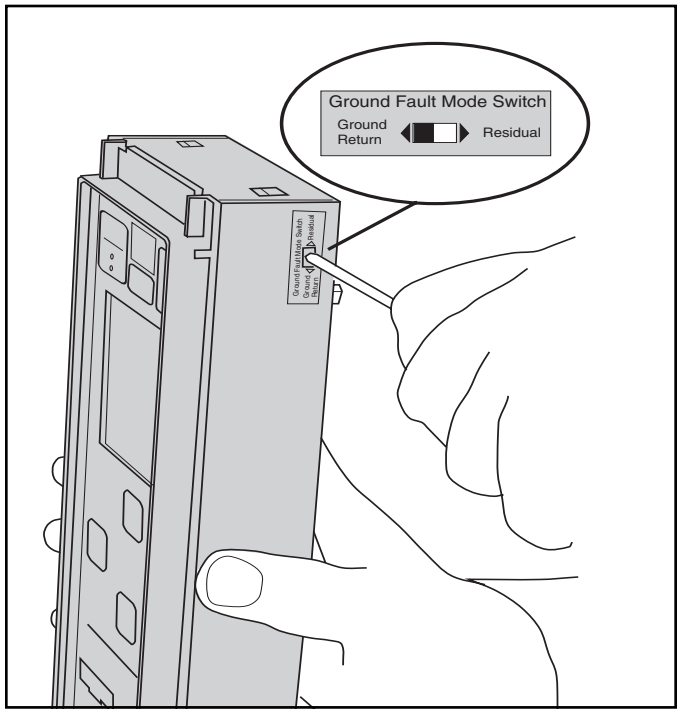
1. To install the trip unit, the front cover of the circuit breaker must first be removed. This is done by removing the eight Phillips head screws that hold the front cover in place.



2. Lift off the front cover.



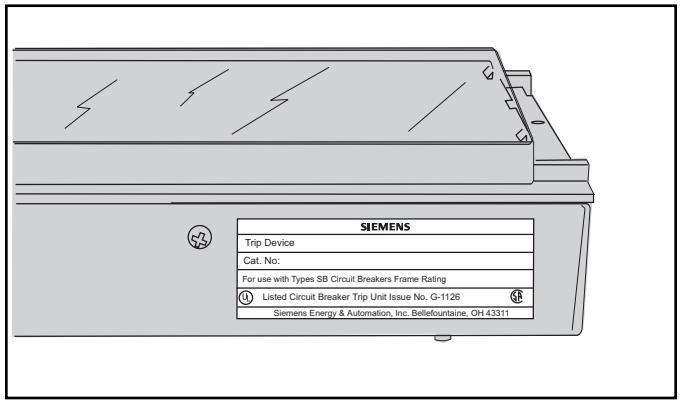
3. Set the ground fault mode switch.



On trip units with ground fault protection, the ground fault selection switch on the side of the trip unit must be set to the appropriate sensing scheme—Residual or Ground Return—prior to installing the trip unit. The ground fault sensing schemes are discussed in **Section 5.7, Ground Fault Sensing Scheme**.

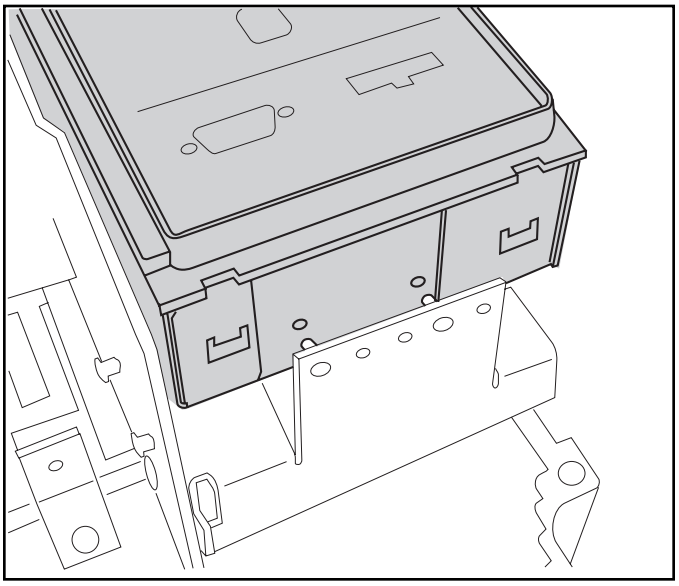
Residual is the factory pre-setting and is the setting most commonly used.

4. Check the label on the side of the trip unit.



Before attempting to install the trip unit, check the label on the side of the device to make sure that it is the proper device for the SB circuit breaker.

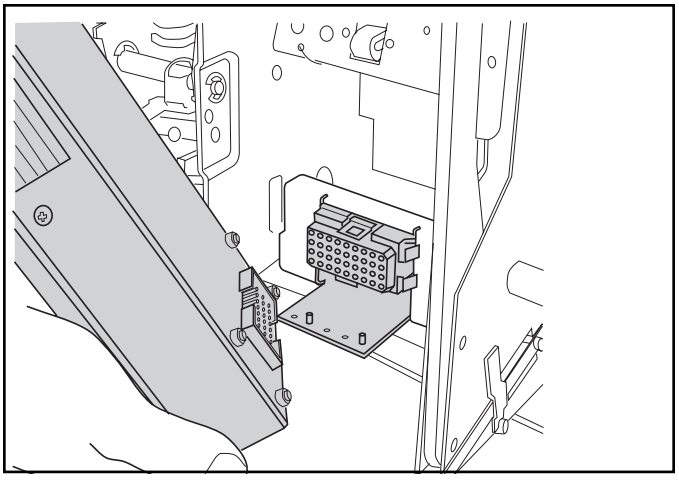
5. Check alignment of pins and holes.



If there is any doubt about a trip unit being the proper device for an SB circuit breaker, check the alignment of the pins and holes. A built-in rejection scheme will prevent the installation of a trip unit into a breaker for which it is not intended.

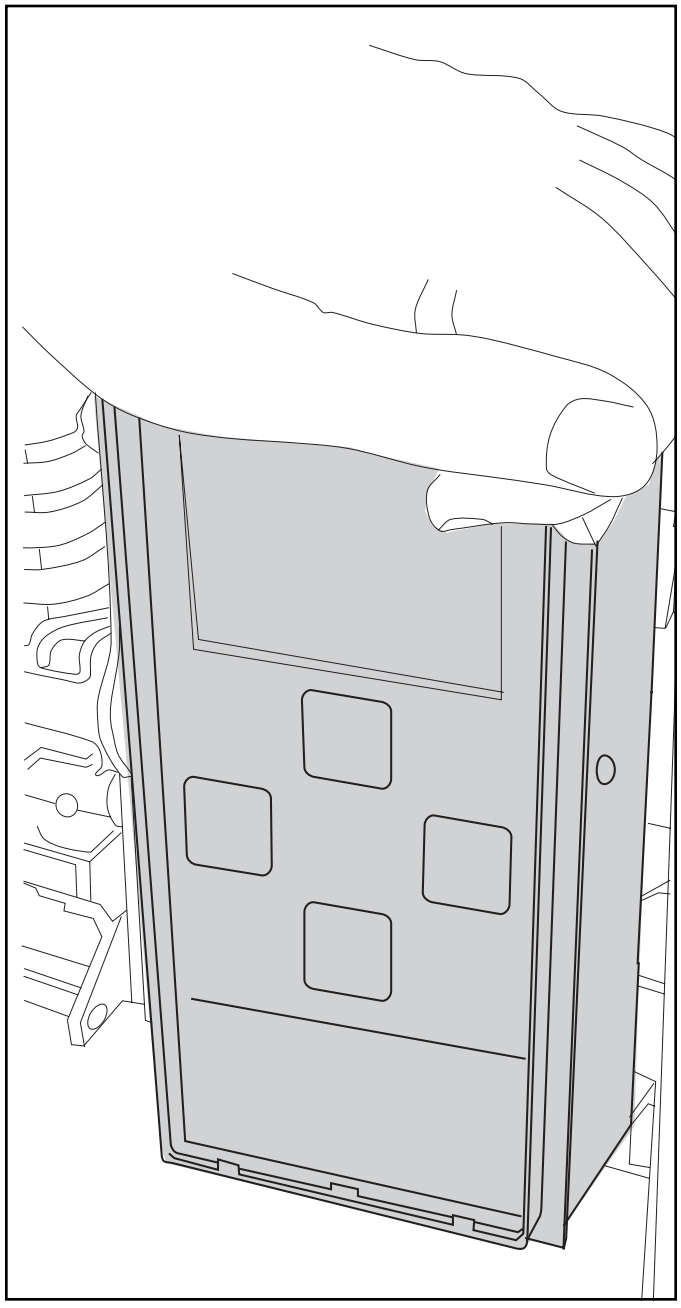
This scheme consists of two pins on the support plate on which the trip unit will set into two matching holes in the bottom of the trip unit. If the holes in the bottom of the trip unit cannot be aligned with the pins, the trip unit cannot be installed in the SB circuit breaker.

6. Mate the pin connectors.



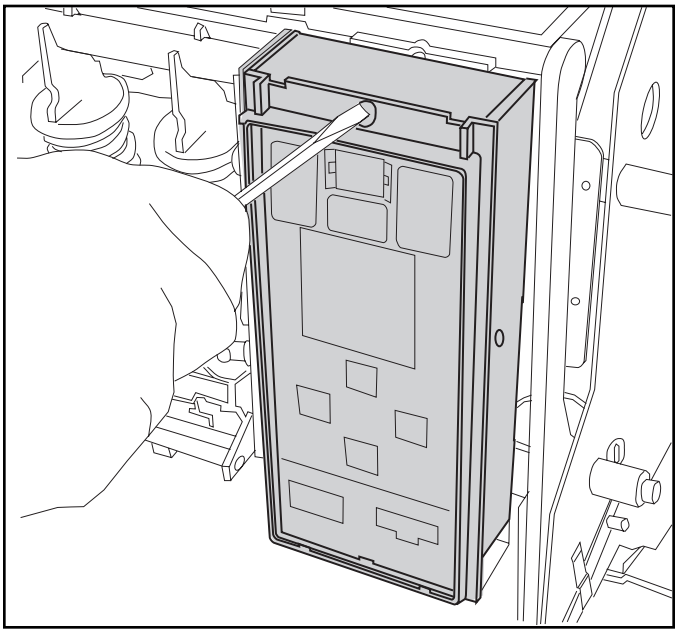
Mate the connector half on the back of the trip unit with its corresponding connector half in the circuit breaker.

7. Lower the trip unit onto the support plate.



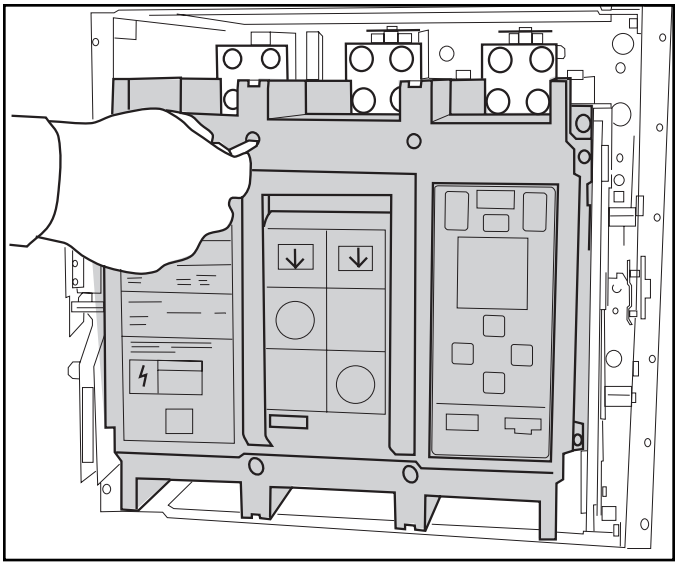
After the connector has been mated, lower (push) the trip unit onto the support plate. The pins on the support plate will fit into the holes in the bottom of the trip unit.

8. Secure the trip unit.



Secure the trip unit in place with the retaining screw located at the top of the device. Torque 6 to 8 in-lbs. If the trip unit top is not secured correctly the interlock will stop the breaker from closing.

9. Replace the front cover.



Replace the front cover and the eight (8) front cover screws. Torque 6 to 8 in-lbs.

Note: Before energizing the breaker, install a proper rating plug. Refer to **Section 2.7, Inserting and Removing the Rating Plug**.

Note: Take care not to pinch any wires when replacing the front cover of the breaker.

2.7 Inserting and Removing the Rating Plug

The trip unit executes its overcurrent protection functions based on the rating plug value and the setting of the current adjustments. Therefore, care should be taken to make proper selections and settings. All pick-up values, except ground fault, are multiples of the rating plug value, I_n. Ground fault pick-up is a multiple of the Max ampere rating, up to a maximum of 1200 amperes. All pick-up settings are expressed in RMS amperes.

Field interchangeable rating plugs are used to set the effective ampere rating of the circuit breaker. Available rating plugs for each frame ampere rating appear in the following table. Note that the maximum rating plug value for a particular trip unit is equal to the Max ampere rating. A rejection scheme is built into the rating plugs and trip units to prevent the insertion of a rating plug into a trip unit for which it is not intended.

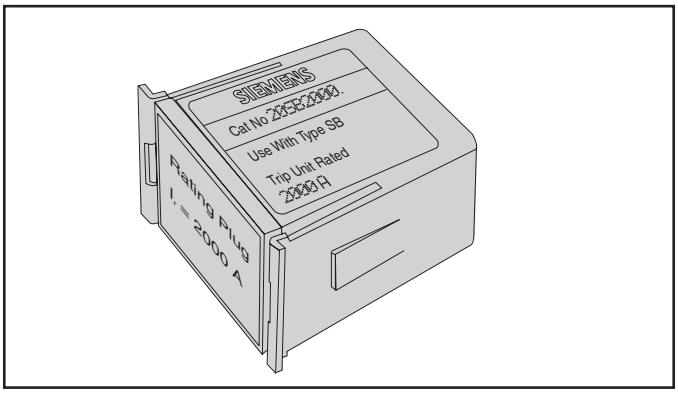
Table 2.2 Available Rating Plugs

Max Ampere Rating	Rating Plug Ampere Values, I_n
400	200, 225, 250, 300, 350, 400
800	400, 450, 500, 600, 700, 800
1200	600, 700, 800, 1000, 1200
1600	800, 1000, 1200, 1600
2000	1000, 1200, 1600, 2000
2500	1600, 2000, 2500
3200	1600, 2000, 2500, 3000, 3200
4000	2000, 2500, 3000, 3200, 4000
5000	2500, 3000, 3200, 4000, 5000

Follow these steps to install the rating plug.

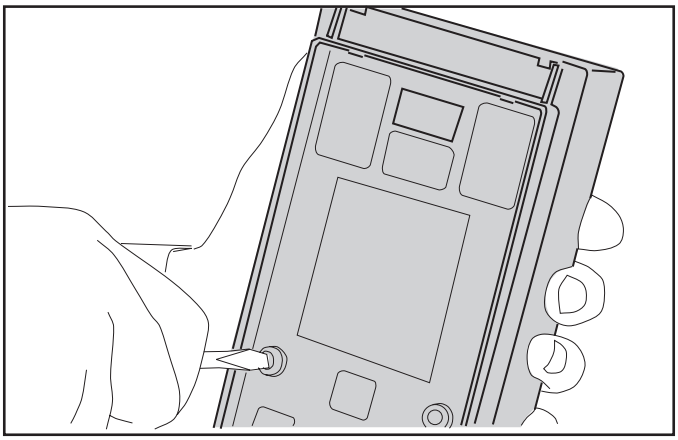
Note: Prior to inserting or removing a rating plug, check to see that the circuit breaker is in the “Open” position. The circuit breaker should always be in the “Open” position when a rating plug is not in the trip unit. Take precautions to prevent damage to equipment protected by the breaker prior to opening the circuit.

1. Check the label on the rating plug.



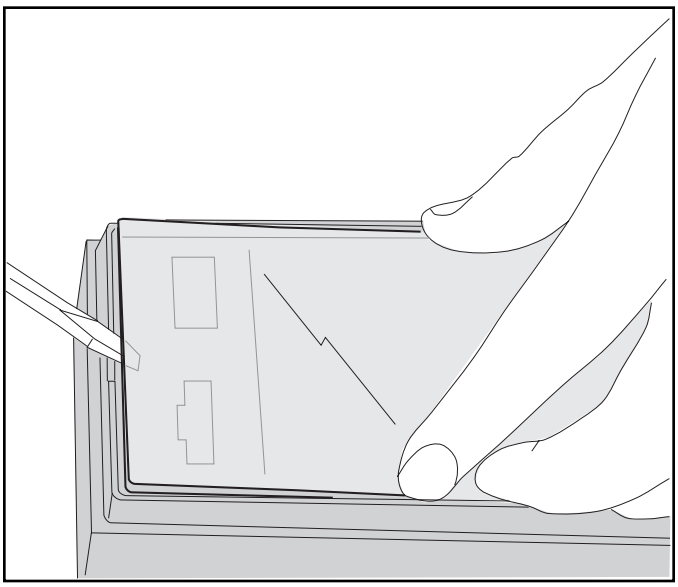
Before attempting to insert the rating plug, check the label on the rating plug to verify that it is a proper plug for the trip unit. If it is not a proper plug, the pins on the plug will not mate with the connector in the trip unit.

2. Remove the plexiglass shield.

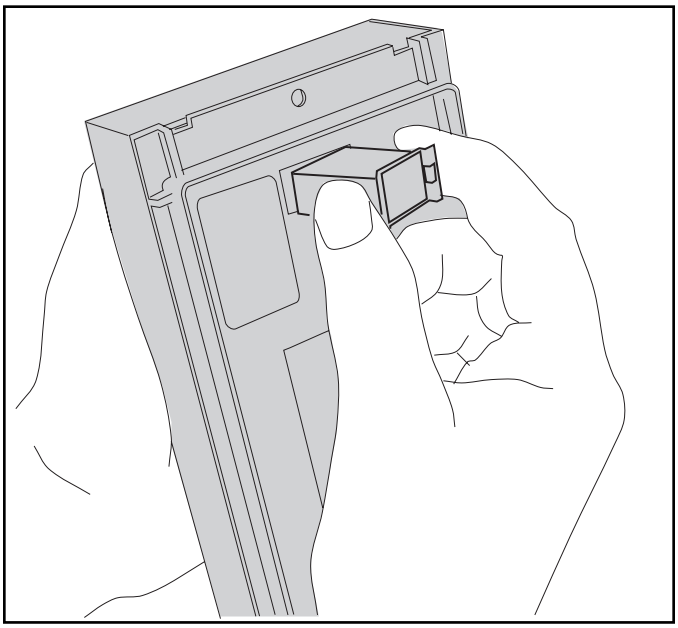


Inserting and removing the rating plug requires removal of the clear plexiglass shield. To remove the shield, remove the two screws that hold it in place.

3. Gently pry one end of the cover loose with a small screwdriver, and lift. Then remove the plexiglass shield.



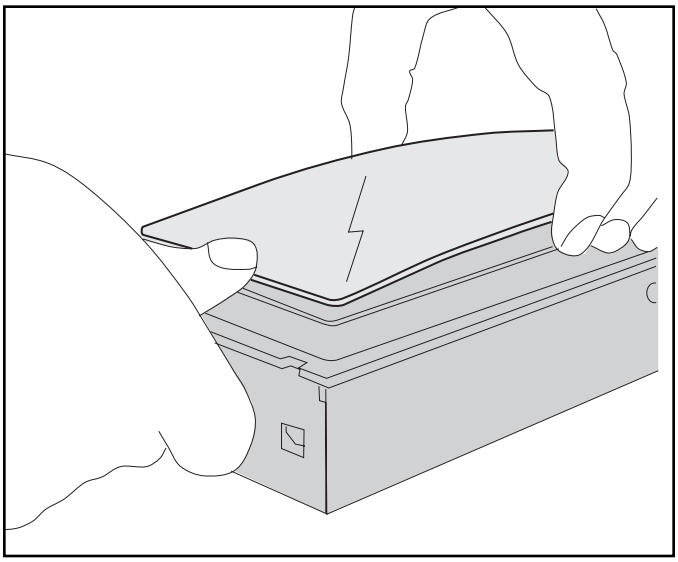
4. Press the plug into place (or remove).



Note: To **insert** a rating plug in the trip unit, align the plug with the plug receptacle and press the plug into place. The clips on the rating plug and the compression fitting of the plug hold the plug in place, eliminating the need for screws or latches—it will snap into place without excessive force. Do not force the rating plug into place.

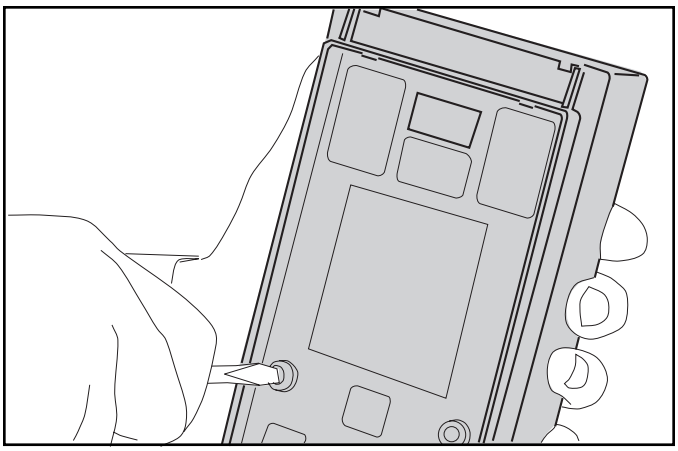
Conversely, to **remove** a rating plug, squeeze the clips, located on the sides of the plug, and pull the plug from the plug receptacle. Since the plug is held in place by compression, some force will be required to remove the plug. Do **not** close the circuit breaker with the rating plug removed from the trip unit.

5. Replace the plexiglass shield.

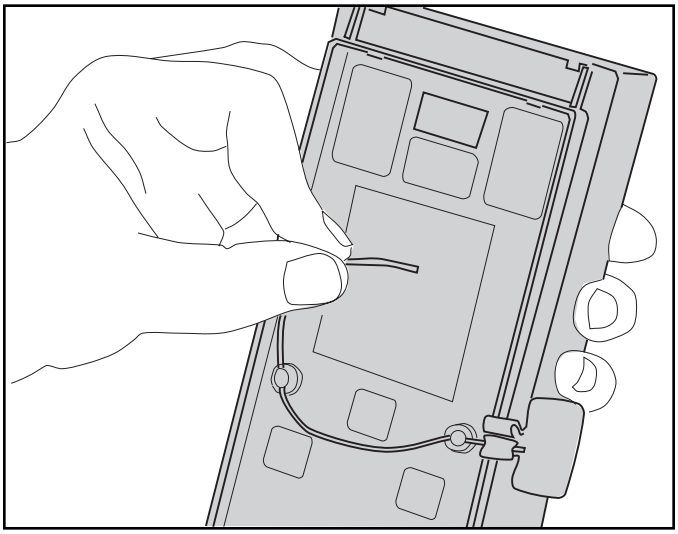


Slide the protective shield into the top of the trip unit, bow it slightly in middle, and press down with your thumb on bottom to snap the shield into place.

6. Replace the two (2) retaining screws.



7. Seal the cover as needed with a lead seal for tamper evident protection.



After the cover has been replaced a wire lock may be inserted through holes in the screws and sealed with a lead seal. This will help prevent tampering by unauthorized personnel.

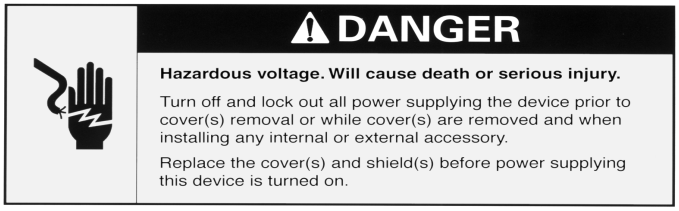
2.8 Communications

To connect the trip unit for communications with a PC, connect a serial cable to the Serial Port on the front panel of the trip unit.

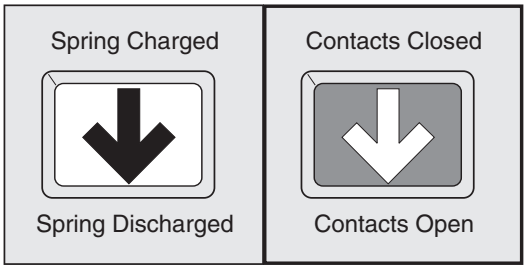
Refer to the ***ACCESS Systems Installation Guide*** for a thorough explanation of how to connect several devices on the SEAbus network to a personal computer.

2.9 Removing the Trip Unit from a Systems Breaker

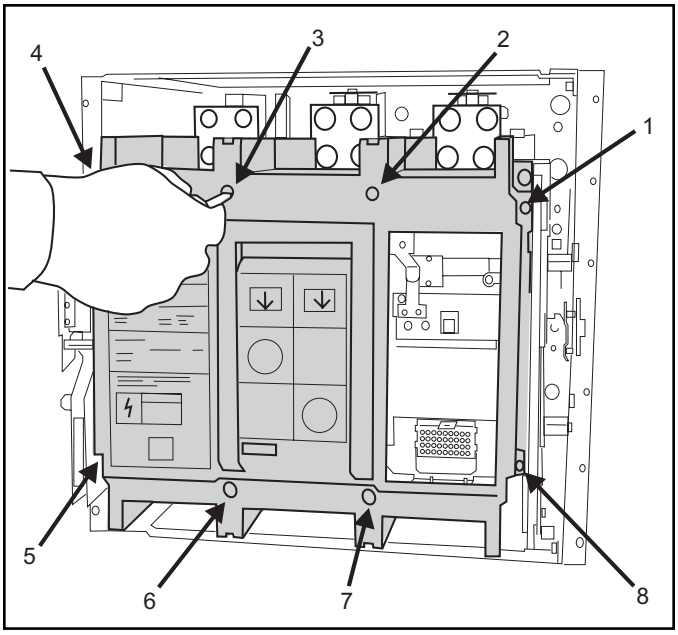
Follow the steps below when removing the trip unit from an SB Encased Systems Breaker. Before starting to remove the trip unit, set the circuit breaker to the "Open" and "Discharged" positions. If the circuit breaker is in the "Closed" position, the breaker will trip when the trip unit is removed.



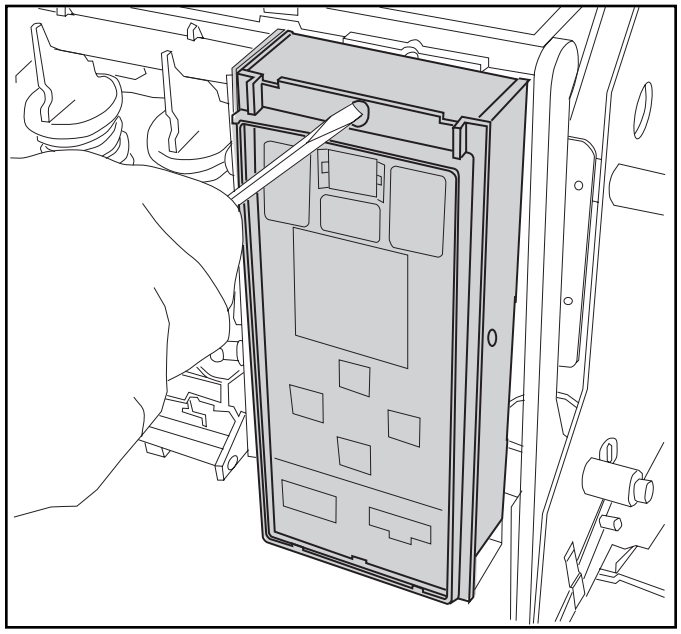
Make sure that the circuit breaker is in the open position. Refer to the breaker's information and instruction guide for the proper operating procedure.



1. Remove the eight screws from the breaker front cover. Lift off the front cover.

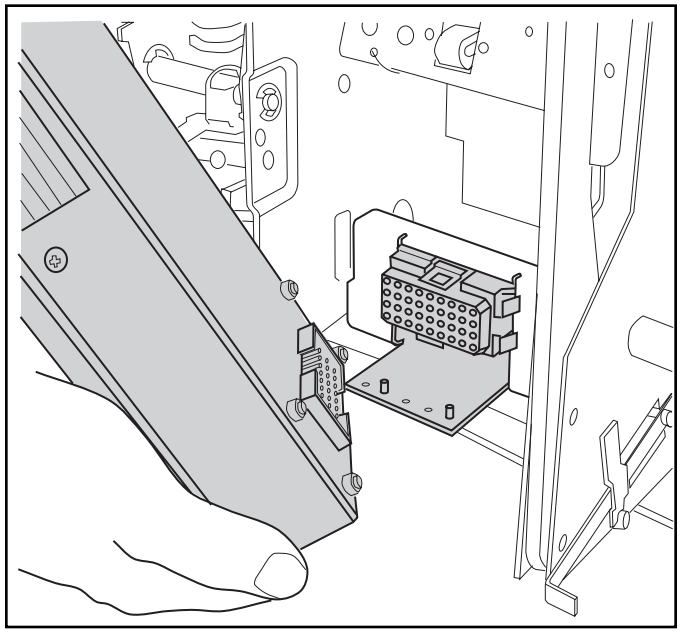


2. Remove the trip unit retaining screw.



Remove the front cover of the breaker and trip unit retaining screw. Lift the trip unit from the support plate and unmate the connector. Note that the trip unit must be lifted from the support plate high enough for the pins on the support plate to clear the holes in the bottom of the trip unit; otherwise, the connector cannot be unmated.

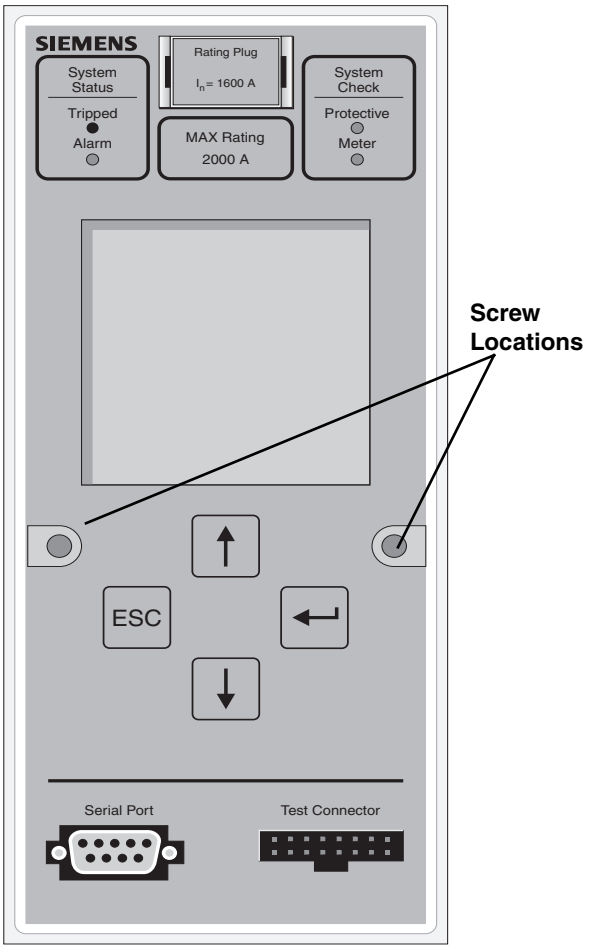
3. Remove the trip unit.



2.10 Starting Up

1. Remove the screws from the seals to access the display interface keypad.

The screws are on both sides of the display shield as shown below.



2. Turn on external 120 VAC control power. The “Protective” light flashes when the protection functions are operational. The “Meter” light flashes when the metering functions are operational. Now you are ready to learn how to use the front panel to configure the trip unit for protection and metering.

3 User Interface

3.1 Front Panel Display

The integral front panel keypad and display of the SB Energy-Comm trip unit provide the user with direct access to device data and settings. Through custom menus and graphical displays, the user may view and modify the system configuration and communication parameters, as well as protective and metering function settings. Both real-time and accumulated data are available, in addition to current and voltage waveforms. The user may also view information in the trip log associated with the five most recent trips.

The large liquid crystal display (LCD) on the front panel shows menus of commands and graphical information about the status of the trip unit and the circuit breaker. It is a 128 x128 pixel backlit display, which is viewable in many types of lighting. The LCD displays many types of information about the trip unit and about the circuit breaker.

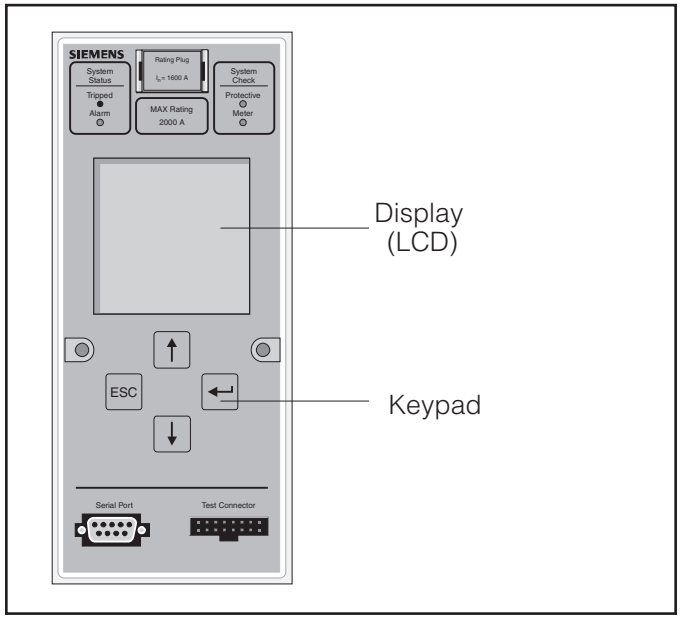


Figure 3.1 Display and Keypad on Front Panel

Note: On trip units with software version 3.00 or later, the LCD backlighting is activated by pressing any keypad button. The backlight is turned off 5 minutes after the last keypad button is pushed.

The LCD displays the menu of options and the status of the device. The menu allows the user to request configuration settings and protective or metered data, as well as time-stamped information stored in the various logs of the trip unit. Pickup and delay settings for alarm and protective relay functions can also be viewed and modified.

If the device is powered and left idle for five minutes, it will go into idle display mode and cycle between several informational screens repeatedly. See **Section 3.5, Idle Display Mode** for descriptions of the screens displayed in idle display mode. To end the scrolling of these screens, press Escape [ESC] and the previously selected menu appears.

3.2 Front Panel Keys

The front panel provides the user with a keypad with four keys for easy touch-control interface. No switches or knobs are needed to set the device parameters. The keypad includes four keys that allow the user to navigate through the menus, to choose parameter settings, and to view data.

Menu Screens

For menu screens, the up and down arrow buttons help navigate among the options listed vertically. When a menu is first displayed, the top choice on the list is highlighted. To scroll down to an option lower in the list, press the down arrow button. Continuing to press the Up [↑] or Down [↓] Arrow will cycle through to the top of the list again.

To select a highlighted option, press Enter [↵].

For example, to choose a menu choice from the Main Menu, press the Up [↑] or Down [↓] Arrow until the selection you want is highlighted and press Enter [↵].

Press Escape [ESC] to leave a menu without choosing any of the selections.

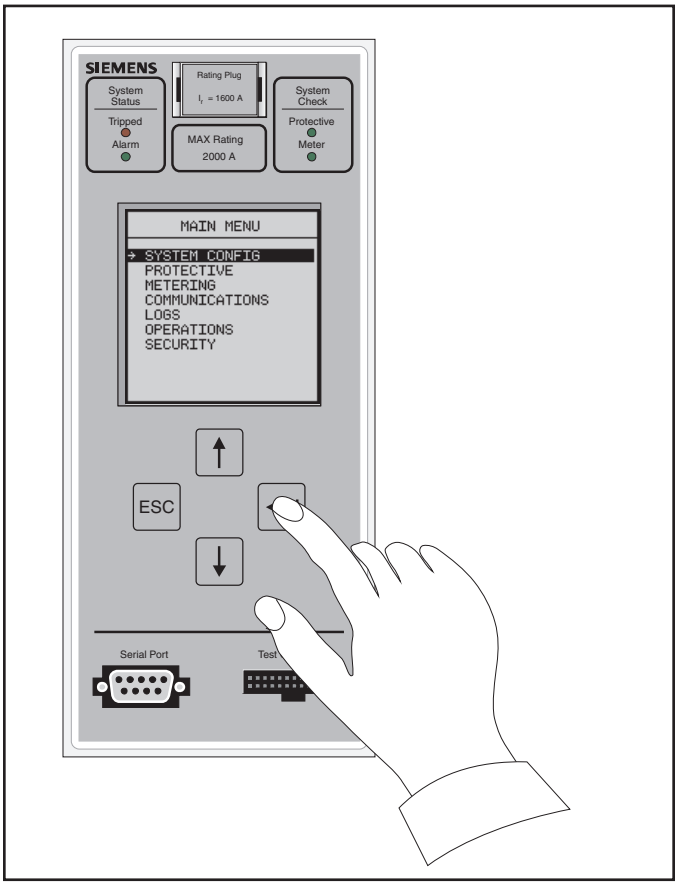


Figure 3.2 Selecting a Menu Option

Parameter Setting Screens

Besides menus, the front panel display also shows settings that can be changed by pressing the keys on the front panel. Several actions are available for parameter setting screens. When several parameters are displayed on one screen, the first choice is darkened (highlighted). The Enter key moves the highlighting from one parameter to the next. The up and down arrow buttons scroll through available values for a particular parameter.

Press Enter ↵ to move from one parameter to the next. For a given parameter, press the Up ↑ or Down ↓ Arrow keys to view the possible settings. After the setting is at the desired value, press Enter ↵ to move to the next parameter.

Press Escape ESC to leave this group of parameter settings. If security is inactive, an additional screen appears.

Press Enter ↵ to accept the settings or press Escape ESC to leave without changing or choosing any of the selections. If security is active, you cannot change parameters without first typing in the password.

To review, general functions of the keypad are summarized in **Figure 3.3**.

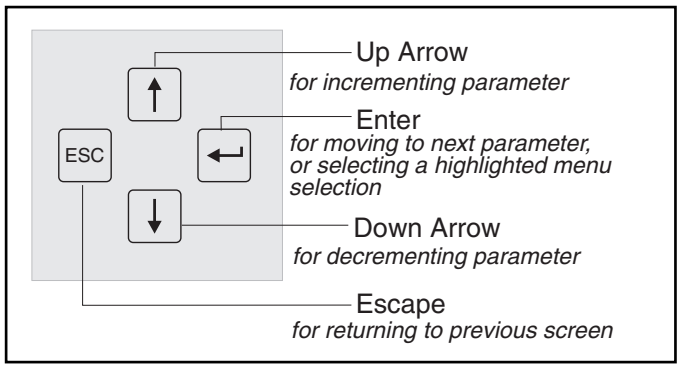


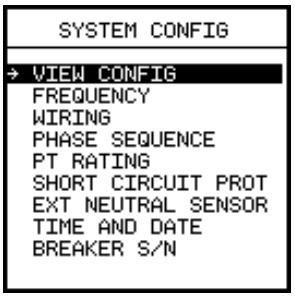
Figure 3.3 Key Functions

3.3 Menu Structure

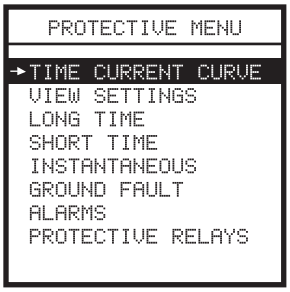
The user interface displays provide the functions and status information. They are organized in a menu structure with the Main Menu being the highest level of organization. Refer to the appendix, **Menu Structure** for additional details about menu organization. On start-up the Main Menu is the first display.

The **Main Menu** lists the major groupings of menus or displays that allow the user to view or set various settings of the device or data collected about the breaker. These menus are summarized next.

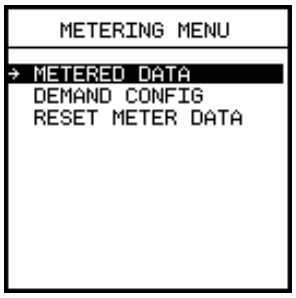
The **System Configuration** menu shows the options used to configure the system. This menu is used to set the application-specific parameters for the trip unit after the device is installed. It involves such settings as the voltage sensor rating and system frequency.



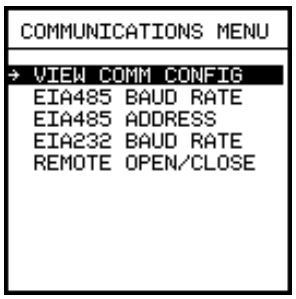
The **Protective** menu shows the types of protective functions for the user to configure. Within each type of protection, the user can set the extent of protection. For each type of protection, the user may select parameter settings or use default settings.



The **Metering** menu shows the types of metered data and configuration settings for demand values. It also includes the screen for resetting the meter data.



The **Communications** menu shows the various parameters for communicating remotely with the device from a PC.



The **Log** menu shows a list of the logs that can be viewed or reset. Each log has metered values or data about trips and events that have occurred.

The **Operations** menu is used for troubleshooting and for reviewing the history of the breaker. It shows a list of tests and counters that can be viewed.

The **Security** menu allows the user to set the password and enable the password protection.

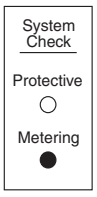
The **View Data** menu places the SB Energy-Comm trip unit into idle display mode.

For each menu, the user can view the present settings and can change any of the parameter settings (if the user has proper security clearance.)

3.4 Front Panel LEDs

At the top of the front panel are four light-emitting diode (LED) indicators which provide information about the operation of the trip unit and the status of the breaker. These indicators are the System Check LEDs (for trip unit function information) and the System Status LEDs (for breaker status information).

3.4.1 System Check LEDs

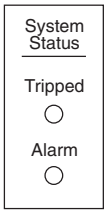


Two green LEDs indicate the proper operation of the SB Energy-Comm trip unit. The System Check LEDs blink approximately once every 3 seconds when the microprocessors are properly cycling through their protection and metering routines.

The Protective LED indicates the operation of the protective functions of the trip unit and blinks when operating properly. This LED operates at current levels over 20% of the rated load without external power, and at all current levels with external power.

The Metering LED indicates the operation of the metering functions of the trip unit and blinks when operating properly. Since the metering function requires external power, this LED will not light when the external power supply is not supplying power.

3.4.2 System Status LEDs



These two LEDs indicate the status of the breaker and associated power line. The Tripped LED is red and indicates a trip. The Alarm LED is yellow and indicates an alarm condition. These LEDs require the external power supply to be operational and supplying power.

The Tripped LED will light when the trip unit senses that the breaker has tripped.

For more information about breaker monitoring, refer to the breaker's seperate information and instruction guide.

The Alarm LED will light when one of the alarm functions has exceeded a limit set by the user. For more information about Alarms, refer to **Chapter 6, Alarm Setpoints.**

3.5 Idle Display Mode

When the SB Energy-Comm trip unit is on and left idle for five minutes, the front panel display switches to idle display mode and displays its configuration and metered data in real time. Selecting **View Data** from the main menu also causes the trip unit to enter idle display mode.

In idle display mode, the trip unit cycles through its metered and configuration values until the operator presses a button on the front panel. This cycling action allows the operator to see information at a glance without having to use the keypad and go through several menus to see the data.

Setting changes via the communications port is only allowed when the trip unit is in idle display mode. This prevents conflicts between remote and front panel configuration.

The screens that display during idle display mode, in order, are the Protection Configuration screen, the Metered Data screens (the metered real-time values screen, and the metered energy values screen), and the Demand Data screen. Examples of these are shown below:

```
PROTECTIVE CONFIG

     PU  DLY  TYPE
LT  1800  10   I2T
ST 10000 .07  FIXED
GF  1100 .40   I2T

       PU
INST  6000
```

For more information on the protection settings, refer to **Chapter 5**.

```
  AMPS        VOLTS
AØ   2011  AB   241
BØ   2011  BC   241
CØ   2011  CA   241
AVG  2011  AVG  241
GND     0  AØ   139
NØ   2011  BØ   139
           CØ   139
    PF     AVG  139
AØ 0.00 LG
BØ 1.00 LG    FREQ
CØ 0.80 LG    60.0
```

```
FWD KW       711
FWD KVAR     420
    KVA      840

FWD KWH      144
REV  WH        0
FWD  VARH  85483
REV  VARH      0

AØ  CF      1.48
BØ  CF      1.48
CØ  CF      1.48
```

For more information on the metered data, both real-time and energy calculations, refer to **Chapter 8.**

```
       DEMAND

PERIOD TIME    00:24

  AVG AMP DEMAND
PRESENT AMPS    1206
    MAX AMPS    2011

    WATT DEMAND
PRESENT FWD KW   426
    FWD MAX KW   711
    REV MAX  W     0
```

Chapter 8 also contains more information on the metered demand data.

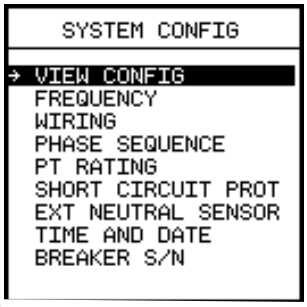
4 System Configuration

4.1 Viewing System Configuration

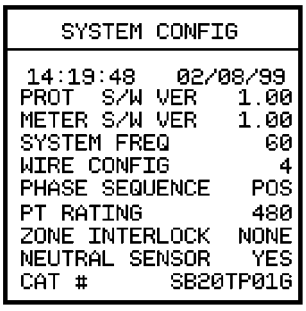
The **System Configuration** function allows you to set up the device to match the line frequency, phase sequence, and breaker connection settings of your system.

Configure the trip unit using the **System Configuration** menu.

At system power-up, the time and date starts at 12:00 Jan. 1, 1997. To set the time and date, select the **Time and Date** option from the **System Configuration** menu and press Enter ↵. See **4.3, Setting Other Device Parameters** for detailed information on setting device parameters.



To see how the device is configured for your system, select **View Config** from the **System Configuration** menu and press Enter ↵. A screen similar to the following appears.



This display shows the time and the date and lists the software version in the device, the settings, and the catalog number. The software version numbers and catalog number may be different from the illustration above.

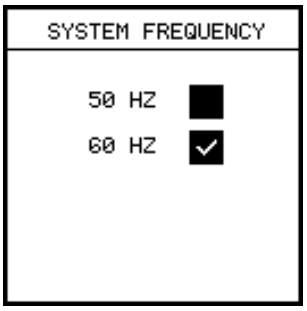
4.2 Setting System Configuration Parameters

Several of the system configuration parameters can be set using the **System Configuration** menu. These parameters include:

- System Frequency
- System Wiring Configuration
- Phase Sequence
- Potential Transformer (PT) Rating
- Short Circuit Protection
- External Neutral Sensing (Neutral CT)

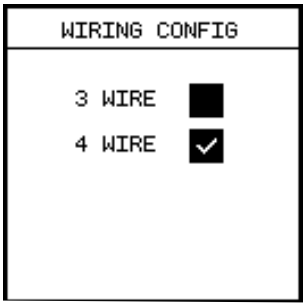
System Frequency

To select the frequency of AC power, begin from the **System Configuration** menu, select **Frequency,** and press Enter ↵. Select 50 or 60 Hz by pressing the Up ↑ or Down ↓ Arrow key; when finished, press Escape ESC, and then press Enter ↵ to accept the change.



System Wiring Configuration

To inform the SB Energy-Comm trip unit that your system is either a three-wire or four-wire configuration, select **Wiring** from the **System Configuration** menu. Use the Up ↑ or Down ↓ Arrow key to select either one and press Escape ESC, and then press Enter ↵ to accept the change.



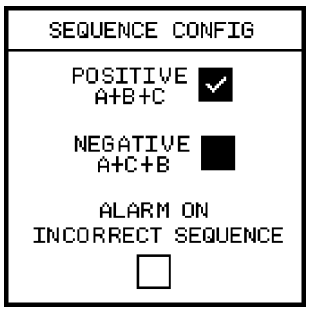
For three-wire delta systems, select **3 Wire**. For four-wire wye systems, select **4 Wire**.

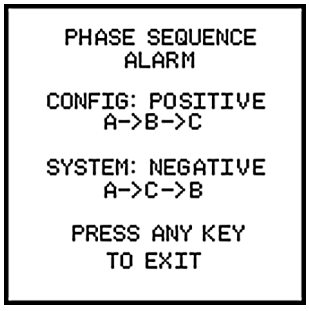
Phase Sequence Protection

A phase sequence configuration screen SEQUENCE CONFIG is available on trip units with software version 3.00 or later. The Sequence Config screen will display a POSITIVE sequence check box, a NEGATIVE sequence check box, and an ALARM ON INCORRECT SEQUENCE check box. The default configuration settings are positive sequence selected (checked) and alarm disabled (unchecked).

The SEQUENCE CONFIG screen will open with both the positive and negative sequence boxes highlighted. When the Up ↑ key is pressed, positive sequence is selected (checked). When the Down ↓ key is pressed, negative sequence is selected (checked). Pressing the Enter ↵ key moves the highlight to the ALARM ON INCORRECT SEQUENCE check box. When the Up ↑ key is pressed, the alarm is enabled (checked). When the Down ↓ key is pressed, the alarm is disabled (unchecked). Another press of the Enter ↵ key moves the highlight back to the positive and negative sequence check boxes. Pressing the Escape ESC key at any time will exit the screen and, (if changes were made) the standard change confirmation screen will be displayed. If the Alarm box is checked and the system phase sequence does not match the selected phase sequence configuration, an alarm will be issued. This is a local alarm only and is not reported via ACCESS communication, but will activate the Alarm Relay if installed.

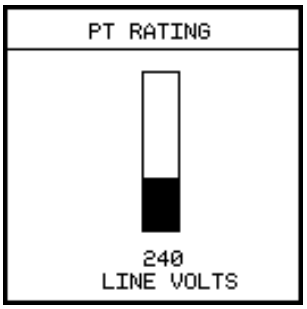
A PHASE SEQUENCE ALARM screen will be displayed any time the phase sequence alarm is active. Pressing any key will exit the alarm screen and return the user to the normal menu screens. The user can then change the phase sequence configuration or disable the phase sequence alarm if desired. Thirty seconds after the last key press, if the alarm is still active, the phase sequence alarm screen will again be displayed.





Potential Transformer Rating

To inform the trip unit which potential transformer (PT) is used in your system, select **PT Rating** from the **System Configuration** menu. The following screen appears:



Make sure the PT installed in the system matches the PT Rating (line-to-line) setting. Use the table below for various system voltages:

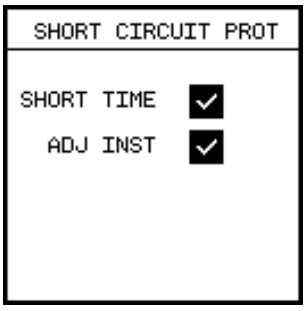
Table 4.1 PT Ratings

For System Voltage of:	Select This PT Rating:
120/208V, 120/240V, 220V	240V
277/480V, 415V	480V
575V	600V

Use the Up ↑ or Down ↓ Arrow keys to select the desired value. When finished, press Escape ESC, and then press Enter ↵ to accept the change.

Short Circuit Protection

The short time and instantaneous overcurrent protective functions can be enabled or disabled from the **System Configuration** menu. To specify the extent of such short circuit protection required in your system, select **Short Circuit Prot** from the **System Configuration** menu. The following screen appears:

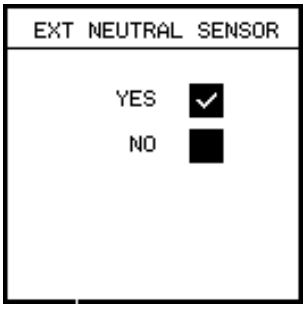


For short circuit protection either short time, or instantaneous tripping, or both can be chosen. Select these types of protection by pressing the Up ↑ or Down ↓ Arrow key until a check appears in the desired box(es). When the desired box(es) are checked, press Escape ESC, and then press Enter ↵ to accept the change.

To set the pickup and time delay values for short time protection and the pickup value for instantaneous protection, refer to the sections **5.4, Short Time Fault Protection,** and **5.5, Instantaneous Fault Protection**.

External Neutral Sensing

For 4-wire systems that have a separate neutral current transformer (CT), select **Ext Neutral Sensor** from the **System Configuration** menu. The following screen appears:



Select **Yes** if your system has an external neutral CT or **No** if it does not, using the Up ↑ or Down ↓ Arrow keys. When the desired box is selected, press Escape ESC, and then press Enter ↵ to accept the change.

4.3 Setting Other Device Parameters

Time and Date

The time and date setting internal to the SB Energy-Comm trip unit is used when reporting events in the event log, trip log, and min/max log. To set the time and date, begin from the **System Configuration** menu; select **Time and Date** and press Enter ↵. The following screen appears:

First, the user will set the time in hours (HH), minutes (MM), and seconds (SS). When the **Set Time and Date** screen first appears, the HH value is highlighted.

1. Press the Up ↑ or Down ↓ Arrow keys for each value until the desired value displays.

2. Press Enter ↵ to accept this value and move to the next value.

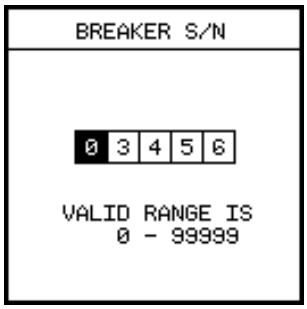
When you have completed the time settings, the first value, month (MM), in the date settings will be highlighted. You will set the date in months (MM), days (DD), and years (YY). Set the date in the same way as the time, described previously. When both the date and time are entered, press Escape ESC, and then press Enter ↵ to accept the change.

Display (LCD) Contrast

The LCD is equipped with a self-adjusting contrast circuit for variations in ambient temperature change. Note that some earlier models may be equipped with manual contrast adjust circuits.

Breaker Serial Number (S/N)

To set the serial number of the breaker to which the trip unit corresponds, from the **System Configuration** menu, select **Breaker S/N** and press Enter ↵. The following screen appears:



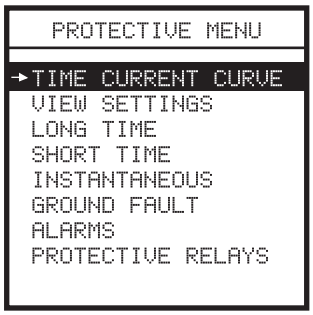
For each digit, select a number between 0 and 9 by pressing the Up ↑ or Down ↓ Arrow keys until the desired number is displayed. Press Enter ↵ and the highlighted box will move to the next digit. When the number is complete, press Escape ESC, and then press Enter ↵ to accept the change.

5 Overcurrent Protection Configuration

5.1 Protective Functions Menu

The SB Energy-Comm trip unit provides configurable overcurrent protection functions that can trip the SB circuit breaker. The user can easily accommodate load changes and other protection requirements while still assuring optimum coordination. A standard feature of the SB Energy-Comm trip unit is RMS current sensing. As opposed to peak-current sensing, RMS sensing measures the true heating potential of the current waveform. This allows more accurate overcurrent protection and eliminates nuisance tripping that results from harmonic distortion of the current waveform. The current transformers (CTs) in the circuit breaker provide operating power as well as current level data. When the circuit breaker is carrying load currents, the trip unit requires no external connections or control power to perform the basic overcurrent protective functions.

To set the overcurrent protection, from the **Main Menu**, select **Protective** and press Enter ↵. This displays the **Protective Menu**, which includes the functions for setting the characteristics of the time-current curve.



Long time overcurrent protection is always enabled. For the models with ground fault protection, this protective function is similarly always enabled. The short time and instantaneous protective functions can be enabled or disabled from the **System Configuration** menu; either the short time or instantaneous protection must be enabled. Refer to Short Circuit Protection in **4.2, Setting System Configuration Parameters.**

The **Time Current Curve**, which displays a graphical representation of the time-current curve is available only on trip units with software version 3.00 or later.

Figure 5.1 shows a typical time-current curve that summarizes the protection. The settings in the **Protective Menu** allow the user to define this overall curve by selecting parameters that define parts of that curve. The overall curve is then a summation of the individual parts. This gives the user the maximum flexibility in defining the appropriate protection for a specific application.

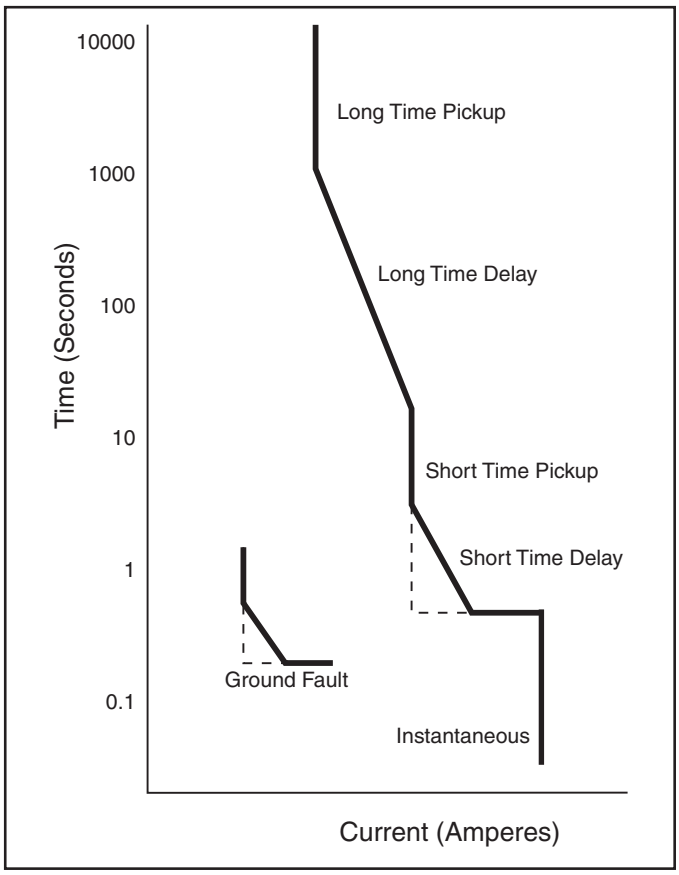


Figure 5.1 Time-Current Curve

For each part of the curve, there is a set of adjustable parameters. When each set of parameters is adjusted, if security is inactive, press Escape ESC and the verification screen appears.

Press Enter ↵ to accept the changes (accept the settings you have entered). If you want to quit without saving these changes, press Escape ESC.

Each of the menu options available for the **Protective Menu** is discussed next. Note that chapters 6 and 7 are devoted entirely to alarms and protective relays, respectively.

5.2 Viewing Settings

To check the protection settings from the **Protective Menu**, select **View Settings**. The screen lists the values for the long time, short time, ground fault and instantaneous protection.

```
PROTECTIVE CONFIG

      PU  DLY  TYPE
LT  1800  10   I2T
ST 10000 .07  FIXED
GF  1100 .40   I2T

      PU
INST  6000
```

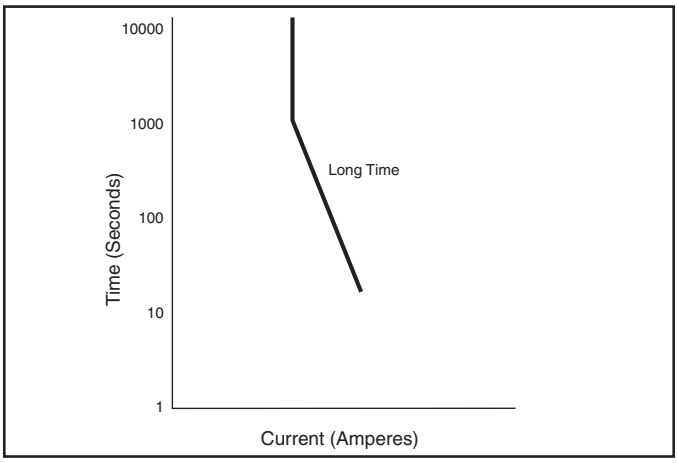
The abbreviations used in the screen are:

LT	Long Time
ST	Short Time
GF	Ground Fault
INST	Instantaneous
PU	Pickup Value (amperes)
DLY	Time Delay Value (seconds)
TYPE	Mode of protection, Fixed or I^2t

The values that appear on this screen and on the other screens shown in this chapter depend on which rating plug is used. Actual values rather than percentages are displayed. For example, the screen shows 1800A, instead of 90% for a 2000A breaker.

5.3 Long Time Fault Protection

The long time setting establishes the highest current limit at which the circuit breaker will continuously operate without initiating a tripping sequence. This protective function is always enabled and cannot be disabled. Two values must be set to adequately specify this protection: the continuous current and the time delay. The continuous current is the amplitude of the current in amperes above which the trip unit will pick up.



To set these values for the long time fault protection, from the **Protective Menu** select **Long Time** and press Enter ↵. The following screen appears:

```
LONG TIME

CONTINUOUS CURRENT    DELAY
      1800 AMPS       10 SEC AT 6X
```

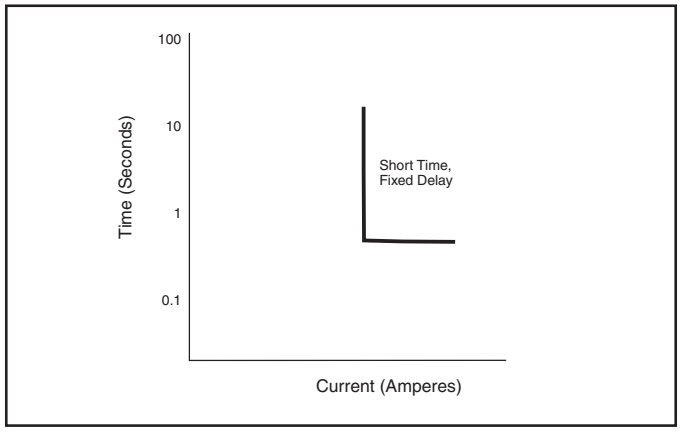
The protection may be set to one of several values of continuous current from 50% to 100% of the rating plug. For example, for a 2000A rating plug, the long time continuous current may be set to values between 1000A and 2000A. For a complete list of possible values for all ratings, refer to the Appendix, **Parameter Settings**.

The long time delay scale is used to set the tripping delay in seconds, based on the amplitude of the overcurrent condition. The long time delay, which is an inverse I^2t ramp function, may be set to one of ten values calibrated at a current equal to 6 times I_n for each frame rating.

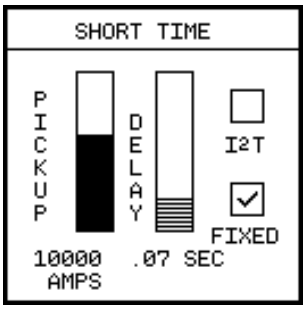
To program this value from the front panel, with the CONTINUOUS CURRENT scale selected, press the Up ↑ or Down ↓ Arrow until the scale shows the desired value. When displayed, press Enter ↵ to select the DELAY parameter. Press the Up ↑ or Down ↓ Arrow to set the desired value. After setting the current level and delay, press Escape ESC then Enter ↵ to accept these settings.

5.4 Short Time Fault Protection

The short time setting establishes the maximum current level at which the circuit breaker will operate for brief durations without initiating a tripping sequence. Two values must be set to provide this protection: the continuous current Pickup and the Delay.



To select short time fault protection, from the **Protective Menu** select **Short Time** and press Enter ↵. The following screen appears:



The short time pickup sets the maximum level of current the circuit breaker is allowed to carry for a short period of time without tripping. This pickup, together with the short time delay, allows downstream circuit breakers time to clear short circuit faults without tripping the upstream circuit breakers. When the pickup level is exceeded, the trip unit initiates the short time fault protection sequence. On trip units for the 1200A and 2000A breaker frame sizes, the short time pickup may be set to 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, or 9 times the rating plug, I_n. On trip units for the 3200A and 5000A breaker frame size, the short time pickup may be set to 1.5, 2, 2.5, 3, 3.5, 4, 5, 6, 7, or 8 times I_n.

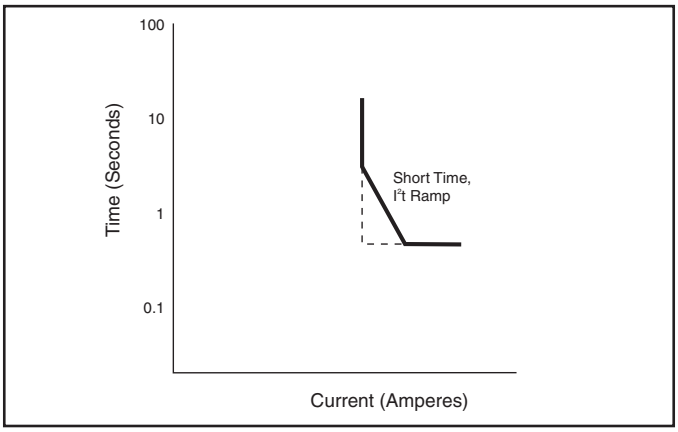
To program this value from the front panel, with the PICKUP scale selected, press the Up ↑ or Down ↓ Arrow until the scale shows the desired value. When displayed, press Enter ↵ to go to the DELAY parameter or press Escape ESC to accept these settings.

The short time delay setting is used to set the time interval the breaker will wait before initiating a trip command at the current value selected on the short time pickup setting. This setting has two modes of operation: a fixed delay, and an inverse I^2t ramp delay.

To set the mode, press Enter ↵ until the I^2T and the FIXED checkbox is highlighted. Press the Up ↑ or Down ↓ Arrow key so that a check appears in the desired selection box.

To program the delay value, press Enter ↵ until the **Delay** parameter is selected. Press the Up ↑ or Down ↓ Arrow key until the scale shows the value. When selected, press Enter ↵ to go to the mode parameter or press Escape ESC then Enter ↵ to accept these settings.

The I^2t ramp delay has the characteristic of being inversely proportional to the square of the magnitude of the overcurrent condition. This means that higher overcurrent conditions have shorter delays and conversely lower overcurrent conditions have longer delays. This characteristic can provide better coordination with downstream circuit breakers and fuses.

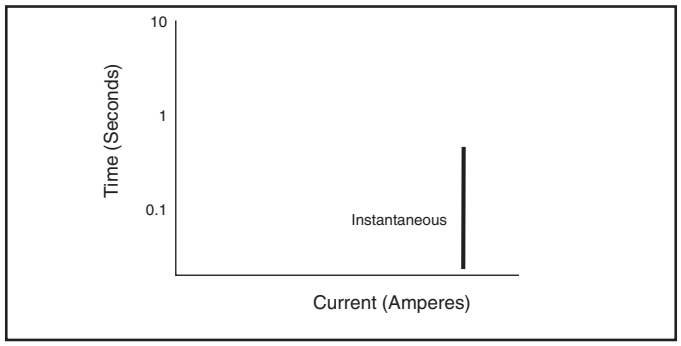


In the fixed delay mode, the short time delay may be set to 0.07, 0.1, 0.15, 0.2, or 0.3 seconds.

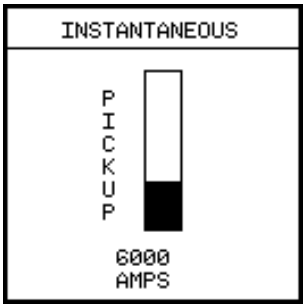
In the inverse I^2t ramp short time delay mode, the delay may be set to a calibrated value of 0.07, 0.10, 0.15, 0.2, or 0.3 seconds at a current equal to 8 times I_n .

5.5 Instantaneous Fault Protection

The instantaneous pickup sets the level of high current at which the trip unit will trip the circuit breaker without a time delay. Non-delayed tripping, in response to a severe overcurrent condition, minimizes potential damage to electrical systems and equipment. The instantaneous pickup may be set to a range of continuous current values depending on the breaker rating. The pickup is independent of the long time setting.



To select instantaneous fault protection, from the **Protective Menu**, select **Instantaneous** and press Enter ↵. The following screen appears:



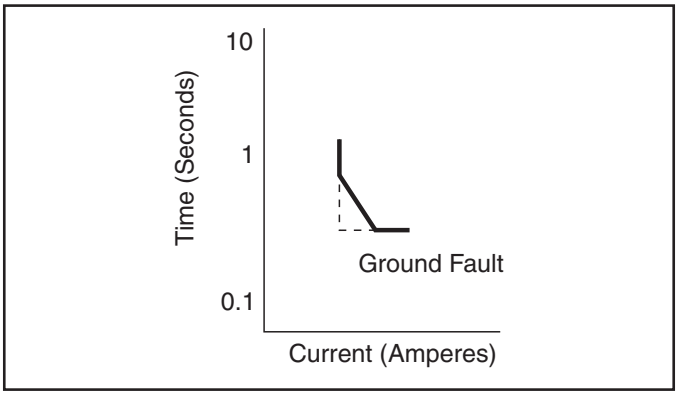
The pickup value is the only value to set. To program this value, press the Up ↑ or Down ↓ Arrow key until the scale shows the desired value. When displayed, press Escape ESC then Enter ↵ to accept this setting.

5.6 Ground Fault Protection

Trip units equipped with the protective ground fault option can be configured to accommodate the following ground fault sensing schemes:

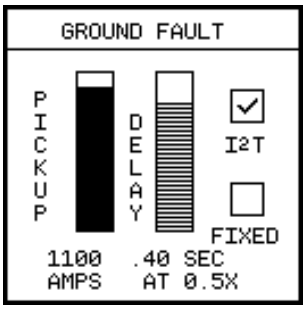
- Residual
- Ground Return

To configure the trip unit to support these protection schemes, the user is required only to set the ground fault selection switch to the desired configuration. The selection switch is on the top right side of the trip unit and must be set prior to the installation of the trip unit in the circuit breaker. Refer to **Chapter 2, Installation**.



Two values must be set to provide the ground fault protection: the Pickup value and the Delay value. The pickup value is used to set the level of ground current at which circuit interruption will be initiated. Together with the delay value, this setting allows selective tripping between main and feeder or other down-stream breakers. In compliance with the National Electric Code (NEC 230-95), no trip point setting exceeds 1200A. A complete listing of the available ground fault pickup settings is given in a table in Appendix, **Parameter Settings**.

To select ground fault protection, from the **Protective Menu** select **Ground Fault** and press Enter ↵. The following screen appears:

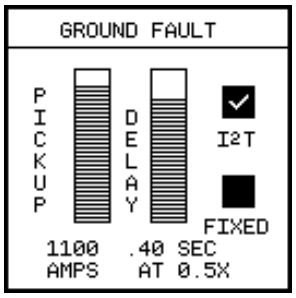


To program the pickup first make sure the Pickup scale is selected, pressing Enter ↵ as necessary to move the highlight to the Pickup parameter. Then press the Up ↑ or Down ↓ Arrow key until the scale shows the desired value. When displayed, press Enter ↵ to move to the delay parameter, or press Escape ESC to accept these settings.

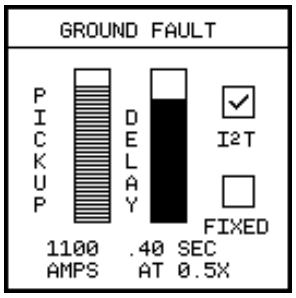
The Ground Fault Delay value is used to set the time interval the breaker will wait before responding once the ground fault pickup level has been reached. This setting has two modes of operation: a fixed delay, and an inverse I^2t ramp delay.

In the fixed delay mode, the Ground Fault Delay may be set to 0.1, 0.2, 0.3, 0.4, or 0.5 seconds. In the inverse I^2t ramp delay mode, the delay may be set to a calibrated value of 0.1, 0.2, 0.3, 0.4, or 0.5 seconds at a current equal to 0.5 times the MAX RATING. The inverse I^2t ramp delay reverts to a fixed delay of the same value when the ground current (I_g) exceeds 50 percent of the MAX RATING.

To set the mode, press Enter ↵ until the I^2T and the FIXED checkbox is highlighted. Press the Up ↑ or Down ↓ Arrow key so that a check appears in the desired selection box.



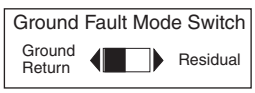
To program the delay value, press Enter ↵ until the Delay parameter is selected. Press the Up ↑ or Down ↓ Arrow key until the scale shows the desired value. In the example shown, the delay is set at 400 milliseconds at 0.5 times rated current. When selected, press Enter ↵ to move to the mode parameter or press Escape ESC then Enter ↵ to accept these settings.



5.7 Ground Fault Sensing Scheme

Brief descriptions follow for the ground fault sensing schemes as they relate to the trip unit. Detailed technical and application information of the ground fault sensing schemes is contained in **NEMA Standard No. PB 2.2 "Application Guide for Ground Fault Protective Devices for Equipment."**

Set the switch on the side of the trip unit to either Ground Return or Residual mode.



5.7.1 Ground Return

In this scheme, also called Source Ground Return, the phase currents are not used to detect and process ground faults. The trip unit executes the ground fault protection function based on data from a ground current sensor. This sensor is located on the neutral connection to ground at the service entrance, and is connected to the neutral transformer input terminals on the trip unit.

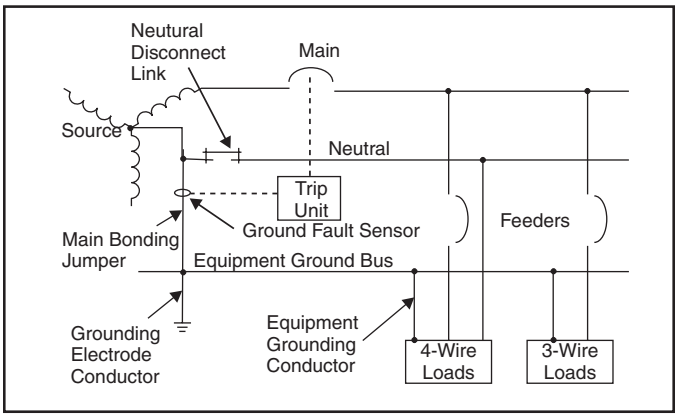


Figure 5.2 Ground Return Sensing Scheme

5.7.2 Residual (3-Phase, 3-Wire)

Under normal system conditions (without a ground fault condition), the vector sum of the phase currents being monitored by the trip unit is zero. This is also true for overcurrent, phase-to-phase fault, and phase-unbalance conditions. When a phase-to-ground fault occurs, the vector sum of the phase currents is directly proportional to the magnitude of the fault. The trip unit's microprocessor uses this vector sum data from the internal breaker current transformers in the execution of the ground fault protection function.

5.7.3 Residual (3-Phase, 4-Wire)

In the 3-Phase, 4-Wire Residual scheme a fourth current transformer is connected in the neutral conductor to sense normal neutral currents. Under normal system conditions the vector sum of the currents in all phases and neutral equals zero. This is also true under the condition of an overcurrent phase-to-phase fault and phase-unbalance condition. When a phase-to-ground fault occurs, the fault current returns via a path other than the neutral. Therefore, the vector sum of the currents no longer equals zero. This current differential is detected by the trip unit and used in the execution of the ground fault protection function.

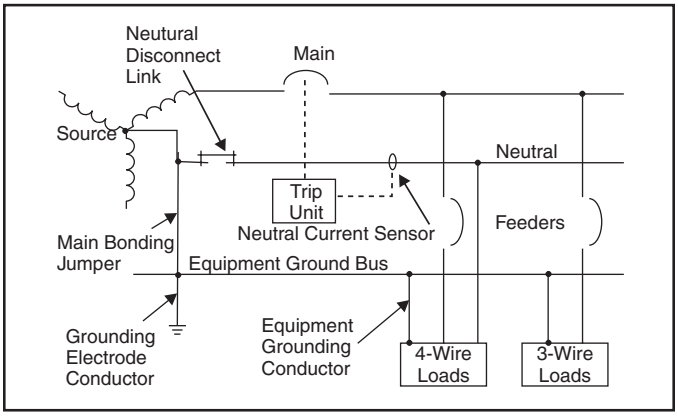


Figure 5.3 Residual Sensing Scheme

6 Alarm Setpoints

6.1 Alarms

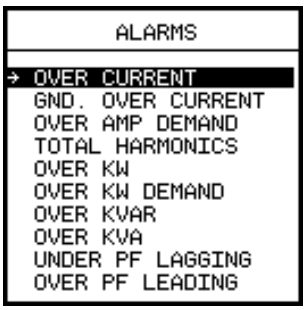
The SB Breaker has an optional relay output contact for controlling audible or visible alarms. The trip unit can be configured to initiate an alarm based on any or all of ten measured parameters. (The protective relaying functions discussed in the next chapter can also be configured to initiate an alarm. The functions discussed in this chapter are alarm-only functions.) Exceeding the configured setpoint will result in the following actions by the trip unit:

- Close the optional relay output contact, which may be connected to a visible or audible alarm (or both)
- Store a record of the event in the event log including the date and time of the alarm
- Communicate with any supervisory device that an alarm condition is reached

The following parameters can be configured to cause an alarm and a record in the event log.

- Line Overcurrent
- Ground Overcurrent
- Overcurrent Demand
- Total Harmonic Distortion (THD)
- Over Real Power (kW)
- Over Power Demand (kW Demand)
- Over Reactive Power (kVAR)
- Over Apparent Power (kVA)
- Under Power Factor Lagging
- Over Power Factor Leading

To view the setting of or to set these alarms, from the **Main Menu**, select **Protective Functions**. From the **Protective Menu**, select **Alarms**. The **Alarms Menu** is displayed:



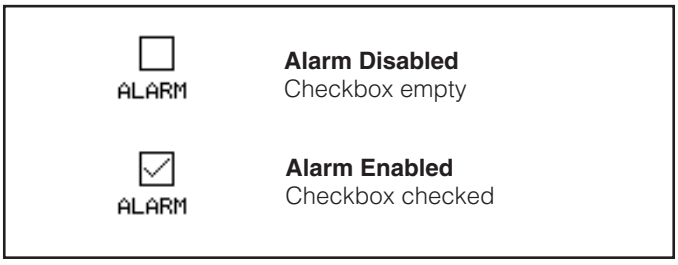
Each alarm limit has three parameters:

- Pickup value
- Delay value
- Alarm enabled or disabled

Setting these alarms involves enabling the alarm, setting the limit above which the trip unit considers alarmable (pickup), and setting the time interval the device will wait before setting off the alarm (delay). The pickup and delay values can be chosen from a range based on the rating of the device. The default setting is for all alarm limits to be disabled.

To set the pickup and delay values and to turn the alarm feature on or off for each of these parameters, select them from the **Alarms Menu**. For each of these three parameters, use the Up ↑ or Down ↓ Arrow keys to increment or decrement the value. When satisfied with a particular setting, press Enter ↵ to move to the next parameter.

To enable the alarm for a given limit, highlight the Alarm box and press the Up ↑ Arrow key to select it. A check mark in the alarm box indicates that the alarm is enabled.

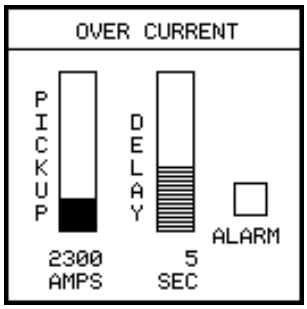


Press Escape ESC to leave this group of parameters. An additional screen, called the Verification screen, appears if security is inactive (if no password protection is on). Press Enter ↵ to accept the settings, or press Escape ESC to leave without changing or choosing any of the selections.

6.2 Overcurrent

To alarm on overcurrent:

1. From the **Alarms Menu**, select **Over Current.**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. The values will depend on the rating of the breaker. The possible values are, for any breaker rating, one of the following percentages of the breaker current rating:115%, 125%, 150%, 200%, or 250%. For example, if your trip unit is mounted to a 2000A breaker, the lowest pickup would be 115% of 2000A or 2300A (as illustrated above). The highest setting for this breaker would be 5000A (250% of 2000A). For a complete list of pickup values, refer to the appendix, **Parameter Settings**. When the desired value is set, press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

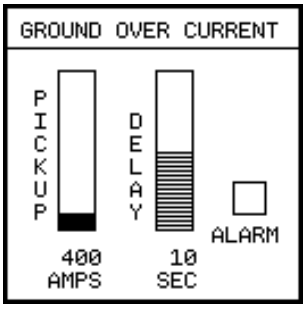
5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.3 Ground Overcurrent

The Ground Overcurrent alarm provides a preset ground fault indication, similar in function to the Ground Fault Monitor (SB-GFM) accessory module for the standard SB trip unit. Note that this ground overcurrent alarm feature is available on *all* SB Energy-Comm trip units with or without ground fault protection and is independent of the ground overcurrent tripping function.

To alarm on ground overcurrent:

1. From the **Alarms Menu**, select **Ground Over Current**.



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. The values will depend on the rating of the breaker.

   The possible values for any breaker rating range from 20% of the CT rating up to a 1200A maximum or the CT rating, whichever is lower. For example, if your system is a 2000A breaker with 2000A CTs, the lowest pickup would be 20% of 2000A or 400A (as illustrated above). The highest setting would be 1200A. For a complete list of pickup values, refer to the appendix, **Parameter Settings**. When the desired value is set, press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. When the desired value displays, press Enter ↵. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

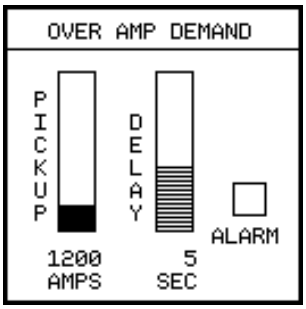
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.4 Overcurrent Demand

To alarm on demand overcurrent:

1. From the **Alarms Menu**, select **Over-Amp Demand.**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. The values will depend on the rating of the breaker.

   The possible values are, for any breaker rating, one of the following percentages of the breaker current rating: 115%, 125%, 150%, 200%, or 250%. For example, if your trip unit is mounted to a 2000A breaker, the lowest pickup would be 115% of 2000A or 2300A. The highest setting for this breaker would be 5000A (250% of 2000A). For a complete list of pickup values, refer to the appendix, **Parameter Settings**. When the desired value is set, press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value is displayed, press Enter ↵.

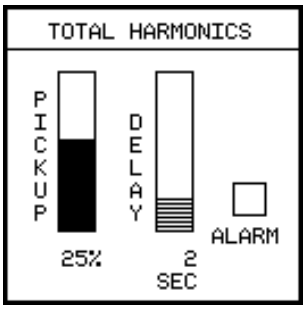
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.5 Total Harmonic Distortion

To alarm on total harmonic distortion:

1. From the **Alarms Menu**, select **Total Harmonics.**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. The values will depend on the rating of the breaker and are given in the table below. When the desired value is set, press Enter ↵.

Harmonic Distortion	Alarm Settings			
Pickup Values (%)	5	10	15	20
	25	30	40	50

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

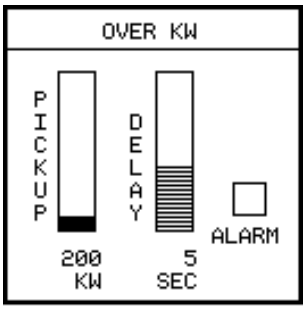
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.6 Over Real Power

To alarm on over real power (kilowatts):

1. From the **Alarms Menu**, select **Over kW.**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. For a complete list of pickup values, refer to the appendix, **Parameter Settings**. Press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

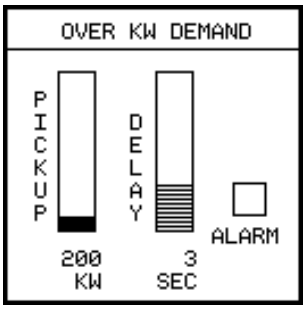
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.7 Over Power Demand

To alarm on over power (kilowatt) demand:

1. From the **Alarms Menu**, select **Over kW Demand**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. For a complete list of pickup values, refer to the appendix, **Parameter Settings**. Press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value is displayed, press Enter ↵.

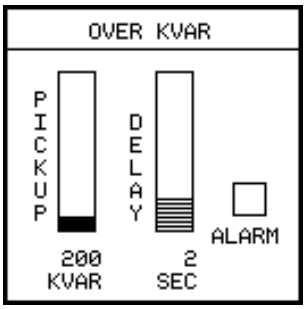
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.8 Over Reactive Power

To alarm on over reactive power (kilovolt-amps reactive):

1. From the **Alarms Menu**, select **Over kVAR.**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. You can choose between ten values, based on the frame rating. Press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

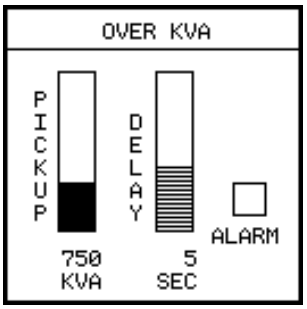
4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.9 Over Apparent Power

To alarm on over apparent power (kilovolt-amps):

1. From the **Alarms Menu**, select **Over kVA**



2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. You can choose between ten values, based on the frame rating. Press Enter ↵.

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.10 Under PF Lagging

To alarm on under power factor lagging:

1. From the **Alarms Menu**, select **Under PF Lagging.**

2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Press Enter ↵. Values appear in the following table.

	Under Power Factor (Lagging) Alarm Settings			
Pickup Values	0.50	0.60	0.70	0.80
	0.90	0.95		

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

6.11 Over PF Leading

To alarm on over power factor leading:

1. From the **Alarms Menu**, select **Over PF Leading**

2. Select a pickup value by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Press Enter ↵. Values appear in the following table.

	Over Power Factor (Leading) Alarm Settings			
Pickup Values	0.50	0.60	0.70	0.80
	0.90	0.95		

3. Select a delay time by pressing the Up ↑ or Down ↓ Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 5, 10, 20, 30, 60, 120, and 300 seconds. When the desired value displays, press Enter ↵.

4. Highlight the ALARM box and press the Up ↑ Arrow key so that a checkmark appears in the box.

5. Press Escape ESC to leave the menu and press Enter ↵ at the verification screen to accept the new settings and leave the menu.

7 Extended Protective Relaying

7.1 Overview

The SB Energy-Comm trip unit offers several protective relaying functions beyond the standard trip unit functionality. These extended functions include types of current, voltage, and frequency protection usually associated with a protective relay.

- Neutral Overcurrent
- Current Unbalance
- Undervoltage
- Voltage Unbalance
- Over Voltage
- Reverse Power
- Over Frequency
- Under Frequency

Exceeding the configured setpoint (limit) will result in the following actions by the trip unit:

If set to trip and alarm:

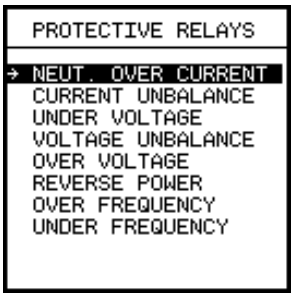
- Trip the circuit breaker
- Store a record of the event in the trip log including the time and date of the trip
- Close the optional breaker relay output contact, which may be connected to a visible or audible alarm (or both)
- Communicate with any supervisory device that a trip condition was reached

If set to alarm only:

- close the relay output contact, which may be connected to a visible or audible alarm (or both)
- Store a record of the event in the event log including the time and date of the alarm
- Communicate with any supervisory device that an alarm condition was reached

To find settings for the protective relay functions:

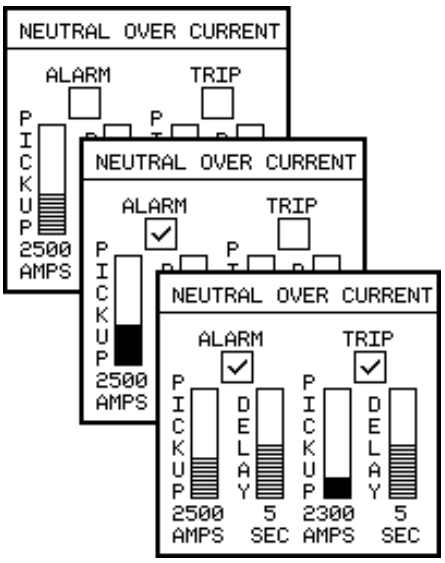
1. From the **Main Menu**, select **Protective Functions**.
2. From the **Protective Menu**, select **Protective Relays**.



For each protection type, users may choose that the trip unit either alarms, or trips and alarms, when these parameters exceed a set value.

7.2 Tripping and Alarming

For the protective relaying functions, users may either alarm on the function, or both trip and alarm on the function. You cannot trip without alarming. In the examples below, the first case shows no alarm or trip; the second shows the alarm set, and the third shows both trip and alarm set.



To activate this function:

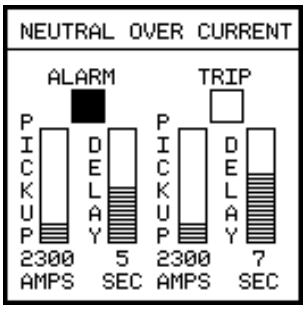
1. Press the Up Arrow key ↑ when either the alarm or the trip checkbox is highlighted.
2. If you select tripping, the alarm checkbox is automatically highlighted as well.

7.3 Neutral Overcurrent

If an external neutral sensor has been selected during configuration, the allowable overcurrent on the neutral line can be set using the parameters from the **Neutral Over Current** selection of the **Protective Relays Menu**.

To alarm, or to trip and alarm, on neutral overcurrent:

1. From the **Protective Relays Menu**, select **Neutral Overcurrent.** The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

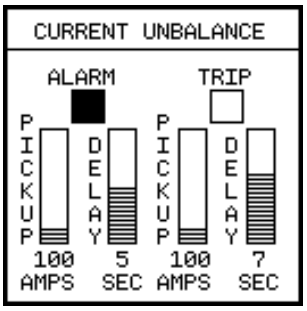
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.4 Current Unbalance

Current unbalance is a protective relay function that protects against an unbalance in the phase currents. Each phase current is compared to the arithmetic average of the three phase currents. Tripping or alarming occurs when any phase current exceeds the unbalance pickup for a period of time equal to the delay time setting. To alarm, or to trip and alarm, on current unbalance:

1. From the **Protective Relays Menu**, select **Current Unbalance**. The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

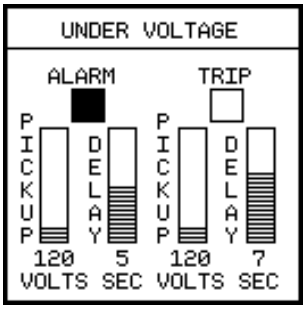
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.5 Undervoltage

If the amount of voltage on any phase goes below a specified level, the trip unit can alarm or trip by setting the parameters from the **Undervoltage** selection of the **Protective Relays Menu**. To alarm, or to trip and alarm, on undervoltage:

1. From the **Protective Relays Menu**, select **Under Voltage.** The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

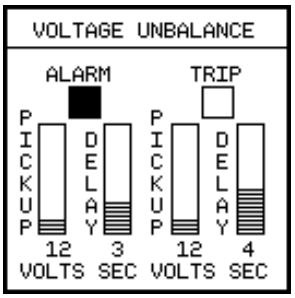
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.6 Voltage Unbalance

Voltage unbalance is a protective relay function that protects against an unbalance in the line to line voltages. Each line-to-line voltage is compared to the arithmetic average of the three voltages. Tripping or alarming occurs when any voltage exceeds the unbalance pickup for a period of time equal to the delay time setting. To alarm, or to trip and alarm, on current unbalance:

1. From the **Protective Relays Menu**, select **Voltage Unbalance**. The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

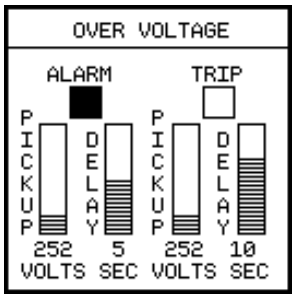
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.7 Overvoltage

If the amount of voltage on any phase goes above a specified level, the trip unit can alarm or trip by setting the parameters from the **Over Voltage** selection of the **Protective Relays Menu**. To alarm, or to trip and alarm, on overvoltage:

1. From the **Protective Relays Menu**, select **Over Voltage**. The alarm checkbox is highlighted, but alarming has not been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

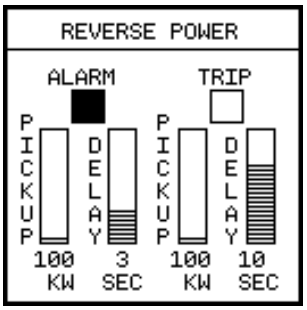
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.8 Reverse Power

If the amount of reverse power goes above a specified level, the trip unit can alarm or trip by setting the parameters from the **Reverse Power** selection of the **Protective Relays Menu**. To alarm, or to trip and alarm, on over reverse kilowatts:

1. From the **Protective Relays Menu**, select **Reverse Power.** The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values depend on the rating of the breaker; see the table in the appendix, **Parameter Settings**. Press Enter [↵].

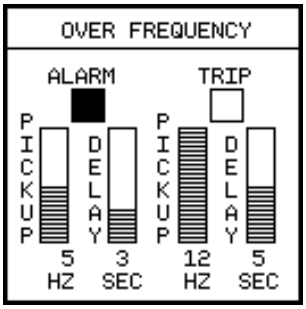
4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

5. Refer to the individual PT Module instruction sheet for PT Module connections for bottom-fed breakers.

7.9 Over Frequency

The trip unit can alarm or trip on the frequency of the monitored power by setting the parameters from the **Over Frequency** selection of the **Protective Relays Menu**. To alarm, or to trip and alarm, on over frequency:

1. From the **Protective Relays Menu**, select **Over Frequency**. The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

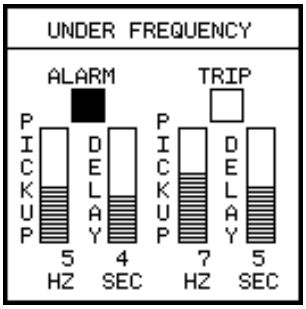
3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values are 1, 2, 3, 4, 5, 7, 9, 12 Hz above the nominal frequency. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

7.10 Under Frequency

The trip unit can alarm or trip on the frequency of the monitored power by setting the parameters from the **Under Frequency** selection of the **Protective Relays Menu**. To alarm, or to trip and alarm, on under frequency:

1. From the **Protective Relays Menu**, select **Under Frequency**. The Alarm checkbox is highlighted, but alarming has not yet been set.



If you want to enable...	Then...
alarming only	follow steps 2–4 and press Escape [ESC]. Then press Enter [↵] at the verification screen.
alarming and tripping	follow steps 2–4, press Enter [↵] to highlight the Trip checkbox, then repeat the process you used in steps 2–4 to set pickup and delay values. After setting both the alarm and trip values, press Escape [ESC]. Then press Enter [↵] at the verification screen.

2. To enable alarming, press the Up [↑] Arrow key, then press Enter [↵]. If you have enabled alarming, a checkmark appears and the pickup settings are highlighted.

3. Select a pickup value by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. The possible pickup values are 1, 2, 3, 4, 5, 7, 9, 12 Hz below the nominal frequency. Press Enter [↵].

4. Then select a delay time by pressing the Up [↑] or Down [↓] Arrow keys until the value is at the desired level. Possible time delay settings are 1, 2, 3, 4, 5, 7, 10 and 15 seconds. Press Enter [↵].

8 Metering

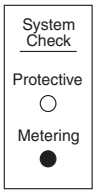
8.1 Overview

The SB Energy-Comm trip unit measures and communicates real-time and accumulated metering data as well as harmonics and waveform data. Current level values are derived from current transformers (CTs) mounted in the circuit breaker. These values can be viewed on the front panel display or viewed on a personal computer when it is connected properly to the trip unit's communications port. The list below summarizes the metering features available for the trip unit.

- Phase Currents
- Average Phase Current
- Neutral Current
- Ground Current
- Crest Factor (each phase)
- Current Demand
- Line-to-Line Voltages
- Average Line-to-Line Voltage
- Line-to-Neutral Voltages
- Average Line-to-Neutral Voltage
- Frequency (phase A)
- Power Factor (each phase)
- Real Power (kilowatts)
- Real Energy (kilowatt hours, forward and reverse)
- Power Demand (kW Demand)
- Apparent Power (kVA)
- Reactive Power (kVAR)
- Reactive Energy (kVARhr, forward and reverse)

All metered parameters are RMS values up to at least the 19th harmonic of a 60 Hz system. Trip unit accuracy for current is measured to ±2% over the range of 10 to 200% of the rated value.

The flashing green LED on the front panel of the trip unit indicates that the metering functions are operational.



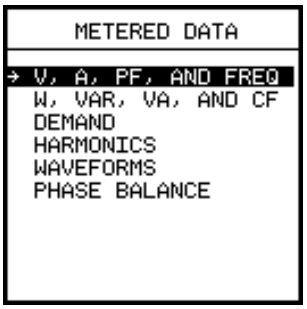
To access the metering functions and data, from the **Main Menu** select **Metering** and press Enter ↵.

The following screen appears:

From the Metering menu, you may examine the metered data in real time, configure how the demand values are calculated, or zero out and reset the metered data.

8.2 Metered Data

The values reported for the metered data are displayed in real time and can be viewed from the **Metering Menu** by choosing the **Metered Data** option. From the **Metering Menu**, select **Metered Data** and press Enter ↵. The following screen appears:



To view the real-time data from the display:

From the **Metering Menu**, select **Metered Data** and select the first choice, **V,A,PF, and Freq**.

The following screen appears:

```
   AMPS          VOLTS
Aø    2011   AB    241
Bø    2011   BC    241
Cø    2011   CA    241
AVG   2011   AVG   241
GND      0   Aø    139
Nø    2011   Bø    139
              Cø    139
     PF       AVG   139
Aø 0.00 LG
Bø 1.00 LG      FREQ
Cø 0.80 LG      60.0
```

On this screen, the current for each phase is shown in Amps. The voltage between any two lines and from each line to ground is shown in Volts. Also shown are the per phase power factors and whether each is leading (LD) or lagging (LG). The frequency is a calculated value in Hertz and may differ slightly from the system frequency. In the example above, the frequency was calculated to 60.0 Hz.

The SB Energy-Comm trip unit calculates the averages of the metered parameters every second and calculates the Watt, VAR, and VA values. The frequency calculation task is performed once per second.

The conventions for power flow and power polarity are shown in **Figure 8.1** and **Figure 8.2,** respectively.

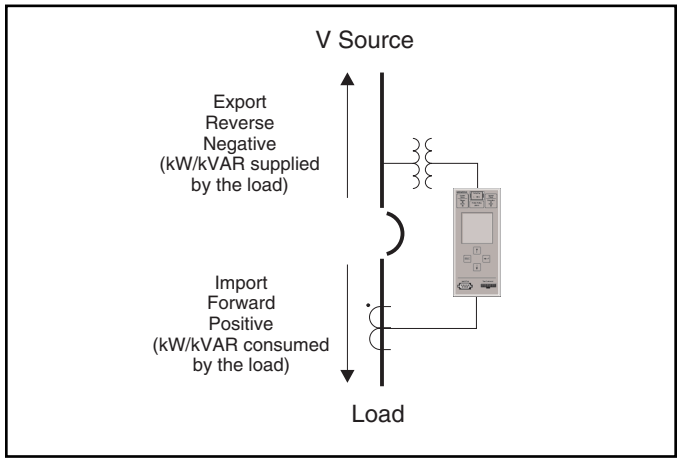


Figure 8.1 Power Flow Conventions

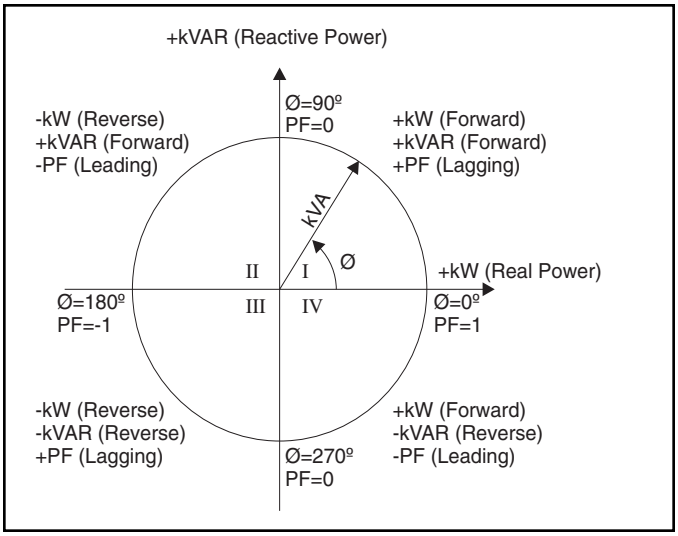


Figure 8.2 Power Polarity Conventions

To view the calculated values, select **Metering Data** from the **Metering Menu** and then select the second choice, **W, VAR, VA, and CF**.

The following display appears:

```
FWD KW        711
FWD KVAR      420
    KVA       840

FWD KWH       144
REV  WH         0
FWD  VARH   85483
REV  VARH       0

Aø  CF       1.48
Bø  CF       1.48
Cø  CF       1.48
```

The forward real power (kW), reactive power (kVAR), and apparent power (kVA) are shown first, followed by the real energy (kWhr) values. Finally the crest factor is shown for each phase (A, B, and C).

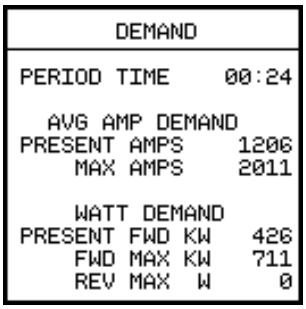
8.3 Demand Configuration

8.3.1 Viewing Demand Data

Two types of demand calculations are performed: amp demand (demand current) and watt demand (demand power).

To view the demand data, from the **Metering Menu**, select **Metering Data,** and then select **Demand**.

The following display appears:

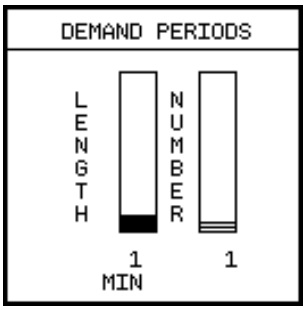


8.3.2 Setting Demand Parameters

The length of the demand period and the number of periods are programmable, but they are the same for both amp demand and kilowatt demand.

To set the demand parameters, from the **Main Menu**, select the **Metering Menu**. From the **Metering Menu**, select **Demand Config**.

The following display appears:



The length of time of the demand calculation displayed in **Demand Periods** may be set to 1, 2, 5, 10, 12, 15, 20, 30, 60, or 90 minutes. The left column allows that to be adjusted by clicking the Up ⇧ or Down ⇩ Arrow keys while the Length function is selected (darker). The number of periods per sliding window demand calculation may be between 1 and 15 inclusive.

Demand is calculated by summing the three-phase average current or the total watts over the interval, after which a new value is calculated. At the end of the interval the sum is divided by the number of samples. The calculations for demand values are performed once per second.

If the number of demand periods is set to 1, then the maximum demand is simply the largest demand value that has been calculated since demand was last cleared. If the number of demand periods is greater than 1, then a sliding window average calculation is performed. The maximum demand is the largest average demand over the specified number of demand periods.

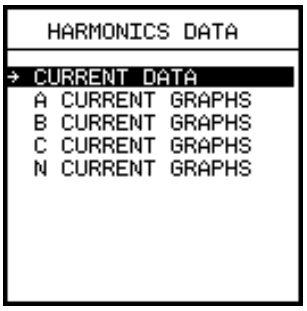
Each time a new maximum demand value is calculated, the oldest calculation is discarded and the new one is used to get a new average. For example, if the length is set to 15 minutes and the number of intervals is set to 15, at 15 intervals the maximum current and power demand is calculated based on the first 15 measurements. After 16 intervals, the demand is calculated as the largest average demand during the second through sixteenth intervals, with the first interval discarded.

8.4 Harmonics

The SB Energy-Comm trip unit is equipped with digital harmonics sampling capabilities. This function can be independently triggered by a user-defined setpoint condition or by a command issued from communications. The data can be viewed on the display of the trip unit or it can be sent to a personal computer and read remotely.

To view the harmonics data, from the **Main Menu**, select **Metering.** From the **Metering Menu**, select **Metered Data**. From the **Metered Data Menu**, select **Harmonics**.

The following display appears:

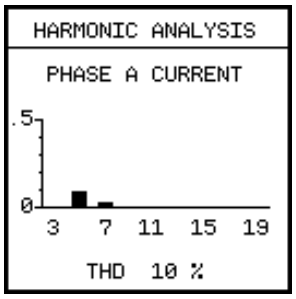


Harmonics are calculated on a per-phase basis using a Fast Fourier Transform to convert from the sampled time domain to the frequency domain. The harmonic calculation routine is activated by the metering task when one cycle worth of samples has been collected for a given phase.

As the following example shows, the **Current Data** selection displays three phases and the neutral line. The percentage for each odd harmonic is shown (from the 3rd to the 19th) along with the total harmonic distortion (THD).

HARMONIC DATA				
	AØ%	BØ%	CØ%	NØ%
3	0	0	0	0
5	9	9	9	9
7	3	3	3	3
9	0	0	0	0
11	0	0	0	0
13	0	0	0	0
15	0	0	0	0
17	0	0	0	0
19	0	0	0	0
THD	10	10	10	10

An example of the **Current Graph** selection is shown below. In this screen, the harmonic data shows that the current in phase A has some distortion due to the presence of the 5th and 7th harmonic.



8.5 Metered Data Waveforms

The SB Energy-Comm trip unit is equipped with digital waveform sampling capabilities, which allows a graphical view in the time domain of the same power quality data presented in the **Harmonics** menu. This function displays the waveforms of the selected phase. The data can be viewed on the display of the trip unit (as shown in **Figure 8.3**) or it can be sent to a personal computer and read remotely.

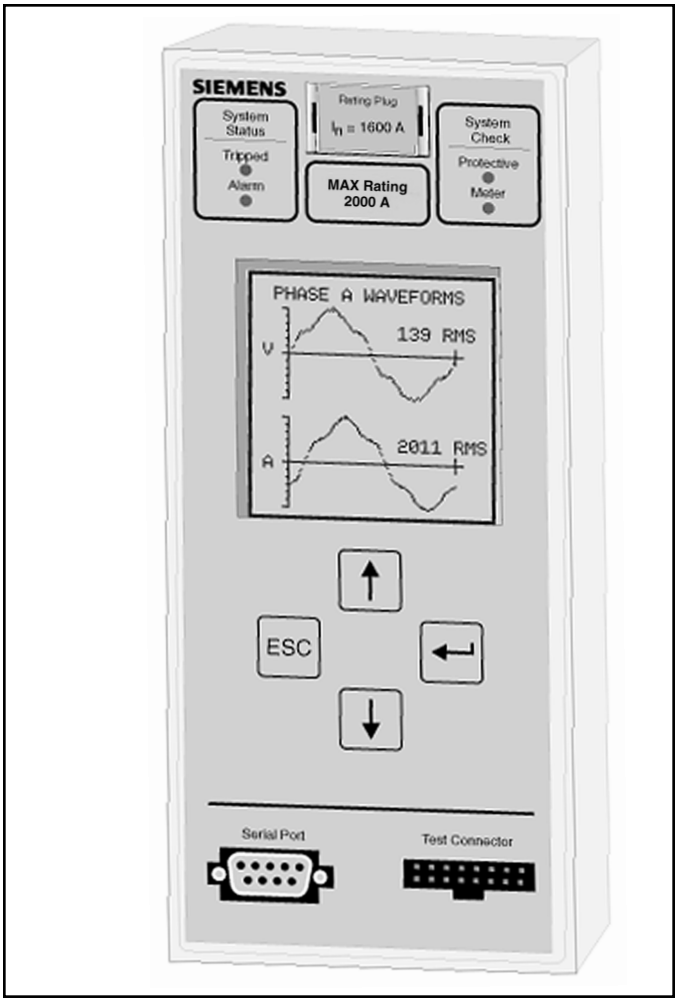


Figure 8.3 Waveform Displayed on Front Panel

8.5.1 Monitoring Power Quality

Power quality has become a foremost concern for power utilities and their customers because of an increasing presence of induced harmonic voltages and currents in industrial, commercial, and residential electrical systems. Harmonics are typically generated within a power distribution system by nonlinear loads (variable frequency drives, UPS systems, HVAC and lighting systems, computers, etc.).

Poor power quality can have serious and potentially damaging consequences, including equipment malfunctions or failures, reduced efficiency and mechanical vibration in motors, or incorrect tripping and/or failure of circuit breakers. Harmonic currents from individual phases can also add in the neutral line, sometimes producing dangerously high neutral currents.

As harmonic sources become more prevalent, it is important to have the analytical tools necessary to identify potential problem sources and to help determine the preventive or corrective measures necessary to improve power quality in electrical distribution systems.

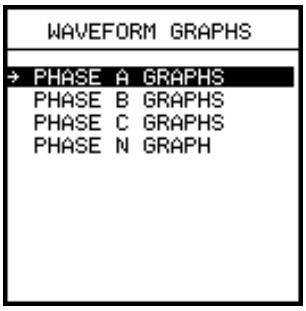
8.5.2 Waveform Graphs

Waveform graphs allow the user to view the line and neutral voltages and currents on a per-phase basis.

Sampled waveform data is stored in memory and can be read via the communications port. The sampling rate used by the SB Energy-Comm trip unit produces high-resolution data which allows analysis of frequency components to the 19th harmonic.

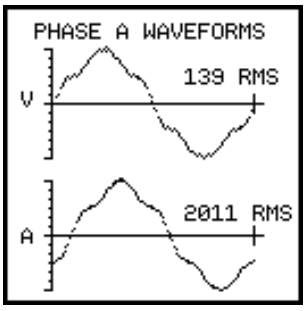
To view the waveforms on the display of the trip unit, select **Metering** from the **Main Menu**. Then select **Metered Data,** and then **Waveforms**.

The following screen is displayed:



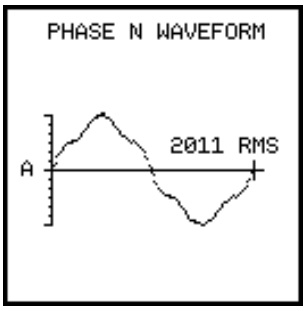
The list lets you select the data to be viewed from a particular phase or neutral.

An example of the waveform on phase A as it appears on the front display is shown below:



The display includes one full cycle of data of the rms voltage (V) and the rms current (A). As this example shows, there are harmonics that distort the waveform. Also note that the phase relationship between voltage and current is shown.

An example of the waveform for the neutral line is shown with only the current data in Amps (A).



Viewing the waveforms remotely from a personal computer requires the Siemens WinPM or SB Win software. This software can be used to upload waveform data from the trip unit to a personal computer and display the waveforms on the computer screen. WinPM software automatically performs a Fast Fourier Transformation on each waveform. It then provides an indication of total harmonic distortion and a breakdown of individual frequency components in both graphical and tabular form. This wide variety of data formats can help to quickly pinpoint the source and severity of harmonics, evaluate which sources must be minimized, and develop corrective strategies.

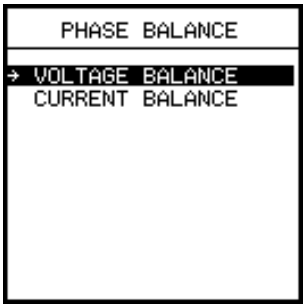
8.5.3 Triggering Manually via Communications

With Siemens supervisory software, you can obtain graphical waveforms for each of the eight possible inputs. A command from the computer initiates data transfer from the trip unit. The computer then uploads the data and displays the waveforms on the screen.

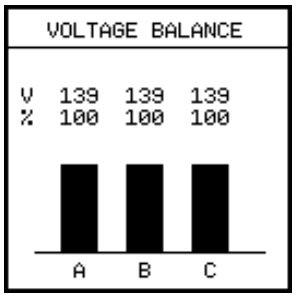
8.6 Phase Balance

To view the phase balance data, from the **Metering Menu**, select **Metered Data,** and then select **Phase Balance.**

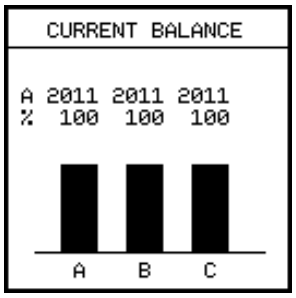
The following display appears:



The voltage balance data shows the voltage in Volts for each phase and the percentage balance (ratio of the indicated phase voltage to the average of all three phases).



The current balance data shows the current in amperes for each phase, and the percentage balance (ratio of the indicated phase current to the average of all three phases).



8.7 Reset Meter Data

To reset the meter data, from the **Main Menu**, select **Metering** and then select **Reset Meter Data**.

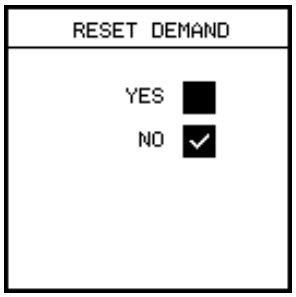
The following display appears:

Choose **Energy Registers** to reset the real-time (energy) values.

Use the Up Arrow ↑ to move from **No** to **Yes** and the Down Arrow ↓ to move from **Yes** to **No**. The check shows whether the data will be reset or not. When finished, press Escape ESC.

Similarly, to reset the accumulated (demand) values, choose **Demand** from the **Reset Meter Data** menu.

A **Reset Demand** screen appears:



Use the Up Arrow ↑ to move from **No** to **Yes** and the Down Arrow ↓ to move from **Yes** to **No**. The check shows whether the data will be reset or not. When finished, press Escape ESC.

9 Logs

Data logging can be extremely useful to study growth patterns, to schedule loads and cost allocation, to isolate problem sources, or to analyze a variety of power system operating conditions.

The SB Energy-Comm trip unit supports three types of data logs:

- Event Log
- Trip Log
- Minimum/Maximum Log

All three logs make their data available to communications so the information can be viewed remotely. For a quick view of the data, users can view the logs from the front panel.

To see the latest logged data or to reset a specific log, from the front panel **Main Menu**, select **Logs**.

The **Log Menu** appears:

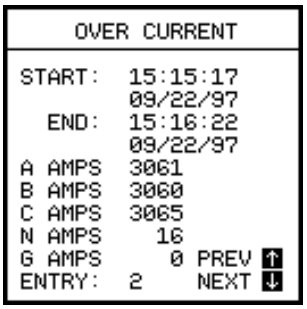
To see any data in the Event log, for example, select **View Event Log**, shown highlighted above, and press Enter ↵.

9.1 Event Log

The Event Log is a chronological record of alarms. Each entry in the log provides a description of the event and its start and end date and time (to the nearest second). The Event Log records automatically the 10 most recent alarm events.

To view the events, from the **Log Menu** select **View Event Log**. The log appears, showing the most recent event first; to see the other events, press the Up ↑ or Down ↓ Arrow key for previous and next events in the log.

The following is an example of an event log screen:



The event is date and time-stamped. The date provides the month, day, and year. Event times are recorded in hours, minutes, and seconds.

To reset the log, select the **Reset Event Log** command from the **Log Menu**, and then press the Up ↑ or Down ↓ Arrow key until the Yes box is checked. Press Escape ESC, then press Enter ↵ to exit this menu and reset the log.

If no events have occurred, the display shows the following:

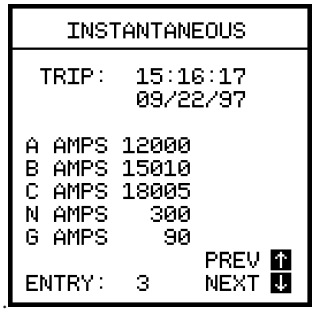
9.2 Trip Log

The Trip Log function displays device information for the last five trip events. This includes actions triggered by the trip unit's protective relay functions, or manually via communications. Each trip event is stored as its own separate log entry.

The SB Energy-Comm trip unit also keeps a count of the lifetime protective function trips in the **Operations Menu**.

To view the trips, from the **Log Menu**, select **View Trip Log**.

The most recent trip displays as follows:



Press the Up ↑ and Down ↓ Arrow keys as shown on the display to view previous (up) or the next (down) trips in the log.

To reset the log, select **Reset Trip Log** from the **Log Menu** and press the keypad arrow buttons until the Yes box is checked. Press Escape Esc, then press Enter ↵ to exit this menu and reset the log.

If no trips have occurred, the display shows the following:

9.3 Min/Max Log

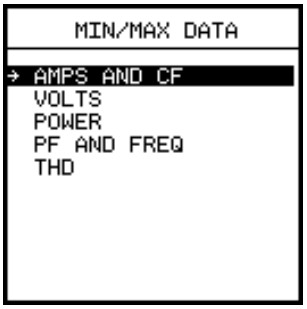
The SB Energy-Comm trip unit provides a log of the recorded minimum and maximum (min/max) data. The Min/Max Log is a log that automatically records the extreme values for all parameters measured by the trip unit. This includes all voltage, current, power, frequency, power factor, harmonic distortion, and auxiliary input parameters. Minimum and maximum values are also provided for all demand measurements.

The trip unit Min/Max Log can be used to determine such values as the highest loading on a plant or feeder, peak demand, voltage operating ranges, worst case power factor, highest VAR loading for capacitor sizing, etc.

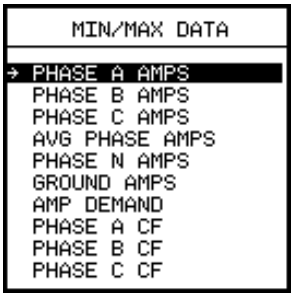
Minimum and maximum values for each parameter are logged independently with a date and time stamp. Each value in the Min/Max Log can be accessed from the front panel as well as remotely through communications.

To view the min/max logs, select **View Min/Max Log** from the **Log Menu**.

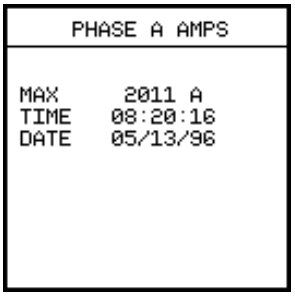
A menu of the types of available min/max data appears:



The first set of min/max data is the current and crest factor data for each phase, as well as neutral and ground current, and current demand.



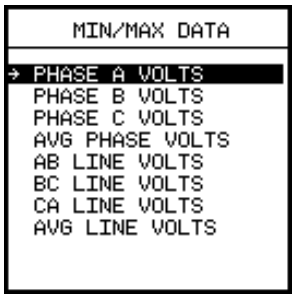
Selecting an individual piece of information, such as the **Phase A Amps**, shows the following:



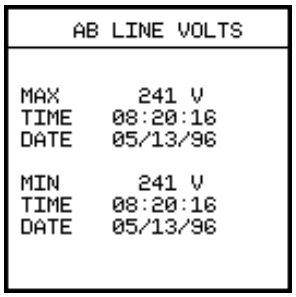
The data includes only the maximum values for current. Each piece of data also includes the time and date when the value was

recorded. An example of data with both minimum and maximum values is the voltage data.

To view the max/min voltage data, select **Volts** from the **Min/ Max Data Menu**. The following screen appears:



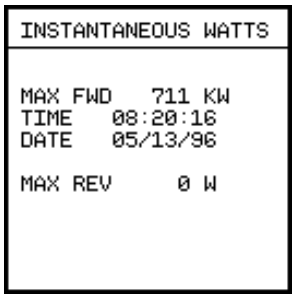
Then select **AB Line Volts**, for example, to see the minimum and maximum values of the line-to-line (A-B) voltage:



The various data values for power included in the min/max logs include instantaneous and demand values. From the **Min/Max Data Menu**, select **Power**.

The following menu appears:

The maximum values for power are given for both forward and reverse power:



To reset this log, select **Reset Min/Max Log** from the **Log Menu**. Press the keypad arrow buttons until the Yes box is checked. Press Escape [ESC], then press Enter [↵] to exit this menu and reset the log.

10 Communications

10.1 Overview

This chapter provides additional information about remote communications connections, programming, and general operation.

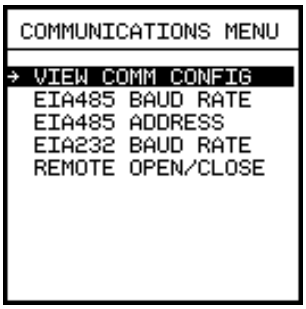
The SB Energy-Comm trip unit is equipped with communications ports that allow it to be integrated in energy monitoring networks. The serial (EIA-232) port on the front of the device allows a PC or laptop to download device settings and request information in much the same way as an ACCESS supervisory device. Five different data transfer rates are available, independent of the transfer rate setting for the EIA-485 port.

The SB Energy-Comm trip unit is fully compatible with Siemens supervisory software that can display all measured parameters and status information, waveform data, and data logs provided by the trip unit. The supervisory software can also be used to program all the setup parameters remotely.

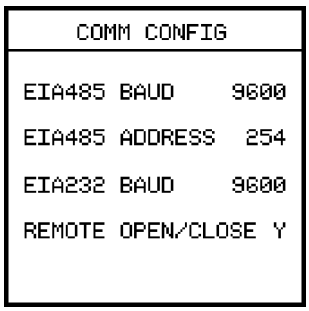
The open communications protocol of the SB Energy-Comm trip unit allows access to all data and setup parameters by third-party systems. Refer to the ***SB Energy-Comm Trip Unit SEAbus Protocol Reference Manual*** (Bulletin IPIM-2209A) for a complete discussion of the protocol and device-specific packets for the SB Energy-Comm trip unit. Refer to the appendix, **SEAbus Plus Packet,** for a general discussion of SEAbus packets. Contact your local Siemens sales office for information on network gateways to other network protocols.

10.2 Viewing Communications Settings

To view and change communications settings, select **Communications** from the **Main Menu**. The following screen appears:



The first option in the **Communications Menu** displays the present configuration of the communications settings. Select **View Comm Config**, and the following screen appears:

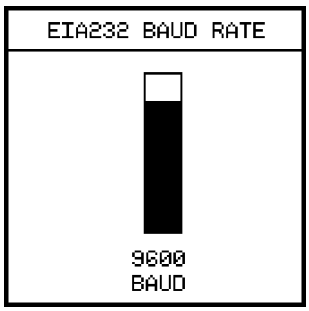


10.3 PC Communication

EIA-232 is commonly used for short distance, point-to-point communications. The distance between a host computer (or PLC) and a single remote device must be less than 50 feet in length for hard-wired connections. Connection using modems via dedicated or dial-up telephone lines is also possible.

Siemens SBWin Software is used to optionally configure trip unit settings via a laptop PC using the serial port on the front of the trip unit.

To configure the EIA-232 serial port baud rate, select **RS232 Baud Rate** from the **Communications Menu**. The following screen appears:



Press the Up ↑ or Down ↓ Arrow keys to adjust the baud rate to match that of your computer, PLC or modem. Then press Escape ESC to set the rate, followed by Enter ↵.

The EIA-232 port RTS line is operational and must be used if required by any hardware device connected to the SB Energy-Comm trip unit.

10.4 ACCESS Communication

ACCESS is a master/slave communications scheme developed by Siemens Energy & Automation. Based on a serial, two-wire EIA-485 network, ACCESS allows a single master device to communicate with many Siemens field (slave) devices. In addition to real-time data, almost all functions and information available locally at the device interface (pushbuttons, diagnostic LEDs, etc.) are accessible by the master from its remote location. Up to 32 slave devices can be connected in a single EIA-485 network, with a maximum of four parallel 485 loops connected to a single master unit.

Communication methods between the remote EIA-485 site and the master computer station can include a direct EIA-485 connection, limited to 4000 feet (approximately 1200 meters), telephone lines with modems, fiber-optic and/or radio links. An EIA-232 to EIA-485 converter, such as the Siemens Isolated Multi-Drop Converter, is required between the EIA-232 port of the computer or modem and the EIA-485 network. The RS-485 port is connected via the breaker's secondary terminals.

The master, or ACCESS host, is typically a PC running supervisory software. Siemens field devices supporting ACCESS communications include the 4300, 4700, and 4720 power meters, various protective relays, the SAMMS motor controller, and Sensitrip, SB, and Static Trip III trip units. **Figure 10.1** illustrates a typical ACCESS system.

All information transferred between the master and slave devices is sent within a SEAbus protocol message packet. SEAbus is a byte-count oriented open protocol originally developed for ACCESS communications between the devices. Each ACCESS device supports the SEAbus protocol.

The SB Energy-Comm trip unit is one of several field devices that can communicate with a monitoring supervisory device in an ACCESS supervisory and control system. In order to communicate in an ACCESS system, the device must be connected using the EIA-485 network connection. This connection is through the rear connector of the SB Energy-Comm trip unit. EIA-485 communication can be used to concurrently connect up to thirty-two remote devices on a single communications loop. Each device is given an address, a unique unit ID (identification number). In this way, each remote device may be monitored and controlled from one location by a single computer or PLC. For more information on setting up and installing an ACCESS system network, see ***Installing the ACCESS System***.

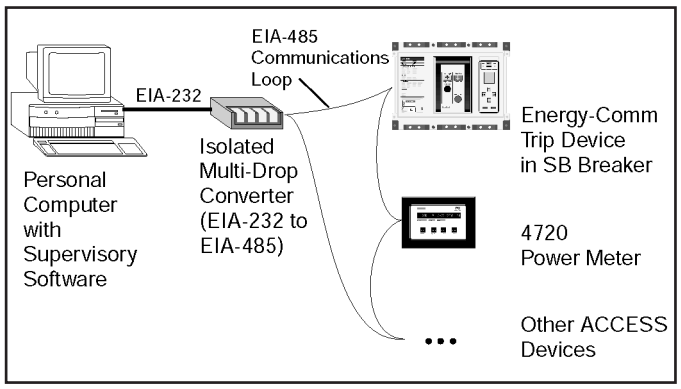


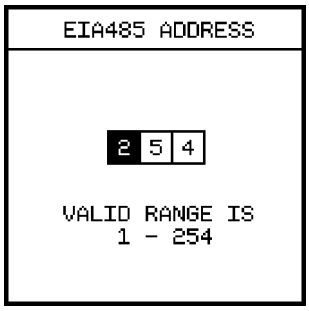
Figure 10.1 Typical ACCESS Communications System

10.5 Setting the Address and Baud Rate

Before communication with the host computer/PLC is possible, users must ensure that the SB Energy-Comm trip unit and all other connected devices are configured for the required communications standard (EIA-232 or EIA-485).

The next step is to program the communication parameters of the SB Energy-Comm trip unit and all other connected devices. The Address and Baud Rate parameters of the SB Energy-Comm trip unit can be programmed via the front panel. The address is the number that will uniquely represent the trip unit as a unique slave device in a master/slave system. It must be set to a unique value between 1 and 254.

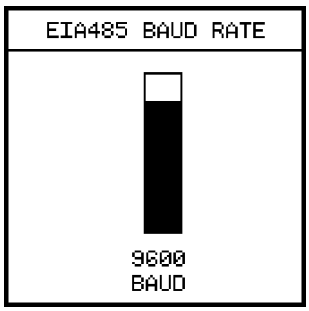
To configure the device address, select **Slave Address** form the **Communications Menu**. The following screen appears:



Use the Up ↑ and Down ↓ Arrow keys to select the value for each digit. Press Enter ↵ to move between digits. Press Escape ESC to set the new address and then exit.

The baud rate of each device on the network must be set to correspond with the baud rate selected from the computer. Options include 1200, 2400, 4800, 9600 or 19,200 baud.

To change the baud rate, select **EIA 485 Baud Rate** from the Communications menu.



Use the Up ↑ and Down ↓ Arrow keys to select the baud rate. Press Escape ESC then Enter ↵ to exit and set the new baud rate setting.

When using a modem interface between the host computer and any remote device(s), ensure that the host computer is not used to set the BAUD RATE parameter of any selected device outside the working range of the modem. Doing so will cause that device to cease communicating.

10.6 Supervisory Software

10.6.1 SBWin™ and WinPM™ Software

WinPM electrical distribution communication software operates in the Microsoft® Windows™ 95 operating environment on a personal computer (PC). Through communications drivers, WinPM software collects and displays real-time data from Siemens ACCESS field devices. WinPM software displays information and adds the capabilities of programming, monitoring alarms, and logging system events. WinPM software also monitors and displays historical data, minimum and maximum data, and waveform data. In addition, WinPM software can deliver its data to other compatible Windows applications, in real-time, through dynamic data exchange (DDE), a method of sharing information that is supported by Windows applications.

Your computer running WinPM software can be connected to intelligent field devices via a Siemens Isolated Multi-Drop Converter or through a modem and a Siemens Isolated Multi-Drop Converter to the ACCESS system's SEAbus communications bus.

SBWin software is available from Siemens to allow viewing real-time data and to view and set all trip unit parameters via a laptop PC connected to the EIA-232 connector on the front of the trip unit.

10.6.2 Third-Party System Compatibility

The SB Energy-Comm trip unit communications use an advanced object- and register-based open protocol which supports an efficient exception reporting methodology. This feature allows the SB Energy-Comm trip unit to be easily adapted to third-party PLC, DCS, EMS, and SCADA systems. Protocol converters are also available from Siemens to connect to many different PLC and supervisory protocols.

All data and configuration registers are accessible via communications. All configuration and control operations have embedded password protection.

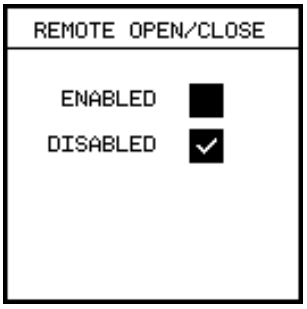
Contact Siemens for complete documentation on the SB Energy-Comm trip unit SEAbus communications protocol or to discuss a specific application.

10.7 Remote Operation

Remote, automatic open and close operation of the breaker is possible via the ACCESS Communication System or a 120VAC hard-wired input. For remote operation via ACCESS communications, the shunt trip and remote open/close relay accessories are required for the remote open function, and the electrical operator accessory is required in addition for both remote open and close operation. For remote operation via a 120VAC hard-wired input, only the shunt trip accessory is necessary for the remote open function, and the electrical operator accessory is additionally required for both remote open and close operations. Refer to the SB breaker instruction manual for information on the breaker accessories.

To allow remote operation of the breaker via ACCESS communications, you must enable the trip unit to open the breaker remotely. If the trip unit has this function disabled, remote operation of the breaker via ACCESS communications will not be possible.

To enable or disable the remote open/close function, select **Remote Open/Close** from the **Communications Menu**. The following screen appears:



Use the Up ↑ and Down ↓ Arrow keys to move the selection mark between Enabled and Disabled. Press Escape ESC then Enter ↵ to exit and set the remote open/close control.

11 Operations Menu Functions

11.1 Overview

The **Operations Menu** contains testing options and breaker information.

Four test options are provided to verify that the SB Energy-Comm trip unit can initiate a trip for overcurrent and ground fault conditions. These tests are performed from the **Breaker Test Menu.**

To assist the operator in servicing the breaker and the trip unit, the SB Energy-Comm trip unit provides several counters. These counters may be used for troubleshooting or reviewing the history of the breaker when it is changed out. The counters include:

- Mechanical counter
- Interruption level
- Fault counter

Trip units with software version 3.00 or later provide an option to turn off the trip LED via the trip Unit's keypad.

To access the maintenance counters and the test menus, select the **Operations** from the **Main Menu**. The following screen appears:

11.2 Breaker Test

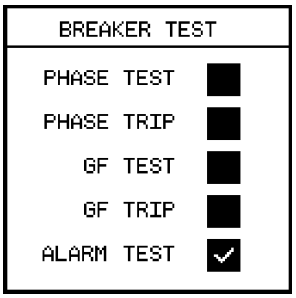
The breaker test consists of five separate tests: overcurrent, overcurrent with trip, ground fault, ground fault with trip, and alarm test. In these tests, the trip unit simulates an overcurrent or ground fault signal from the CTs and checks the circuitry that initiates a trip. The overcurrent with trip and ground fault with trip tests actually trip the breaker, while the other two phase and GF tests only check that the trip unit generates the signal to trip.

When the **Alarm Test** is initiated, the alarm LED will be turned on for four seconds, and if an alarm relay is installed in the breaker it will be activated, for a period of four seconds. The Reset Tripped LED and Alarm Test function are available on units with software version 3.00 or later.

Note: The overcurrent with trip and ground fault with trip tests will cause the circuit breaker to trip, thus interrupting power to protected circuits.

Take precautions to prevent damage to equipment protected by the breaker prior to performing the tests.

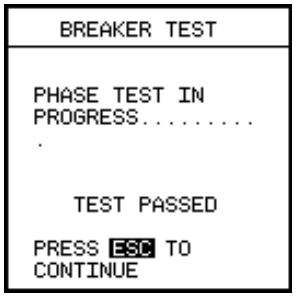
To run a breaker test, select **Operations** from the **Main Menu**. Then select **BreakerTest**. The test selection menu appears:



To select a particular test, press the up ↑ or down ↓ arrow keys until a check appears next to the desired test. Press Escape ESC to confirm the selection. The **BreakerTest Menu** appears:

Press Enter ↵ to start the test, or press Escape ESC to cancel the test. A progress screen appears:

Leader dots appear after the word “Progress” to indicate the test is running. After the test is successfully completed, the message “Test Passed” appears:



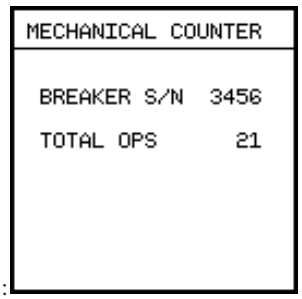
If the message “Test Failed” appears, contact Siemens customer service for assistance

Press Escape [ESC] to return to the **Operations Menu**.

Note: Phase or GF trip tests require a minimum current equal to 20% of the breakers MAX RATING to be flowing through the breaker in order to trip the breaker.

11.3 Mechanical Counter

The mechanical counter lists the total number of breaker operations and the serial number for the breaker. To view this counter, select **Mechanical Counter** from the Operations menu. The following screen appears:



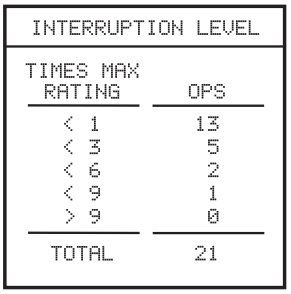
This example screen summarizes the number of mechanical operations of the breaker regardless of the cause.

The total number of operations reported on this screen is identical to the total reported in the **Interruption Level** screen.

From the Fault counter example, described in **Section 11.5, Fault Counter**, the total trips caused by electrical faults is reported as 10. The difference between the total operations and the total operations caused by faults (11 in this example) would be operations that were caused by the operator, directly from the manual interface on the breaker.

11.4 Interruption Level

The Interruption Level counter lists the number of operations of the breaker; that is, the number of times the breaker tripped. It lists the number of operations for each level of current recorded as a multiple of the breaker’s MAX RATING value. To view the Interruption Level counter, select **Interruption Level** from the **Operations Menu**. The following screen appears:



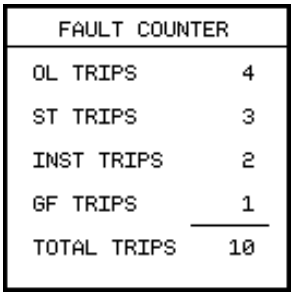
For example, in the screen shown here, the breaker had thirteen trips at less than the nominal current rating of the breaker, so the trips must have been caused manually by an operator or by the Ground Fault trip.

11.5 Fault Counter

The fault counter lists the number of faults recorded by the SB Energy-Comm trip unit. Each of these faults should correspond to a breaker trip. The faults are listed by type of protection.

- OL overload
- ST short time
- INST instantaneous
- GF ground fault

In this example, the trip unit registered four overload trips



12 Security

12.1 Overview

To prevent inadvertent changes to the configuration of the trip unit, the SB Energy-Comm trip unit has password protection. Note that the device password does not prohibit configuration changes from a PC running SBWin or WinPM via the communications ports.

To change the password or to enable this security feature, from the **Main Menu**, select **Security**.

The **Security Menu** shows the password related options. If the password has never been changed, the screen looks like this:

Once the password is set or changed, the screen looks like this:

12.2 Enable Security

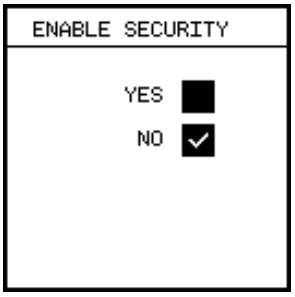
With the security enabled, the user cannot change any of the settings without first entering the password. If the operator attempts to change a setting such as the protective relay or alarms, and then presses Escape [ESC] to leave the particular parameter setting screen, the following message displays:

The operator must then press Escape [ESC] to continue.

To enable security, follow these steps:

1. From the **Main Menu**, select **Security**. The **Security Menu** is displayed:

2. Select **Enable Security** by pressing Enter [↵].



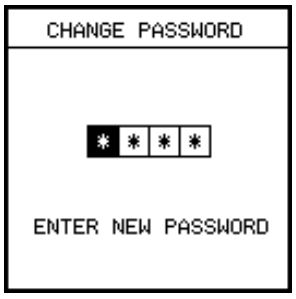
3. Use the Up [↑] or Down [↓] Arrow key to select Yes to enable or No to disable the security feature. Press Escape [ESC] to confirm.

12.3 Change Password

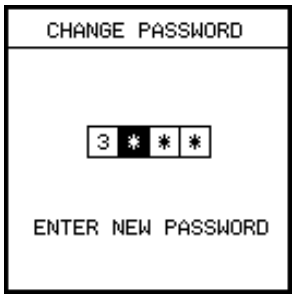
To enable security on the trip unit, the user must first change the password.

1. From the **Main Menu**, select **Security**. The **Security Menu** appears:

   Select **Change Password**. The **Change Password** screen lets you enter a new password one digit at a time.



2. With the leftmost digit highlighted, press the Up ↑ or Down ↓ Arrow key to increment or decrement the number. When you press the Up Arrow ↑ key once, the number increments to 0. When you have entered the desired digit, press Enter ↵ to highlight the next digit.



3. Press the Up ↑ or Down ↓ Arrow until the desired digit is displayed. Then press Enter ↵ to highlight the next digit. Follow this procedure for all the digits in the password. Press Escape ESC, followed by Enter ↵ when finished.

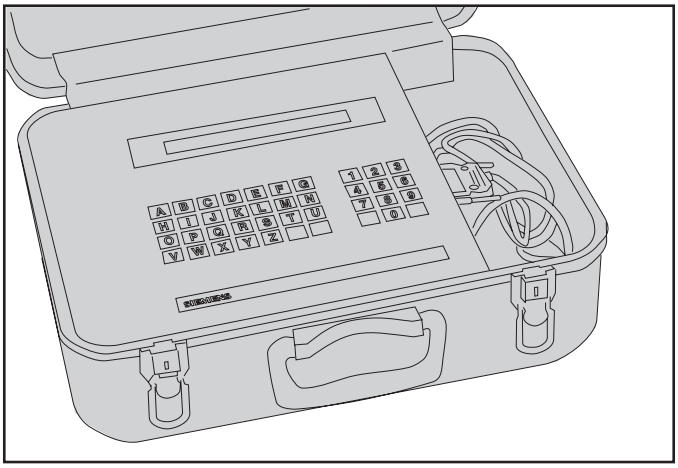
4. The trip unit will prompt you to re-enter your new password. Repeat steps 2 and 3.

Contact Siemens customer service if you have forgotten the password.

13 Testing

13.1 Test Set

The TS-31 test set is used to test the operation of the fault protection functions of the SB Energy-Comm trip unit. It has been designed to be convenient and easy to use. The user is prompted on a front panel display, in a step-by-step format, about the required input information and test instruction. The test results are displayed on the front panel.



Note: Use individual instructions supplied with the TS-31 Test Set for SB Encased Circuit Breaker testing.

Note: The long time, short time, instantaneous, and ground fault tests will cause the circuit breaker to trip, thus interrupting power to protected circuits. Take precautions to prevent damage to equipment protected by the breker prior to performing the tests.

13.2 Operating Instructions

1. Remove electrical loads from the circuit breaker.

2. Plug the TS-31 test set into a grounded 120V AC receptacle and turn it on. The following startup message appears:

```
Siemens Energy & Automation, Inc. TS-31 Test Set.
Press ENTER to continue
```

3. Select the appropriate ribbon cable assembly per the instructions supplied with the TS-31 test set, and connect it between the TS-31 and the circuit breaker, making sure of alignment and polarity. Press ENTER, and the TS-31 will prompt:

```
Enter Catalog Number
```

4. Type in the catalog number and then press ENTER. The catalog number can be found on the nameplate of the circuit breaker, or can be viewed via the **System Configuration** menu (see **4.1, Viewing System Configuration** on page 21). The TS-31 will respond with:

```
Searching Catalog. . .Searching Family Series. . .
```

If an invalid catalog number has been entered, the TS-31 will respond with:

```
Catalog Number xxxxxx Not Found.
Press Enter to Continue
```

and you will be asked to enter another catalog number.

5. If a valid catalog number has been entered, the TS-31 will prompt for the Breaker switch settings. The TS-31 will respond with:

```
Enter continuous current setting in %
```

Note: Energy Com Trip Units display current in Amps, therefore Amps must be converted to % Current Setting.

```
Enter the Rating Plug Value in Amps:

Enter long time delay in seconds.

Enter Short Circuit Protection Setting
1 = Short     2 = Int.      3 = Both:
```

Note: The Short Circuit Protection Setting can be viewed via the **Short Circuit Protection** Menu, which is located in the System Configuration Menu (see **4.2, Setting System Configuration Parameters** on page 21).

```
Enter short time Pickup.

Select Short Time Delay: 1-Fixed 2-I2t

Enter short time delay in seconds

Enter instantaneous pickup setting.
```

For breakers with ground fault you will be prompted:

```
Enter ground fault pickup setting in %
```

Note: Energy Com Trip Units display current in Amps, therefore % Current Setting must be converted to Amps.

```
Enter ground fault delay in seconds
```

In each case, enter your breaker's switch settings. For example if your breaker is set for a continuous current of 70%, type 70 and then press enter. Entry of erroneous data in the above steps will result in false tests and results.

6. Select the test you wish to perform after entering the breaker switch setting. The TS-31 will prompt:

```
Enter test to perform; see instructions.
```

Type in one of the following letters, depending upon the test you wish to perform:

"L" - Long time or overload test,

"S" - Short time test,

"I" - Instantaneous test.

"G" - Ground fault test,

"C" - Current transformer continuity test,

The TS-31 will report the type of test you selected and give you a chance to abort the test. For example, if "I" was pressed above. The TS-31 will display:

```
Instantaneous Test
Press ENTER to continue or A to abort
```

If you pressed the letter “A” to abort, you will be asked again:

```
Enter Test to perform
```

If you press ENTER, you will be prompted for the phase to test: The TS-31 will display:

```
Enter phase to test.
```

7. Enter one of the following letters:

   “A” - Phase A or left pole.

   “B” - Phase B or center pole.

   “C” - Phase C or right pole.

   Press Enter again to start the test. Press any other key to STOP the test.

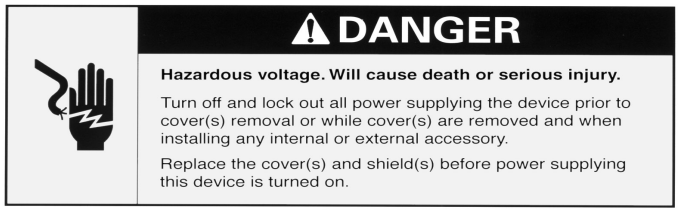
   Once a test has been started, the TS-31 will respond with:

```
Testing. Be careful at this time.
Any key press will abort the test
```

   The test may take anywhere from a fraction of a second to minutes to complete, depending on which procedure was run. If the test passes, the display will show the following, depending on whether the breaker tripped or not.

```
Passed Test xxx.xx seconds
Press ENTER to continue.
```

8. If the circuit breaker tripped during the test, RESET the circuit breaker before continuing.



   The TS-31 will prompt for the next instructions. The display will show:

```
Change: 1 - Test 2 - Catalog 3 - Settings
```

9. Enter one of the following numbers: “1” - Select a new test; “2” - Enter a new catalog number; “3” - Enter new switch settings.

   If you enter “1” you will be sent to step 6. Choosing a “2” will send the program back to step 3. Entering “3” sends you back to step 5, which will be slightly different the second time through.

   On the second line after the prompt for the setting, a number or text in angle brackets will appear. This will indicate the last setting you entered.

10. If you DON’T wish to change a setting, just press ENTER. If you DO wish to change a setting, type in the new setting and press ENTER.

11. In step 6, if you pressed “C” when asked

```
Enter test to perform; see instructions
```

    you will first be prompted by,

```
Current Transformer Test
Press ENTER to continue or A to abort,
```

    and then by the phase to test. One of the following messages will then appear depending on the test results:

```
CT Resistance Test. Phase X Passed
Press ENTER to exit test and continue

CT Resistance Test. Phase X Failed
Press ENTER to exit test and continue

CT Resistance Test. Phase X Open
Press ENTER to exit test and continue

CT Resistance Test. Phase X Short
Press ENTER to exit test and continue
```

    The “Phase X Failed” message indicates that the CT resistance is neither open nor shorted, but is not within design tolerance.

13.3 Error Messages

There are additional ERROR messages which may appear on the display during this operation which were not covered previously:

```
Test Not Running! Check test cable connection
Press ENTER to continue.
```

This message indicates that the test set has sensed that current is not flowing properly in the breaker under test and that there is either an open or short circuit between the TS-31 and the breaker trip unit.

```
Function Not Available
Press ENTER to continue
```

You will get this error message if you enter a choice that is not available, such as entering “G” in step 6 for ground fault test on a catalog number that does not have the ground fault function.

```
Inconclusive Test, check settings
Press ENTER to continue or A to abort
```

This warning will appear if you attempt to run a short time test with the instantaneous pickup set equal to or below the short time pickup. It would also appear if you tried to run a long time test with short time pickup set too low. This is only a warning; the test can still be run. However, passing or failing the test may not be conclusive.

```
Invalid Input
Press Enter to continue
```

This message will appear if you enter a setting value that does not exist. For example, if the trip unit has continuous current settings of 50, 60, 65, 70, 75, 80, 85, 90, 95, and 100 percent, and you enter any other value than those listed, the above message will appear.

```
Test exceeds capability of TS-31
Press ENTER to continue
```

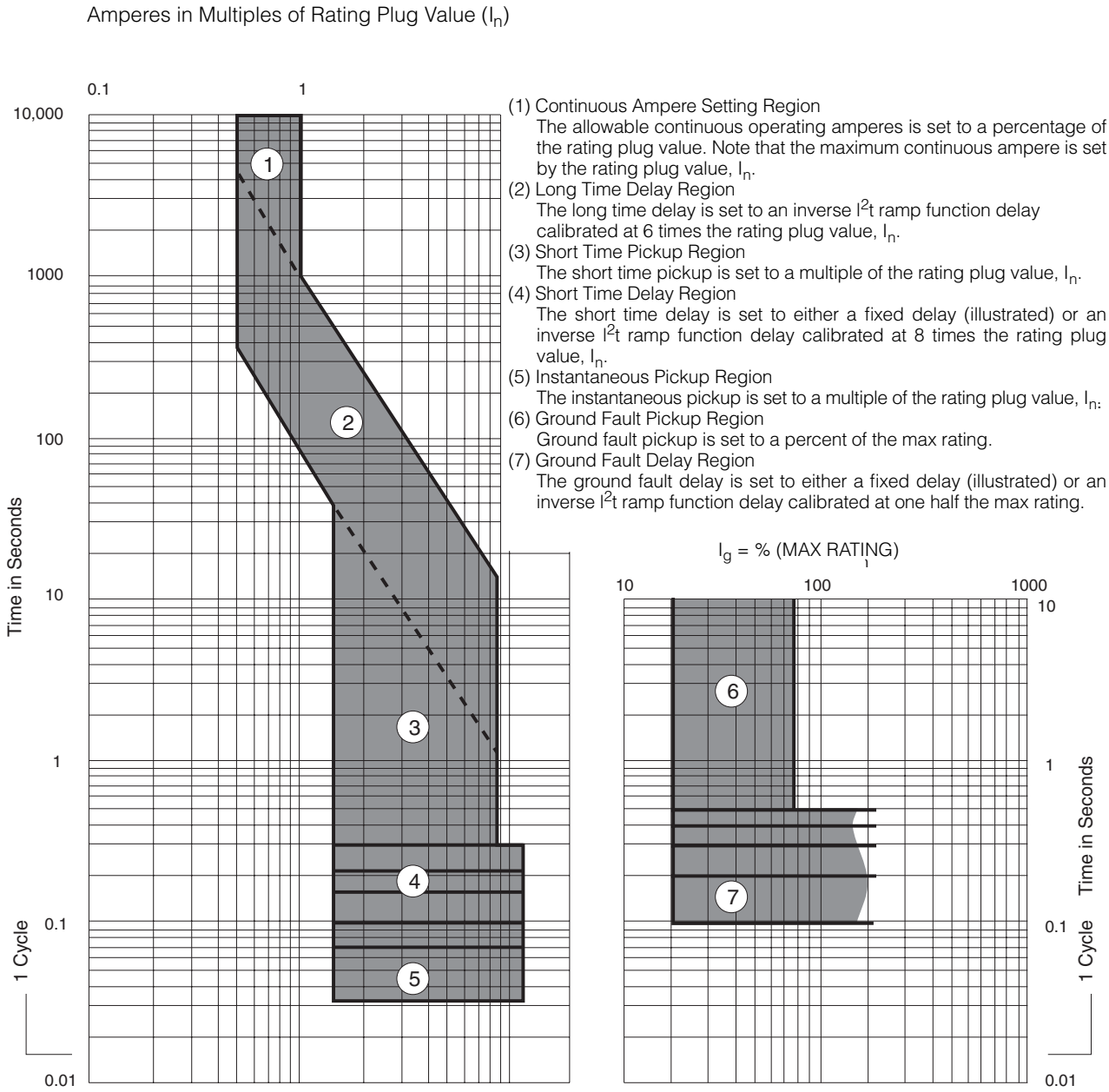
If this message occurs, it means that a test requires more current to run than the TS-31 can produce.

```
Unit too hot! please wait
```

Running many successive, high-current, long time tests may over-heat the test set. It will protect itself from thermal damage by asking the user to wait and allowing the TS-31 to cool down.

	Function	Alarm	Trip	Event Log	Trip Log
Alarm Setpoints (10)	Overcurrent (Alarm)	✓		✓	
	Ground Overcurrent	✓		✓	
	Overcurrent Demand	✓		✓	
	Total Harmonics (THD)	✓		✓	
	Over kW	✓		✓	
	Over kW Demand	✓		✓	
	Over kVAR	✓		✓	
	Over kVA	✓		✓	
	Under PF Lag	✓		✓	
	Over PF Lead	✓		✓	
Overcurrent Protection (4)	Long Time		✓		✓
	Short Time		✓		✓
	Instantaneous		✓		✓
	Ground Fault (models SBxxTP01G, SBxxTP02G)		✓		✓
Extended Protective Relaying (8)	Neutral Overcurrent	✓	✓	✓	✓
	Current Unbalance	✓	✓	✓	✓
	Voltage Unbalance	✓	✓	✓	✓
	Reverse Power	✓	✓	✓	✓
	Under Voltage	✓	✓	✓	✓
	Over Voltage	✓	✓	✓	✓
	Over Frequency	✓	✓	✓	✓
	Under Frequency	✓	✓	✓	✓

Time Current Characteristic Curves



(1) Continuous Ampere Setting Region
The allowable continuous operating amperes is set to a percentage of the rating plug value. Note that the maximum continuous ampere is set by the rating plug value, I_n.

(2) Long Time Delay Region
The long time delay is set to an inverse I^2t ramp function delay calibrated at 6 times the rating plug value, I_n.

(3) Short Time Pickup Region
The short time pickup is set to a multiple of the rating plug value, I_n.

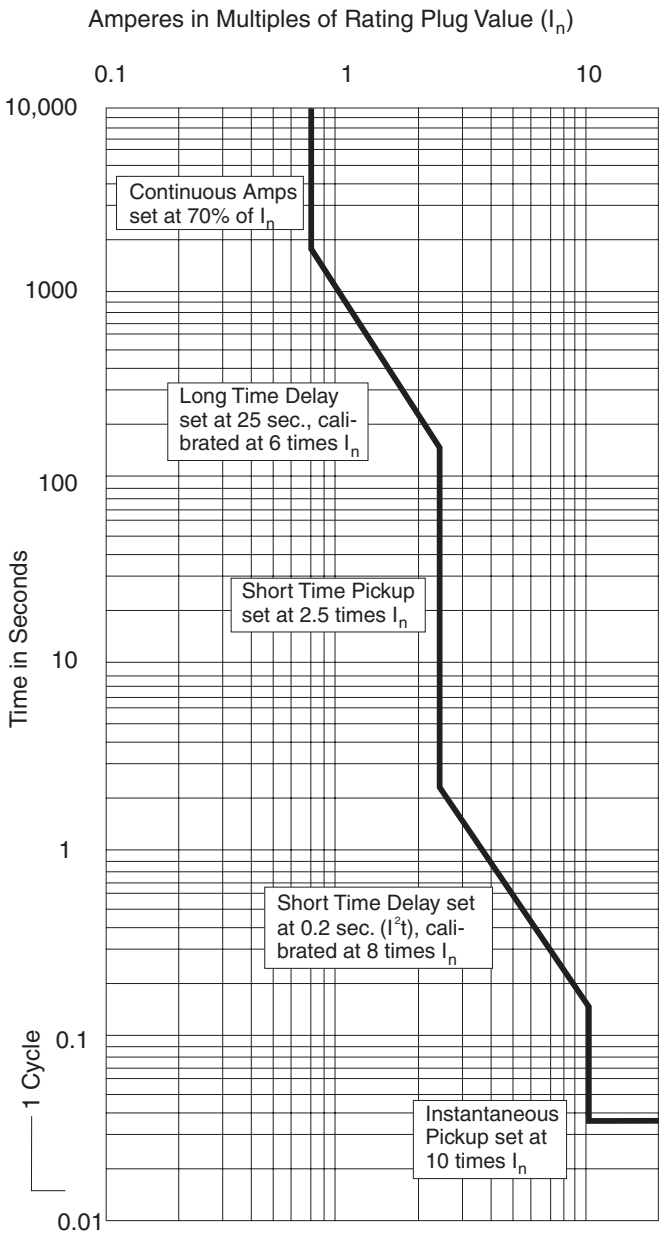
(4) Short Time Delay Region
The short time delay is set to either a fixed delay (illustrated) or an inverse I^2t ramp function delay calibrated at 8 times the rating plug value, I_n.

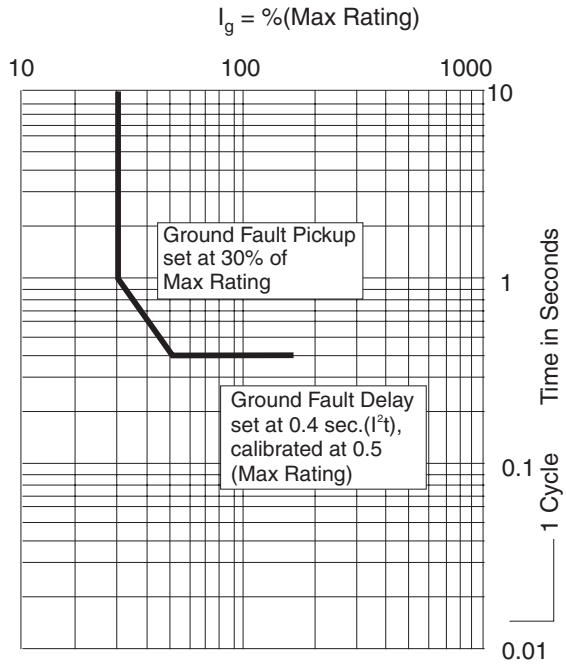
(5) Instantaneous Pickup Region
The instantaneous pickup is set to a multiple of the rating plug value, I_n.

(6) Ground Fault Pickup Region
Ground fault pickup is set to a percent of the max rating.

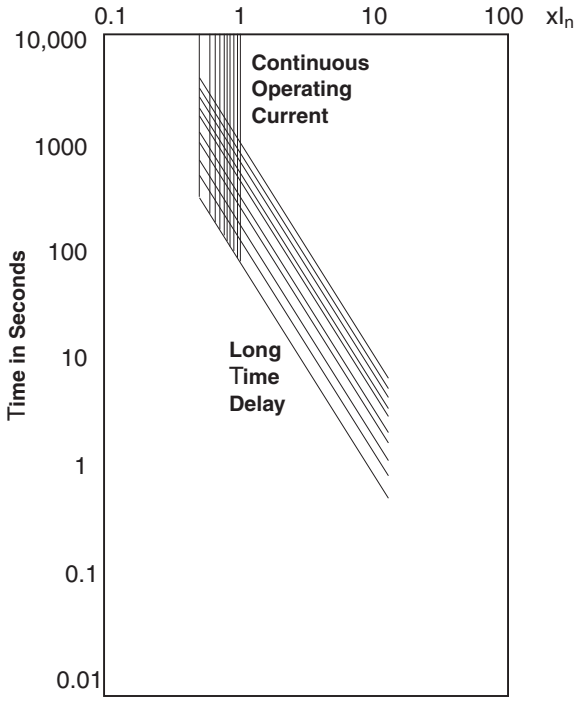
(7) Ground Fault Delay Region
The ground fault delay is set to either a fixed delay (illustrated) or an inverse I^2t ramp function delay calibrated at one half the max rating.

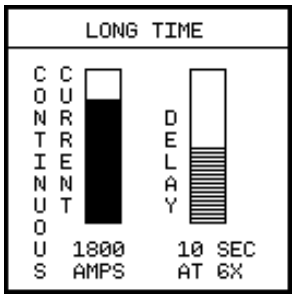
Time Current Characteristic Curves



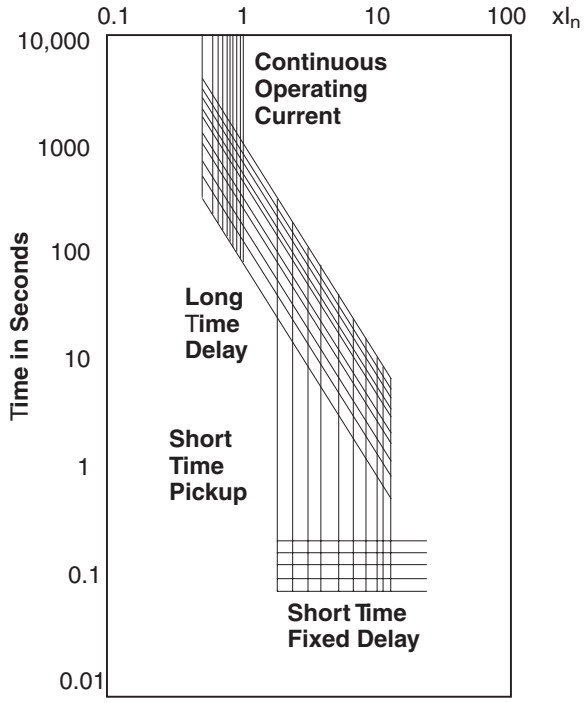


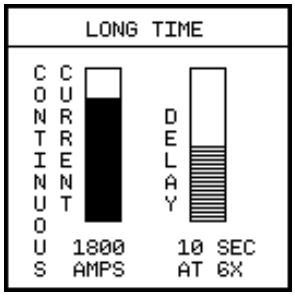
Time Current Characteristic Curves

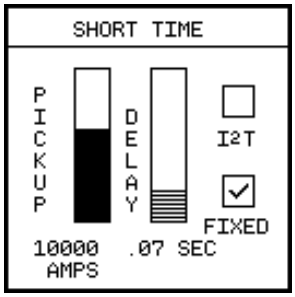




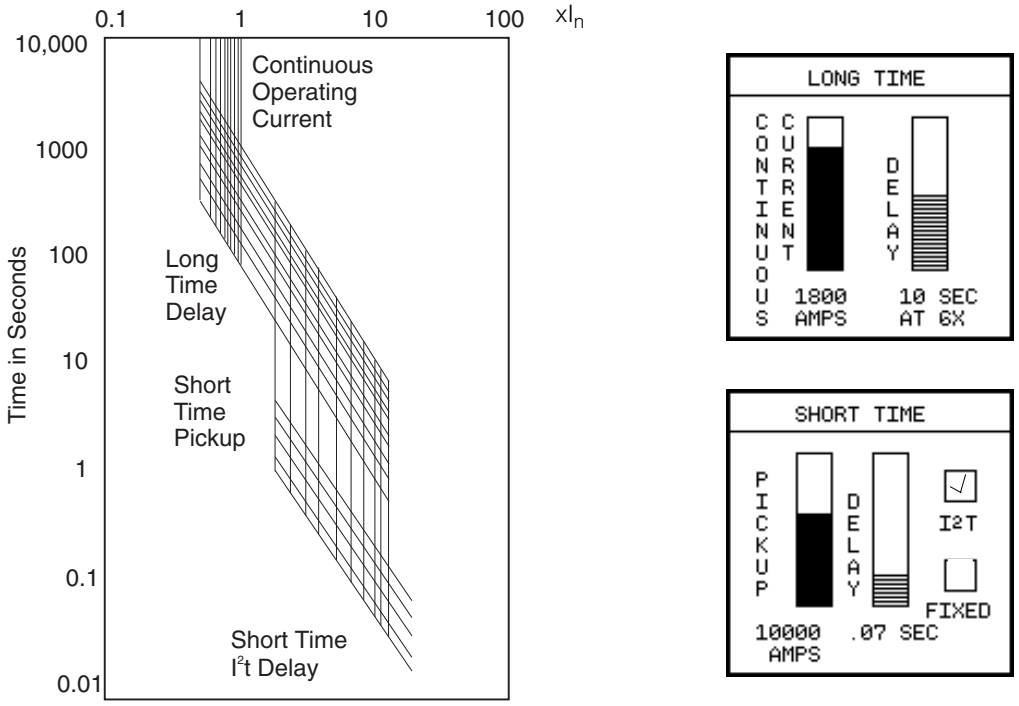
Long Time Overcurrent Protection (curves and parameter screen)



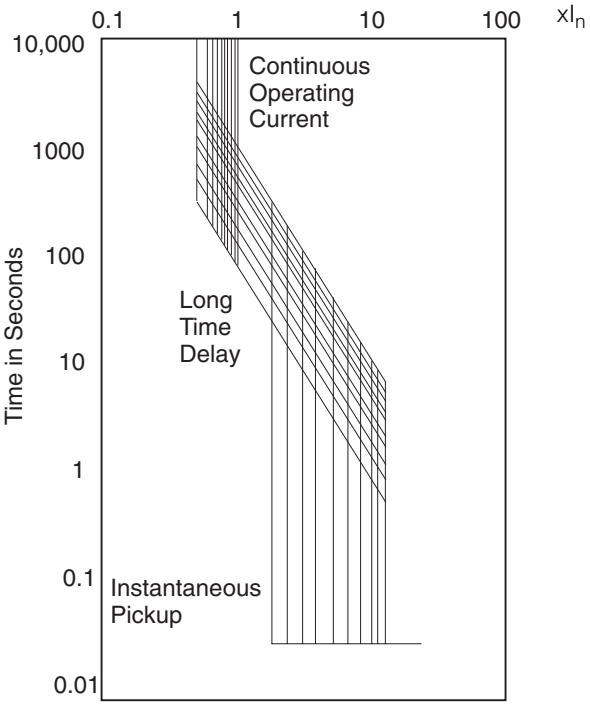


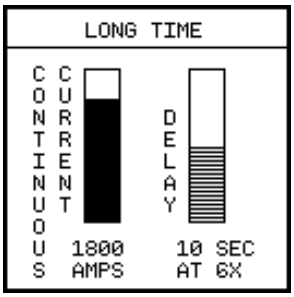


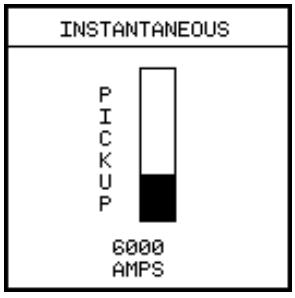
Long Time and Short Time (Fixed) Overcurrent Protection (curves and parameter screens)



Long Time and Short Time (I2t) Overcurrent Protection (curves and parameter screens)

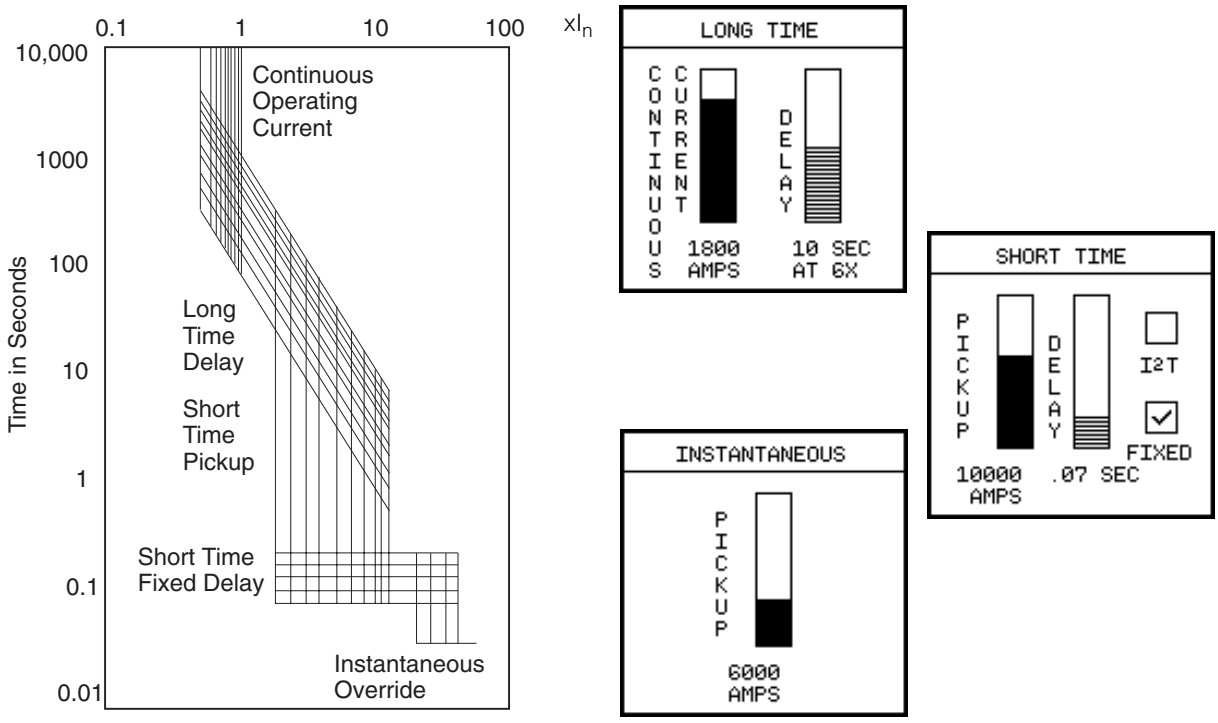




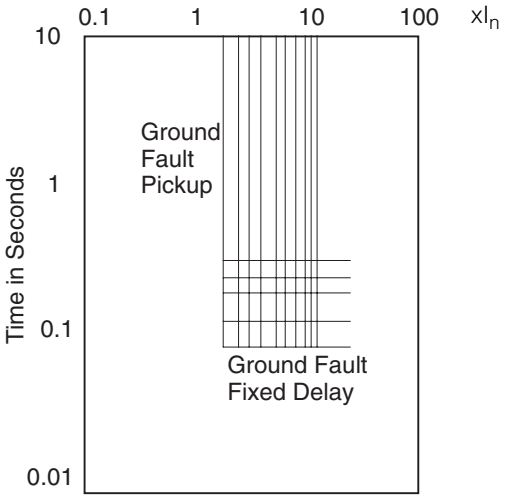


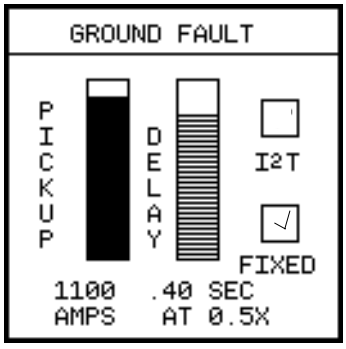
Long Time and Instantaneous Overcurrent Protection (curves and parameter screens)

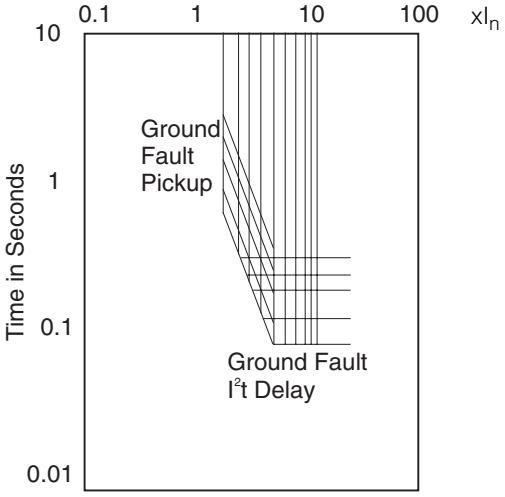
Time Current Characteristic Curves

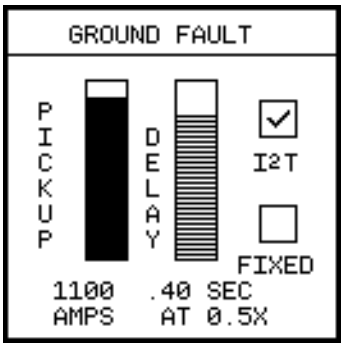


Long Time, Short Time (Fixed), and Instantaneous Protection (curves and parameter screens)









Ground Fault Protection (curves and parameter screens for units with Ground Fault Protection)

Parameter Settings

Long Time Protection Settings										
% I_n	**50%**	**60%**	**65%**	**70%**	**75%**	**80%**	**85%**	**90%**	**95%**	**100%**
I_n = Rating Plug (A)	**Pickup (A)**									
200	100	120	130	140	150	160	170	180	190	200
225	112	135	146	157	168	180	191	202	213	225
250	125	150	162	175	187	200	212	225	237	250
300	150	180	195	210	225	240	255	270	285	300
350	175	210	227	245	262	280	297	315	332	350
400	200	240	260	280	300	320	340	360	380	400
450	225	270	292	315	337	360	382	405	427	450
500	250	300	325	350	375	400	425	450	475	500
600	300	360	390	420	450	480	510	540	570	600
700	350	420	455	490	525	560	595	630	665	700
800	400	480	520	560	600	640	680	720	760	800
1000	500	600	650	700	750	800	850	900	950	1000
1200	600	720	780	840	900	960	1020	1080	1140	1200
1600	800	960	1040	1120	1200	1280	1360	1440	1520	1600
2000	1000	1200	1300	1400	1500	1600	1700	1800	1900	2000
2500	1250	1500	1625	1750	1875	2000	2125	2250	2375	2500
3000	1500	1800	1950	2100	2250	2400	2550	2700	2850	3000
3200	1600	1920	2080	2240	2400	2560	2720	2880	3040	3200
4000	2000	2400	2600	2800	3000	3200	3400	3600	3800	4000
5000	2500	3000	3250	3500	3750	4000	4250	4500	4750	5000

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	Long Time Protection Delay Settings (at 6x)			
Time (s)	2.5	4	5.5	8
	10	14	17	21
	25	30		

Short Time Protection Settings												
% I_n		150%	200%	250%	300%	350%	400%	500%	600%	700%	800%	900%
Max Rating	I_n = Rating Plug (A)	Pickup (A)										
400	200	300	400	500	600		800	1000	1200	1400	1600	1800
	225	337	450	562	675		900	1125	1350	1575	1800	2025
	250	375	500	625	750		1000	1250	1500	1750	2000	2250
	300	450	600	750	900		1200	1500	1800	2100	2400	2700
	350	525	700	875	1050		1400	1750	2100	2450	2800	3150
	400	600	800	1000	1200		1600	2000	2400	2800	3200	3600
800	400	600	800	1000	1200		1600	2000	2400	2800	3200	3600
	450	675	900	1125	1350		1800	2250	2700	3150	3600	4050
	500	750	1000	1250	1500		2000	2500	3000	3500	4000	4500
	600	900	1200	1500	1800		2400	3000	3600	4200	4800	5400
	700	1050	1400	1750	2100		2800	3500	4200	4900	5600	6300
	800	1200	1600	2000	2400		3200	4000	4800	5600	6400	7200
1200	600	900	1200	1500	1800		2400	3000	3600	4200	4800	5400
	700	1050	1400	1750	2100		2800	3500	4200	4900	5600	6300
	800	1200	1600	2000	2400		3200	4000	4800	5600	6400	7200
	1000	1500	2000	2500	3000		4000	5000	6000	7000	8000	9000
	1200	1800	2400	3000	3600		4800	6000	7200	8400	9600	10800
1600	800	1200	1600	2000	2400		3200	4000	4800	5600	6400	7200
	1000	1500	2000	2500	3000		4000	5000	6000	7000	8000	9000
	1200	1800	2400	3000	3600		4800	6000	7200	8400	9600	10800
	1600	2400	3200	4000	4800		6400	8000	9600	11200	12800	14400
2000	1000	1500	2000	2500	3000		4000	5000	6000	7000	8000	9000
	1200	1800	2400	3000	3600		4800	6000	7200	8400	9600	10800
	1600	2400	3200	4000	4800		6400	8000	9600	11200	12800	14400
	2000	3000	4000	5000	6000		8000	10000	12000	14000	16000	18000
2500	1600	2400	3200	4000	4800		6400	8000	9600	11200	12800	14400
	2000	3000	4000	5000	6000		8000	10000	12000	14000	16000	18000
	2500	3750	5000	6250	7500		10000	12500	15000	17500	20000	22500
3200	1600	2400	3200	4000	4800		6400	8000	9600	11200	12800	14400
	2000	3000	4000	5000	6000		8000	10000	12000	14000	16000	18000
	2500	3750	5000	6250	7500		10000	12500	15000	17500	20000	22500
	3000	4500	6000	7500	9000		12000	15000	18000	21000	24000	27000
	3200	4800	6400	8000	9600		12800	16000	19200	22400	25600	28800
4000	2000	3000	4000	5000	6000	7000	8000	10000	12000	14000	16000	
	2500	3750	5000	6250	7500	8750	10000	12500	15000	17500	20000	
	3000	4500	6000	7500	9000	10500	12000	15000	18000	21000	24000	
	3200	4800	6400	8000	9600	11200	12800	16000	19200	22400	25600	
	4000	6000	8000	10000	12000	14000	16000	20000	24000	28000	32000	
5000	2500	3750	5000	6250	7500	8750	10000	12500	15000	17500	20000	
	3000	4500	6000	7500	9000	10500	12000	15000	18000	21000	24000	
	3200	4800	6400	8000	9600	11200	12800	16000	19200	22400	25600	
	4000	6000	8000	10000	12000	14000	16000	20000	24000	28000	32000	
	5000	7500	10000	12500	15000	17500	20000	25000	30000	35000	40000	

	Short Time Protection—Delay Settings (I^2T at 8x)				
Time (s)	0.07	0.1	0.15	0.20	0.30

Parameter Settings

Instantaneous Protection Settings												
% I_n		150%	200%	300%	400%	500%	600%	700%	800%	900%	1000%	1200%
Max Rating	I_n = Rating Plug (A)	Pickup (A)										
400	200	300	400	600	800	1000	1200	1400	1600		2000	2400
	225	337	450	675	900	1125	1350	1575	1800		2250	2700
	250	375	500	750	1000	1250	1500	1750	2000		2500	3000
	300	450	600	900	1200	1500	1800	2100	2400		3000	3600
	350	525	700	1050	1400	1750	2100	2450	2800		3500	4200
	400	600	800	1200	1600	2000	2400	2800	3200		4000	4800
800	400	600	800	1200	1600	2000	2400	2800	3200		4000	4800
	450	675	900	1350	1800	2250	2700	3150	3600		4500	5400
	500	750	1000	1500	2000	2500	3000	3500	4000		5000	6000
	600	900	1200	1800	2400	3000	3600	4200	4800		6000	7200
	700	1050	1400	2100	2800	3500	4200	4900	5600		7000	8400
	800	1200	1600	2400	3200	4000	4800	5600	6400		8000	9600
1200	600	900	1200	1800	2400	3000	3600	4200	4800		6000	7200
	700	1050	1400	2100	2800	3500	4200	4900	5600		7000	8400
	800	1200	1600	2400	3200	4000	4800	5600	6400		8000	9600
	1000	1500	2000	3000	4000	5000	6000	7000	8000		10000	12000
	1200	1800	2400	3600	4800	6000	7200	8400	9600		12000	14400
1600	800	1200	1600	2400	3200	4000	4800	5600	6400		8000	9600
	1000	1500	2000	3000	4000	5000	6000	7000	8000		10000	12000
	1200	1800	2400	3600	4800	6000	7200	8400	9600		12000	14400
	1600	2400	3200	4800	6400	8000	9600	11200	12800		16000	19200
2000	1000	1500	2000	3000	4000	5000	6000	7000	8000		10000	12000
	1200	1800	2400	3600	4800	6000	7200	8400	9600		12000	14400
	1600	2400	3200	4800	6400	8000	9600	11200	12800		16000	19200
	2000	3000	4000	6000	8000	10000	12000	14000	16000		20000	24000
2500	1600	2400	3200	4800	6400	8000	9600	11200	12800		16000	19200
	2000	3000	4000	6000	8000	10000	12000	14000	16000		20000	24000
	2500	3750	5000	7500	10000	12500	15000	17500	20000		25000	30000
3200	1600	2400	3200	4800	6400	8000	9600	11200	12800		16000	19200
	2000	3000	4000	6000	8000	10000	12000	14000	16000		20000	24000
	2500	3750	5000	7500	10000	12500	15000	17500	20000		25000	30000
	3000	4500	6000	9000	12000	15000	18000	21000	24000		30000	36000
	3200	4800	6400	9600	12800	16000	19200	22400	25600		32000	38400
4000	2000	3000	4000	6000	8000	10000	12000	14000	16000	18000	20000	
	2500	3750	5000	7500	10000	12500	15000	17500	20000	22500	25000	
	3000	4500	6000	9000	12000	15000	18000	21000	24000	27000	30000	
	3200	4800	6400	9600	12800	16000	19200	22400	25600	28000	32000	
	4000	6000	8000	12000	16000	20000	24000	28000	32000	36000	40000	
5000	2500	3750	5000	7500	10000	12500	15000	17500	20000	22500	25000	
	3000	4500	6000	9000	12000	15000	18000	21000	24000	27000	30000	
	3200	4800	6400	9600	12800	16000	19200	22400	25600	28000	32000	
	4000	6000	8000	12000	16000	20000	24000	28000	32000	36000	40000	
	5000	7500	10000	15000	20000	25000	30000	35000	40000	45000	50000	

Overcurrent Alarm Settings					
% I_n	115%	125%	150%	200%	250%
I_n = Rating Plug (A)	Pickup (A)				
200	230	250	300	400	500
225	258	281	337	450	562
250	287	312	375	500	625
300	345	375	450	600	750
350	402	437	525	700	875
400	460	500	600	800	1000
450	517	562	675	900	1125
500	575	625	750	1000	1250
600	690	750	900	1200	1500
700	805	875	1050	1400	1750
800	920	1000	1200	1600	2000
1000	1150	1250	1500	2000	2500
1200	1380	1500	1800	2400	3000
1600	1840	2000	2400	3200	4000
2000	2300	2500	3000	4000	5000
2500	2875	3125	3750	5000	6250
3000	3450	3750	4500	6000	7500
3200	3680	4000	4800	6400	8000
4000	4600	5000	6000	8000	10000
5000	5750	6250	7500	10000	12500

Max Rating (A)	Ground Fault Protection Pickup Settings and Ground Overcurrent Alarm Settings									
	Pickup (A)									
400	80	100	120	160	200	240	280	320	360	400
800	160	200	240	320	400	480	560	640	720	800
1200	240	300	360	480	600	720	840	960	1080	1200
1600	320	416	512	608	704	800	896	992	1088	1200
2000	400	460	540	600	700	800	900	1000	1100	1200
2500	500	575	650	725	800	875	950	1025	1100	1200
3200	640	672	736	800	864	928	992	1056	1120	1184
4000	800	840	880	920	960	1000	1040	1080	1120	1200
5000	1200									

Parameter Settings

Neutral Overcurrent Relay Settings					
% Max Rating	**115%**	**125%**	**150%**	**200%**	**250%**
Max Rating (A)	**Pickup (A)**				
400	460	500	600	800	1000
800	920	1000	1200	1600	2000
1200	1380	1500	1800	2400	3000
1600	1840	2000	2400	3200	4000
2000	2300	2500	3000	4000	5000
2500	2875	3125	3750	5000	6250
3200	3680	4000	4800	6400	8000
4000	4600	5000	6000	8000	10000
5000	5750	6250	7500	10000	12500

Overcurrent Demand Alarm Settings						
% I_n	**60%**	**70%**	**80%**	**90%**	**95%**	**100%**
I_n = Rating Plug (A)	**Pickup (A)**					
200	120	140	160	180	190	200
225	135	157	180	202	213	225
250	150	175	200	225	237	250
300	180	210	240	270	285	300
350	210	245	280	315	332	350
400	240	280	320	360	380	400
450	270	315	360	405	427	450
500	300	350	400	450	475	500
600	360	420	480	540	570	600
700	420	490	560	630	665	700
800	480	560	640	720	760	800
1000	600	700	800	900	950	1000
1200	720	840	960	1080	1140	1200
1600	960	1120	1280	1440	1520	1600
2000	1200	1400	1600	1800	1900	2000
2500	1500	1750	2000	2250	2375	2500
3000	1800	2100	2400	2700	2850	3000
3200	1920	2240	2560	2880	3040	3200
4000	2400	2800	3200	3600	3800	4000
5000	3000	3500	4000	4500	4750	5000

Current Unbalance Relay Settings							
% I_n	**5%**	**10%**	**15%**	**20%**	**30%**	**40%**	**50%**
I_n = Rating Plug (A)	**Pickup (A)**						
200	10	20	30	40	60	80	100
225	11	22	33	45	67	90	112
250	12	25	37	50	75	100	125
300	15	30	45	60	90	120	150
350	17	35	52	70	105	140	175
400	20	40	60	80	120	160	200
450	22	45	67	90	135	180	225
500	25	50	75	100	150	200	250
600	30	60	90	120	180	240	300
700	35	70	105	140	210	280	350
800	40	80	120	160	240	320	400
1000	50	100	150	200	300	400	500
1200	60	120	180	240	360	480	600
1600	80	160	240	320	480	640	800
2000	100	200	300	400	600	800	1000
2500	125	250	375	500	750	1000	1250
3000	150	300	450	600	900	1200	1500
3200	160	320	480	640	960	1280	1600
4000	200	400	600	800	1200	1600	2000
5000	250	500	750	1000	1500	2000	2500

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	Alarm Delay Settings			
Time (s)	1	2	3	5
	10	20	30	60
	120	300		

Voltage Unbalance Alarm Settings							
% of Rating	**5%**	**10%**	**15%**	**20%**	**30%**	**40%**	**50%**
PT (V)	**Pickup (V)**						
240	12	24	36	48	72	96	120
480	24	48	72	96	144	192	240
600	30	60	90	120	180	240	300

Parameter Settings

Undervoltage Alarm Settings						
% of PT Rating	**50%**	**60%**	**70%**	**80%**	**90%**	**95%**
PT Rating (V)	**Pickup (V)**					
240	120	144	168	192	216	228
480	240	288	336	384	432	456
600	300	360	420	480	540	570

Overvoltage Alarm Settings					
% of PT Rating	**105%**	**110%**	**115%**	**120%**	**125%**
PT Rating (V)	**Pickup (V)**				
240	252	264	276	288	300
480	504	528	552	576	600
600	630	660	690	720	750

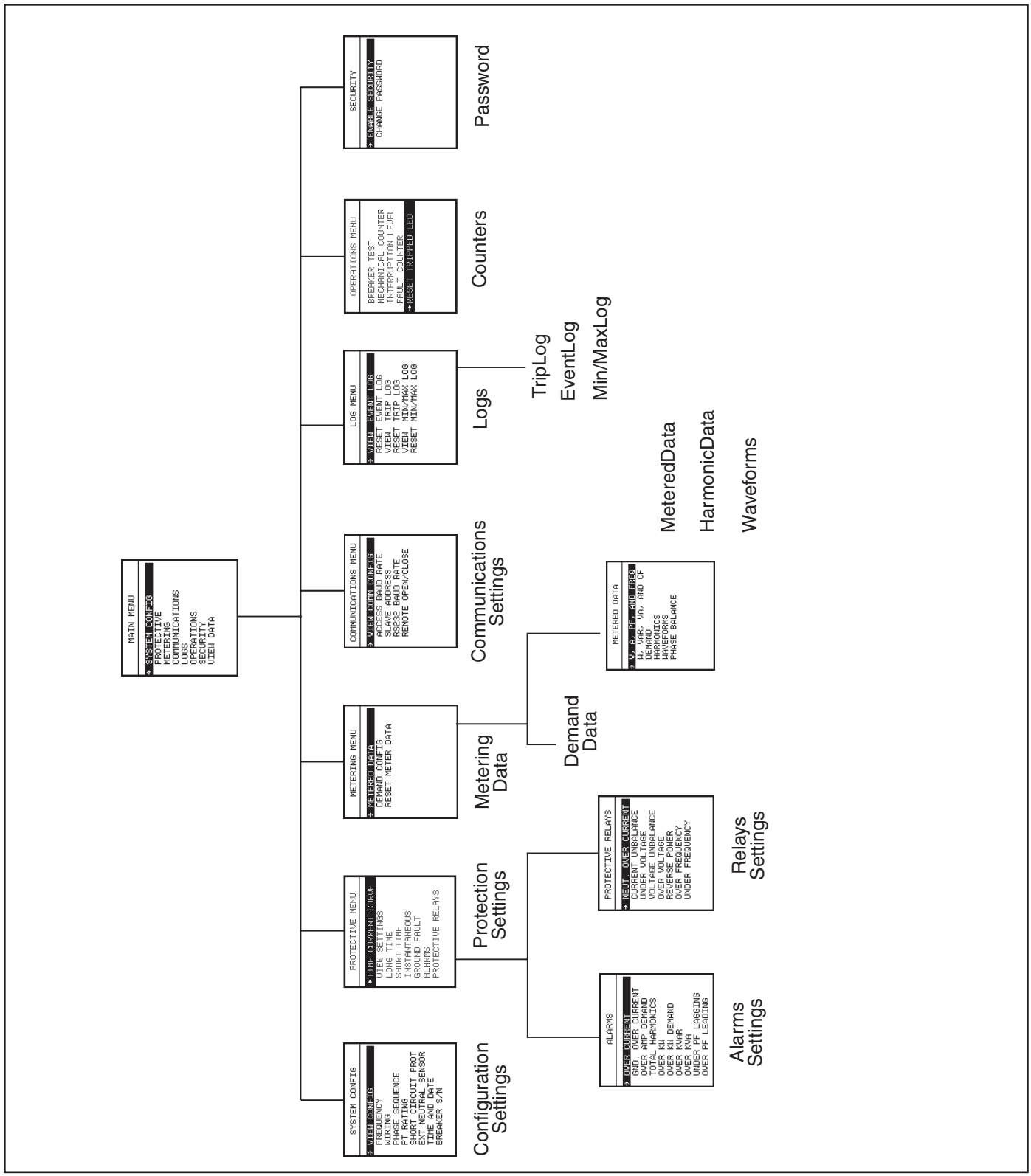
Miscellaneous Pickup Settings								
Overfrequency (Hz)	1	2	3	4	5	7	9	12
Underfrequency (Hz)	1	2	3	4	5	7	9	12
Total Harmonic Distortion (%)	5	10	15	20	25	30	40	50
Over Power Factor	0.50	0.60	0.70	0.80	0.90	0.95		
Under Power Factor	0.50	0.60	0.70	0.80	0.90	0.95		

Max Rating (A)	Over kW, Reverse Power, Over kW Demand (kW)								
400	20	40	60	80	100	125	150	175	200
	225	250	275	300	325	350	375	400	425
800	40	80	120	160	200	250	300	350	400
	450	500	550	600	650	700	750	800	850
1200	60	120	180	240	300	375	450	525	600
	675	750	825	900	975	1050	1125	1200	1275
1600	80	160	240	320	400	500	600	700	800
	900	1000	1100	1200	1300	1400	1500	1600	1700
2000	100	200	300	400	500	625	750	875	1000
	1125	1250	1375	1500	1625	1750	1875	2000	2125
2500	125	250	375	500	625	800	950	1100	1250
	1400	1550	1700	1875	2050	2200	2350	2500	2650
3200	160	320	480	640	800	1000	1200	1400	1600
	1800	2000	2200	2400	2600	2800	3000	3200	3400
4000	200	400	600	800	1000	1250	1500	1750	2000
	2250	2500	2750	3000	3250	3500	3750	4000	4250
5000	250	500	750	1000	1250	1550	1875	2200	2500
	2800	3125	3450	3750	4050	4375	4700	5000	5300

Max Rating (A)	Over kVA (kW)								
400	20	40	60	80	100	125	150	175	200
	225	250	275	300	325	350	375	400	425
800	40	80	120	160	200	250	300	350	400
	450	500	550	600	650	700	750	800	850
1200	60	120	180	240	300	375	450	525	600
	675	750	825	900	975	1050	1125	1200	1275
1600	80	160	240	320	400	500	600	700	800
	900	1000	1100	1200	1300	1400	1500	1600	1700
2000	100	200	300	400	500	625	750	875	1000
	1125	1250	1375	1500	1625	1750	1875	2000	2125
2500	125	250	375	500	625	800	950	1100	1250
	1400	1550	1700	1875	2050	2200	2350	2500	2650
3200	160	320	480	640	800	1000	1200	1400	1600
	1800	2000	2200	2400	2600	2800	3000	3200	3400
4000	200	400	600	800	1000	1250	1500	1750	2000
	2250	2500	2750	3000	3250	3500	3750	4000	4250
5000	250	500	750	1000	1250	1550	1875	2200	2500
	2800	3125	3450	3750	4050	4375	4700	5000	5300

Max Rating (A)	Over kVAR (kW)								
400	20	40	60	80	100	125	150	175	200
	225	250	275	300	325	350	375	400	425
800	40	80	120	160	200	250	300	350	400
	450	500	550	600	650	700	750	800	850
1200	60	120	180	240	300	375	450	525	600
	675	750	825	900	975	1050	1125	1200	1275
1600	80	160	240	320	400	500	600	700	800
	900	1000	1100	1200	1300	1400	1500	1600	1700
2000	100	200	300	400	500	625	750	875	1000
	1125	1250	1375	1500	1625	1750	1875	2000	2125
2500	125	250	375	500	625	800	950	1100	1250
	1400	1550	1700	1875	2050	2200	2350	2500	2650
3200	160	320	480	640	800	1000	1200	1400	1600
	1800	2000	2200	2400	2600	2800	3000	3200	3400
4000	200	400	600	800	1000	1250	1500	1750	2000
	2250	2500	2750	3000	3250	3500	3750	4000	4250
5000	250	500	750	1000	1250	1550	1875	2200	2500
	2800	3125	3450	3750	4050	4375	4700	5000	5300

Menu Structure



Front Panel Men Structure

SEAbus Plus Packet

Both SEAbus and SEAbus Plus use a simple byte-count approach to realize communications between a master and its slave devices. Information is arranged in message packets. All packet fields are one byte in length except Data which can vary between 0 and 255 bytes, depending on the particular message and device type. Communications is standard asynchronous, using one start bit, eight data bits, no parity, and one stop bit. All values are expressed in hex, with multiple-byte values sent least significant byte (LSB) first, most significant byte (MSB) last.

Each packet begins with a 4-byte header (Sync, Devt, Msgt, Len) to indicate the message source, destination, type, and length. The variable length data field (Data) follows the header and contains any actual data. All packets end with the LRC error checksum byte.

The SEAbus Plus protocol is very similar to the original SEAbus protocol in its format and timing requirements. The primary difference is a 16-bit cyclical redundancy check (CRC16) included in the Data field of the message packet to improve error detection. This checksum is produced for each SEAbus Plus packet by treating the data to be transmitted as a binary polynomial and dividing it by a generating polynomial. This technique assures 100% detection of all errors in data up to 16 bits in length and 99.9997% in data 17 bits or longer. SEAbus Plus uses an additional error check byte equal to the inverted Sync byte (~Sync). It follows immediately after the CRC16 at the end of the Data field. A brief description of each message field in a SEAbus Plus packet follows.

Synchronization (Sync) Byte

The Sync byte indicates both the start and direction of a new message packet. The direction is either master-to-slave or slave-to-master. A message sent from the ACCESS host to a field device always begins with 14h(exadecimal). Any response packet sent by a slave back to the ACCESS master uses a value of 27h in the Sync byte. Any messages sent without the proper Sync byte are ignored by all devices.

Device Type (Devt) Byte

Each device placed in an ACCESS system is assigned a unique address to distinguish it from other slave devices on the bus. The range of address values permitted for a particular device depends on the device type's addressing scheme. Slave devices using direct addressing must use an address between 1 and 224, inclusive. Indirectly addressed devices may use any value from 1 to 254. (0 and 255 are reserved by the ACCESS host for universal and global packets, respectively.)

The meaning of the second byte in a SEAbus Plus packet, Devt, changes depending on the addressing scheme used by the field device. For directly addressed devices, such as the SB Energy-Comm trip unit, the Devt byte is simply the device's unique slave address. For devices using indirect addressing, Devt takes on the value of the single-byte "device-type" code assigned to a specific type of device. The device's unique slave address is included later as the first byte in the Data field.

Message Type (Msgt) Byte

The message type byte, Msgt, identifies the particular message being sent. This, in turn, determines the length and type of data (if any) to follow in the Data field of the SEAbus Plus packet. Whenever a slave device responds to a message of type Msgt sent by the ACCESS host, it uses that same value as the message type byte in its return packet.

In the SEAbus Plus protocol, Devt and Msgt define a unique message. With the exception of global messages, different device types can use the same message type value for different purposes without conflict.

Length (Len) Byte

The fourth byte in a SEAbus Plus packet specifies the total number of bytes to follow in the packet's variable-length Data field. The count given by the length byte, Len, includes any actual data bytes, the 2-byte CRC16, and the inverted Sync byte. In the case of indirectly addressed devices, Len also includes the slave address byte appearing as the first byte in the Data subpacket.

Data Subpacket

The Data subpacket contains the actual data to be passed between the ACCESS host and slave device. The particular message type (Msgt) determines both the type and amount of data. For indirectly addressed devices, the first byte appearing in the data field is the device's unique slave address. This is followed immediately by any data values to be sent. The SEAbus Plus protocol requires that a two-byte cyclical redundancy check (CRC16) and another error check byte equal to the inverted Sync byte (~Sync) be placed after the data to complete the Data subpacket.

The receiving device also computes its own CRC16 and ~Sync based on the incoming packet bytes. If these newly calculated check bytes do not equal the received error check values, the message is invalid.

Longitudinal Redundancy Check (LRC) Byte

Both SEAbus and SEAbus Plus terminate all packets with an LRC byte for error checking. For SEAbus, the LRC is the one's complement of the sum (no carry) of all preceding bytes in the packet except the initial Sync byte. SEAbus Plus performs the same summing procedure, but does not take the one's complement.

The LRC is calculated at both the transmitting device and receiving device for each packet. If the receiving device calculates a different LRC based on the incoming bytes than that received at the end of the packet, an error has occurred during transmission and the packet is ignored.

Note: Refer to ACCESS SEAbus Protocol Reference Manual IPIM-2209 and SG6213-00 for detailed information.

Glossary

A

ACCESS system A power monitoring and control system by Siemens. The SB Energy-Comm trip unit is one of several ACCESS system field devices that can communicate with a personal computer or other supervisory device.

ACCESS baud rate *See Baud Rate.*

ACCESS port The RS-485 port on the trip unit that allows it to communicate on the ACCESS system. The physical connection is made on the terminal strip on the left side of the breaker.

acceptance test A preliminary check performed when the device is first received to ensure that it has not been damaged in shipment or retrieval from storage. The SB Energy-Comm trip unit provides a trip test to determine that the trip unit will send the proper trip signal to the breaker, and that the breaker will trip when signalled.

accessory An optional device that can add functionality to the trip unit. All accessories for the SB Energy-Comm unit are external to the trip unit.

address The programmable, unique identifier of the device on the ACCESS system. It is used by the supervisory device to identify the device when communicating.

alarm A signal from the trip unit that can trigger an alert, such as a buzzer or flashing light, that an event has taken place.

alarm setpoint A programmable value, such as current or voltage, which if exceeded, the trip unit will send an alarm signal.

American Wire Gauge (AWG) A standard system for designating wire diameter. Primarily used in the United States.

amps demand See *Current Demand*.

ANSI American National Standards Institute.

B

baud rate The rate of data transfer. The baud rate can be set separately for the ACCESS communications RS-485 port and the front RS-232 port.

breaker See *Circuit Breaker.*

breaker frame size The physical size of the breaker based on its maximum current rating. The SB breaker has five frame sizes. Each breaker frame size has a range of available breaker current ratings.

breaker rating The current rating of the breaker. SB breaker ratings vary from 400 A to 5000 A. It is set by the rating plug.

breaker serial number (S/N) A five-digit number entered in the trip unit that uniquely identifies its associated breaker. Valid numbers range from 00000 to 99999.

C

catalog number See *Order Number*.

circuit breaker The circuit interrupting device (Sentron Systems Breaker) that the SB Energy-Comm trip unit is mounted in.

Communications menu The menu selection available from the Main menu which allows the configuration of communications with a supervisory device.

communications The interchange of data and information between the SB Energy-Comm trip unit and a supervisory device. The trip unit has a serial port for communications with a PC plus a RS-485 port for communications between a network of ACCESS field devices and a supervisory device.

continuous current See *Long Time*.

counters The SB Energy-Comm trip unit tracks the number of breaker operations. There are three types of counters: mechanical, interruption, and fault.

crest factor The ratio between the peak and RMS current, measured per phase.

CT current transformer. A device which generates a current proportional to that in the measured line.

current balance See *Phase Balance*.

current demand The measurement and summation of metered current over a specified time.

current rating See *Breaker Rating*.

current unbalance alarm An alarm activated when the phase current for any one phase exceeds the average current by a set value. The breaker may also be programmed to trip at this, or another value. This feature is available from the Protective Relays menu.

D

delay The amount of time that the trip unit waits before tripping or alarming after a monitored value exceeds the alarm or trip setting.

demand The measurement and summation of current or energy over a specified time, typically 15 or 30 minutes.

demand period The specified time, typically 15 or 30 minutes, over which current or energy data is collected and from which the demand value is calculated.

device address See *Address*.

DLY Time delay (value).

display contrast A setting that can be adjusted to increase or decrease the contrast of the panel display.

E

EIA Electronic Industries Association.

EIA-232 See *RS-232.*

EIA-485 See *RS-485*.

Electronic Bell Alarm Accessory that attaches to the trip unit and provides a solid-state relay contact for remote indication of breaker tripping.

EP Expansion Plug.

event log A record of faults and alarms, including the date and time they occurred.

Expansion Plug Interface between the trip unit and the Multiplexer Translator for zone interlocking.

extended protective relaying See *Protective Relay Functions*.

external neutral sensor The current transformer located on the neutral bus of a four-wire electrical system.

external power supply An AC/DC converter which supplies power for the trip unit's metering and communications functions.

F

fault Electrical disturbance such as a short circuit or open circuit.

fault counter The counter on the trip unit that records breaker operations.

fixed delay A trip time delay that is a constant value, regardless of the magnitude of the overcurrent.

frame size See *Breaker Frame Size*.

G

GF ground fault (protection).

ground fault mode switch The switch on the side of the trip unit that selects the ground fault sensing scheme, either Residual (all three phases added) or Ground Return.

ground fault protection Protection against shorts to ground.

ground overcurrent alarm An alarm activated by current in the ground line exceeding a set limit.

ground return The ground fault sensing scheme in which the ground fault sensor is located at the neutral connection to ground.

H

harmonic analysis Mathematical analysis of a waveform to determine its harmonic components.

I, J

ICCB Insulated Case Circuit Breaker.

idle display mode The trip unit's mode of operation when left idle for five minutes or longer. The display shows several screens of data and configuration settings in sequence until a key on the keypad is pressed. Remote configuration of the trip unit is allowed only while it is in this mode. It is also available from the View Data selection on the main menu.

IEC International Electrotechnical Committee. The international standards organization for electrical and electronic equipment.

I_n Rating Plug value.

I^2t A variable time delay in which the delay is progressively shorter as the overcurrent value increases. I^2t describes the relationship between the overcurrent magnitude and time.

INST Instantaneous fault (protection).

instantaneous Overcurrent protection that occurs immediately, without any delay.

L

logs Tables in the trip unit's memory to store trip information, event information, and metered value minimum/maximum values.

Log menu The menu selection, available from the Main menu, that allows the operator to view or reset the logs.

long time Overcurrent protection that is only activated after a user-defined period, typically several seconds in duration. This is for the lowest levels of overcurrent activity.

LT long time fault (protection).

M

Main menu The primary menu screen on the trip unit. It appears on powering the unit, and after pressing a key while in idle display mode.

maintenance counter The counter on the trip unit that keeps track of all breaker operations, both openings and trips.

MAX Rating The maximum amount of continuous current the breaker is capable of carrying.

mechanical counters The counters in the trip unit (mechanical and fault) that keep track of the number of breaker operations that are caused by manual or mechanical means and not due to electrical fault or remote command.

metering menu The menu selection on the Main menu that allows the operator to view metered parameters.

min/max values Minimum and maximum metered values.

mode switch See *Ground Fault Mode Switch*.

model number See *Order Number.*

MT Multiplexer Translator. Device that allows up to eight field devices to be attached for remote communications and/or zone interlocking. Used with the SB Energy-Comm trip unit only for zone interlocking.

N

NEMA National Electrical Manufacturers Association.

O

operations Openings or trippings of the circuit breaker.order number

The number used to describe which model when ordering. The order number designates which features are on the trip unit.

over amp demand alarm The alarm signal from the trip unit when the system exceeds a specified current demand setting.

overcurrent alarm The alarm signal from the trip unit when the system exceeds a user-specified current setting.

overcurrent protection Protection provided by the trip unit when a line current exceeds a user-specified value. Available forms of overcurrent protection are instantaneous, short time, and long time.

over power demand alarms The alarm signal from the trip unit when the system exceeds a user-specified current power value; either over apparent power (KVA), over reactive power (KVAR) or over real power (Over KW).

over frequency alarm The alarm signal from the trip unit when the system exceeds a user-specified line frequency value.

over voltage alarm The alarm signal from the trip unit when the system exceeds a user-specified voltage value.

P, Q

packet SEAbus communications unit of information that is transmitted between the field device and supervisory device.

password A number, entered from the security menu, used to prevent users from inadvertently changing parameters. The default setting is no password.

period See *Demand Period*.

phase balance The ratio of current or voltage in a particular phase to the average current for all three phases.

pickup The value at which the trip unit detects a trip or alarm condition.

power factor The ratio of resistance to impedance. The ratio of an actual power of an alternating current to apparent power. Mathematically, the cosine of the angle between the voltage applied and the current resulting.

power supply See *External Power Supply.*

Portable Test Set Equipment for verifying the operation of the trip unit; for example, the TS-31 test set may be used to test the protective functions of the SB Energy-Comm trip unit.

protective relay functions Protective functions including tripping when the system exceeds user-defined pickup values for over and under voltage, under and over frequency, reverse power, and unbalance.

Protective menu The available protection functions, including Long Time, Short Time, Instantaneous, and Ground Fault.

PT Potential Transformer. A transformer which generates a voltage in the secondary proportional to the voltage in the primary at a specified ratio.

PT rating The ratio between the potential transformer voltage sensed, and voltage transmitted.

PU Pickup (value).

R

RS-232 (EIA-232) An industry standard (EIA-232) serial communications interface through which data is sent one bit (binary digit) at a time. The physical and electrical specifications that apply to the transfer of data between Data Terminal Equipment (DTE) and Data Communication Equipment (DCE), typically between a personal computer and a peripheral device.

RS-485 (EIA-485) Commonly used communications standard (EIA-485) typically for communication among several field devices.

remote operations Opening or closing of the breaker by a signal from the communications port. This is distinguished from trips caused by actual faults.

residual ground sensing scheme The method of sensing ground current based on the vectorial summation of currents in all phases.

Reverse Power Power flow from the load towards the source. kW and kVAR supplied by the load.

RX Receive signal (communications).

S

SB Systems Breaker. The family of encased systems breakers on which the trip unit operates.

SEAbus The protocol used by the SB Energy-Comm trip unit and other Siemens ACCESS field devices.

Security menu The menu selection, available from the Main menu, that allows the operator to choose the password and enable security.

serial number See *Breaker Serial Number*.

serial port The data port on the front of the trip unit that allows RS-232 communications to a personal computer.

short time Overcurrent protection that is activated after a brief delay. This is for higher levels of overcurrent activity than the long time protective function.

ST Short Time (protection).

supervisory device A device that can remotely configure, read back, check the configuration of, and poll real-time data from field devices. Supervisory devices display the information and add the capabilities of programming, monitoring alarms, and logging system events.

System Check LEDs The indicators on the front panel of the trip unit that indicate the proper operation of the trip unit's protective and metering functions.

System Configuration menu The menu selection, available from the Main menu, that allows the operator to view and configure power system characteristics.

System Status LEDs The two indicators on the front panel of the trip unit that indicate the status of the breaker, whether it has been sent a trip command and whether an alarm has occurred.

T

test set See *Portable Test Set*.

total harmonic distortion (THD) The ratio of the sum of the parts of the system power waveform that resides in the harmonics to the value of the power residing in the fundamental line frequency.

trip The opening of the circuit breaker or the command to open the circuit breaker originating at the trip unit.

trip unit The field device connected to a circuit breaker that senses overcurrent conditions and sends a signal to open the breaker. The SB Energy-Comm trip unit also includes metering, protective relay, and communications capabilities.

trip log The list of trips or breaker openings stored in memory of the trip unit.

TS-31 See *Portable Test Set*.

TX Transmit signal (communications).

U

unbalance See *Phase Balance*.

under voltage alarm The alarm signal that is output by the trip unit when the control voltage drops below a user-specified setting.

under frequency alarm The alarm signal from the trip unit when the system drops below a user-specified line frequency value.

V

voltage balance See *Phase Balance*.

VT Voltage transformer. See PT.

W, X, Y

waveform The graphical depiction of the current or voltage over time.

waveform capture The function of saving the measurement of the current or voltage over one cycle.

WinPM™ Windows-based electrical distribution and communications software designed for personal computers. Through communications drivers, WinPM software collects and displays real-time data from ACCESS field devices. WinPM also monitors and displays historical data, minimum and maximum data, and waveform data. In addition, WinPM can deliver its data to other compatible Windows applications in real-time through dynamic data exchange (DDE).

Z

zone interlock The interconnecting of several circuit protection devices, to protect a specified portion of a power system, and coordinate in timing the action of those devices.

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Bulletin IPIM-2208B
(Supercedes 4.5-2.A)
2.5M1299SP Printed in U.S.A.