# SIEMENS

## PTS 5
## User Manual


18-838-728-502 issue 1.1

## Table of Contents

## Introduction

THIS EQUIPMENT CONTAINS HAZARDOUS VOLTAGES. DEATH, SERIOUS PERSONAL INJURY, OR PROPERTY DAMAGE CAN RESULT IF SAFETY INSTRUCTIONS ARE NOT FOLLOWED. ONLY QUALIFIED PERSONNEL SHOULD WORK ON OR AROUND THIS EQUIPMENT AFTER BECOMING THOROUGHLY FAMILIAR WITH ALL WARNINGS AND SAFETY NOTICES CONTAINED HEREIN. THE SUCCESSFUL AND SAFE OPERATION OF THIS EQUIPMENT IS DEPENDENT UPON PROPER HANDLING, INSTALLATION AND OPERATION.

QUALIFIED PERSON

FOR THE PURPOSE OF THIS MANUAL AND PRODUCT LABELS, A QUALIFIED PERSON IS ONE WHO IS FAMILIAR WITH THE INSTALLATION, CONSTRUCTION AND OPERATION OF THE EQUIPMENT, AND THE HAZARDS INVOLVED. IN ADDITION, HE OR SHE HAS THE FOLLOWING QUALIFICATIONS:

a) Is trained and authorized to energize, 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 practices.
c) Is trained in rendering first aid.

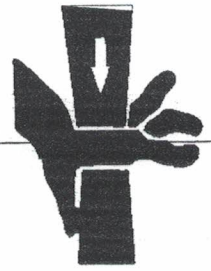
DANGER

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.

## Safety Information



**⚠WARNING**

High Speed Moving Parts

Can cause death or serious injury

Discharge the springs before attempting to perform any inspection or adjustment of the circuit breaker operating mechanism. Keep hands clear of the mechanism if exercising the circuit breaker during the test.

**⚠DANGER**

**Hazardous voltage**

**Will cause death, serious personal injury, and/or property damage.**

Only qualified personnel should work on this equipment, after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein and on the devices.

Turn off power before working on this equipment.

The successful and safe operation of this equipment is dependant on proper handling, installation, operation, and maintenance.



**The use of a ground fault circuit interrupter (GFCI) protected receptacle is strongly recommended. This protection can be provided in the field by the use of an extension cord with an integrated GFCI device where a GFCI protected receptacle is not available.**

## General

The Portable Test Set (PTS 5) is designed for performing secondary injection testing of the Static Trip III (STIII) overcurrent tripping system utilized on the RL breaker. The system is packaged in a self-contained briefcase and requires 120 V ac to operate.

The PTS 5 contains a microprocessor controlled constant current source which enables rapid verification of the performance of the STIII. The desired test current may be directly entered with a numeric keypad for ease of test configuration. The self contained, automatically controlled digital timer allows simple verification of the time-current tripping characteristics. The system also provides a regulated DC voltage to allow functional testing of the tripping actuator.

The incoming power is converted to a filtered and regulated dc bus. From this dc supply, the testing current is generated using a current amplifier regulated by the microprocessor and a precision digital to analog converter. This provides for stable test current even when the incoming line voltage fluctuates. This feature helps to eliminate discrepancies that may occur if a line-derived current source is used for testing. The test current is applied to the current inputs on the STIII, either by a jumper cable for on-breaker testing, or alternatively, the STIII may be connected to a terminal block on the face of the PTS 5 for standalone testing. The STIII connection also provides for the trip feedback that stops the clock and the test current automatically.

The scope of this manual covers the operation of the PTS 5. Additional information on the STIII may be found in publication SGIM-3118C. Additional information on the RL breaker may be found in publication SGIM-3068D. These documents are available from the nearest Siemens sales office, and should be consulted should any questions arise to the function of the STIII or RL breaker.

**Note: The PTS 5 does not support the Static Trip II or earlier trip units associated with the LA breaker. It is necessary to utilize a PTS 4 to test these legacy trip units.**

## Controls and Indicators (refer to Figure 1 for location)

1) POWER 120 VAC and SWITCH: Attach the power supply cord here. The SWITCH applies power to the unit.
2) INPUT OVERCURRENT PROTECTION: Provides protection to the circuit in the event of internal failure. Should this breaker trip repeatedly, the unit likely has an internal fault and requires service.
3) CURRENT OUTPUT SHUNT: Provides a test point for connecting an external ammeter when performing calibration testing. The white shorting plug must be inserted in the jacks when an external ammeter is not connected, or else the current output will not function.
4) ACTUATOR TEST: Provides a controlled low voltage dc source, to be used only for testing the STIII tripping actuator.
5) OUTPUT OVERCURRENT PROTECTION: Provides protection against short circuits on the output.
6) STATIC TRIP III (terminal strip): Attach the fanning strip from a STIII being tested without a circuit breaker here. Note: Pin 1 is the end of the fanning strip opposite the end where the wire bundle is secured. The peg adjacent to Pin 1 serves to block the fanning strip from being attached backwards. Refer to Figure 3 for proper attachment of the fanning strip.
7) OUTPUT (15-pin Molex connector): Attach the test cable here. The test cable is used for tests where the STIII is attached to a circuit breaker. See Figure 2 which shows how to properly attach the test cable.
8) STATIC TRIP III (25-pin DB connector): Attach the adapter cable to this connector. The other end of the adapter cable goes to the 9-pin and 15-pin connectors on the front of the STIII. This cable is only necessary for performing the Long Time, Short Time, and Ground Fault Pickup tests.
9) Indicator lights:
   - ☐ LTPU (amber) lights when the STIII is in Long Time Pickup mode.
   - ☐ STPU (amber) lights when the STIII is in Short Time Pickup mode.
   - ☐ ALARM (red) lights when the test time duration is exceeded, or if there is excessive current on the test leads (caused by a ground fault or short circuit).
   - ☐ OVLD (red) lights when the STIII trips out in the Long Time Delay test or Short Time Delay test.
   - ☐ POWER (green) lights to indicate the unit is turned on.
10) Display: Provides information to the user about the test in progress.
11) Keypad: Allows user to select the desired test routine, choose parameters for the test, as well as start and stop the test routine. The keys have the following functions:
    - ☐ 0-9: Entry of the desired numeric value for the test. The decimal point is implied, so to enter values less than one, a leading zero must be included. For example, to enter the value 0.275 A, the keys 0 2 7 5 must be pressed.
    - ☐ ←: Backspace, clears incorrect numeric entries.
    - ☐ Ø1: Selects the application of current to Phase 1 of the trip unit.
    - ☐ Ø2: Selects the application of current to Phase 2 of the trip unit.
    - ☐ Ø3: Selects the application of current to Phase 3 of the trip unit.
    - ☐ PREV: Selects the previous test from the list at the top of the display.
    - ☐ NEXT: Selects the next test from the list at the top of the display.
    - ☐ START: Starts the selected test.
    - ☐ STOP: Stops the selected test.
    - ☐ ENTER: Confirms the entered value for the test parameter.
    - ☐ (blank key): This key is used to enter the calibration mode.
12) Storage compartment: The test leads are stored in this compartment. To open the compartment, press the latches. To secure the compartment, press the latch buttons again.

Figure 1
Panel Layout

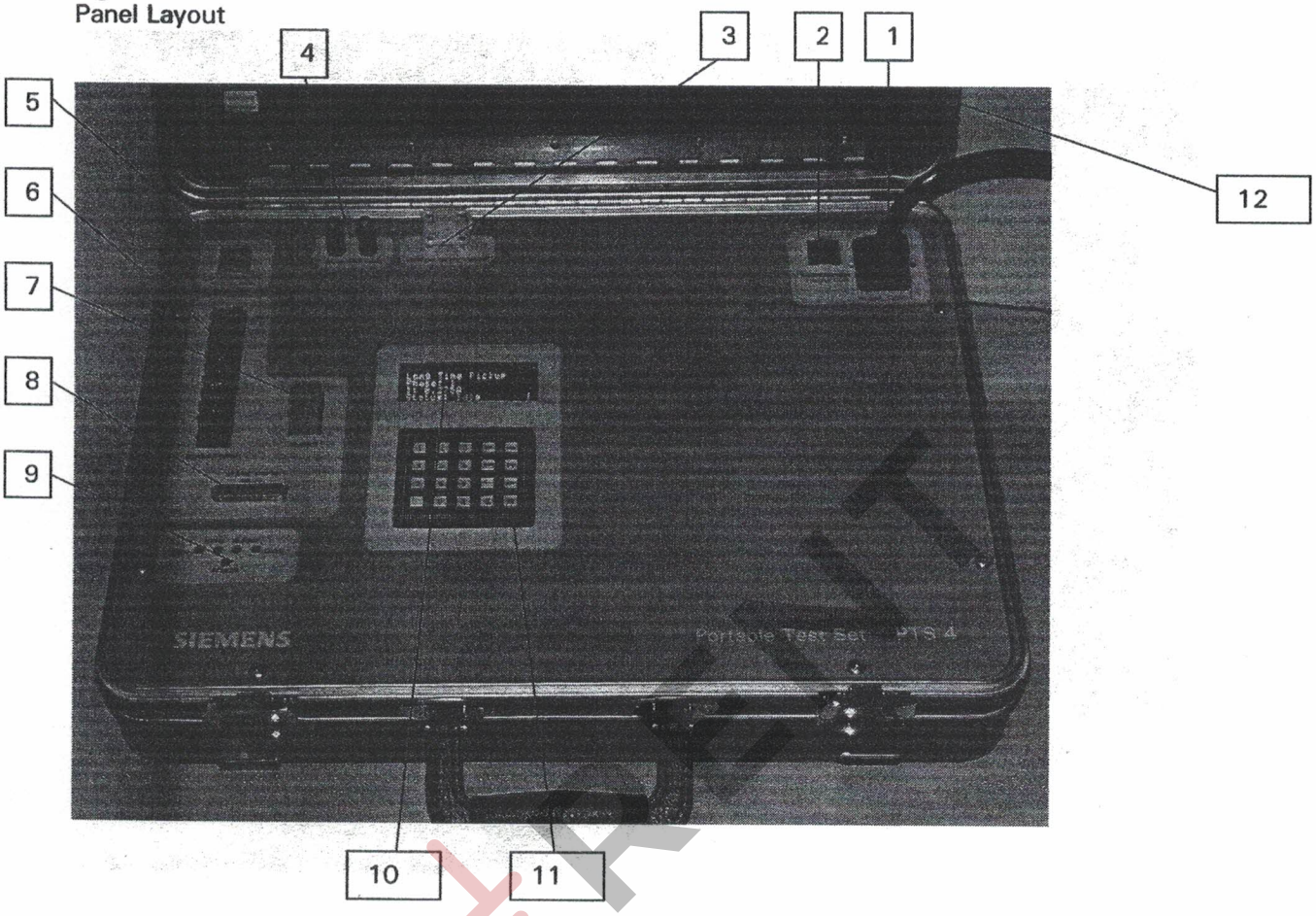
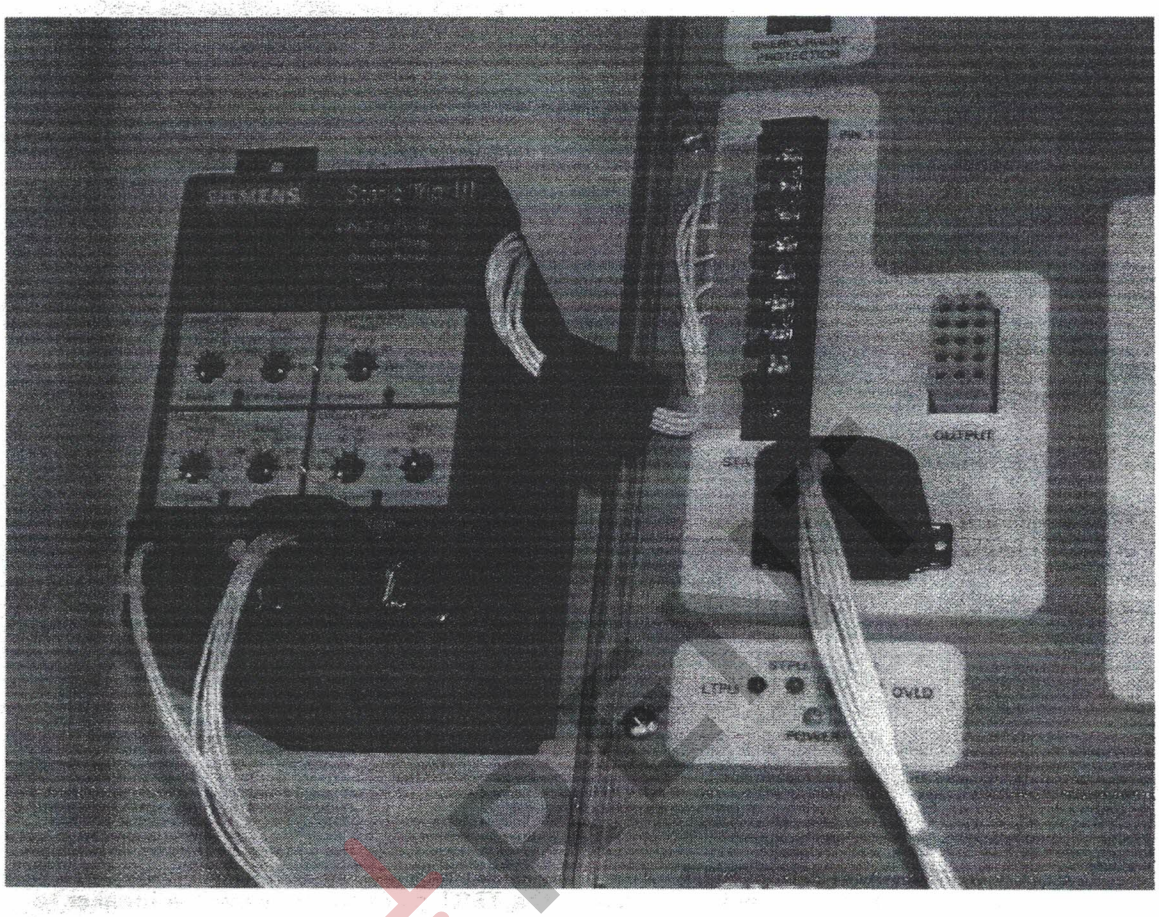
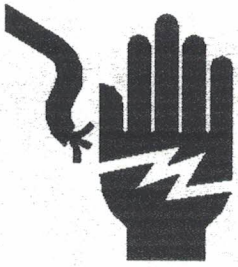


Figure 2
Attachment of the test cable to an STIII mounted on a breaker

Figure 3
Attachment of an STIII directly to the PTS 5



## Test Preparation



**⚠ DANGER**

**Hazardous voltage**

**Will cause death, serious personal injury, and/or property damage.**

Only qualified personnel should work on this equipment, after becoming thoroughly familiar with all warnings, safety notices, and maintenance procedures contained herein and on the devices.

Turn off power before working on this equipment.

The successful and safe operation of this equipment is dependant on proper handling, installation, operation, and maintenance.



Make the following preparations before the test:

- ☐ The breaker must be racked off the power bus, either to the TEST or DISCONNECT position.
- ☐ If the breaker is completely withdrawn from the cubicle (i.e. it is being bench tested), then rotate the racking screw to the TEST position, to allow the breaker to be charged and closed.
- ☐ If the STIII is completely removed from a breaker, then attach the fanning strip to the terminal block on the front panel per Figure 3. If the STIII is still attached to the breaker, connect the leads per Figure 2 to the test connector on the front of the breaker.
- ☐ Plug the 25-pin connector of the adapter cable into the DB-25 connector on the front panel (item 8 in Figure 1.) Plug the 9-pin and 15-pin connectors on the adapter cable into the sockets on the front of the STIII (detach any existing cables from these connectors first). Note: This cable is only needed for the Long Time, Short Time, and Ground Pickup tests.
- ☐ Plug the power cord into the POWER connector on the front panel, and into a properly grounded, 120 V ac receptacle. Turn on the switch located adjacent to the POWER connector. The unit should perform a self test and then display the following:

  Long Time Pickup
  Phase: 1
  I: 0.275A
  Status: Idle /

  The lower right corner of the display will show a rotating marker. This indicates that the microprocessor is running normally. The display will go to screen saver, which is a * symbol traveling across the display, should the unit be left idle for an extended period of time.

Make a note of the front panel settings on the STIII, so that the STIII can be returned to its original state after the test. Set the STIII configuration switches as follows for all tests, unless otherwise noted: Thermal Memory: OUT; Short time $I^2t$: OUT; Zone Interlock: OUT.

## Long Time Pickup (LTPU) Test

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 3.5 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 12 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

Ensure the adapter cable is connected for this test. Press the START button. Accept the default start value of 0.275 A by pressing ENTER. The system will inject current into Phase 1 of the STIII, and will automatically increase the current until one of the following occurs:

- ☐ If the STIII goes into LTPU, the test will stop, the display will show the current value at which LTPU was achieved, and the LTPU light will illuminate. Note that the time is irrelevant for this test, as this test only determines the minimum pickup current value for the Long Time element.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current achieves 120% of its initial value, and the STIII does not go into LTPU, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

It may require more than a minute for the STIII to achieve LTPU. The pickup point may vary from +20% to -0% of the dial setting. As shown on the table below, with the LTPU setting at 0.50, the STIII should have picked up between 0.250 and 0.300 A (or -0, +20%).

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Long Time Setting dial. In each case, the STIII should achieve LTPU within the parameters listed below. To speed up the testing in the higher ranges, a starting value closer to the minimum may be keyed in after pressing the START button. Press ENTER to load the value and start the test.

| LTPU Setting | Long Time Pickup Current | |
|---|---|---|
| | Minimum | Maximum |
| 0.50 | 0.250 | 0.300 |
| 0.55 | 0.275 | 0.330 |
| 0.60 | 0.300 | 0.360 |
| 0.65 | 0.325 | 0.390 |
| 0.70 | 0.350 | 0.420 |
| 0.75 | 0.375 | 0.450 |
| 0.80 | 0.400 | 0.480 |
| 0.85 | 0.425 | 0.510 |
| 0.90 | 0.450 | 0.540 |
| 0.95 | 0.475 | 0.570 |
| 1.00 | 0.500 | 0.600 |

## Short Time Pickup (STPU) Test (only if equipped)

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor (very important!)
Long Time Delay: 30 s

Instantaneous Pickup: 15 x sensor
Short Time Pickup: 2 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

Ensure that the adapter cable is connected for this test. Press the NEXT button to select "Short Time Pickup" mode. Press the START button. Accept the default start value of 0.500 A by pressing ENTER. The system will inject current into Phase 1 of the STIII, and will automatically increase the current until one of the following occurs:

- ☐ If the STIII goes into STPU, the test will stop, the display will show the current value at which STPU was achieved, and the STPU light will illuminate. Note that the time is irrelevant for this test, as this test only determines the minimum pickup current value for the Short Time element.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current achieves 120% of its initial value, or the test persists for one minute, and the STIII does not go into STPU, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

Note that the "Long Time Pickup" light on the STIII will turn on during this test. As shown on the table below, with the STPU setting at 2 x LT, and the LT setting at 0.5 x sensor, the STIII should have picked up between 0.500 and 0.600 A (or -0, +20%).

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Short Time Pickup dial. In each case, the STIII should achieve STPU within the parameters listed below. To speed up the testing in the higher ranges, a starting value closer to the minimum may be keyed in after pressing the START button. Press ENTER to load the value and start the test.

| STPU Setting | Short Time Pickup Current | |
|---|---|---|
| | Minimum | Maximum |
| 2 | 0.500 | 0.600 |
| 3 | 0.750 | 0.900 |
| 4 | 1.000 | 1.200 |
| 5 | 1.250 | 1.500 |
| 6 | 1.500 | 1.800 |
| 7 | 1.750 | 2.100 |
| 8 | 2.000 | 2.400 |
| 12 | 3.000 | 3.600 |

Note: Ensure the Long Time Setting is 0.5 for this test.

## Ground Fault Pickup (GFPU) Test (only if equipped)

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 30 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 2 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

Ensure that the adapter cable is connected for this test. Press the NEXT button to select "Ground Pickup" mode. Press the START button. Accept the default start value of 0.100 A by pressing ENTER. The system will inject current into the Ground element of the STIII, and will automatically increase the current until one of the following occurs:

- ☐ If the STIII goes into GFPU, the test will stop, the display will show the current value at which GFPU was achieved, and the GFPU light will illuminate. Note that the time is irrelevant for this test, as this test only determines the minimum pickup current value for the Short Time element.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current achieves 120% of its initial value, and the STIII does not go into GFPU, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

As shown on the table below, with the GPU setting at 20%, the STIII should have picked up between 0.090 and 0.110 A (or ±10%). Note that since the STIII shares the same output signal and indicator light for Short Time and Ground Fault pickups, that the display will read "STPU" for the status, and the STPU status light on the PTS 5 will turn on, even though the STIII really achieved GFPU.

Note that the Phase buttons are not used for this test.

Test the remaining points on the Ground Fault Pickup dial. In each case, the STIII should achieve GFPU within the parameters listed below. To speed up the testing in the higher ranges, a starting value closer to the minimum may be keyed in after pressing the START button. Press ENTER to load the value and start the test.

| GFPU Setting | Ground Pickup Current | |
|---|---|---|
| | Minimum | Maximum |
| 20% | 0.090 | 0.110 |
| 30% | 0.135 | 0.165 |
| 40% | 0.180 | 0.220 |
| 50% | 0.225 | 0.275 |
| 60% | 0.270 | 0.330 |

## Instantaneous Pickup (IPU) Test (only if equipped)

Note that by nature of the Instantaneous function, pickup causes a trip.

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 1.0 x sensor
Long Time Delay: 30 s
Instantaneous Pickup: 2 x sensor
Short Time Pickup: 12 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

It is not necessary to connect the adapter cable to the 9-pin and 15-pin ports for this test. Press the NEXT button to select "Inst Pickup" mode. Press the START button. Accept the default start value of 1.000 A by pressing ENTER. The system will inject current into the Phase 1 element of the STIII, and will automatically increase the current until one of the following occurs:

- ☐ If the STIII goes into IPU, the test will stop, and the display will show the current value at which IPU was achieved. Note that the time is irrelevant for this test, as this test only determines the minimum pickup current value for the Short Time element.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current achieves 150% of its initial value (up to 10 A max.), and the STIII does not go into IPU, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

As shown on the table below, with the IPU setting at 2 x, the STIII should have picked up between 1.000 and 1.200 A (or -0, +20%). Note that the STIII does not have an indicator for Instantaneous Pickup, due to the nature of the function. The STIII will show "SHORT CIRCUIT" in the window upon successful completion of the test.

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Instantaneous Pickup dial. In each case, the STIII should achieve IPU within the parameters listed below. To speed up the testing in the higher ranges, a starting value closer to the minimum may be keyed in after pressing the START button. Press ENTER to load the value and start the test. The 12x and 15x ranges can only be verified for function at the maximum allowed value. The system cannot sustain sufficient current at these magnitudes long enough to effectively determine the trip point.

| IPU Setting | Instantaneous Pickup Current | |
|---|---|---|
| | Minimum | Maximum |
| 2 | 1.000 | 1.200 |
| 4 | 2.000 | 2.400 |
| 6 | 3.000 | 3.600 |
| 8 | 4.000 | 4.800 |
| 12 | verify function @ 6A | |
| 15 | verify function @ 7.2A | |

## Long Time Delay (LTD) Test

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 3.5 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 12 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

Press the NEXT button to select "Long Time Delay" mode. Press the START button. Accept the default start value of 1.500 A by pressing ENTER. This value is the easiest one to use, because at this current value, the time delays will equal the dial setting.

The system will inject current into the Phase 1 element of the STIII, and will automatically maintain the current at the preset value, until one of the following occurs:

- ☐ If the STIII trips, the test will stop, and the display will show the current and elapsed time that the trip occurred.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current persists for more than 7 minutes (1 minute, if the current is greater than 1 A), and the STIII does not trip, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

As shown on the table below, with the LTD setting at 3.5 s, the STIII should have tripped between 3.500 s and 5.250 s, when 1.5 A is applied. The STIII will show "OVERLOAD" in the window upon successful completion of the test. If the STIII is attached to the breaker, and the breaker is closed, it should trip at the end of the delay.

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Long Time Delay dial. In each case, the STIII should trip the breaker within the parameters listed below. Other combinations of time delay and pickup current may be tested if desired, however, the expected trip time will need to be determined from the time-current curve. Press ENTER to load the value and start the test. Note that at currents above 2 A, long duration testing is rather stressful on the STIII; avoid repeated or prolonged testing at the high ranges.

| LTD Setting | Long Time Delay (s) | |
|---|---|---|
| | Minimum | Maximum |
| 3.5 | 3.500 | 5.250 |
| 6 | 6.000 | 9.000 |
| 10 | 10.000 | 15.000 |
| 17 | 17.000 | 25.500 |
| 30 | 30.000 | 45.000 |

This table is valid for input current of 1.5 A, with a Long Time Setting of 0.5 x sensor.

## Short Time Delay (STD) Test (only if equipped)

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 30 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 2 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s

Press the NEXT button to select "Short Time Delay" mode. Press the START button. Accept the default start value of 1.000 A by pressing ENTER.

The system will inject current into the Phase 1 element of the STIII, and will automatically maintain the current at the preset value, until one of the following occurs:

- ☐ If the STIII trips, the test will stop, and the display will show the current and elapsed time that the trip occurred.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current persists for more than 1 minute, if the current is greater than 1 A, and the STIII does not trip, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

As shown on the table below, with the STD setting at 0.40 s, the STIII should have tripped between 0.080 s and 0.180 s, when 1.0 A (or greater) is applied. The STIII will show "SHORT CIRCUIT" in the window upon successful completion of the test. If the STIII is attached to the breaker, and the breaker is closed, it should trip at the end of the delay.

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Short Time Delay dial. In each case, the STIII should trip the breaker within the parameters listed below. Other combinations of time delay, trip current, and Short time $I^2t$ mode may be tested if desired, however, the expected trip time will need to be determined from the time-current curve. Press ENTER to load the value and start the test.

| STD | Short Time Delay (s) | |
|---|---|---|
| Setting | Minimum | Maximum |
| 0.08 | 0.080 | 0.180 |
| 0.15 | 0.150 | 0.225 |
| 0.22 | 0.220 | 0.330 |
| 0.30 | 0.300 | 0.400 |
| 0.40 | 0.400 | 0.500 |

This table is valid for Long Time Pickup setting of 0.5 x sensor, with a Short Time Setting of 2 x Long Time, at currents greater than 1 A.

## Ground Fault Time Delay (GFTD) Test (only if equipped)

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 30 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 12 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.10 s

Press the NEXT button to select "Ground Time Delay" mode. Press the START button. Accept the default start value of 0.500 A by pressing ENTER.

The system will inject current into the Ground element of the STIII, and will automatically maintain the current at the preset value, until one of the following occurs:

- ☐ If the STIII trips, the test will stop, and the display will show the current and elapsed time that the trip occurred.
- ☐ If the operator pushes the STOP button before the test finishes, the test will stop, and the display will indicate "Stopped".
- ☐ If the current persists for more than 7 minutes, and the STIII does not trip, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

As shown on the table below, with the GFTD setting at 0.10 s, the STIII should have tripped between 0.100 s and 0.200 s, when 0.5 A is applied. The STIII will show "GROUND FAULT" in the window upon successful completion of the test. If the STIII is attached to the breaker, and the breaker is closed, it should trip at the end of the delay.

To test another phase, press the STOP button to return to the "Idle" status, and then press Ø2 or Ø3 as desired. Observe that the display indicates the selected phase. Then press START and then ENTER to test the next phase.

Test the remaining points on the Ground Fault Delay dial. In each case, the STIII should trip the breaker within the parameters listed below. Other combinations of time delay and pickup current may be tested if desired, however, the expected trip time will need to be determined from the time-current curve. Press ENTER to load the value and start the test.

| GFTD Setting | Ground Fault Time Delay (s) | |
|---|---|---|
| | Minimum | Maximum |
| 0.10 | 0.100 | 0.200 |
| 0.25 | 0.250 | 0.350 |
| 0.40 | 0.400 | 0.500 |

This table is valid for Ground Fault Pickup setting of 20% of ground sensor.

## Zone Selective Interlock (ZSI) Tests

There are two parts to the ZSI system. The first is a signal which is issued by a STIII when it goes into Short Time or Ground Fault pickup. The second is a signal receiver in the STIII that drives the Short Time and Ground Fault delays to the minimum whenever the ZSI mode is enabled and the signal is not present. If the ZSI mode is enabled, and the signal is present, then the Short Time and Ground Fault delays will obey their dial settings. The inputs and outputs are connected together using the wiring in the switchgear and the Zone Interlock Couplers and Expanders. Here is a table that summarizes the behavior of the STIII as pertains to the ZSI system:

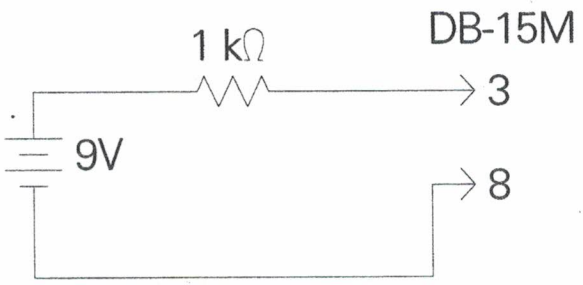
| ZSI Mode | ZSI Signal | ST/GF Delay |
|---|---|---|
| OUT | n/a | Dial Setting |
| IN | OFF | Minimum |
| IN | ON | Dial Setting |

The purpose of ZSI is that it allows greater protection of the bus from short circuits and ground faults. In normal selective coordination, the delays for Short Time and Ground Fault must be set higher on the mains and tie than the feeders, to allow the feeder to trip first. However, if the fault occurs on the bus, between the main and feeder, then the main breaker will have to wait through a longer delay to clear the fault.

Normally, the STD and GFTD are set on the mains in the usual manner, higher than the corresponding delays on the feeders. When a feeder STIII goes into ST or GF pickup, it sends the signal to the main breaker STIII. The main breaker STIII receives this signal, which causes the main STIII to obey its dial setting. The result is that the main STIII restrains tripping the breaker until the feeder has a chance to clear the fault. If, however, the main STIII does not receive any signal when it goes into ST or GF pickup, it assumes that the fault is in the bus. The STD or GFTD is driven to the minimum, and the main breaker trips in the shortest possible time. The system is failsafe in the event of a wire breakage in the ZSI wiring or malfunction of the feeder STIII in that the absence of the signal makes the STIII go to its minimum delay.

**Testing the ZSI system in the switchgear**

Testing the ZSI in the switchgear may be accomplished by building a simple device containing a 9 V battery, a 1 k Oresistor, and a DB-15 female connector. The purpose of this device is to emulate the feeder breaker going into short time pickup and issuing its restraint signal to the main breaker.




To perform the test, attach the PTS 5 to the main breaker. It is not necessary to attach the adapter cable from the 9-pin and 15-pin connectors on the front of the STIII for this test. If the switchgear has more than one main breaker, each feeder will need to be tested with each main or tie breaker. When switchgear is equipped with a tie breaker, the ZSI signals are set up so that they are presented to the main and tie breaker that are connected to the same bus as the feeder breaker.

For example, if testing a feeder on the left side of the tie breaker, then the test would need to be repeated three times. The first test would be to ensure the main on the left is restrained. The second test would be to ensure the tie is restrained. The final test would be to ensure that the main on the right side of the tie is not restrained.

Set up the PTS 5 for a Short Time Delay test per the instructions above. Note that it is not necessary to actually close the breaker for these tests. The STIII will indicate its tripped status to the PTS 5 whether or not the breaker is closed.

Set the STIII dials as follows (ignore any that are not present on the unit under test):

- Long Time Setting: 0.5 x sensor
- Long Time Delay: 30 s
- Instantaneous Pickup: 15 x sensor
- Short Time Pickup: 2 x LT setting
- Short Time Delay: 0.40 s
- Ground Fault Pickup: 20%
- Ground Fault Delay: 0.40 s
- Thermal Memory: OUT
- Short time $I^2t$: OUT
- Zone Interlock: OUT

Perform the STD test. The STIII should trip in the normal range for the 0.40 second delay.

Set the Zone Interlock switch to IN and perform the STD test again. This time, the STIII should trip within the normal range for the 0.08 second delay.

Unplug the umbilical from the STIII of the first feeder in the lineup, and insert the test device into the free end of the umbilical (that was plugged into the STIII). Ensure the other end of the umbilical is plugged securely into the connector on the switchgear frame. Perform another STD test. The STIII should now trip at the normal range for the 0.40 second delay.

Remove the test device from the first feeder, and test each of the feeders in turn. Remember that when the device is connected, the main breaker should delay its trip by

approximately 0.40 seconds, and when the device is disconnected, the main breaker should delay its trip by approximately 0.08 seconds.

**Testing the ZSI capabilities of a standalone STIII (whether attached to a breaker or not)**

The ZSI capabilities of a standalone STIII may be verified by obtaining the ZSI Signal Tester, part number 18-732-790-563, from Siemens customer service.

Attach the STIII to the PTS 5, either by direct connection to the terminal block, or through the test cable. It is not necessary to attach the 9-pin and 15-pin adapter cable for this test. Plug the ZSI Signal Tester into the 15-pin connector on the front of the STIII and turn the switch to the OFF position (to the left).

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 30 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 2 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s
Thermal Memory: OUT
Short time $I^2t$: OUT
Zone Interlock: OUT

Perform the STD test. The STIII should trip in the normal range for the 0.40 second delay. Turn the ZSI Tester switch ON and repeat the test. The STIII should still trip at approximately 0.40 seconds. Note that the LED on the front of the ZSI Tester will blink when the STIII goes into Short Time Pickup, which should coincide with the Short Time/Ground Pickup LED on the front of the Static Trip III.

Set the Zone Interlock switch on the front of the STIII to IN and perform the STD test again. This time, with the ZSI Tester switch ON, the STIII should trip within the normal range for the 0.40 second delay.

Turn the ZSI Tester switch OFF, and perform the STD test once again. The STIII now should trip in the normal range for the 0.08 second delay.

## Thermal Memory (TM) Testing

The purpose of the thermal memory function is to allow the Long Time element to react to repeated momentary overloads. The thermal memory circuit uses the charge on a capacitor to emulate the heating and cooling of a bimetal element as may be found in a traditional overcurrent relay. If the STIII goes into Long Time Pickup, but drops out before the time to trip elapses, the capacitor will be partially charged. After the overload passes, the capacitor will begin to discharge. If, however, another LT Pickup occurs before the capacitor discharges, the capacitor will begin to charge up again, and if enough charge accumulates, the STIII will trip on Long Time.

The capacitor may be engaged (Thermal Memory switch to the IN position), or disengaged (switch in the OUT position). If the capacitor is disengaged, then the Long Time delay timer gets reset whenever the LT element drops out. As long as the current drops back below the LT pickup threshold before the LT delay element times out, even momentarily, the STIII will not trip on Long Time as the timer resets every time the LT element drops out.

A total of four tests need to be performed, to ensure the circuit is functioning properly. The first two tests use the standard Long Time Delay test discussed previously. The second two tests use the Thermal Memory test mode. The STIII needs to be connected to the PTS 5 either directly or through the test cable. The DB 25 Adapter Cable is not needed for these tests.

Set the STIII dials as follows (ignore any that are not present on the unit under test):

Long Time Setting: 0.5 x sensor
Long Time Delay: 3.5 s
Instantaneous Pickup: 15 x sensor
Short Time Pickup: 12 x LT setting
Short Time Delay: 0.40 s
Ground Fault Pickup: 20%
Ground Fault Delay: 0.40 s
Thermal Memory: OUT

The first two tests establish a baseline to ensure that the capacitor circuit is not affecting the ability of the trip unit to respond to a single overload event.

Perform the first test by pressing the NEXT button to select "Long Time Delay" mode. Press the START button. Change the default current value to 0.550 A by pressing 0, 5, 5, 0, ENTER. The STIII should trip in about 30-35 seconds. Record this time value for later comparison.

Now change the Thermal Memory switch to IN. Perform another LTD test, again with a start value of 0.550 A. The STIII should trip very close to the same time as the first test. Record this time value for later comparison.

The next two tests verify that the capacitor circuit is correctly accumulating brief overloads, only when the Thermal Memory switch is set to the IN position.

To perform the third test, press the NEXT button to select "Thermal Memory" mode. Press the START button to begin the test. The PTS 5 will inject a current into the STIII with the following characteristics:

- ☐ 10 seconds of 0.55 A (to drive the STIII into LT Pickup)
- ☐ 1 second transition to 0.20 A
- ☐ 3 seconds of 0.20 A (to cause the LT element to drop out, yet still provide enough energy to keep the STIII microprocessor running)
- ☐ 1 second transition back to 0.55 A and repeat the cycle

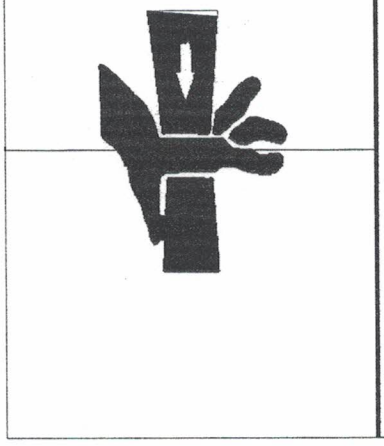
NOTE: The Long Time Pickup LED on the STIII does not immediately extinguish when the LT element drops out. Therefore, it is normal for the LTPU LED on the STIII to remain illuminated even during the low portion of the cycle, even though the element is actually dropped out.

This pattern will repeat until either the STIII trips on Long Time, or 225 seconds (which is 15 iterations) have elapsed, or the user pushes the STOP button.

Since the Thermal Memory switch is IN, the capacitor will begin to charge up on each pulse of current. The STIII should trip in about 45-55 seconds. Record the time it took the STIII to trip out and compare it to the times recorded previously. This time should be longer than the other two tests, since the overload was not constant. NOTE: If the PTS 5 times out, with the Thermal Memory switch set to IN, then the test did not pass.

To perform the final test, change the Thermal Memory switch to OUT. Select the Thermal Memory test mode and repeat the test. This time, since the capacitor is out of the circuit, the time delay gets reset every time the LT element drops out. The STIII should go through all 15 iterations of current pulses (this will take 3 minutes, 45 seconds) without tripping. If the STIII trips during this test, with the Thermal Memory switch set to OUT, then the test did not pass.

## Testing the STIII Actuator



**⚠WARNING**

High Speed Moving Parts

Can cause death or serious injury

Discharge the springs before attempting to perform any inspection or adjustment of the circuit breaker operating mechanism. Keep hands clear of the mechanism if exercising the circuit breaker during the test.



The actuator may be tested either on or off the breaker. If the actuator is mounted on the breaker, it is necessary to disconnect the actuator leads from the STIII by disconnecting the fanning strip from the terminal block.

Attach the red and black leads from the actuator to the corresponding binding posts on the PTS 5. Ignore the blue lead.

If the actuator is mounted on the breaker, close the breaker.

If the actuator is not mounted on the breaker, ensure the plunger is pushed in, by pushing on the end of the rod without the locknut, until the actuator latches. A fair amount of finger pressure is required to latch the actuator. Keep the actuator away from all ferrous objects during the test as nearby objects may interfere with its operation.

Press the NEXT button to select "Actuator" mode. Press the START button. Accept the default start value of 0.0 V by pressing ENTER.
The system will inject voltage into the actuator winding, and will automatically increase the voltage until one of the following occurs:

- ☐ If the operator pushes the STOP button, the test will stop, and the display will indicate "Stopped", and display the final voltage.
- ☐ If the voltage achieves 10.0 V, the test will stop, the display will indicate "Fail", and the ALARM light will turn on.

Watch the actuator and press the STOP button when the breaker trips (or the plunger pops out, if bench testing).

If the breaker fails to trip, refer to the breaker instruction manual SGIM-3068D and follow the troubleshooting instructions therein.

Disconnect the actuator from the PTS 5 and perform the following resistance checks:

Red lead to black lead: 15-20 O
Black lead to blue lead: 40-50 O

Red lead to blue lead: 55-70 O
Any lead to ground, measured with a standard ohmmeter: infinite.

If the actuator fails these tests, replace it. No attempt should be made to repair the actuator in the field.

## Calibration

The calibration of the current source may be checked using a precision ammeter. There are two sets of calibration points. One set is for the 0-1.5 A range, and the other set is for the 1.0-10 A range.

Attach a known good STIII to the unit either using the test cables or directly with the fanning strip. Do not attempt to calibrate the unit using only a short circuit on the output. The calibration will not be valid unless the STIII is in the circuit, as the STIII presents a non-linear load to the current source, which cannot be duplicated by a simple short circuit connection across the output.

Remove the shorting plug and insert a precision ammeter capable of measuring the desired current into the circuit.

To calibrate the low current set, select the Constant Low Current test and press the START key. Press the NEXT and PREV keys to step through the calibration points. Note that the default points are the only valid points allowed for calibration. If the current is operated at a user-defined value, it is not possible to calibrate, and an error message will be generated should the calibration procedure be attempted at other than a defined calibration point.

Start the test at the selected value by pressing the ENTER key. It is only necessary to use Phase 1 for the calibration, as all three phases are driven by the same current source. Before attempting calibration, let the unit run at 0.5 A for at least 10-15 minutes to allow the system to stabilize.

Observe the displayed current on the ammeter and compare it to the displayed value. If the values do not match within 2%, press the white unlabeled calibration key. Enter the four most significant digits of the ammeter reading into the keypad, and press ENTER.

Repeat the test again at the same calibration point, and verify that the current is now within tolerance. Repeat the procedure if necessary.

Select the next calibration point in the series, and perform the calibration procedure again with the next current value. Repeat until all the low and high series points have been calibrated.

When finished, disconnect the ammeter and insert the shorting plug in the jacks.

## Repair of Static Trip Devices

Because of the complexity of the semi-conductor components and circuits and because some of the components are especially selected or matched, we strongly discourage field repair of the static trip devices. Moreover, component failure usually does not show up as visual damage and locating the defective component or components requires specialized techniques. Therefore, if the tests described in these instructions indicate that a static trip device or the test itself is defective, contact your nearest Siemens representative for instructions on returning the unit to the factory or other authorized service repair facility. Any efforts to attempt to make repairs in the field will result in voiding all equipment warranties.