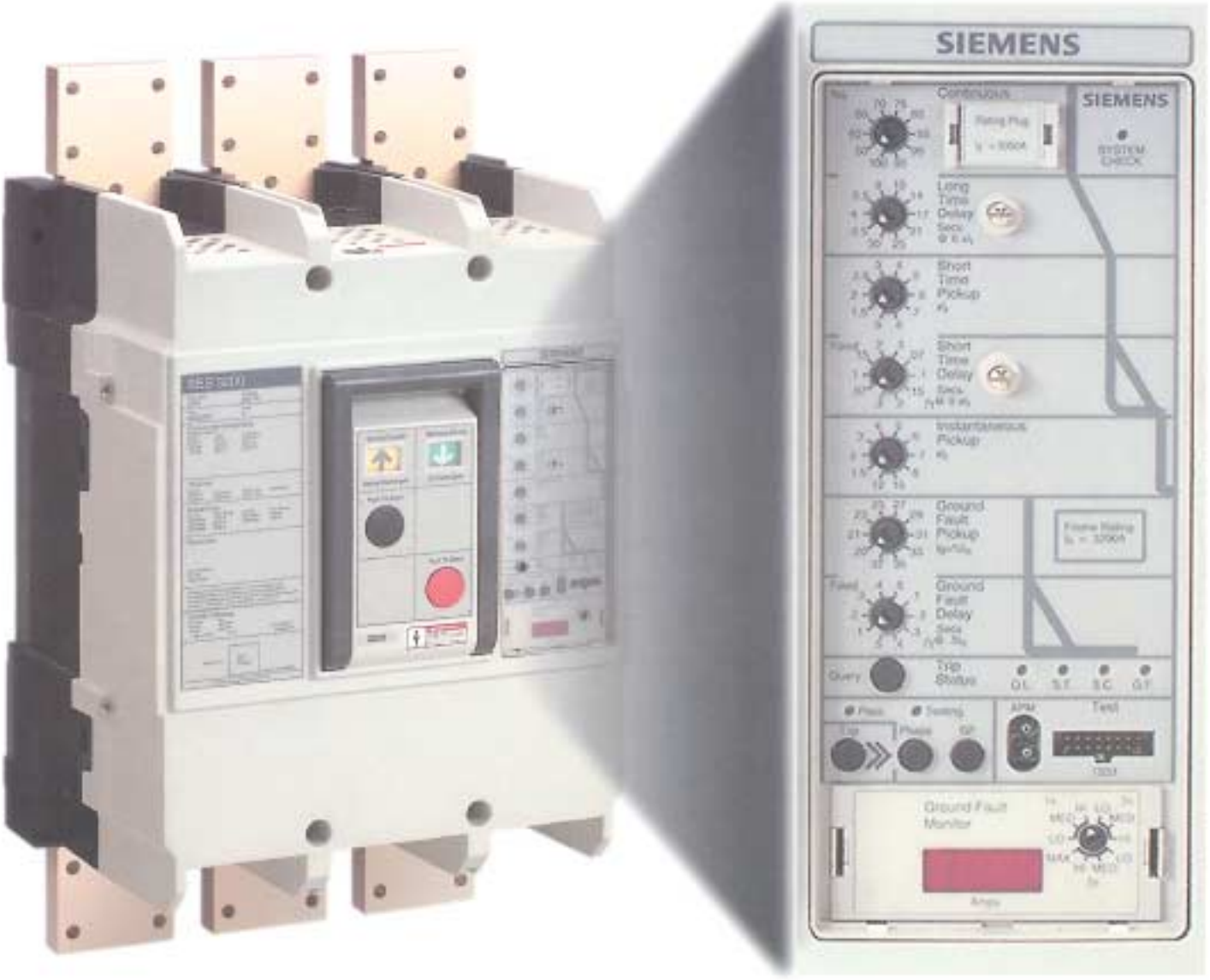
SIEMENS

Electronic Trip Unit for SB Encased Systems Breakers

Information and Instruction Guide



⚠ DANGER

Hazardous voltage. WIll cuase death of 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.

Circuit breaker indicators shown in this booklet are for illustration purposes only. Circuit breakers are to be installed in "Discharged" and "Open" positions only.

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. Siemens reserves the right to make changes in the specifications shown herein or to make improvements 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.

NOTE

***Authorized and qualified personnel —**

For the purpose 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, he 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 correct 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 practices.

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

SUMMARY

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 sales office, listed on back of this instruction guide.

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

Electronic Trip Unit for Siemens Type SB Systems Breakers

Table of Contents

NOTE: Information related to specific catalog numbers does not guarantee product availability. Technical information may change due to product revisions. Consult Siemens sales office concerning any variation of product information contained herein.

Description

Electronic Trip Units For Siemens SB Encased Systems Breakers

Electronic Trip Unit
The Electronic Trip Unit is a microprocessor controlled multi-function overcurrent protective device for application with Siemens state-of-the art family of SB Encased Systems Breakers. The adjustment flexibility provided by the trip unit allows the user to easily accommodate load changes and other protective requirements while still assuring optimum coordination. In addition to the adjustable protection functions, the unit is designed to use field interchangeable rating plugs. These ratings plugs allow the ampere rating of the 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 a SB breaker frame.

Current sensors within the SB breakers provide signal currents and operating power for the trip unit. Therefore, when the breaker is closed, the trip unit requires no external connections or control power to perform its protection functions.

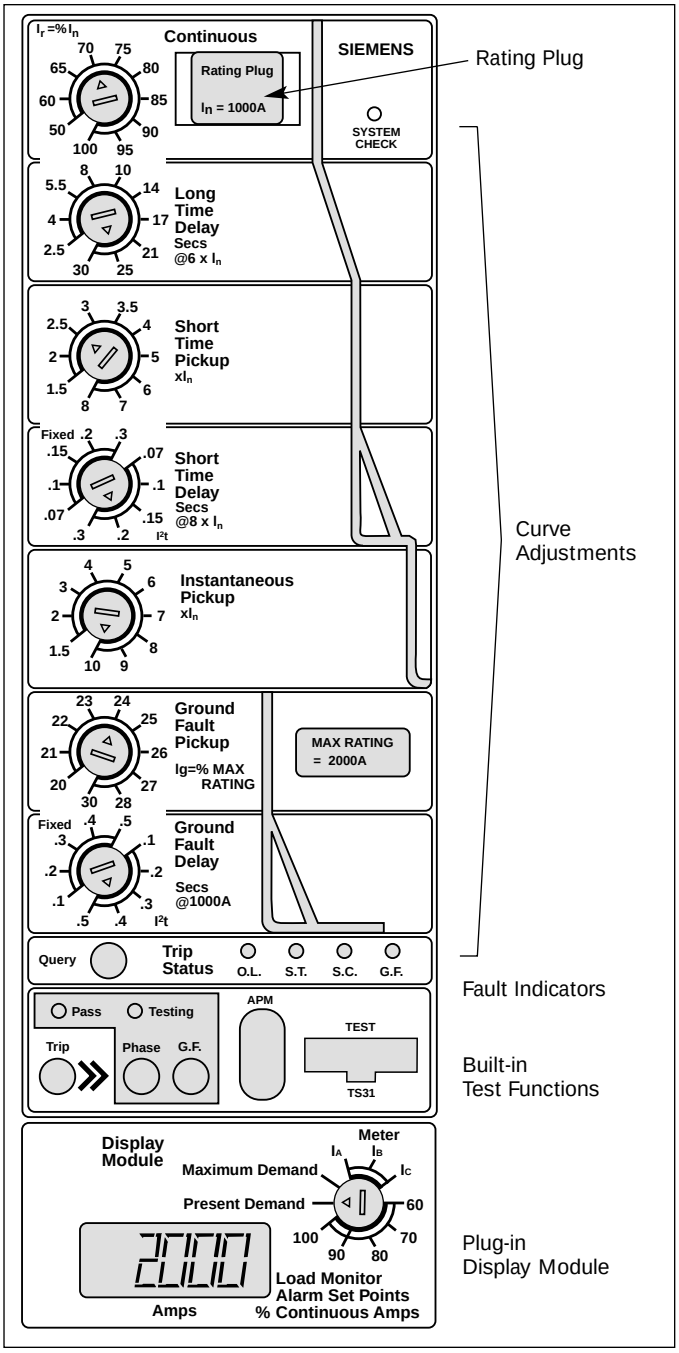
Overcurrent Protection Configurations
Trip units are available in seven overcurrent protection configurations to meet specific protection requirements. Six trip units have Adjustable Continuous Current and Long Time Delay. Optional protection configurations are:

Protection Configuration	Identifier
Long Time/Short Time	LS
Long Time/Instantaneous	LI
Long Time/Short Time/Instantaneous	LSI
Long Time/Short Time/Ground Fault	LSG
Long Time/Instantaneous/Ground Fault	LIG
Long/Short Time/Instantaneous/Ground Fault	LSIG
Fixed Long Time/Instantaneous	MLI

As standard features, the trip unit has two built-in-test functions and a fault identification function. System Check is a built-in-test function that continuously checks the status of the microprocessor and protective algorithms. A green LED on the front panel blinks approximately every 3 seconds when the microprocessor is correctly cycling through its protection routines. Integral Test is a built-in-test that allows the user to exercise the trip unit electronics. LED indicators display the testing status. Trip Status is a fault identificaton function that stores information when a fault current causes the trip unit to trip the circuit breaker. By pressing the Query button the user can display the cause of the breaker trip by illuminating one of four LED's: OL (overload), ST (short time), SC (short circuit), or GF (ground fault). Newer version trip units are equipped with a Trip Status LED Reset Button for resetting the trip indicator.

Additional optional features include:
Display Module for local current monitoring (field addable)
Zone Selective Interlocking
Communications for remove monitoring

Full Function Trip Unit



NOTE: Earlier model trip units may use (I_r) as the Rating Plug designator and (I_n) to denote (MAX Rating). The designations for the current model trip unit are shown above. Note however, that the change in designation has no effect on the switch settings used for selecting continuous, Long Time, Short Time, Instantaneous and Ground Fault pickup and delay values.

Description

Frame Sizes and Ampere Ratings, Rating Plugs, and Interrupting Ratings

Frame Sizes and Frame Ampere Ratings
Siemens SB Encased Systems Breakers come in six frame sizes with frame ampere ratings ranging from 400 to 5000 amperes. All frames are rated for 100% continuous operation. The max ampere rating is determined by the current transformers within the frame. Correctly rated electronic trip units are available for all SB 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 two-pin rejection scheme is shown on page 7. The combinations of frame sizes and frame ampere ratings are listed in the following table.

Frame Size and Rating Combinations

Breaker Frame Ampere Size	Breaker Max Ampere Rating
1200 Amperes (SBA, SBS only)	400, 800, 1200
2000 Amperes	800 (SBH only), 1200, 1600, 2000
3200 Amperes	2500, 3200
5000 Amperes	2500, 3200, 4000, 5000

Rating Plugs
Field interchangeable rating plugs are used to set the effective ampere rating of the circuit breaker. Available rating plugs, as a function of the frame ampere ratings, are given in the following table. Note that the maximum rating plug value for a particular electronic trip unit is equal to the frame rating; the minimum is equal to 50% of the MAX 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.

Available Rating Plugs

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

RMS Current Sensing
The Siemens microprocessor-controlled Electronic Trip Unit executes the overcurrent fault protection functions of Siemens SB Encased Systems Breakers. The adjustment flexibility provided by the trip unit allows the user to easily accommodate load changes and other protection requirements while still assuring optimum coordination.

A standard feature of the trip unit is RMS 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.

Interruption and Short Time Ratings
Four short circuit interruption ratings are available to meet specific applications. The interruption ratings and short time ratings are given in the following table:

UL 489 Interruption and Short Time Ratings

	Breaker Frame Size			
	1200	2000	3200	5000
Type SBA Alternative Interrupt Rating (Blue Label)				
240V AC 480V AC 600V AC	65 kA 65 kA 42 kA	85 kA 65 kA 50 kA	—	—
Type SBS Standard Interrupt Rating (Black Label)				
240V AC 480V AC 600V AC	100 kA 100 kA 50 kA	150 kA 100 kA 65 kA	150 kA 100 kA 85 kA	150 kA 100 kA 85 kA
Type SBH High Interrupt Rating (Red Label)				
240V AC 480V AC 600V AC	—	200 kA 150 kA 100 kA	200 kA 150 kA 100 kA	200 kA 150 kA 100 kA
Short Time Rating (t=0.5 seconds)				
	25 kA	35 kA	50 kA	65 kA

IEC 947-2 Ratings (SBS Units Only)

		Frame Sizes			
Voltage 50/60 Hz		1200	2000	3200	5000
Type SBS Standard Interrupt Rating (Black Label)					
415V AC	Icu Ics Icw	100 kA 100 kA 25 kA	100 kA 100 kA 35 kA	100 kA 100 kA 50 kA	100 kA 100 kA 65 kA
690V AC	Icu Ics Icw	65 kA 65 kA 25 kA	65 kA 65 kA 35 kA	65 kA 65 kA 50 kA	65 kA 65 kA 65 kA

The interruption 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. **Blue** indicates the "alternate" or the lowest interrupting category. **Black** indicates the "standard" interrupting rating. A **Red** label indicates the highest available interrupting rating for the SB breaker.

The trip unit that may be used with a specific circuit breaker is identified on the front cover label.

NOTE: For trip units not requiring full-function adjustability, integral testing functions, local indication, or ACCESS communications compatibility, specify trip unit with catalog suffix MLI.

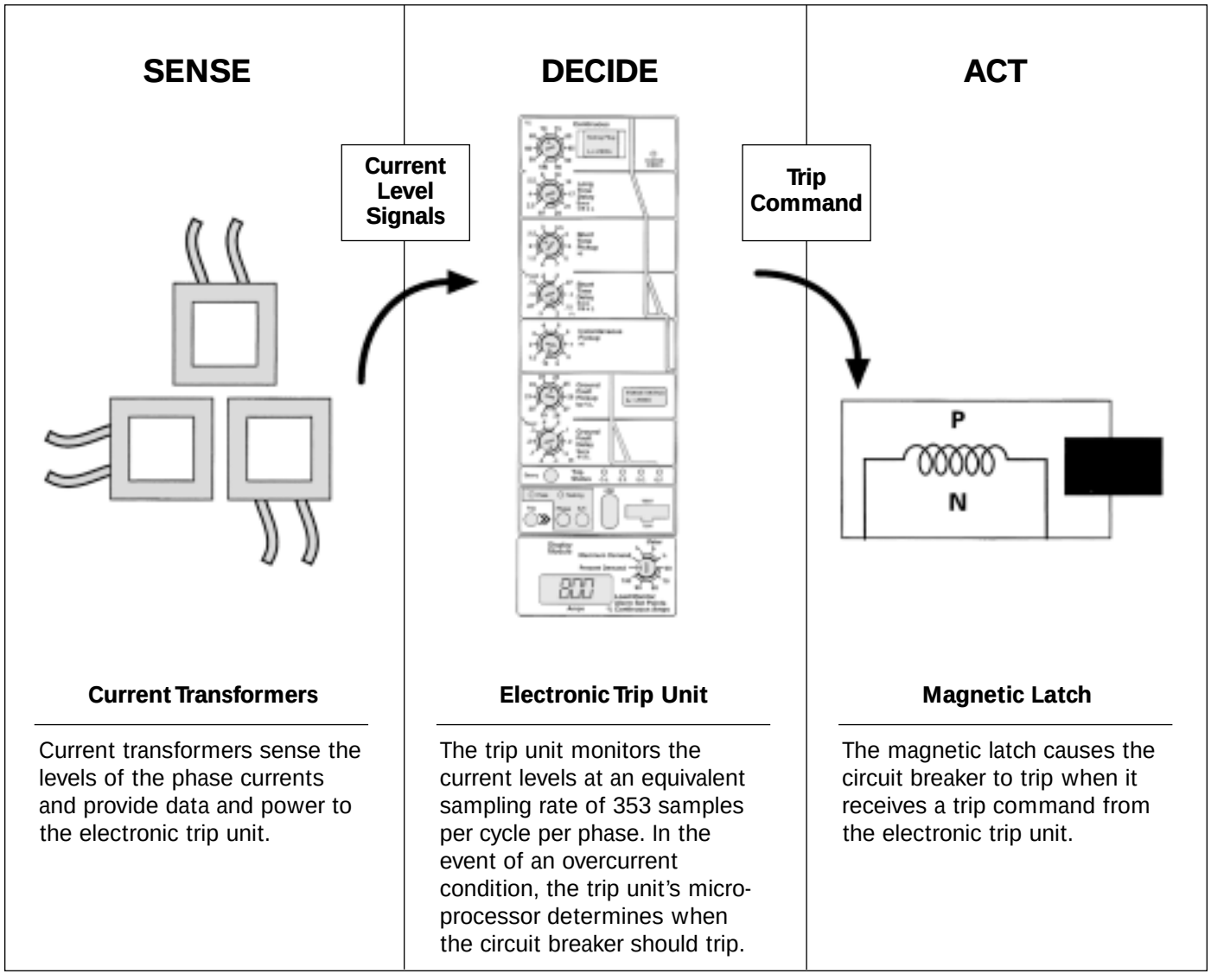
Principles of Operation

The Siemens Electronic Trip Unit utilizes a microprocessor to execute the myriad of numeric and logic functions programmed in the unit. The adjustments on the trip unit face allow the user to select the numerical values to be used by the microprocessor in performing its protection function. (The numerical values are stored in the processor's permanent memory.)

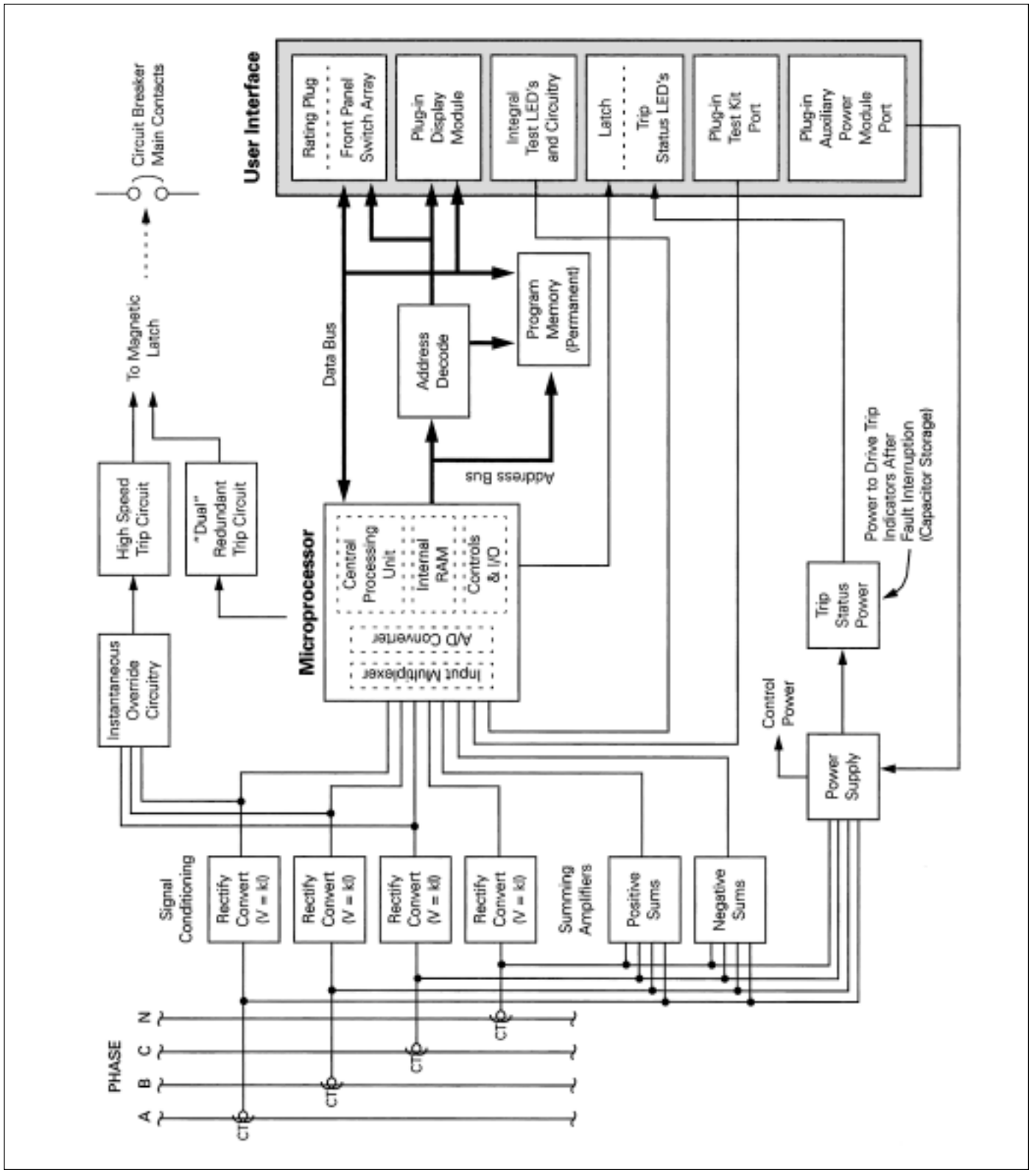
Current data is derived from current sensors mounted in the Siemens SB Systems Breaker. These sensors are current transformers. As passive devices they provide high reliability with minimum signal error, while providing power for the trip unit. The current signals from the transformers are converted to digital voltages in the trip unit. These digital voltages are stored in temporary memory. The digital signals are used by the microprocessor in detecting and processing overcurrent conditions.

The microprocessor reads the temporarily stored digital voltages and compares these values with the permanently stored values that correspond to the user-selected adjustment settings. When an overcurrent condition is detected, the microprocessor's software begins to process the appropriate protection function. During the processing of the protection function, 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, a tripping command is issued by the microprocessor.

The tripping command from the microprocessor causes a signal to be sent from the electronic 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.



Principles of Operation – Functional Diagram



⚠ DANGER

Hazardous Voltage. Will cause death or serious injury.

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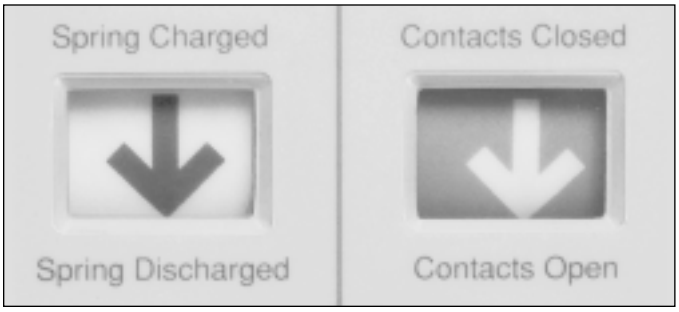
Replace the cover(s) and shield(s) before power supplying this device is turned on.



⚠ CAUTION

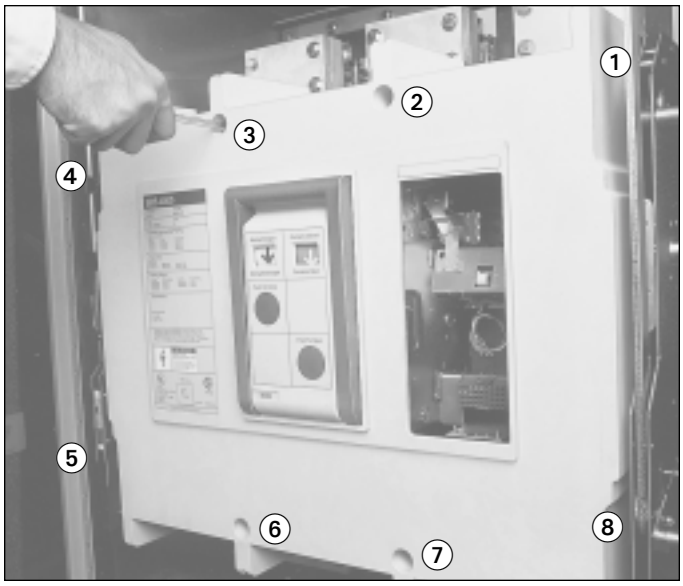
Do not attempt to install a trip unit with the breaker "Closed" or "Charged." Make certain breaker is "Open" or "Discharged" as shown above. Personal injury or mechanical damage may occur.

Installation of Electronic Trip Unit

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

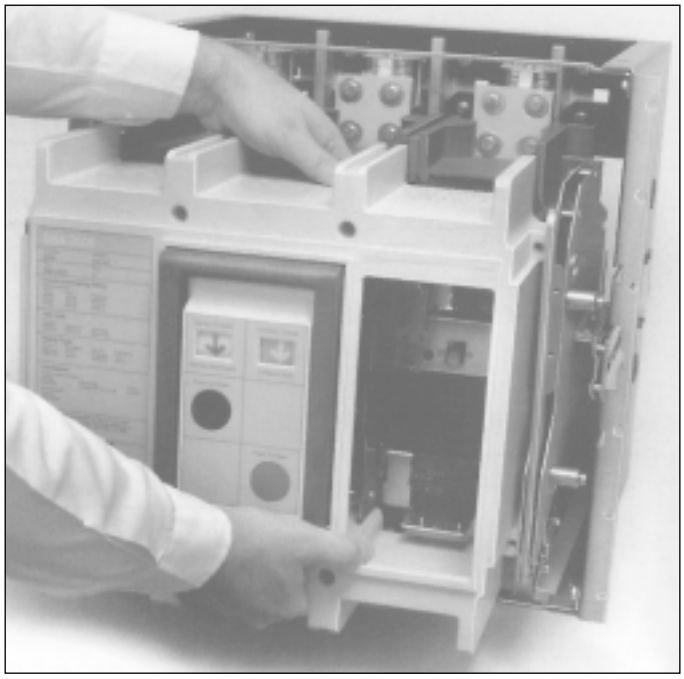
Electronic Trip Unit Installed into Circuit Breaker

Steps 1 through 9.



1. Remove 8 screws from breaker front cover.

To install the trip unit, the front cover of the breaker must first be removed. This is done by removing the four (4) recessed Phillips head screws in positions 2, 3, 6, and 7, along with the four (4) Phillips head screws in positions 1, 4, 5, and 8, which hold the front cover in place.



2. Lift off front cover.

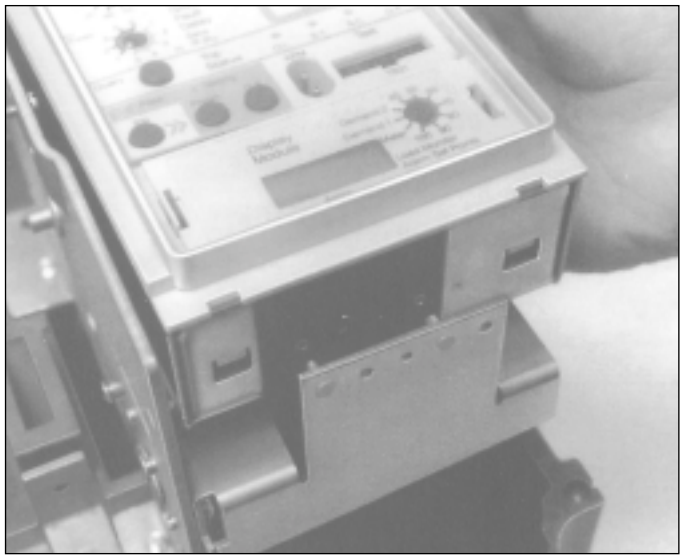
3. Set ground fault selection switch.

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 Source Ground/Zero Sequence—prior to installing the trip unit. These ground fault sensing schemes are discussed on page 18.

4. Check label on side of trip unit.

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

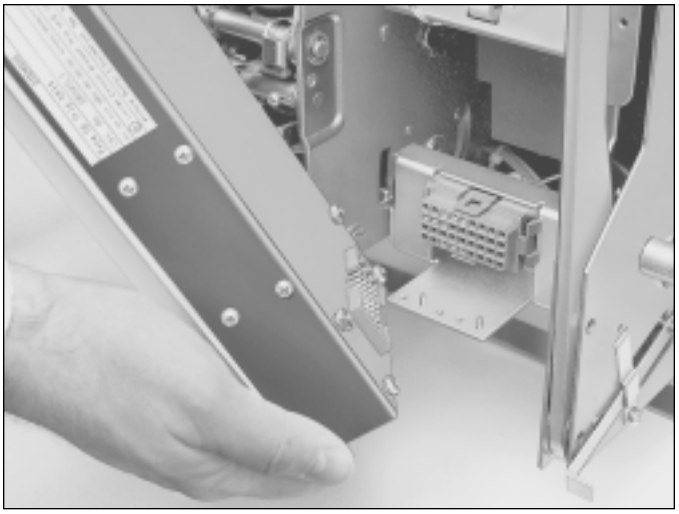


5. Check alignment of "rejection-scheme" pins with holes.

If there is any doubt about a trip unit being the correct trip unit for a breaker, hold the trip unit upside down and check the alignment of the pins and holes.

⚠ WARNING

Do not attempt to modify rejection features.

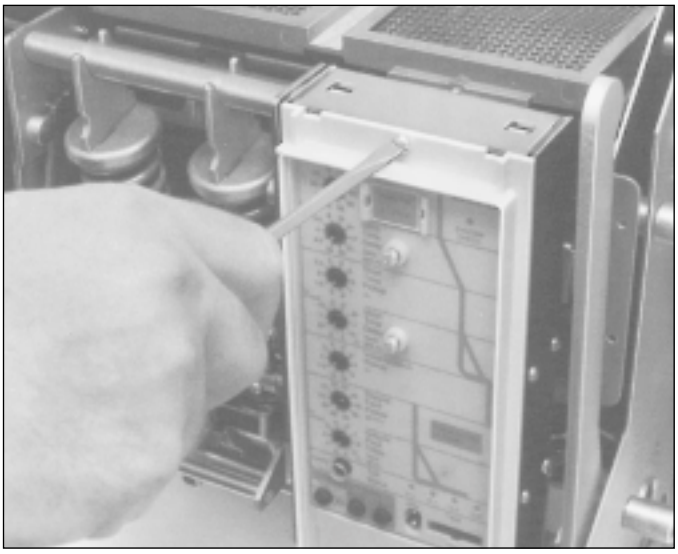


6. Mate pin connectors.

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

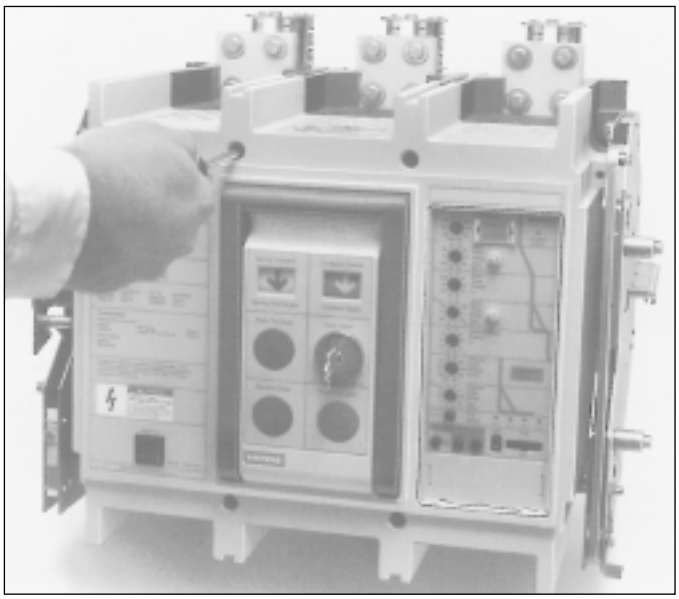
7. Lower trip unit onto support plate.

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 trip unit.

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



9. Replace the front cover.

Replace the front cover. Then, replace the eight (8) front cover screws. If trip unit top is not secured correctly, the interlock will prohibit closing of the breaker.

NOTE: Before energizing breaker be sure to install a correct rating plug. See pages 10 and 11.

Removal Instructions

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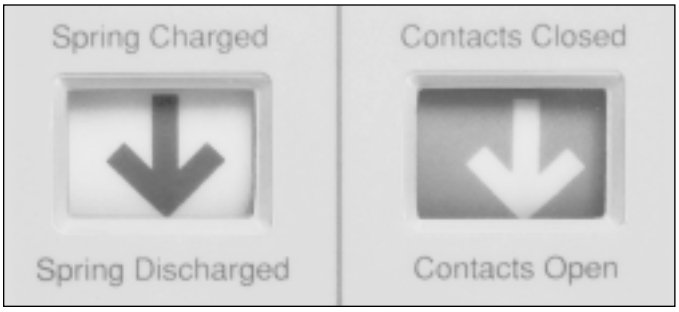


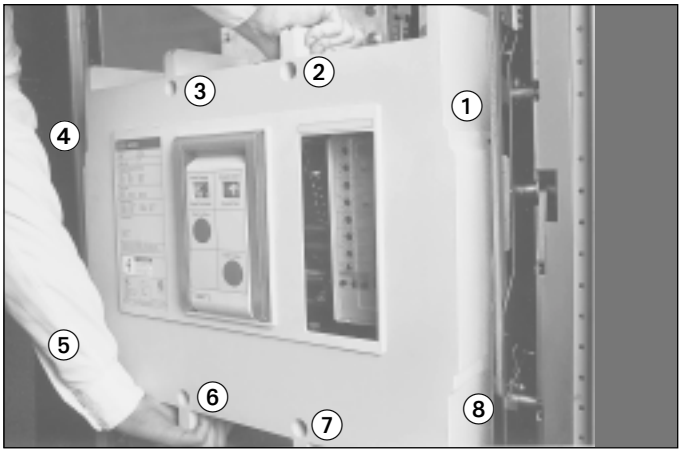
⚠ CAUTION

Do not attempt to install a trip unit with the breaker "Closed" or "Charged." Make certain breaker is "Open" or "Discharged" as shown above. Personal injury or mechanical damage may occur.

NOTE: When practical, the trip unit should be removed from the SB breaker when removing or inserting rating plug.

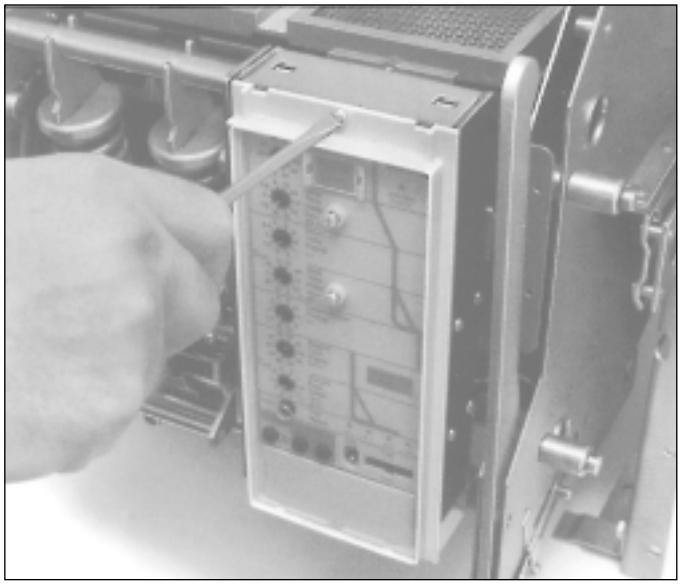
Removing Electronic Trip Unit from Breaker
Steps 1 through 3.

Before starting to remove the trip unit, set the breaker to the "Open" and "Discharged" positions. If the breaker is in the "Closed" position, the breaker will trip when the trip unit is removed.



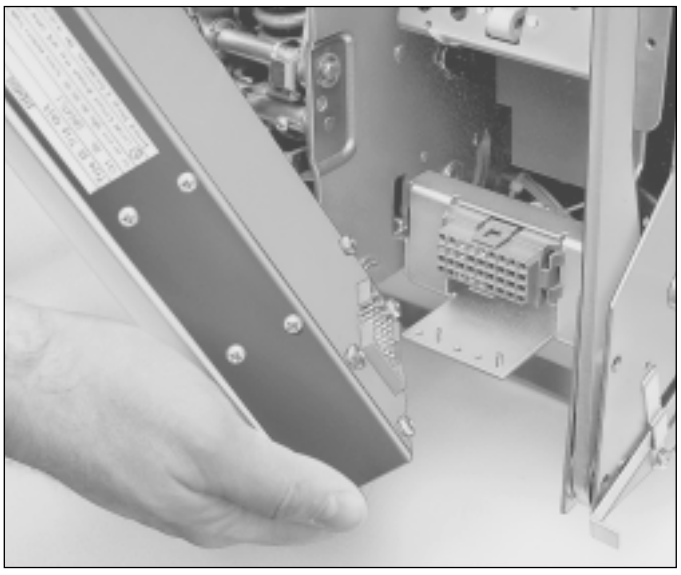
1. Remove 8 screws from breaker front cover and lift off.

To remove the trip unit the front cover of the breaker must first be removed. This is done by removing the four (4) recessed Phillips head screws in positions 2, 3, 6, and 7, along with the four (4) Phillips head screws in positions 1, 4, 5, and 8, which hold the front cover in place.



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. Remove the trip unit.



3. Remove the trip unit.

Rating Plug Installation – Insertion and Removal

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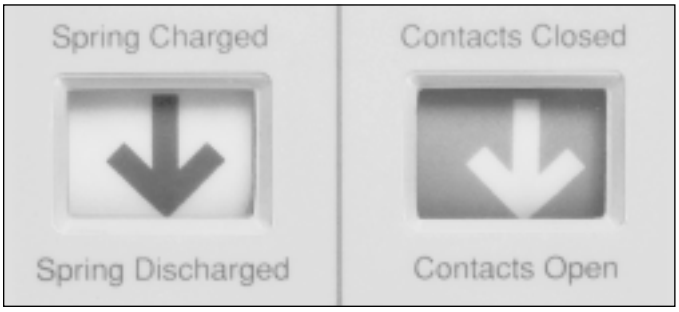
Replace the cover(s) and shield(s) before power supplying this device is turned on.



⚠ CAUTION

Do not attempt to remove a rating plug with the breaker "Closed". Make certain breaker is "Open" as shown above to prevent inadvertent interruption of service.

⚠ CAUTION

Do not attempt to force incorrect rating plug into trip unit.

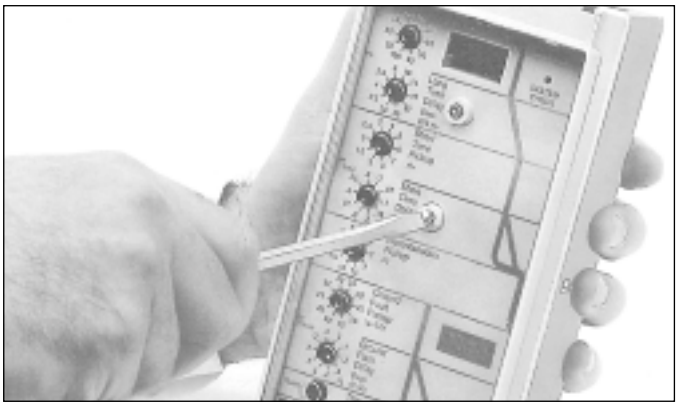
Inserting and Removing Rating Plug from Trip Unit
Steps 1 through 7.

Prior to inserting or removing a rating plug, check to see that the breaker is in the "Open" position. The breaker should always be in the "Open" position when a rating plug is not in the trip unit. The trip unit will default to the lowest possible settings if a rating plug is not installed.

To prevent the insertion of a rating plug into a trip unit for which it is not intended, the rating plug connector on the trip unit has been keyed to reject incorrect plugs.

1. Check label on the rating plug.

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

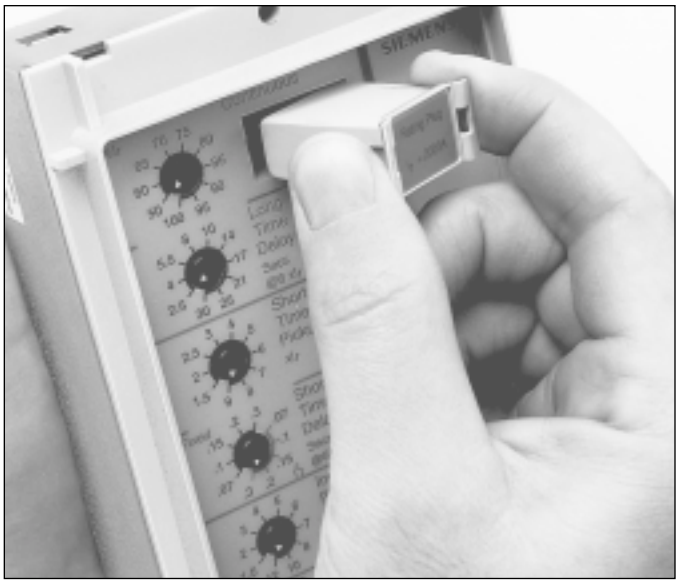


2. Remove two (2) retaining screws from the plexiglass cover.

Inserting and removing the rating plug requires the removal of the clear plexiglass cover. To remove the cover, unscrew the two screws that hold it in place, gently pry one end of the cover loose with a small screwdriver, and lift off.

3. Remove plexiglass cover.

Rating Plug Installation – Insertion and Removal



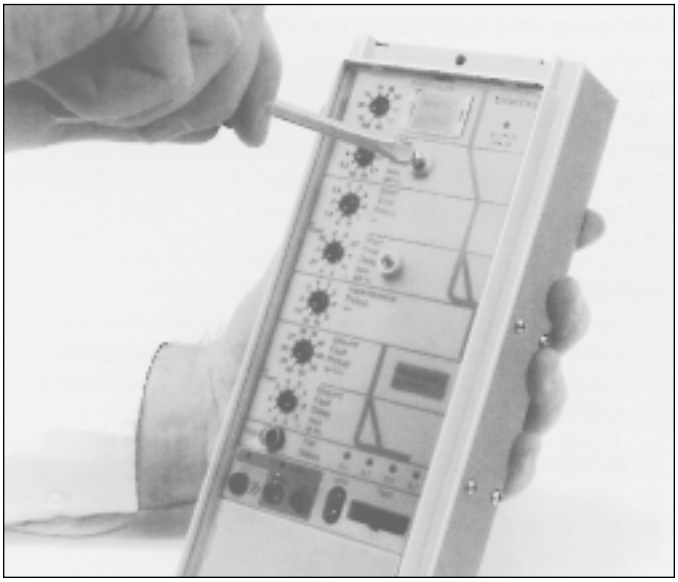
4. Squeeze plug clips to insert or remove from trip unit.

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 plug and the compression fit hold the plug in place, eliminating the need for screws or latches. The plug will "snap" into place without excessive force. Do not force the rating plug into place.

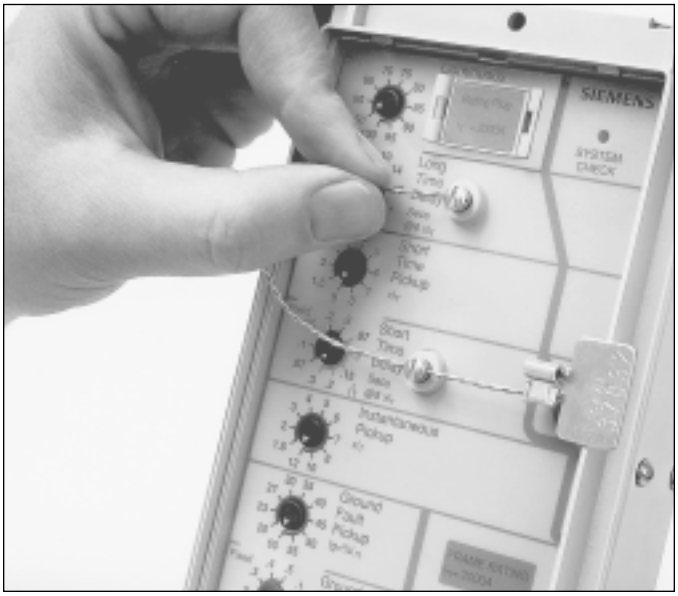
To **remove** a rating plug, squeeze the clips and pull the plug from the plug receptacle. Since the plug is held in place by compression, some force will be required to remove the plug. **Do not close** the breaker with the rating plug removed from the trip unit.

5. To replace the cover, bow slightly in the middle, and snap into place.

After the rating plug has been inserted and the necessary setting adjustments have been made (see Fault Protection Adjustments, pages 13-18), replace the cover by sliding the protective cover into the top lip of the trip unit, bow slightly in middle, and press down with thumb on bottom to snap cover into place. Replace the two (2) special retaining screws.



6. Replace two (2) screws retaining the plexiglass cover.



7. The cover may be sealed with a lead seal for tamper evident protection.

After the cover has been replaced, a wire may be inserted through the holes in the screws and secured with a meter seal. This will help prevent tampering.

Operations – Functions and Adjustments

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

Removing and Replacing the Plexiglass Cover
To remove the plexiglass cover, loosen the two screws that hold it in place and gently pry one end of the cover loose with a small screwdriver. After the rating plug has been installed and any necessary adjustments have been made, the cover must be replaced to prevent unauthorized adjustments. (See pages 10 and 11, steps 2, 3, 5, 6, and 7).

Electronic Trip Unit Functions
Displayed and accessible on the front panel of the trip unit are adjustments, switches, and indicators that are available to the user for local control, test, and monitoring. These include:

- System Check Indicator
- Fault Protection Adjustments
- Trip Query Switch and Indicators
- Integral Test Switches and Indicators
- Current Demand Indicators (Display Module Option)

Also accessible on the front panel is a receptacle for an external test set and power supply.

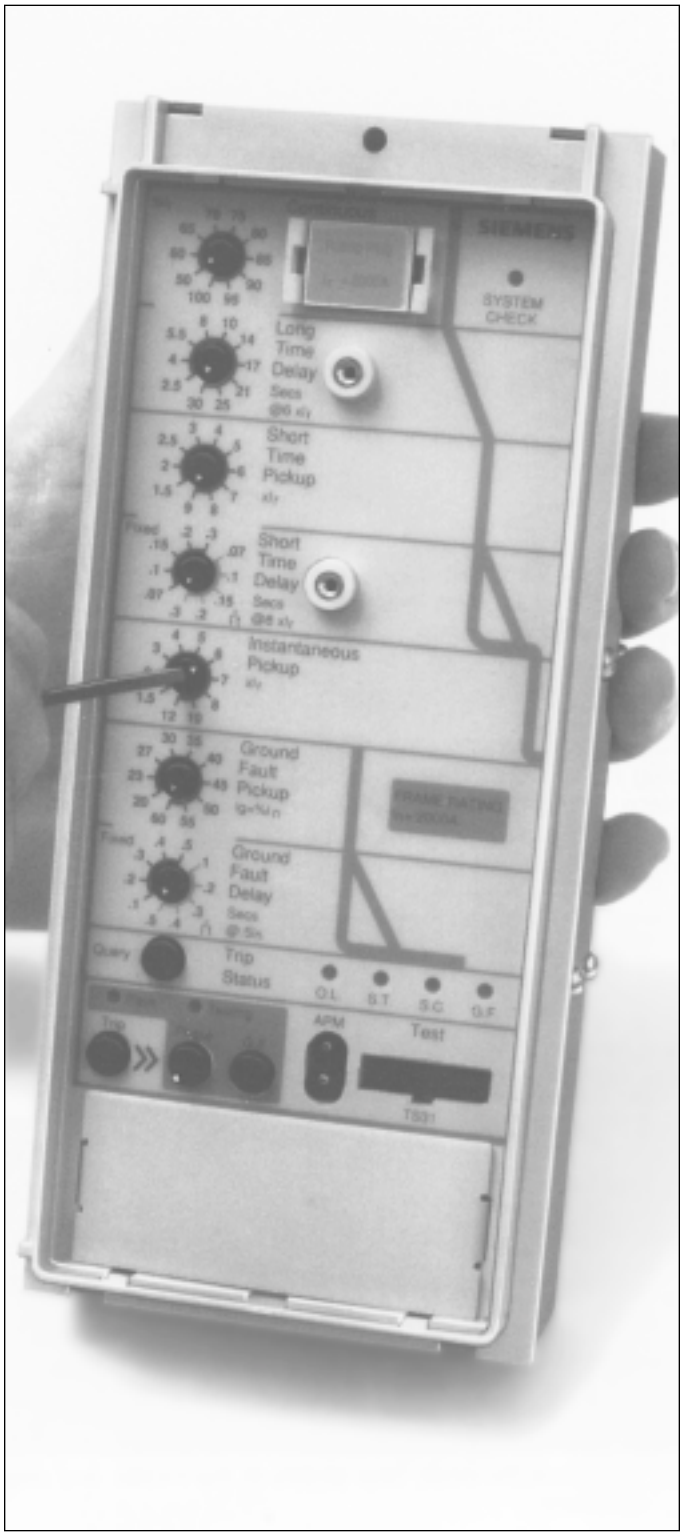
The trip unit has factory-installed capability for zone selective interlocking and communications for remote monitoring. These functions are accessible via the TS-31 test port.

Setting the Fault Protection Adjustments
The Electronic 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 by the user to make correct selections and settings.

To avoid potential nuisance tripping while changing settings, Siemens recommends that all adjustments be made with the SB breaker in the “Open” position.

To set an adjustment, place a slotted screwdriver onto the point-to-point adjustment switch and rotate the switch to the desired setting. The following figures and test illustrate and describe the fault protection adjustments.

All pick-up adjustments, except ground fault, are multiples of the rating plug value, I_n. Ground fault pick-up is a multiple of the MAX rating. All pick-up settings are RMS amperes or values.

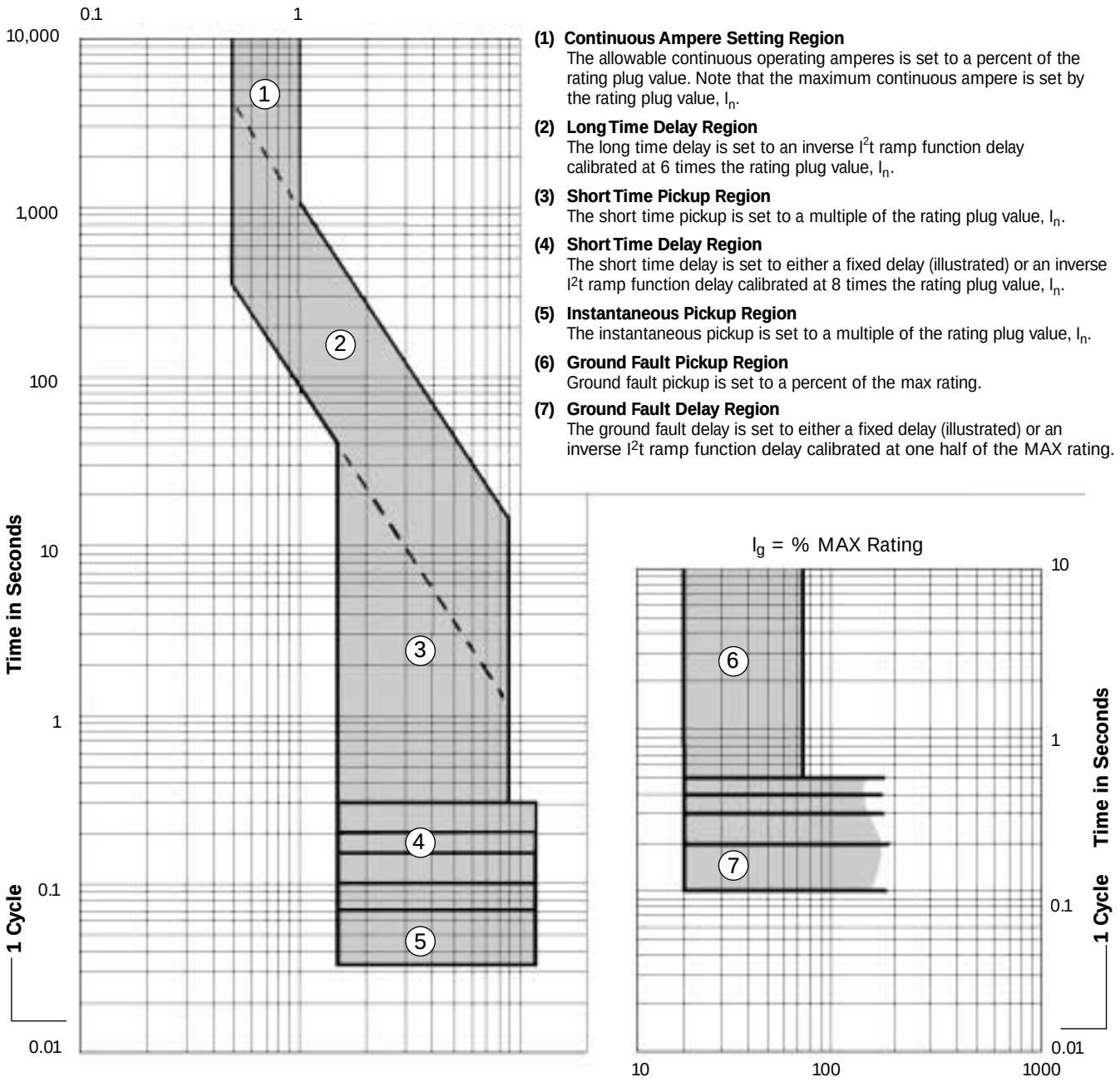


2000A Electronic Trip Unit adjustment panel with plexiglass cover removed and access adjustment switches shown.

Operations – Fault Protection Adjustments

Trip Unit Current Shaping Adjustments

(This curve is for illustration purposes only)



(1) Continuous Ampere Setting Region
The allowable continuous operating amperes is set to a percent 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.

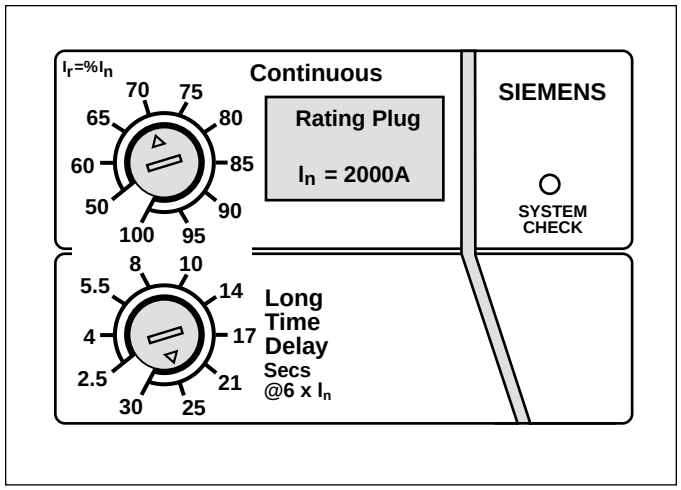
(5) Instantaneous Pickup Region
The instantaneous pickup is set to a multiple of the rating plug value, I_n.

(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 of the MAX rating.

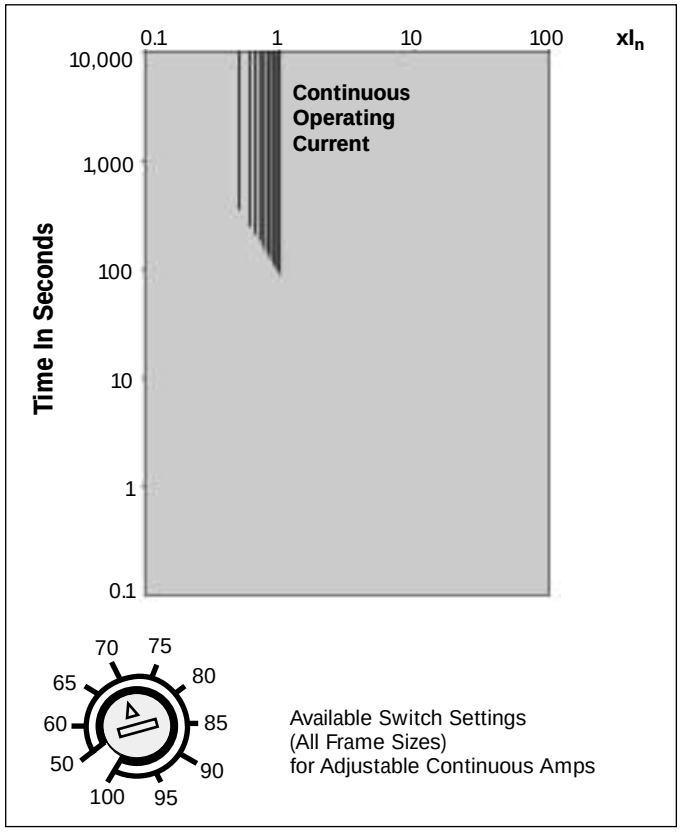
Operations – Long Time Fault Protection

Adjustable Continuous Amps and Adjustable Long Time Delay



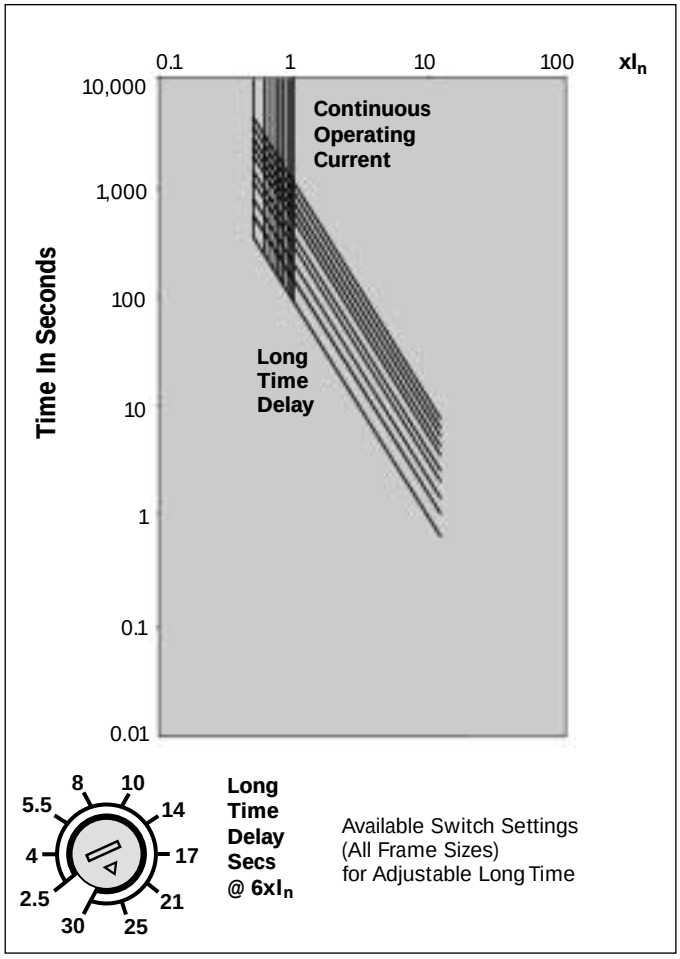
2000A Rating Plug Used for Illustrative Purposes Only

Adjustable Continuous Amps
The Continuous Ampere Adjustment sets the current level at which the breaker will continuously operate without initiating a tripping sequence. On Siemens Electronic Trip Units, the continuous operating current may be set to 50, 60, 65, 70, 75, 80, 85, 90, 95, and 100% of the rating plug value I_n.



Continuous Operating Current

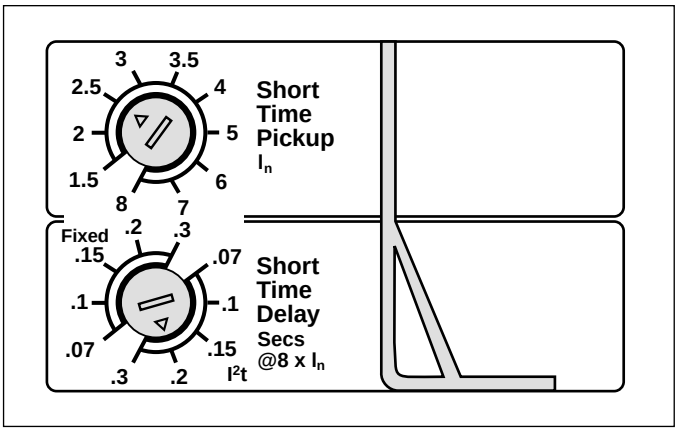
Adjustable Long Time Delay
The Long Time Pickup is nominally set at 115% of the continuous amps setting. The Long Time Delay adjustment is used to set the tripping delay of the SB breaker based on the magnitude of the overcurrent condition. On Siemens Electronic Trip Units, the long time delay, which is an inverse I^2t ramp function, may be set to a calibrated value of 2.5, 4, 5.5, 8, 10, 14, 17, 21, 25, or 30 seconds at a current equal to 6 times I_n.



Long Time Delay

Operations – Short Time Fault Protection

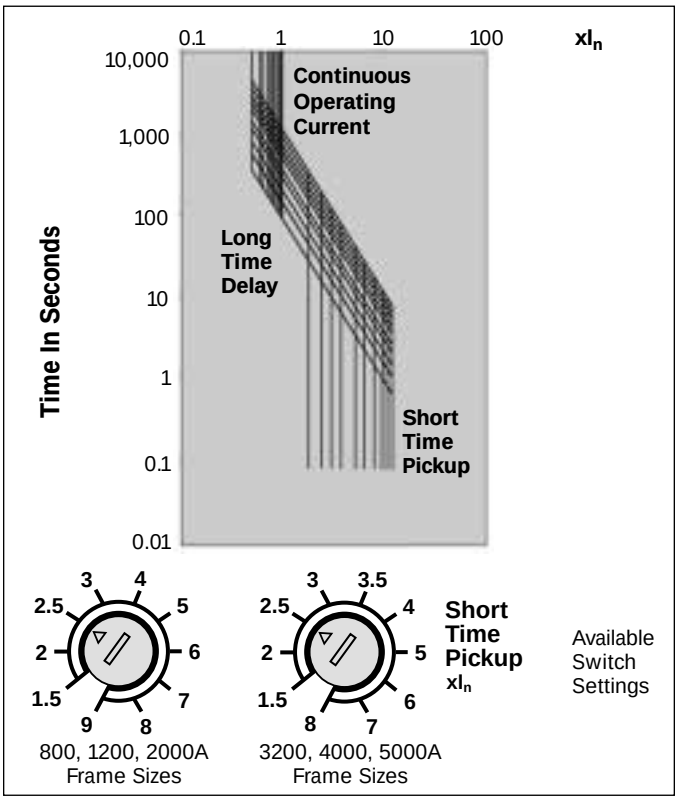
Adjustable Short Time Pickup and Adjustable Short Time Delay



800 – 2000A Short Time Pickup for Illustrative Purposes

Adjustable Short Time Pickup

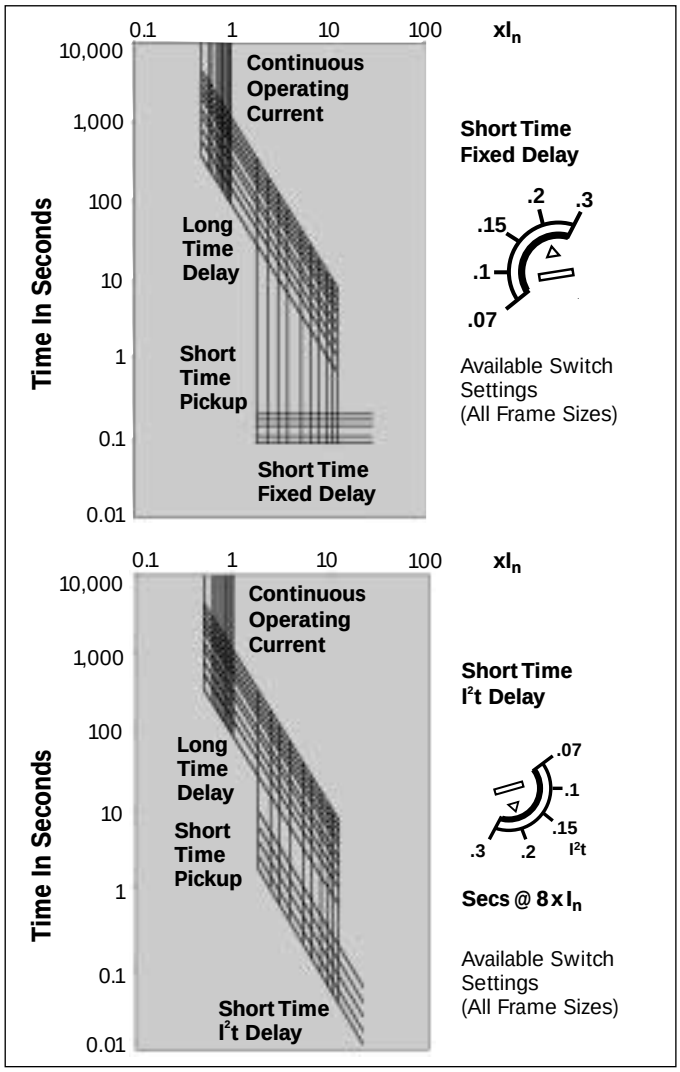
The Short Time Pickup adjustment is used to set the level of high current the breaker will carry for a short period of time without tripping. This adjustment, together with the Short Time Delay, allows downstream breakers time to clear short circuit faults without tripping the upstream breakers. On trip units for 800, 1200, and 2000A SB breaker sizes, Short Time Pickup may be set to 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, or 9 times I_n. On trip units for 3200, 4000, and 5000A frame sizes, Short Time Pickup may be set to 1.5, 2, 2.5, 3, 3.5, 4, 5, 6, 7, or 8 times I_n.



Short Time Pickup

Adjustable Short Time Delay

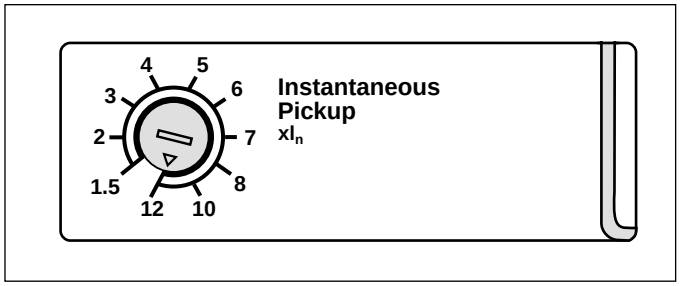
The Short Time Delay adjustment is used to set the time interval the breaker will wait before responding to the current value selected on the Short Time Pickup adjustment. There are two modes of operation of this adjustment on all Siemens Electronic Trip Units; one is a fixed delay, the other is an inverse I^2t ramp delay. The I^2t 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 allows for 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, 0.1, 0.15, 0.2, or 0.3 seconds at a current equal to 8 times I_n.



Short Time Delay

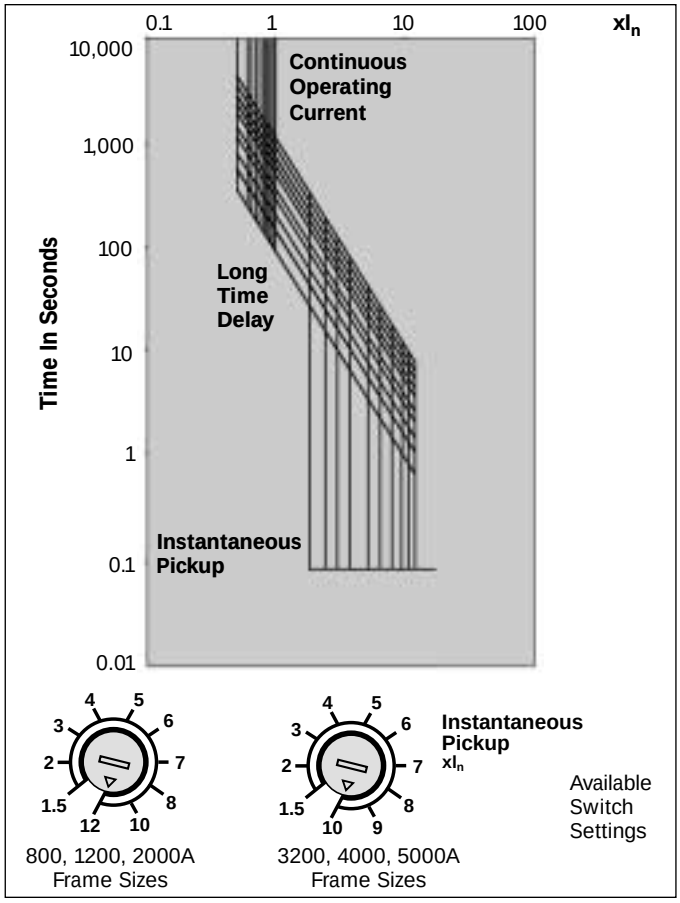
Operations – Instantaneous Fault Protection

Adjustable Instantaneous Pickup



800 – 2000A Instantaneous Pickup for Illustrative Purposes

Adjustable Instantaneous Pickup
The Instantaneous Pickup adjustment is used to set the current level at which the breaker will trip without an intentional time delay. Non-delayed tripping, as a result of a severe overcurrent condition, minimizes potential damage to electrical systems and equipment. On trip units for 800, 1200, and 2000A SB breaker sizes, Instantaneous Pickup adjustment may be set to 1.5, 2, 3, 4, 5, 6, 7, 8, 10, or 12 times I_n. On trip units for 3200, 4000, and 5000A frame sizes, Instantaneous Pickup adjustment may be set to 1.5, 2, 3, 4, 5, 6, 7, 8, 9, or 10 times I_n.

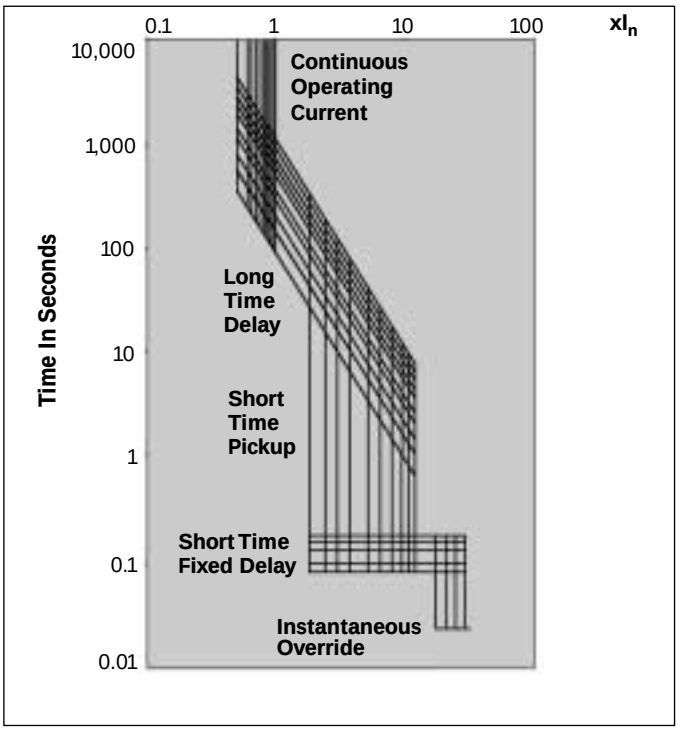


Instantaneous Pickup

Instantaneous Override
On all trip units, an instantaneous override function has been provided. It is set nominally at the short time rating of the respective breaker frame size. This allows the breaker to ride through high faults up to its short time capability; however, it is self-protecting above these values.

Breaker Frame Size	Short Time kA Rating (t=0.5 seconds)
1200A	25
2000A	35
3200A	50
5000A	65

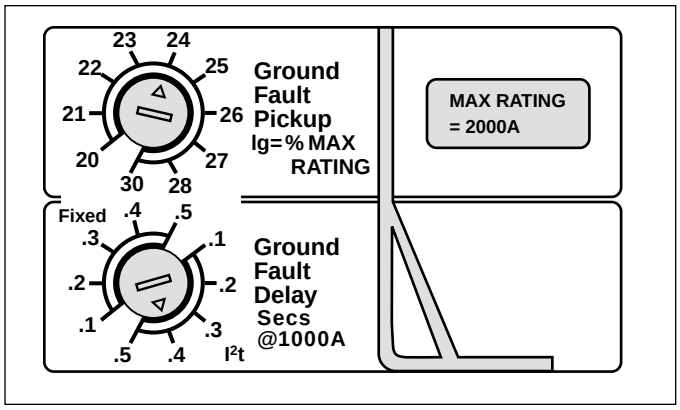
Discriminator Circuit (Making Current Release)
This circuit overrides the short time delay function should the breaker attempt to close into a faulted system, tripping the breaker instantaneously. This discriminatory function is enabled for the first 6 cycles of current flow, after which normal short time characteristics operate.



Instantaneous Override (Illustrated with Short Time Fixed Delay)

Operations – Ground Fault Protection

Adjustable Ground Fault Pickup and Adjustable Ground Fault Delay



Adjustable Ground Fault Pickup
The Ground Fault Pickup adjustment is used to set the level of ground current at which circuit interruption will be initiated. Together with the Ground Fault Delay, this adjustment allows selective tripping between main and feeder or other downstream breakers. The available ground fault pickup settings as a percent of the SB breaker MAX ampere rating are listed below. In compliance with the National Electric Code (NEC 230-95), no trip point setting exceeds 1200A.

MAX Rating	Available Setting = %MAX Rating									
400A	20	25	30	40	50	60	70	80	90	100
800A	20	25	30	40	50	60	70	80	90	100
1200A	20	25	30	40	50	60	70	80	90	100
1600A	20	26	32	38	44	50	56	62	68	75
2000A	20	23	27	30	35	40	45	50	55	60
2500A	20	23	26	29	32	35	38	41	44	48
3200A	20	21	23	25	27	29	31	33	35	37
4000A	20	21	22	23	24	25	26	27	28	30
5000A	– – – (SETTING FIXED AT 1200A) – – –									

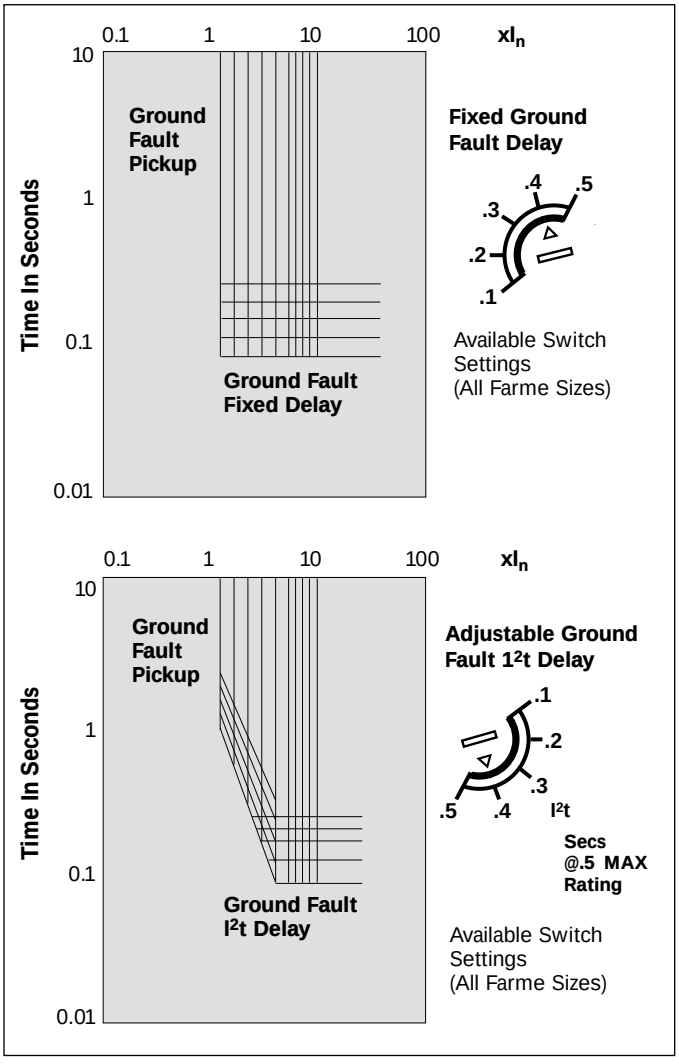
Adjustable Ground Fault Delay
The Ground Fault Delay adjustment is used to set the time interval the breaker will wait before responding once the ground fault pickup level has been reached. There are two modes of operation for this adjustment for Siemens Electronic Trip Units; one is a fixed delay and the other is 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.

Ground Fault Memory Circuit
Electronic Trip Units with ground fault protection come equipped with a ground fault memory circuit. This circuit integrates ground fault currents with time. This provides added protection by preventing ground fault delay circuits from being reset to zero when the ground fault currents are intermittent and erratic. Time constants for the current integration are preset within the unit as a function of the Ground Fault Delay.

Ground Fault Sensing Schemes
The trip unit can be configured to accommodate the following ground fault sensing schemes:

- 3-Phase, 3-Wire Residual
- 3-Phase, 4-Wire Residual
- Source Ground

All that is required of the user to configure the trip unit to support these protection schemes is to set the ground fault selection switch to the desired configuration. The selection switch is on the right side of newer version trip units and the left side of earlier versions. The selection switch must be set prior to the trip unit being installed in the SB breaker.



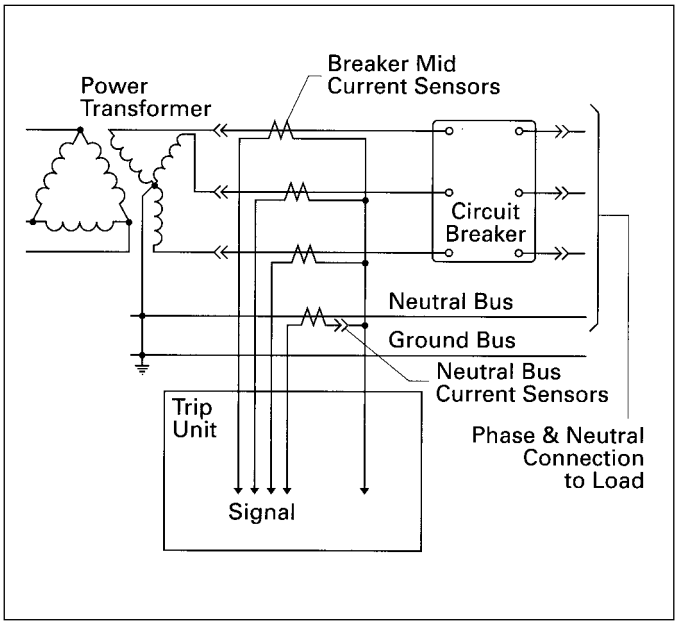
Ground Fault Delay

Ground Fault Sensing Scheme

The following are brief descriptions of the ground fault sensing schemes as they relate to the Siemens Electronic 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."

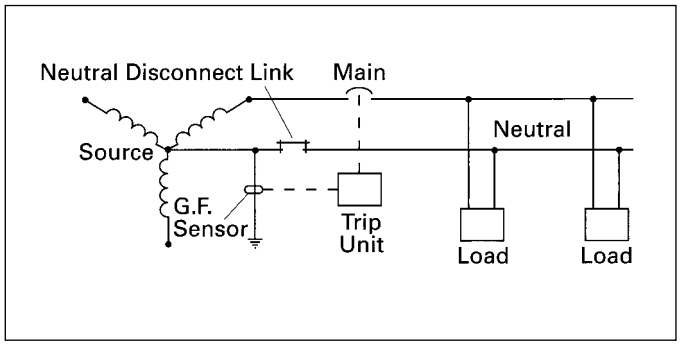
Residual (3-Phase, 3-Wire): Under normal system conditions (without ground fault), the vector sum of the phase currents being monitored by the trip unit is zero. This is also true under the condition of an overcurrent phase-to-phase fault and phase-unbalance condition. When a phase-to-ground fault occurs, the 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 in the execution of the ground fault protection function. The trip unit utilizes the internal breaker current transformers. No external current transformers are required.

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 equals the neutral current. 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 phase currents no longer equals the neutral current. This current differential is detected by the trip unit and used in the execution of the ground fault protection function.

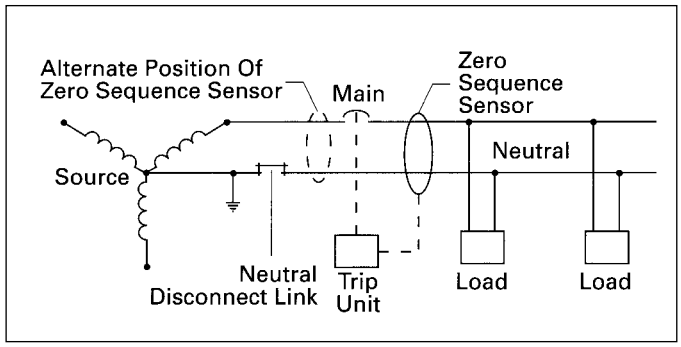


Residual Sensing: Circuit Breaker Wiring for Ground Protection (3-Phase, 4-Wire System Shown)

Source Ground: In this scheme, the phase currents are not used in detecting and processing 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.



Source Ground Current

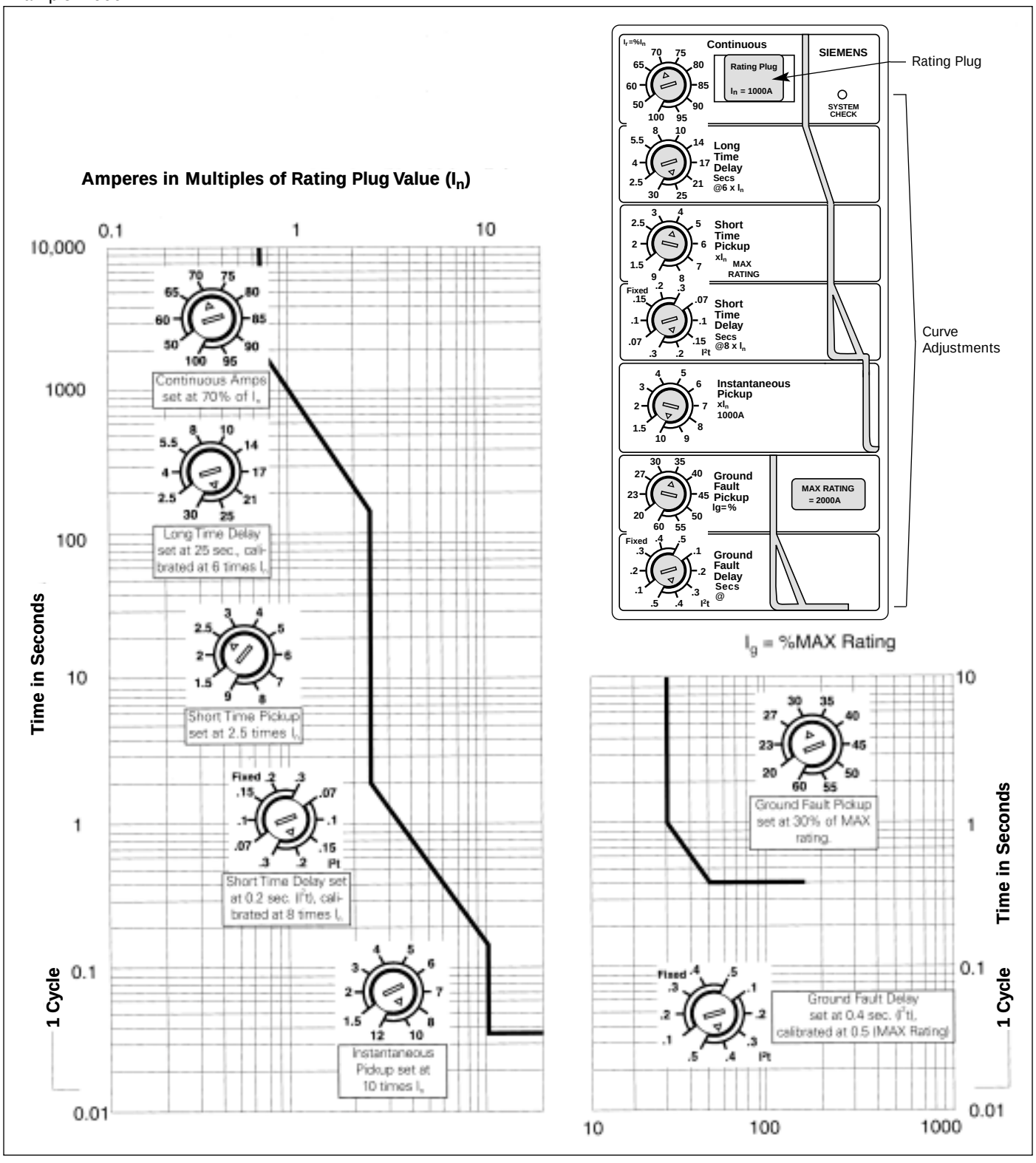


Zero Sequence Ground Fault Protection

Operations – Example Time Current Curve

Type SB Breaker Frame Time Current Curve

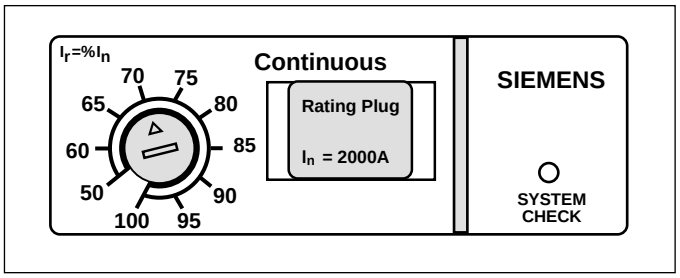
Example: 2000A



Part Three – Monitoring the Electronic Trip Unit

Trip Unit Test and Monitoring Functions
Siemens Electronic Trip Unit is equipped with three standard test and monitoring functions to aid the user in the installation and operation of the SB breaker.

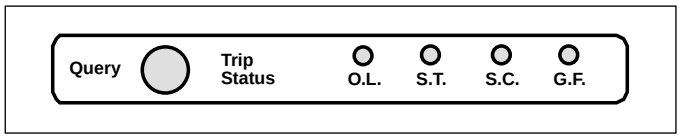
System Check Indicator



The System Check Indicator is a green LED that blinks approximately once every three seconds when the microprocessor is correctly cycling through its protection routines.

The trip unit derives its operating power from the phase currents in the SB breaker. The phase current required to operate the trip unit is approximately 20% of the MAX rating. If the microprocessor is not correctly cycling through its protection routines, the phase current is below 20% (MAX rating), the LED will not light.

Trip Status



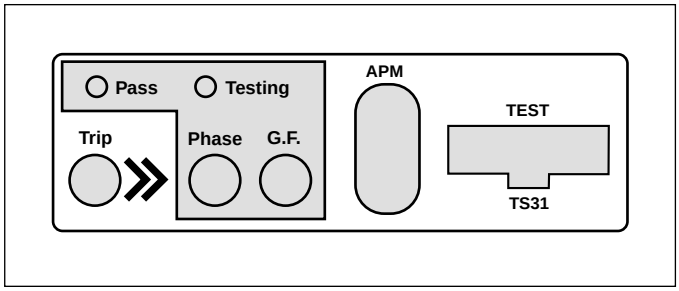
NOTE: A Trip Status Reset Button is provided on newer version trip units.
The trip Query button and Trip Status indicator lights provide the user the means for determining what type of fault caused the trip unit to trip the breaker. Fault indicators are provided for:

O.L. — Overload or Long Time Fault
S.T. — Short Time Fault
S.C. — Short Circuit or Instantaneous Fault
G.F. — Ground Fault

When a fault occurs, the fault information is stored in the trip unit by latching the appropriate red LED fault indicator to the "On" position. When the Query button is depressed, the latched fault indicator will light. The electrical power to the indicators is automatically stored in the trip unit, eliminating the need for a battery pack. A hole is provided in the transparent cover to allow the user access to the Query button.

NOTE: During trip unit power up, the S.C. fault indicator LED will latch, providing a means to check that the circuitry is correctly operating. In case of a fault, the correct indicator will be latched to the fault position. The indicator circuitry will latch the most recent event. Newer version trip inits feature a Trip Status LED Reset Button.

Integral Test Modes



The integral test function enables the user to "exercise" the trip unit electronics, the magnetic latch, and the breaker mechanism. The purpose of the integral test function is to provide the user an easy means to conduct a "go/no go" type test before bringing the breaker online. After the breaker has been brought on-line, it may be used during routine inspection and maintenance.

Both phase fault current protection and ground fault current protection may be tested. The integral ground fault test function tests the circuit breaker's ground fault protection system in accordance with NEC Article 230-95(c).

Electrical power to operate the integral test function is provided internally, if the breaker is closed and the phase currents are greater than 20% of the MAX rating, or by a plug-in power source (see Accessories section).

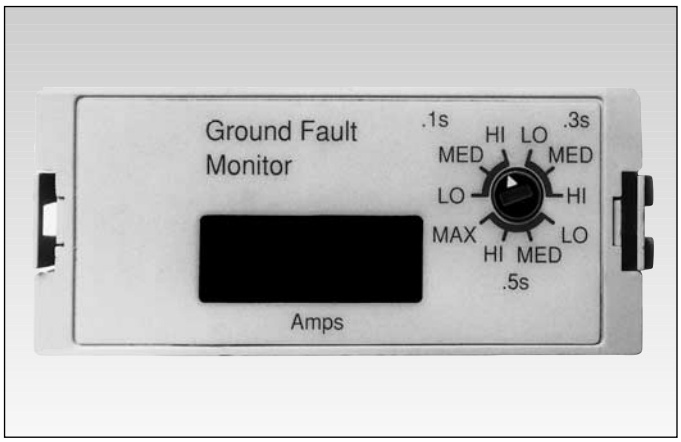
The user may execute the test function in either a "no trip" mode, which will test only the trip unit electronics, or a "trip" mode, which will also test the magnetic latch and breaker mechanism. The execution of the integral test function in both the "no trip" and "trip" modes is based on the settings of the long time delay and ground fault delay adjustments. Therefore, the Phase Test will take several seconds to execute and the Ground Fault Test will appear to be nearly instantaneous. To execute a test function in the "no trip" mode, depress the appropriate pushbutton test switch, **Phase** or **GF**. As the trip unit is performing the test, the **Testing** Indicator will light. If the trip unit successfully passes the test, the **Pass** Indicator will light. If the Pass Indicator does not light after the Testing Indicator indicates that the test is complete, a more extensive test should be run with Siemens TS-31 Universal Test Kit (see Accessories).

⚠ CAUTION

Before doing a "Trip" test on a SB Breaker which is "Closed" and in service, caution should be taken to evaluate effects on downstream loads. Breaker will open during test, resulting in a disruption of service.

External Accessories

Ground Fault Monitor



Ground Fault Monitor

Ground Fault Monitor
The Ground Fault Monitor (GFM) is an optional module that allows the user to locally monitor the ground fault current and can be used in trip units with or without the integral ground fault protection function. Trip units with the integral ground fault protection function are identified by a "G" in the catalog number and the presence of ground fault adjustments on the face of the trip unit. If the trip unit is equipped with ground fault protection, the Ground Fault Monitor utilizes the same ground fault sensing method as the electronic trip unit. If the trip unit is not equipped with ground fault protection, then the GFM uses a residual ground fault sensing method. The Ground Fault Monitor works independently from the trip unit's ground fault protection.

Ground Fault Monitor Settings
There are three ground fault pickup levels offered on the Ground Fault Monitor:

"LO" equals 20% of the frame rating.

"HI" equals the MAX rating of 1200A, whichever is less.

"MED" equals the average of "LO" and "HI" pickup levels.

The ground fault delays are divided into three fixed time delay bands: 0.1, 0.3, and 0.5 seconds. The "MAX" setting is defined as a 1200A pickup and 0.5 second delay.

Display
The Ground Fault Monitor displays the ground fault current in amps. When the ground fault current reaches a level of 12% below the selected pickup setting, the amps display will start to flash. Then the ground setting, the display will flash "-OL-" for overload and the alarm line will be set to its "ON" state.

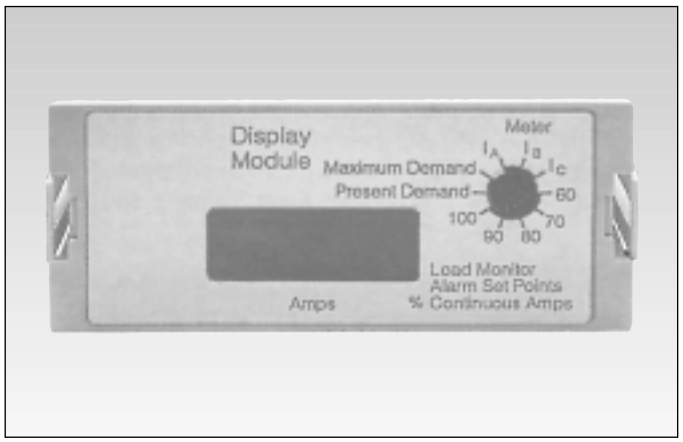
Remote Interface
The Ground Fault Monitor can be utilized with a Display Module Relay, a Bell Alarm and Alarm Relay Combination Module, (mounted inside the breaker) or a Remote Indicator Panel (externally-mounted) to provide a set of relay contacts for ground fault alarm. When used in conjunction with either of these devices and a Shunt Trip, the Ground Fault Monitor can be used as Ground Fault Sensing and Relaying Equipment per UL-1053. For more information, see the Installation Instructions for the Ground Fault Sensing and Relaying System.

Also, note that if the Ground Fault Monitor is removed while the circuit breaker is powered up the alarm line will be set to its' "ON" state.

NOTE: Option for Ground Fault Detection and Alarm without tripping in accordance with NEC Article 700 Section 700-26 is available. Consult Siemens Sales Office for further information.

External Accessories

Display Module



Display Module

Display Module
The Display Module provides features for allowing the user to locally monitor the phase currents. The switch to set and select the display is accessible to the user through a hole in the transparent cover of the trip unit.

Maximum Current Demand
This feature provides a display of the maximum current demand since the unit was last reset. The unit is reset by depressing both the phase and ground fault test pushbuttons simultaneously. Phase and ground fault pushbuttons are located on the SB Electronic Trip Unit in the integral testing section.

Present Current Demand
This feature provides a display of the present current demands. The present current demands are calculated, averaged over thirty (30) minute intervals. The user may display the most recent stored values by setting the switch to the present demand position for the 30-minute interval.

Local Monitor Relay
This feature provides a local alarm display and an output signal for an external alarm when the average of the phase currents exceeds the alarm set point. The display automatically resets itself when the alarm condition ceases. The output alarm signal is a 5V DC level. The signal may be used to display an alarm on a remote indication panel or by using an internal Systems Breaker Modular Relay (SBDMR) or (SBBADMR). Alarm set point may be set to 60, 70, 80, 90, or 100% of the continuous current setting.

Local Current Meter
This feature provides a local display of the present 3-phase currents. The user may display the current value by setting the switch to the I_A, I_B, or I_C positions.

Before installing the display module, the breaker should be placed in the open position.

The display is a plug-in unit. To install the module:

1. Remove the trip unit's transparent cover.

2. Remove cover from the display module receptacle.

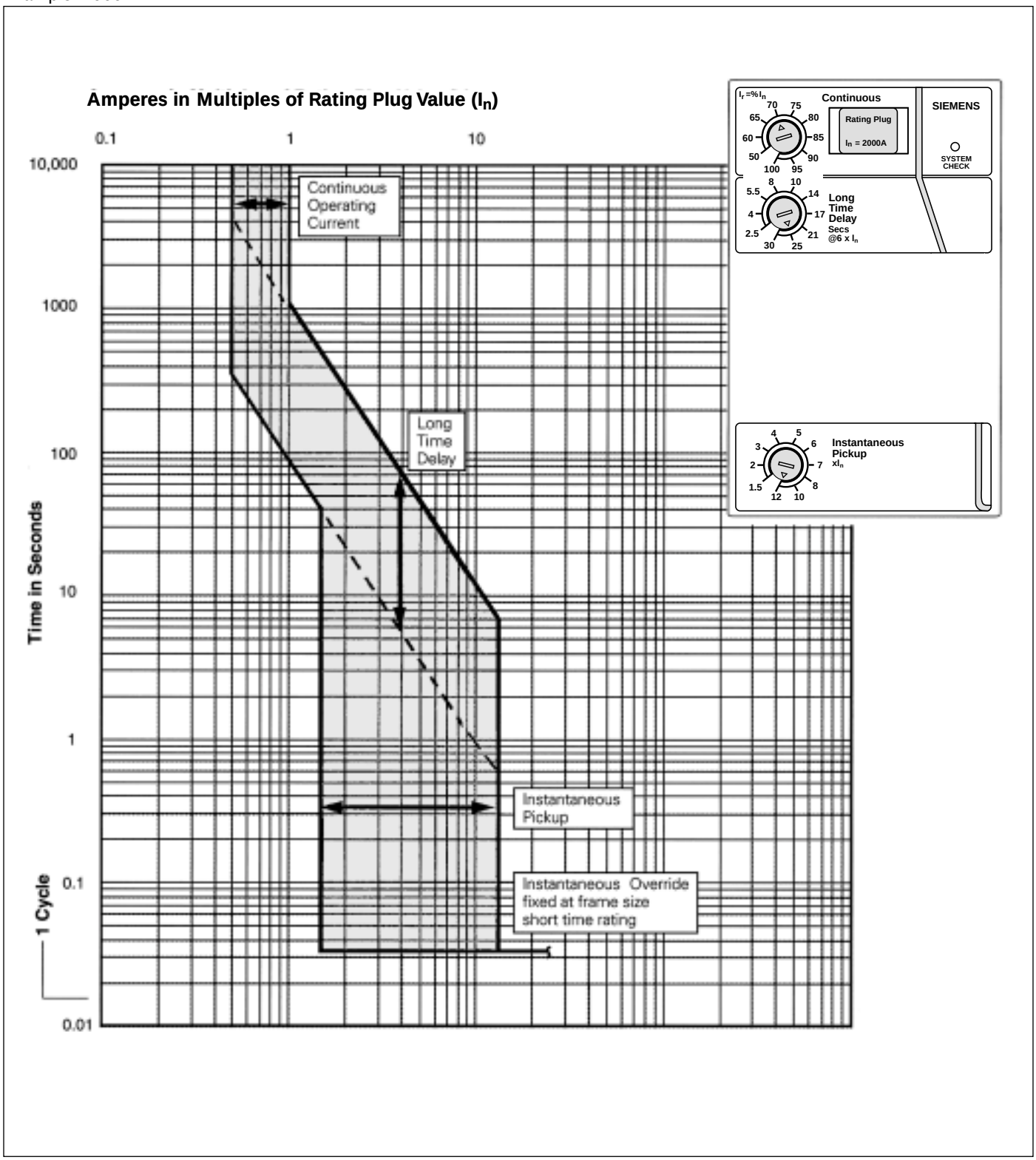
3. Insert the module into the receptacle.

4. Replace and seal the transparent cover.

Time Current Characteristic Curve

Long Time / Instantaneous Protection Configuration

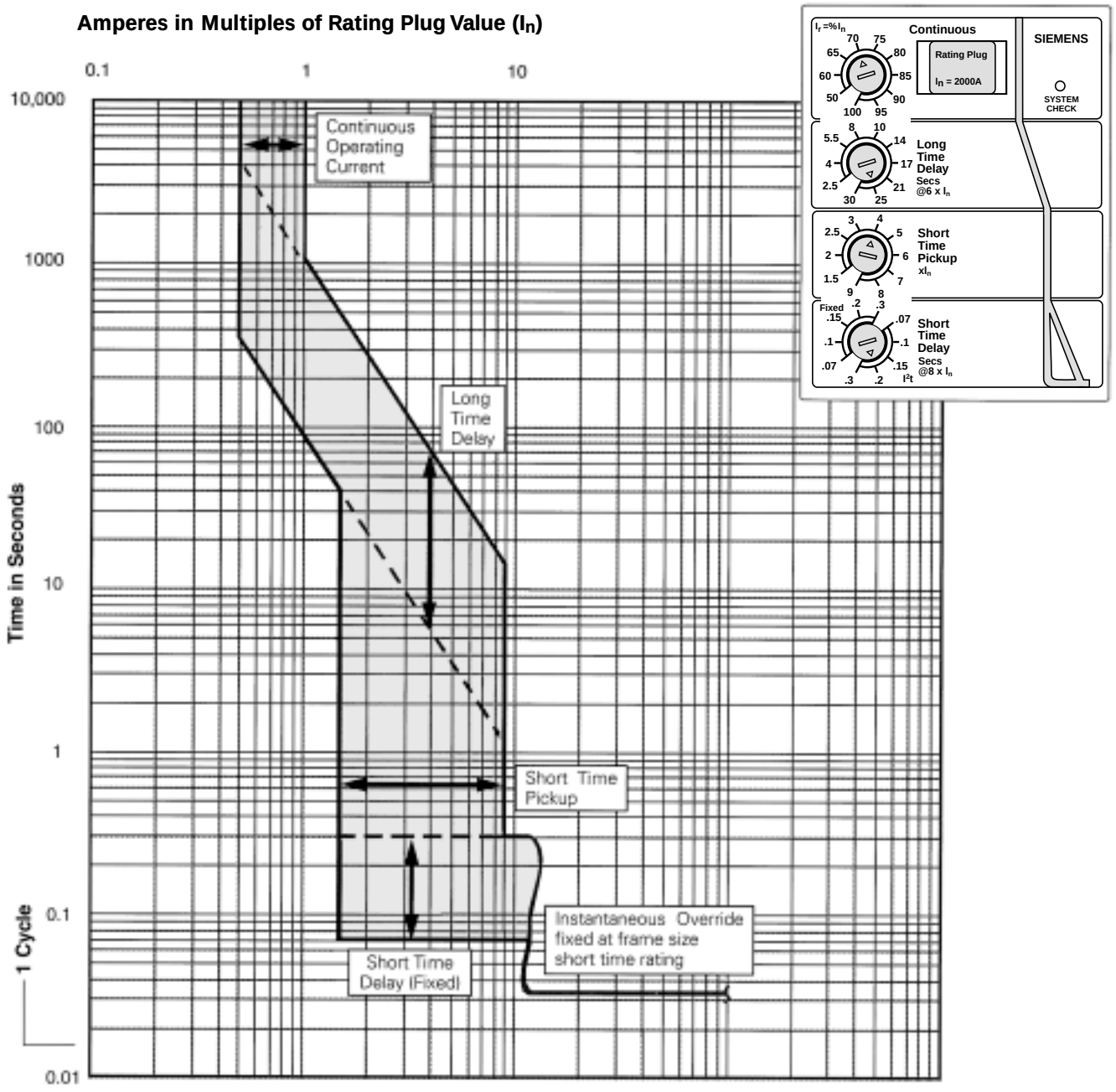
Example: 2000A



Time Current Characteristic Curve

Long Time / Short Time (Fixed Delay) Protection Configuration

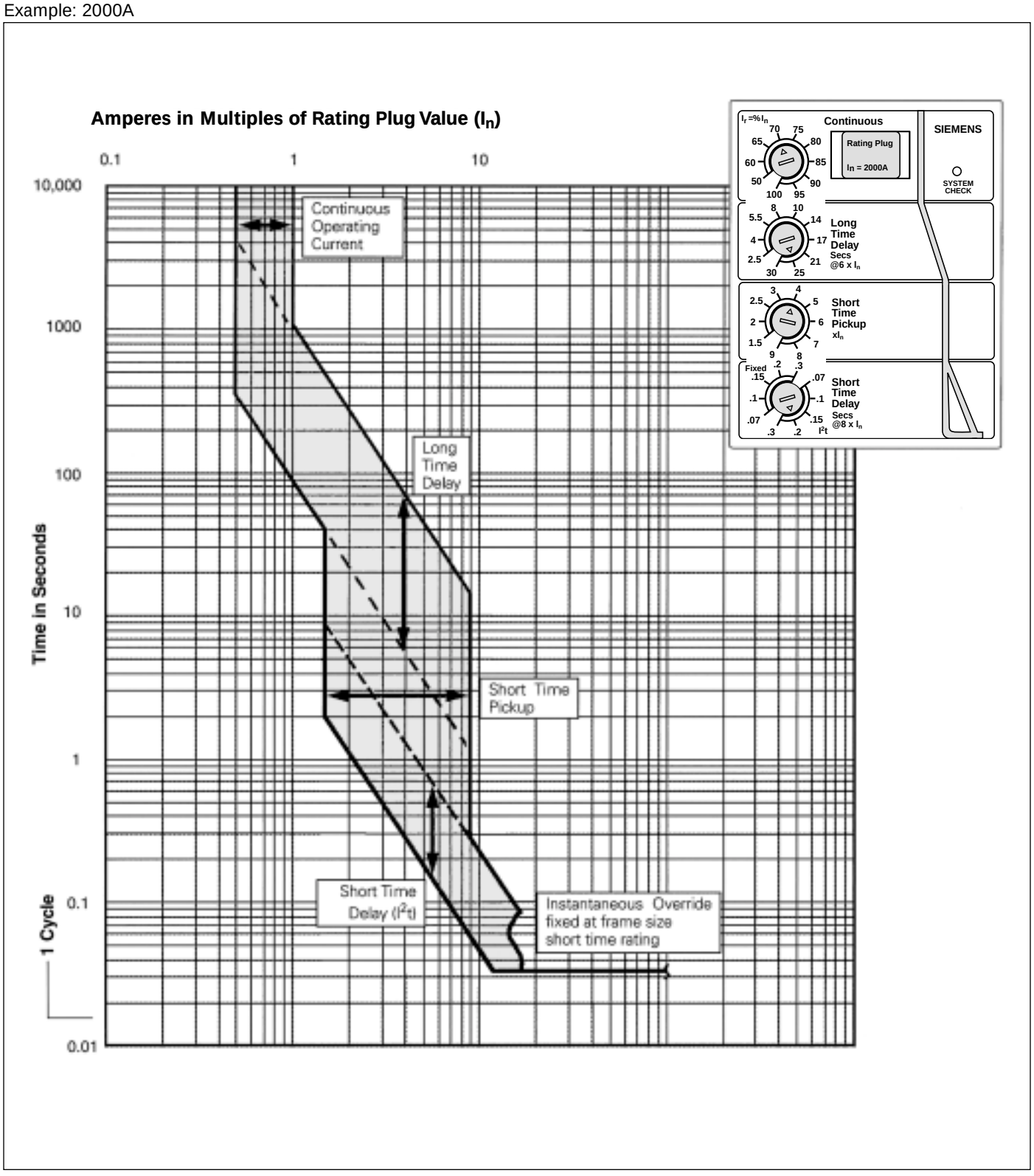
Example: 2000A



Time Current Characteristic Curve

Long Time / Short Time (I^2t Delay) Protection Configuration

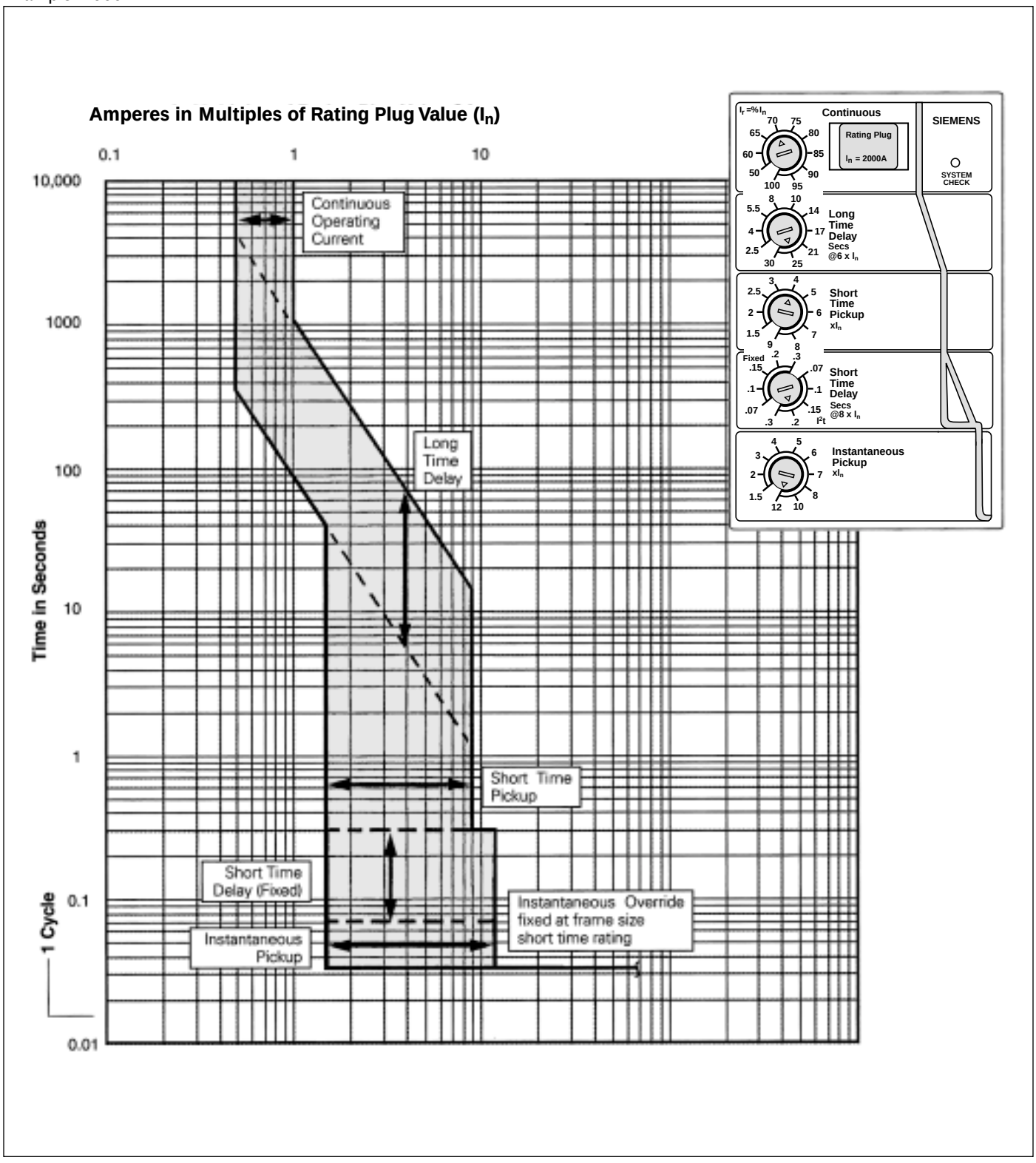
Example: 2000A



Time Current Characteristic Curve

Long Time / Short Time (Fixed Delay) / Instantaneous Protection Configuration

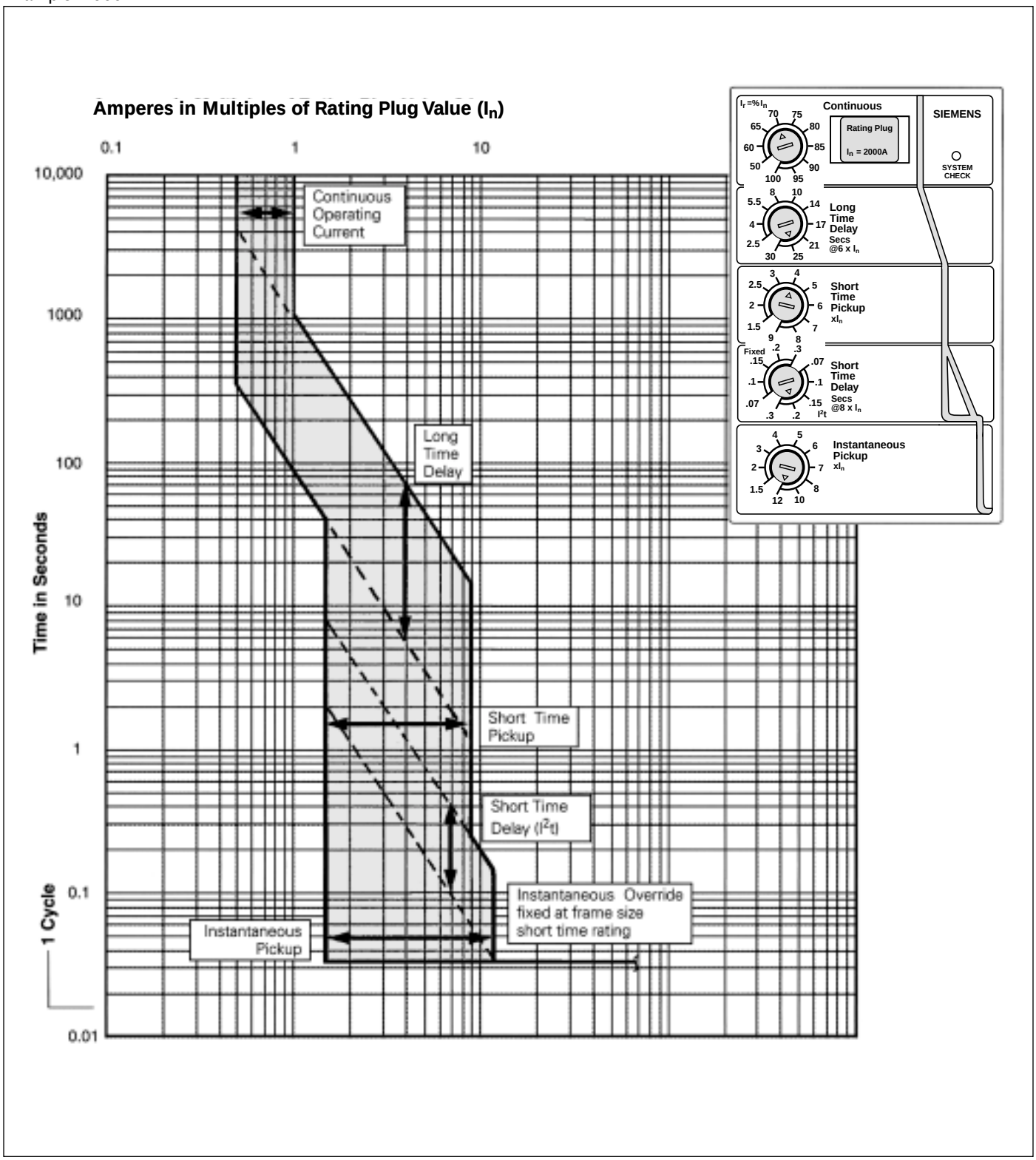
Example: 2000A



Time Current Characteristic Curve

Long Time / Short Time (I^2t Delay) / Instantaneous Protection Configuration

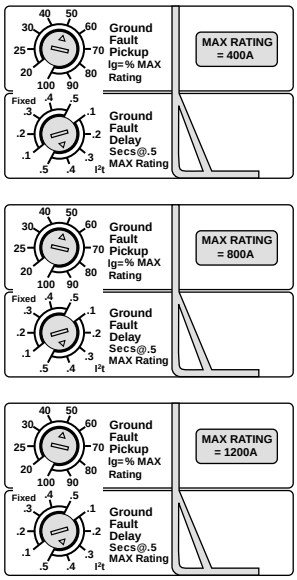
Example: 2000A

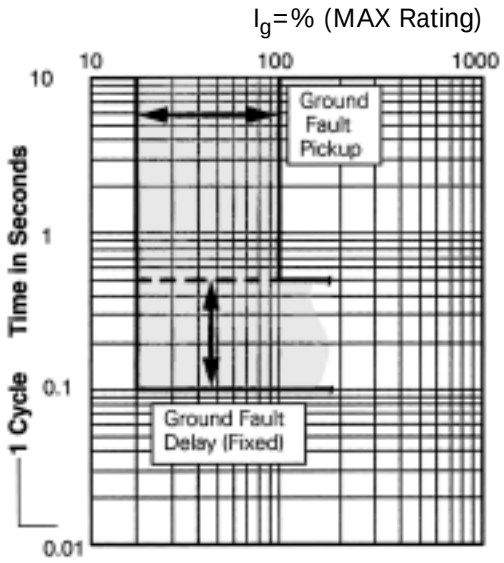


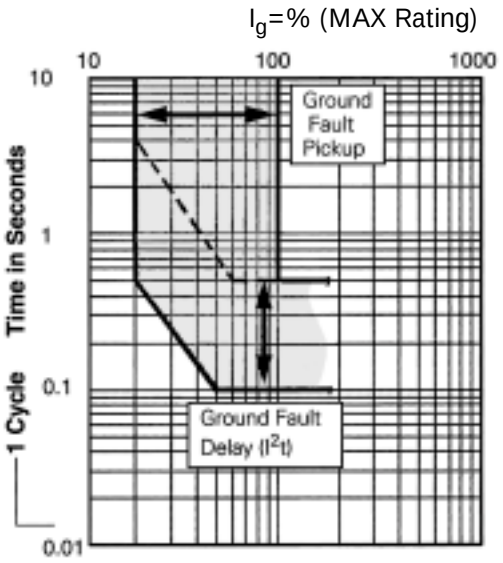
Time Current Characteristic Curve

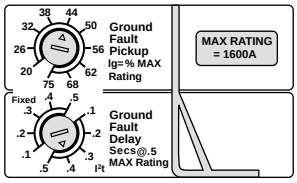
Ground Fault Protection

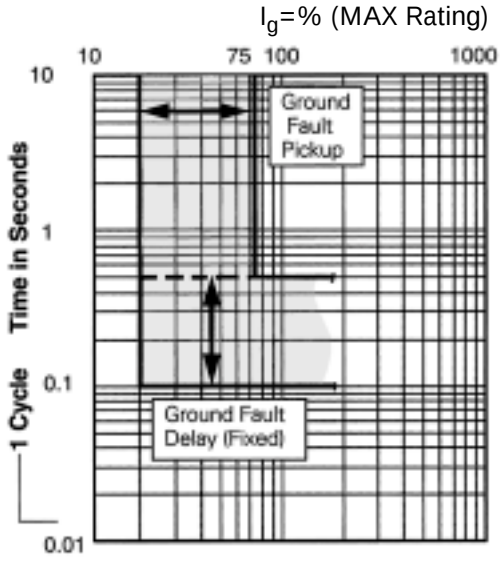
400A, 800A, 1200A, and 1600A

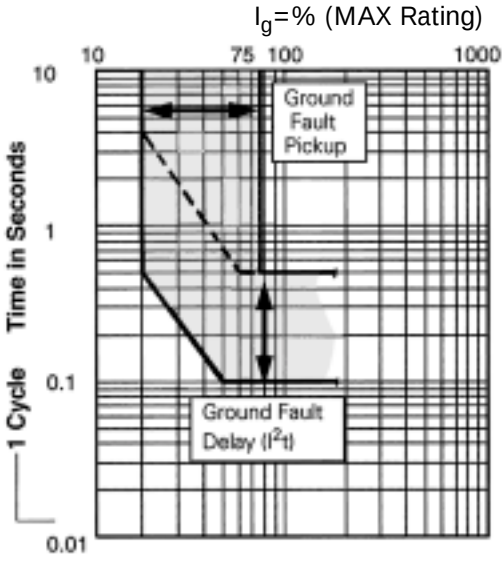








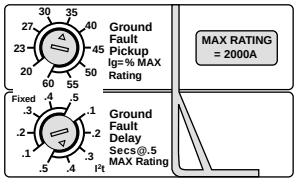




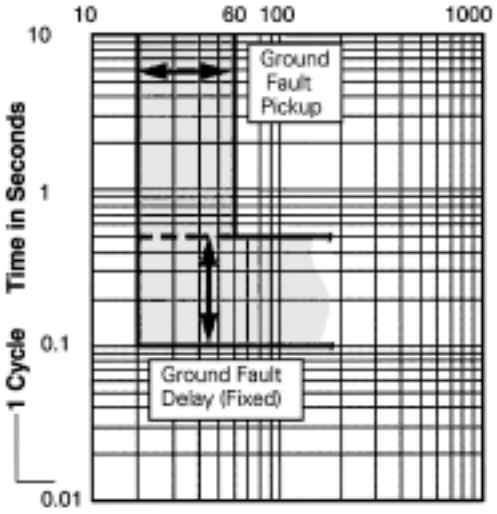
Time Current Characteristic Curve

Ground Fault Protection

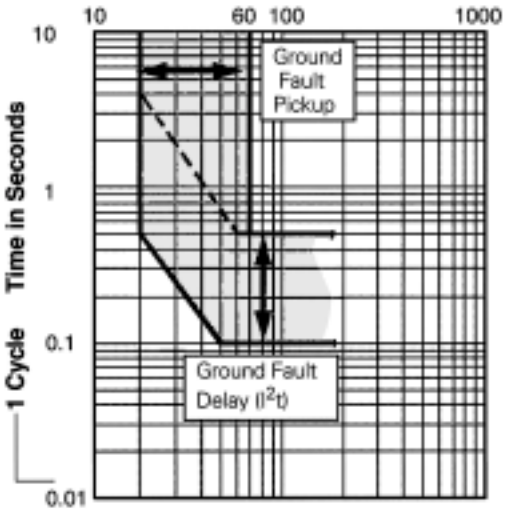
2000A and 2500A

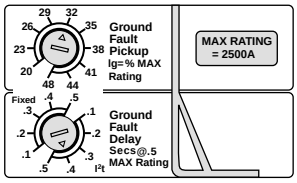


I_g=% (MAX Rating)

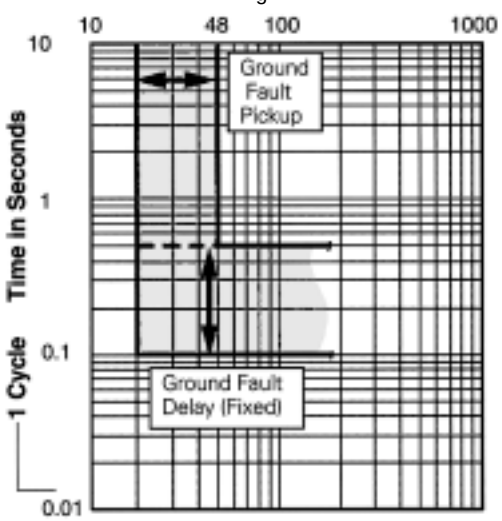


I_g=% (MAX Rating)

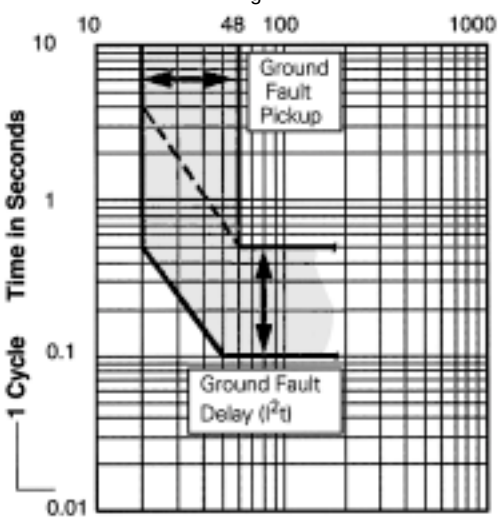




I_g=% (MAX Rating)



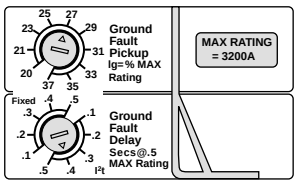
I_g=% (MAX Rating)



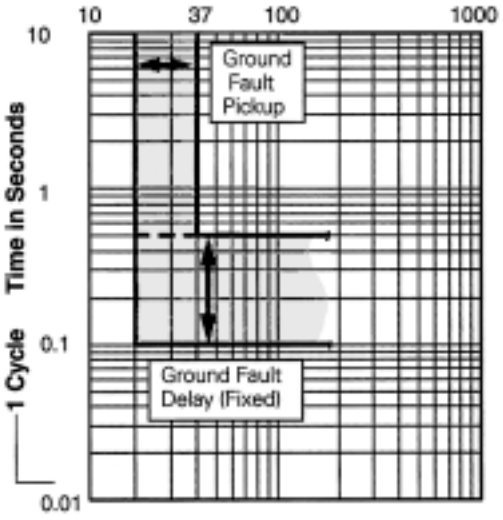
Time Current Characteristic Curve

Ground Fault Protection

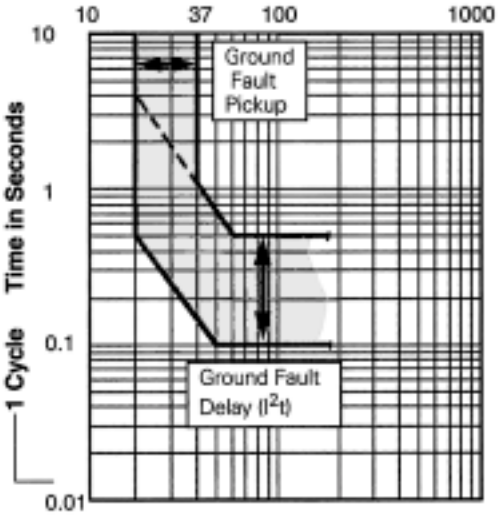
3200A and 4000A

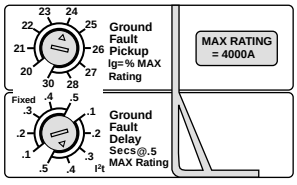


I_g=% (MAX Rating)

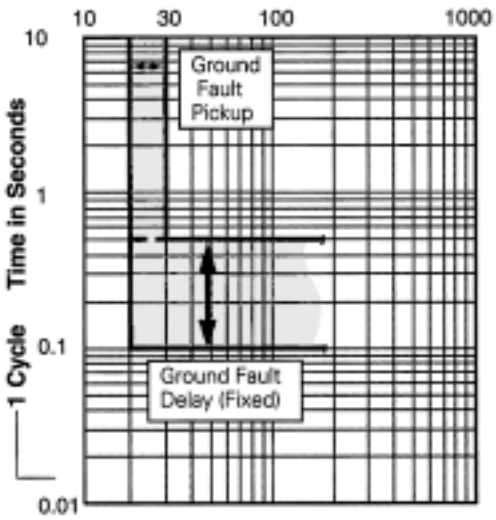


I_g=% (MAX Rating)

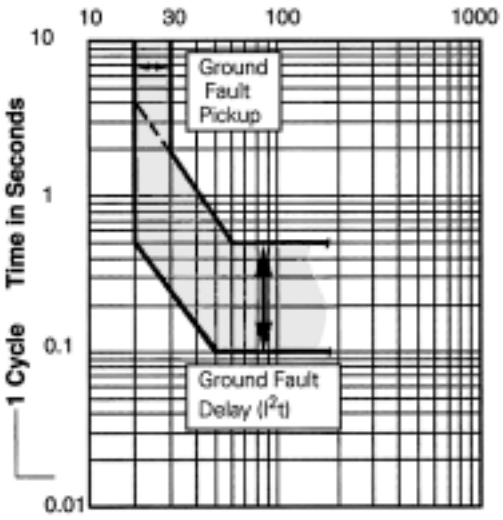




I_g=% (MAX Rating)



I_g=% (MAX Rating)



External Accessories

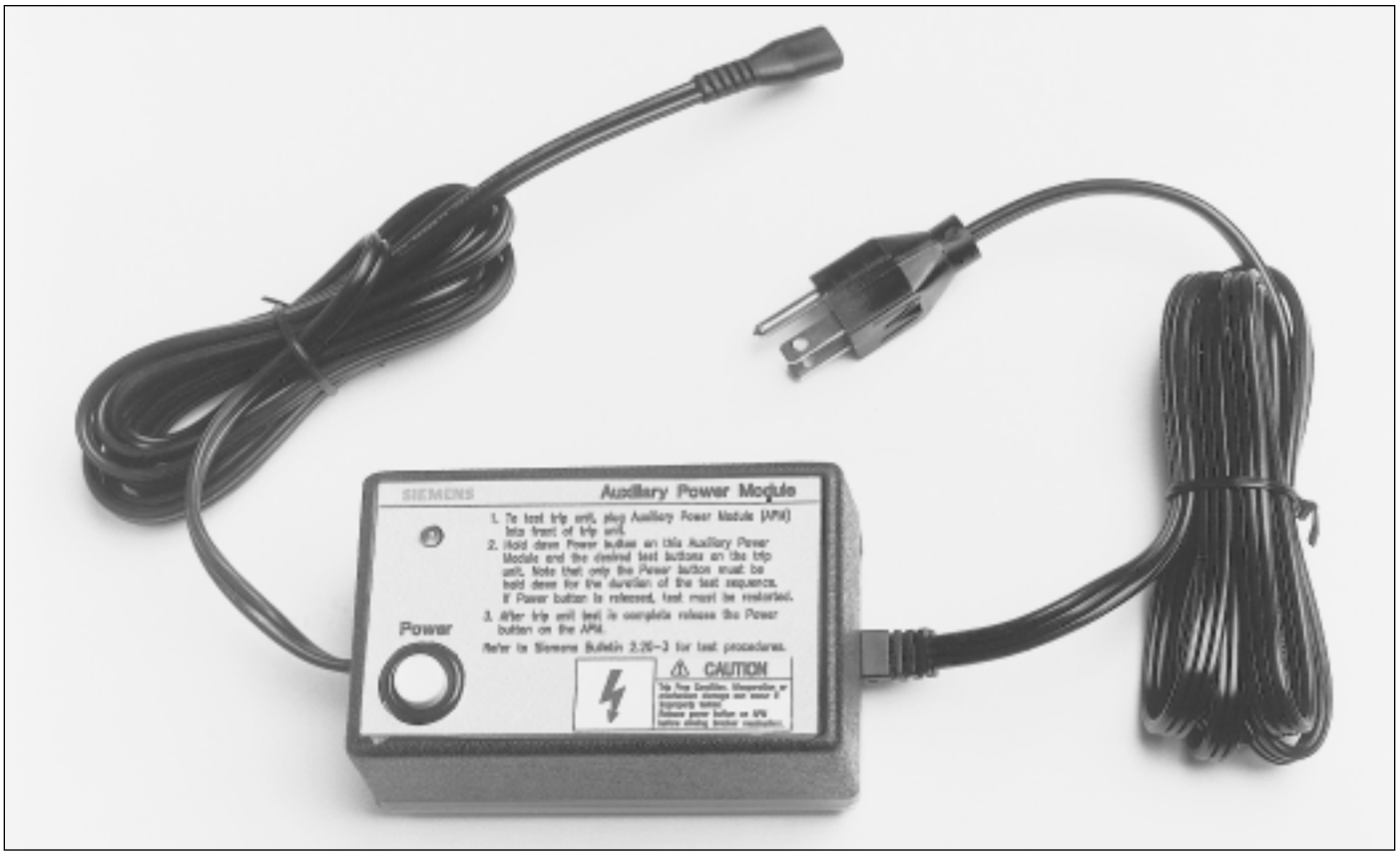
Auxiliary Power Supply

⚠ WARNING

Trip Free Condition. Misoperation or mechanism damage can occur if incorrectly tested.

Release power button on APM before closing breaker mechanism

Auxiliary Power Supply
The auxiliary power supply is used for bench testing the Electronic Trip Unit. The supply may also be used to power the trip unit during the execution of a "go/no-go" type test before bringing the SB breaker on-line (see Monitoring the Trip Unit in the Operating Instructions section). The auxiliary power supply operates from the 120V AC source power.



Auxiliary Power Supply

Test Procedures

1. Remove trip unit clear plastic cover.

2. To test trip unit, plug Auxiliary Power Module (APM) into front of trip unit.

3. Hold down Power button on this Auxiliary Power Module and the desired test buttons on the trip unit. Note that only the Power button must be held down for the duration of the test sequence. If Power button is released, test must be restarted.

4. After trip unit test is compete, release the Power button on the APM.

5. Reinstall trip unit clear plastic cover.

External Accessories

Universal Test Kit (TS-31)

General Information

⚠ 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.

⚠ Safety Instructions

Universal Test Kit

⚠ DANGER

Remove electrical loads from the circuit breaker to be tested prior to performing tests. Failure to do so can produce erroneous results and possible electrical malfunction.

Operating Instructions

A. Remove electrical loads from circuit breaker.

B. Plug TS-31 test set into a grounded 120V AC receptacle and turn it on. The identifying turn-on message will appear:

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

C. Select appropriate ribbon cable assembly and connect it between the TS-31 and the circuit breaker. Check alignment and polarity. After pressing ENTER, the TS-31 will prompt:

```
Enter catalog number:
```

D. Type in the catalog of the circuit breaker if a JD, LD, MD, ND, PD Frame. If the unit being tested is a SB Encased Breaker, type in the catalog number of the trip unit (located on the side of the trip unit correct.)

After entering the catalog number information, press the ENTER key. If an invalid catalog number has been entered, the TS-31 will respond with:

```
XXX...NOT found.
Press any key to continue.
```

and you will be asked to enter another catalog number.

E. If valid catalog number has been entered, the TS-31 will prompt for breaker settings. The TS-31 will respond with:

```
Enter Continuous Current Setting in %:
```

```
Select Long Time Delay in Seconds:
```

For breakers with short time functions you will be asked:

```
Enter Short Time Pickup:
```

```
Enter Short Time Delay, 1-Fixed, 2-I²t:
```

```
Enter Short Time Delay in Seconds:
```

For breakers with Instantaneous Pickup Setting:

```
Enter Instantaneous Pickup Setting:
```

For breakers with ground fault you will be asked:

```
Select Ground Fault Type: 1-Residual,
2-Ground Return, 3-Unsure:
```

```
Enter Ground Fault Pickup Setting in %:
```

```
Enter Ground Fault Delay, 1-Fixed, 2-I²t:
```

```
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.

F. After entering breaker switch settings, you must select the test you wish to have performed: The TS-1 will request:

```
Enter test, L-Long, S-Short, I-Inst, G-Gnd Fault, C-CT,
Cont?
```

Enter one of the following letters:
"L" Long time or overload test
"S" Short time test
"I" Instantaneous test
"G" Ground fault test
"C" Current transformer continuity test

G. After entering the desired test, you will be prompted for the phase to be tested. The TS-31 will display:

```
Enter phase to test:
```

Enter one of the following letters:
"A" Phase A or Left Pole
"B" Phase B or Center Pole
"C" Phase C or Right Pole
"N" Neutral

H. 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 given new options (See Step K).

Universal Test Kit (TS-31)

I. To proceed, 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:

```
Trip Test. Press Any Key to Abort.
Time Remaining: xx.xxx Sec.
```

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

J. 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 TS-31 will display:

```
Test Passed. xxx.xx seconds
Press any key to continue.
```

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

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

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

Enter one of the following numbers:
"1" Select a new test
"2" Enter a new catalog number
"3" Enter a new switch setting.

If you enter "1" you will be sent to step F. Choosing "2" will send the program back to Step C. Entering "3" sends you back to step E, which will be slightly different the second time through. On the second line after the prompt for the setting, a number or text in brackets will appear. This will indicate the last setting you entered. 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.

L. If you pressed "C" when asked:

```
Enter test, L-Long, S-Short, I-Inst, G-Gnd Fault, C-CT,
Cont?
```

You will first be prompted by:

```
Current Transformer Test
Press ENTER to Continue or A to abort.
```

and then the phase to test. A message will then appear stating the test results. For example:

```
CT Resistance Test. Phase X PASSED.
Press any key to continue.
```

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

```
Test Not Running — Check Test Cable.
Press enter to continue.
```

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

```
XXXXXXX is NOT available on a XXXXXXX
Press any key to continue.
```

This message will appear if you enter a type of test that is not available on the breaker being tested. For example:

```
Ground Fault is NOT available on a SJD69300.
Press any key to continue.
```

You will get this message if you enter "G" (for ground fault test) in step F because that catalog number does have ground fault.

```
XX is NOT a Valid Setting.
Press any key to continue.
```

This message will appear if you enter a setting value that does not exist. For example, a SMD9700ANGT has continuous current settings of 20, 30, 40, 50, 60 70, 80, 90, and 100%. If you were to enter any value other than those listed, the above message would appear.

```
Test Exceeds Capability of TS-31.
Press any key to continue.
```

This message means that a test requires more current to run than the TS-31 can produce. The settings on this breaker should be lowered and the new settings should be entered into the TS-31 (Step K, Option 3). Then re-run the desired test.

```
Unit Too Hot, Please Wait.
```

Running many successive high-current long time tests may overheat the test set. It will protect itself from damage by preventing further tests until it has cooled down. This display will indicate when testing can resume.

N. The TS-31 will warn you of possible fault coverage conflicts. These conflicts may occur if, for example, the short time and instantaneous pickup settings overlap or interfere with one another. In this case, the following sequence of messages will appear:

```
You've chosen the Short Time Test, but the following
may trip first:
```

```
Instantaneous
Press any key to continue.
```

```
Do you wish to proceed with the test? (Y/N)
```

These messages indicate that something other than the desired function may trip the breaker. You then have the option of continuing with the test or aborting it.

NOTE: For trip unit values, refer to pages 34-35 of this bulletin, or the information sheets supplied with the TS-31 kit.

External Accessories

Universal Test Kit (TS-31)

Testing Parameters — SB

ICCB Long Time Trip Out

Setting (% of I_n)	2.5 sec.	4 sec	5.5 sec	8 sec	10 sec	14 sec	17 sec	21 sec	25 sec	30 sec
50%	96.0 – 224	154 – 358	211 – 493	307 – 717	384 – 896	538 – 1254	653 – 1523	806 – 1882	960 – 2240	1152 – 2688
60%	66.7 – 156	107 – 249	147 – 342	213 – 498	267 – 622	373 – 871	453 – 1058	560 – 1307	667 – 1556	800 – 1867
65%	56.8 – 133	90.9 – 212	125 – 292	182 – 424	227 – 530	318 – 742	386 – 901	477 – 1113	588 – 1325	682 – 1591
70%	49.0 – 114	78.4 – 183	108 – 251	157 – 366	196 – 457	274 – 640	333 – 777	411 – 960	490 – 1143	588 – 1371
75%	42.7 – 99.6	68.3 – 159	93.8 – 219	137 – 319	171 – 398	239 – 558	290 – 677	358 – 836	427 – 996	512 – 1195
80%	37.5 – 87.5	60.0 – 140	82.5 – 193	120 – 280	150 – 350	201 – 490	255 – 595	315 – 735	375 – 875	450 – 1050
85%	33.2 – 77.5	53.1 – 124	73.1 – 171	106 – 248	133 – 310	186 – 434	226 – 527	279 – 651	332 – 775	399 – 930
90%	29.6 – 69.1	47.4 – 111	65.2 – 152	94.8 – 221	119 – 277	166 – 387	201 – 470	249 – 581	296 – 691	356 – 830
95%	26.6 – 62.0	42.5 – 99.3	58.5 – 137	85.1 – 199	106 – 248	149 – 347	181 – 422	223 – 521	266 – 620	319 – 745
100%	24.0 – 56.0	38.4 – 89.6	52.8 – 123	76.8 – 179	96.0 – 224	134 – 314	163 – 381	202 – 470	240 – 580	288 – 672

ICCB I^2T Short Time Trip Out

Pickup Setting	0.07 sec	0.1 sec	0.15 sec	0.2 sec	0.3 sec
1.5	0.995 – 1.650	1.370 – 2.330	2.050 – 3.470	2.730 – 4.610	4.100 – 6.880
2.0	0.537 – 0.949	0.767 – 1.330	1.150 – 1.970	1.540 – 2.610	2.300 – 3.890
2.5	0.344 – 0.627	0.491 – 0.873	0.737 – 1.280	0.983 – 1.690	1.470 – 2.510
3.0	0.238 – 0.452	0.341 – 0.622	0.511 – 0.907	0.682 – 1.190	1.020 – 1.760
4.0	0.134 – 0.277	0.191 – 0.373	0.287 – 0.533	0.383 – 0.693	0.575 – 1.010
5.0	0.086 – 0.197	0.122 – 0.258	0.184 – 0.361	0.245 – 0.463	0.368 – 0.668
6.0	0.059 – 0.153	0.085 – 0.196	0.127 – 0.267	0.170 – 0.338	0.255 – 0.480
7.0	0.043 – 0.127	0.062 – 0.158	0.094 – 0.210	0.125 – 0.262	0.188 – 0.367
8.0	0.033 – 0.109	0.047 – 0.133	0.071 – 0.173	0.095 – 0.213	0.143 – 0.293
9.0	0.026 – 0.098	0.037 – 0.117	0.056 – 0.148	0.075 – 0.180	0.113 – 0.243

ICCB Fixed Short Time Trip Out

ST Delay Setting	ST Trip Out Time
0.07 sec	0.052 – 0.141
0.10 sec	0.074 – 0.178
0.15 sec	0.112 – 0.241
0.20 sec	0.149 – 0.303
0.30 sec	0.224 – 0.428

Universal Test Kit (TS-31)

Testing Parameters — SB

ICCB I^2T Ground Fault Trip Out

Setting (% MAX Rating)	0.1 sec	0.2 sec	0.3 sec	0.4 sec	0.5 sec
20%	0.096 – 0.307	0.192 – 0.596	0.289 – 0.886	0.385 – 1.180	0.482 – 1.460
21%	0.196 – 0.608	0.393 – 1.200	0.590 – 1.790	0.787 – 2.380	0.984 – 2.970
22%	0.179 – 0.556	0.358 – 1.090	0.538 – 1.630	0.717 – 2.170	0.896 – 2.710
23%	0.164 – 0.510	0.328 – 1.000	0.492 – 1.490	0.656 – 1.990	0.820 – 2.480
24%	0.150 – 0.470	0.301 – 0.922	0.452 – 1.370	0.602 – 1.830	0.753 – 2.280
25%	0.138 – 0.434	0.277 – 0.851	0.416 – 1.270	0.555 – 1.680	0.694 – 2.100
26%	0.128 – 0.403	0.256 – 0.788	0.385 – 1.170	0.513 – 1.560	0.642 – 1.940
27%	0.119 – 0.375	0.238 – 0.732	0.357 – 1.090	0.476 – 1.450	0.595 – 1.800
28%	0.110 – 0.350	0.221 – 0.682	0.332 – 1.010	0.442 – 1.350	0.553 – 1.680
29%	0.103 – 0.327	0.206 – 0.637	0.309 – 0.946	0.412 – 1.260	0.516 – 1.570
30%	0.096 – 0.307	0.192 – 0.596	0.289 – 0.886	0.385 – 1.180	0.482 – 1.460
31%	0.090 – 0.288	0.180 – 0.559	0.270 – 0.830	0.361 – 1.100	0.451 – 1.370
32%	0.084 – 0.272	0.169 – 0.526	0.254 – 0.780	0.339 – 1.040	0.423 – 1.290
33%	0.079 – 0.257	0.159 – 0.496	0.239 – 0.735	0.318 – 0.974	0.398 – 1.210
35%	0.070 – 0.230	0.141 – 0.443	0.212 – 0.655	0.283 – 0.868	0.354 – 1.080
37%	0.063 – 0.208	0.126 – 0.398	0.190 – 0.588	0.253 – 0.778	0.317 – 0.969
38%	0.060 – 0.198	0.120 – 0.378	0.180 – 0.559	0.240 – 0.739	0.300 – 0.919
40%	0.054 – 0.180	0.108 – 0.343	0.162 – 0.506	0.227 – 0.669	0.271 – 0.831
41%	0.051 – 0.172	0.103 – 0.327	0.154 – 0.482	0.206 – 0.637	0.258 – 0.792
44%	0.049 – 0.167	0.099 – 0.317	0.149 – 0.467	0.199 – 0.617	0.250 – 0.767
45%	0.049 – 0.167	0.099 – 0.317	0.149 – 0.467	0.199 – 0.617	0.250 – 0.767
48%	0.049 – 0.167	0.099 – 0.317	0.149 – 0.467	0.199 – 0.617	0.250 – 0.767
50%	0.049 – 0.167	0.099 – 0.317	0.149 – 0.467	0.199 – 0.617	0.250 – 0.767

ICCB Fixed Ground Fault Trip Out

Setting (% MAX Rating)	0.1 sec	0.2 sec	0.3 sec	0.4 sec	0.5 sec
20% to 100%	0.049 to 0.167	0.099 to 0.317	0.149 to 0.467	0.199 to 0.617	0.250 to 0.767

Ordering Information

Electronic Trip Unit

1200A Frame Size

Catalog Number	Max Rating	Continuous Current Setting	Long Time Delay	Short Time Pickup/Delay	Instantaneous Pickup	Ground Fault Pickup/Delay
SB04TLI	400A	✓	✓	—	✓	—
SB04TLS	400A	✓	✓	✓	—	—
SB04TLSI	400A	✓	✓	✓	✓	—
SB04TLIG	400A	✓	✓	—	✓	✓
SB04TLSG	400A	✓	✓	✓	—	✓
SB04TLSIG	400A	✓	✓	✓	✓	✓
SB08TLI	800A	✓	✓	—	✓	—
SB08TLS	800A	✓	✓	✓	—	—
SB08TLSI	800A	✓	✓	✓	✓	—
SB08TLIG	800A	✓	✓	—	✓	✓
SB08TLSG	800A	✓	✓	✓	—	✓
SB08TLSIG	800A	✓	✓	✓	✓	✓
SB12TLI	1200A	✓	✓	—	✓	—
SB12TLS	1200A	✓	✓	✓	—	—
SB12TLSI	1200A	✓	✓	✓	✓	—
SB12TLIG	1200A	✓	✓	—	✓	✓
SB12TLSG	1200A	✓	✓	✓	—	✓
SB12TLSIG	1200A	✓	✓	✓	✓	✓

2000A Frame Size

Catalog Number	Max Rating	Continuous Current Setting	Long Time Delay	Short Time Pickup/Delay	Instantaneous Pickup	Ground Fault Pickup/Delay
SB12TLI	1200A	✓	✓	—	✓	—
SB12TLS	1200A	✓	✓	✓	—	—
SB12TLSI	1200A	✓	✓	✓	✓	—
SB12TLIG	1200A	✓	✓	—	✓	✓
SB12TLSG	1200A	✓	✓	✓	—	✓
SB12TLSIG	1200A	✓	✓	✓	✓	✓
SB16TLI	1600A	✓	✓	—	✓	—
SB16TLS	1600A	✓	✓	✓	—	—
SB16TLSI	1600A	✓	✓	✓	✓	—
SB16TLIG	1600A	✓	✓	—	✓	✓
SB16TLSG	1600A	✓	✓	✓	—	✓
SB16TLSIG	1600A	✓	✓	✓	✓	✓
SB20TLI	2000A	✓	✓	—	✓	—
SB20TLS	2000A	✓	✓	✓	—	—
SB20TLSI	2000A	✓	✓	✓	✓	—
SB20TLIG	2000A	✓	✓	—	✓	✓
SB20TLSG	2000A	✓	✓	✓	—	✓
SB20TLSIG	2000A	✓	✓	✓	✓	✓

Ordering Information

Electronic Trip Unit

3200A Frame Size

Catalog Number	Max Rating	Continuous Current Setting	Long Time Delay	Short Time Pickup/Delay	Instantaneous Pickup	Ground Fault Pickup/Delay
SB25TLI	2500A	✓	✓	—	✓	—
SB25TLS	2500A	✓	✓	✓	—	—
SB25TLSI	2500A	✓	✓	✓	✓	—
SB25TLIG	2500A	✓	✓	—	✓	✓
SB25TLSG	2500A	✓	✓	✓	—	✓
SB25TLSIG	2500A	✓	✓	✓	✓	✓
SB32TLI	3200A	✓	✓	—	✓	—
SB32TLS	3200A	✓	✓	✓	—	—
SB32TLSI	3200A	✓	✓	✓	✓	—
SB32TLIG	3200A	✓	✓	—	✓	✓
SB32TLSG	3200A	✓	✓	✓	—	✓
SB32TLSIG	3200A	✓	✓	✓	✓	✓

5000A Frame Size

Catalog Number	Max Rating	Continuous Current Setting	Long Time Delay	Short Time Pickup/Delay	Instantaneous Pickup	Ground Fault Pickup/Delay
SB25TLI	2500A	✓	✓	—	✓	—
SB25TLS	2500A	✓	✓	✓	—	—
SB25TLSI	2500A	✓	✓	✓	✓	—
SB25TLIG	2500A	✓	✓	—	✓	✓
SB25TLSG	2500A	✓	✓	✓	—	✓
SB25TLSIG	2500A	✓	✓	✓	✓	✓
SB32TLI	3200A	✓	✓	—	✓	—
SB32TLS	3200A	✓	✓	✓	—	—
SB32TLSI	3200A	✓	✓	✓	✓	—
SB32TLIG	3200A	✓	✓	—	✓	✓
SB32TLSG	3200A	✓	✓	✓	—	✓
SB32TLSIG	3200A	✓	✓	✓	✓	✓
SB40TLI	4000A	✓	✓	—	✓	—
SB40TLS	4000A	✓	✓	✓	—	—
SB40TLSI	4000A	✓	✓	✓	✓	—
SB40TLIG	4000A	✓	✓	—	✓	✓
SB40TLSG	4000A	✓	✓	✓	—	✓
SB40TLSIG	4000A	✓	✓	✓	✓	✓
SB50TLI	5000A	✓	✓	—	✓	—
SB50TLS	5000A	✓	✓	✓	—	—
SB50TLSI	5000A	✓	✓	✓	✓	—
SB50TLIG	5000A	✓	✓	—	✓	✓
SB50TLSG	5000A	✓	✓	✓	—	✓
SB50TLSIG	5000A	✓	✓	✓	✓	✓

Ordering Information

Rating Plugs, Transformers, and Miscellaneous Accessories

400A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
04SB200	200A
04SB225	225A
04SB250	250A
04SB300	300A
04SB350	350A
04SB400	400A

800A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
08SB400	400A
08SB450	450A
08SB500	500A
08SB600	600A
08SB700	700A
08SB800	800A

1200A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
12SB600	600A
12SB700	700A
12SB800	800A
12SB1000	1000A
12SB1200	1200A

1600A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
16SB800	800A
16SB1000	1000A
16SB1200	1200A
16SB1600	1600A

2000A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
20SB1000	1000A
20SB1200	1200A
20SB1600	1600A
20SB2000	2000A

2500A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
25SB1600	1600A
25SB2000	2000A
25SB2500	2500A

3200A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
32SB1600	1600A
32SB2000	2000A
32SB2500	2500A
32SB3000	3000A
32SB3200	3200A

4000A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
40SB2000	2000A
40SB2500	2500A
40SB3000	3000A
40SB3200	3200A
40SB4000	4000A

5000A MAX Ampere Rating

Rating Plug Catalog Number	Rating (Ampere)
50SB2500	2500A
50SB3000	3000A
50SB3200	3200A
50SB4000	4000A
50SB5000	5000A

Neutral Transformers

Catalog Number	MAX Rating (Ampere)
N04SB	400A
N08SB	800A
N12SB	1200A
N16SB	1600A
N20SB	2000A
N25SB	2500A
N32SB	3200A
N40SB	4000A
N50SB	5000A

Miscellaneous Accessories

Catalog Number	Item
TS-31	Universal Test Kit
SBAPM	Auxiliary Power Module

UL Listings and File Numbers

Item	Listing
Trip Unit and Breaker	E9896
Accessories	E57501
Drawout	E135453
CSA	LR57039

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