TVRMS2 Digital Test Kit

User's Guide

GEK-97367A

WARNINGS, CAUTIONS, AND NOTES AS USED IN THIS PUBLICATION

WARNINGS

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

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

CAUTIONS

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

NOTES

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

This document is based on information available at the time of its publication. While efforts have been made to ensure accuracy, the information contained herein does not cover all details or variations in hardware and software, nor does it provide for every possible contingency in connection with installation, operation, and maintenance. Features may be described herein that are not present in all hardware and software systems. GE Electrical Distribution & Control assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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TVRMS2 Digital Test Kit

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1–1 Description

The TVRMS2 Digital Test Kit, is a light-weight, portable test instrument designed for field testing of RMS-9, Epic, MicroVersaTrip® Plus, and MicroVersaTrip® PM Trip Units. The Test Kit includes the following features:

- Operation from 120 Vac or six D-cell batteries.
- Trip Unit testing without de-energizing the breaker or removing the Trip Unit from the breaker.
- Verification of switch settings on RMS-9 and Epic Trip Units.
- Either trip or no-trip testing for time-overcurrent characteristics.
- Monitoring of pickup current and trip time during high-current injection testing.
- Menu-driven test procedures for ease of use.

The Test Kit interface with the Trip Unit is a three-wire digital communication link through the test jack on the front of the Trip Unit, as illustrated in Figure 1.

Figure 1. TVRMS2 Digital Test Kit connected to an RMS-9 Trip Unit.

1–2 Application to Pre-RMS-9 Trip Units

The TVRMS2 Test Kit cannot be used to test earlier MicroVersaTrip solid-state programmers. Table 1 is a matrix showing the compatibility among types of Trip Units and Test Kit models.

CAUTION: The older TVTS1 Test Kit cannot be used to test RMS-9, Epic, MicroVersaTrip® Plus, and MicroVersaTrip® PM Trip Units and could cause damage to the Trip Unit if an attempt is made to do so.

ATTENTION: Ne pas utiliser TVTS1 (modèle précedent) Test Kit avec les déclencheurs RMS-9, Epic, MicroVersaTrip® Plus, et MicroVersaTrip® PM (le déclencheur pourrait être endommagé).

CAUTION: The older TVRMS Test Kit cannot be used to test MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units and could cause incorrect test results if an attempt is made to do so.

ATTENTION: Ne pas utiliser TVRMS (modèle précedent) Test Kit avec les déclencheurs MicroVersaTrip® Plus et MicroVersaTrip® PM (les résultants peuvent être incorrects).

	Trip Unit Type		
Test Kit	**MicroVersaTrip® TP4VT, TP9VT, TAVT, and T4VT**	**RMS9 and Epic ("TS" type)**	**MicroVersaTrip® Plus and MicroVersaTrip® PM ("TT" and "A,B,orC" type or Spectra RMS™ breaker**
TVTS1	Yes	No	No
TVRMS	No	Yes	No
TVRMS2	No	Yes	Yes

Table 1. Matrix showing compatibility among Test Kit models and Trip Unit types.

1–3 Definition of Terms

The terms listed and defined in Table 2 are displayed on the Test Kit and are used throughout this guide.

Term	Definition
S, xCT	The current sensor rating – the primary current rating of the breaker's current sensors.
X, xIn	The current rating of the Trip Unit, set by the rating plug.
C, xLT	The current setting of the Trip Unit – determined as a multiplier of the rating plug value.
LT	Long Time overcurrent protection function
ST	Short Time overcurrent protection function
INST	Instantaneous overcurrent protection function
GF	Ground Fault overcurrent protection function
H	The Short Time rating of the breaker frame.
Trip Test	A test that causes the breaker to trip.
No-Trip Test	A test that does not cause the breaker to trip.

Table 2. Definitions of terms used in this guide.

1–4 Test Selection

The Test Kit can perform three types of tests on Trip Units:

- *Function tests* verify the operation of the Trip Unit, including:
  - Time-overcurrent tests, both trip and no-trip
  - Switch-setting verification (RMS-9 and Epic only)
  - Trip Unit self-test report
- *High-current tests* monitor the functioning of the Trip Unit during primary current-injection testing of the breaker with a separate, commercially available high-current test set. Under high-current tests, the Test Kit can temporarily suppress or defeat Ground Fault protection. The Test Kit monitors the time at which the Trip Unit goes into overcurrent pickup and displays the overcurrent condition and the time required to trip.
- *Quick test* verifies that the Trip Unit and the breaker mechanism can cause the breaker to trip by actually tripping the breaker.

The tested functions are listed in Table 3.

Test Selected	Trip Unit					Flux Shifter Trip Activator & Breaker Tripping Mechanism	Input Sensors (CTs)
	Function Switches	A/D Converter	Micro-processor (also ROM & RAM)	Nonvolatile Memory	Rating Plug		
Switch Settings①	X	X	X	X	X		
Self-Test		X	X	X			
Overcurrent Simulation:							
No Trip	X		X	X	X		
Trip	X		X	X	X	X	
Quick Test			X			X	
High-Current (Primary) Injection	X	X	X	X	X	X	X

① *RMS-9 and Epic only.*

Table 3. Tests available with the TVRMS2 Digital Test Kit and the functions tested.

2–1 Front Panel

Figure 2 shows the front panel of the Test Kit.

Figure 2. Front panel of the Test Kit.

The functions of the various switches and displays on the front panel are as follows:

- *Display Panel* – The display panel is a 40-character by 2-line liquid crystal display (LCD). The top line contains instructions and information for each stage of the test. The bottom line identifies the functions of each of the four function keys during each test.
- *Function Keys* – The function of each of the keys is determined by the test state of the Test Kit and is identified on the bottom line of the display panel. The function keys are labeled form left to right as F1, F2, F3, and F4.
- *LEDs* – There are six light-emitting diodes (LEDs) on the front panel:

  FUNCTION TEST – A yellow LED that lights when the Test Kit is in the function test sequence.

  HI CURRENT TEST – A yellow LED that lights when the Test Kit is in the High-Current test sequence.

  NO TRIP TEST – A yellow LED that lights if the test being performed will not trip the breaker.

  BREAKER TRIPPED – A red LED that flashes when the Trip Unit under test has tripped the breaker.

  TRIP TEST – A red LED that flashes if the test being performed will trip the breaker. This will occur if `Quick Test` is selected or if `Trip Test` is selected during an Overcurrent Test sequence.

  LOW BATTERY – A red LED that lights when the Test Kit battery is becoming weak. Further testing under low-battery conditions can yield erroneous test results.
- *Escape Key* – Pressing the ESCAPE key returns the Test Kit to its power-up or "home" state and initiates the self-test sequence.
- *On-Off Switch* – The ON-OFF rocker switch has a red band that is visible when the Test Kit is on.
- *Legend* – The legend provides a quick reference to the various abbreviations used on the display.

2–2 Top Panel (Test Cable Connection)

The top panel contains a test port, Test Port A, which accepts the 3.5 mm, three-conductor plug attached to the test cable. The other end of the test cable is inserted into the test jack of the Trip Unit rating plug. A similar test cable can be obtained from Radio Shack (catalog number 42-2387).

CAUTION: Switch the Test Kit power off before inserting the test jack into or removing it from the Trip Unit rating plug.

ATTENTION: Eteindre le Test Kit avant de connecter ou de déconnecter la prise jack du calibreur.

2–3 Bottom Panel

The battery compartment and power-cord storage compartment are located in the bottom panel of the Test Kit, as illustrated in Figure 3. Plugging the power cord into a 120 Vac outlet automatically switches the Test Kit from battery to line operation. The battery compartment (located under the power-cord storage area) accepts six "D" cells; these may be zinc oxide, alkaline, or rechargeable nickel-cadmium batteries. The Test Kit does not recharge nickel-cadmium batteries when operating on 120 Vac. To replace the batteries, loosen the thumb screws and remove the battery cover.

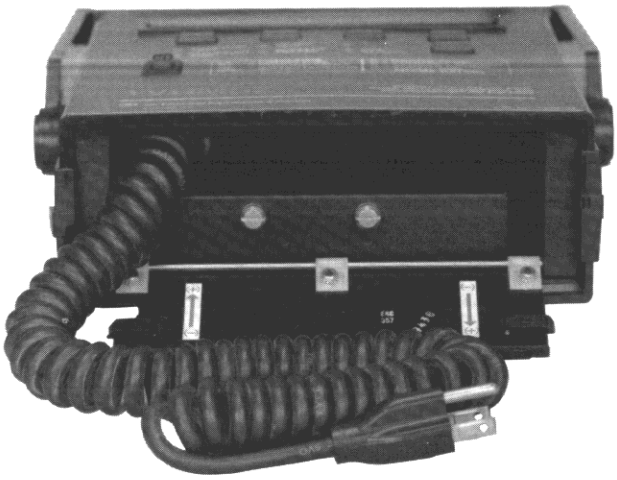

Figure 3. Bottom panel of the Test Kit, showing the 120 Vac power cord and the battery-storage area.

Power Cord Storage

To store the power cord into the power-cord storage compartment, first insert the plug end of the cord, then fold the cord into the compartment, as illustrated in Figures 4, 5, and 6

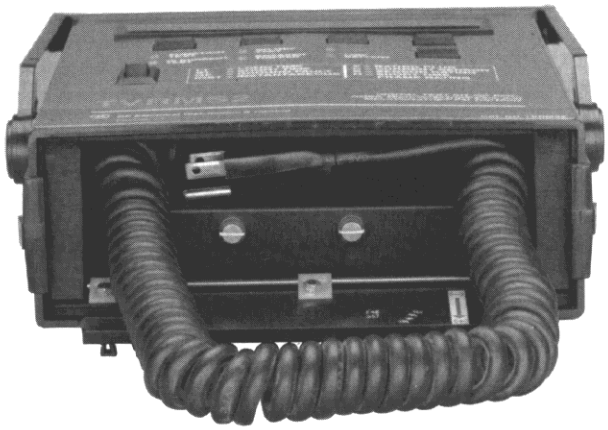

Figure 4. Insertion of the power cord into the storage compartment.

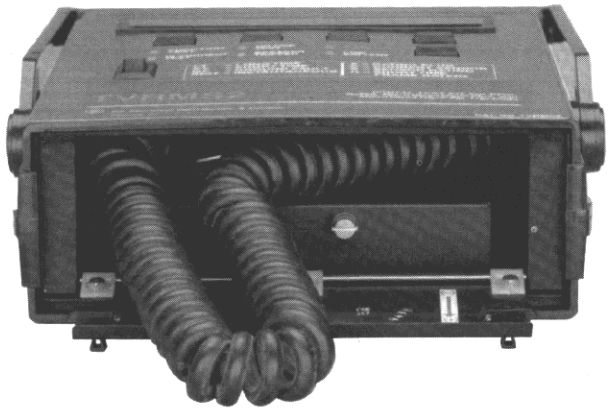

Figure 5. Folding the power cord into the storage compartment.

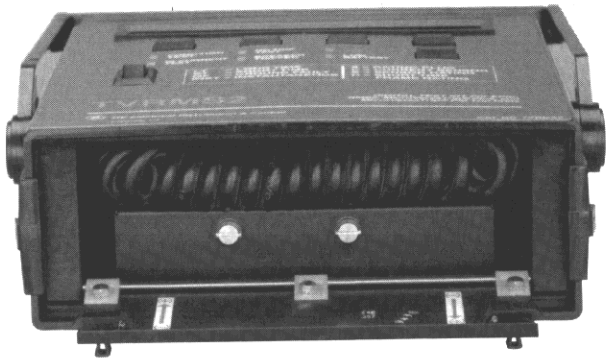

Figure 6. Power cord completely inserted in the storage compartment.

3-1 Introduction

This section describes the process of setting up the Test Kit for Trip Unit testing. Figure 7 is a block diagram of the initialization process.

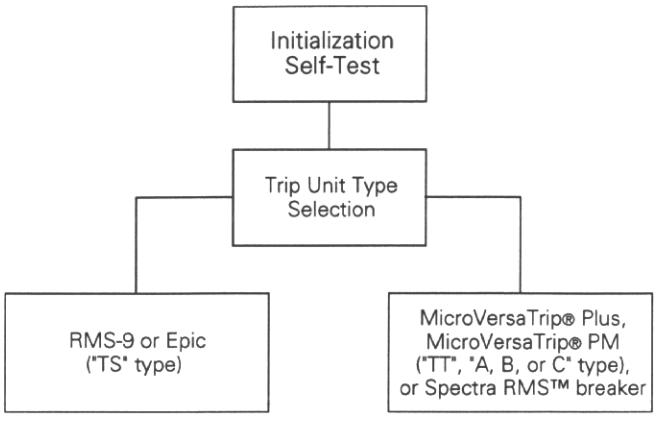

Figure 7. Block diagram of Test Kit initialization and Trip Unit selection.

3-2 Initialization and Self-Test

Every time the Test Kit is turned on, it performs a self-test of all major functions before tests can begin. These functions include:

- Keyboard
- Read-only memory (ROM) to verify program integrity
- Random-access memory (RAM)
- Battery

If all functions pass the self-test, the following message appears on the display:

```
Testkit Okay
|- MORE -|
```

Self-test okay display.

Press the F1 key (identified as MORE) to begin Trip Unit testing.

If any function fails the self-test, an appropriate message appears on the display. Press MORE (F1) to display all error messages if there are more than one.

If the RAM or ROM fails the self-test, press the ESCAPE key (several times, if necessary) to repeat the self-test. If this fails to clear the error, turn the power switch off and on. If the error is still not cleared, refer the Test Kit to an authorized GE service representative.

If the keyboard fails, try pressing each of the four keys in turn to clear a possible stuck key, then press ESCAPE or toggle the power switch to rerun the self-test. If the error is still present after several attempts to clear it, refer the Test Kit to an authorized GE service representative.

If the battery failure message appears, either replace the batteries or power the Test Kit with the 120 Vac line cord. If the battery failure message appears after these have been done, refer the Test Kit to an authorized GE service representative.

3-3 Trip Unit Type Selection

Pressing the F1 key displays the following menu on the Test Kit:

```
Select Trip Unit CAT. NO. Prefix
|- MORE -|-  TS  -|-  TT  -| A,B,orC|
```

Trip Unit selection menu #1.

The catalog number prefix "TS" refers to RMS-9 and Epic Trip Units, while "TT" and "A, B, or C" refer to various models of MicroVersaTrip Plus and MicroVersaTrip PM trip Units. Press the MORE (F1) key to display an additional menu allowing the selection of a MicroVersaTrip Plus or MicroVersaTrip PM in a Spectra RMS™ molded-case circuit breaker:

```
Select Breaker type
|- MORE -|-Spectra-|
```

Trip Unit selection menu #2.

Select MORE (F1) to return to the previous menu.

Selecting the wrong type of Trip Unit causes the following message to appear on the Test Kit display:

```
WRONG TRIP UNIT; Verify Selection
|- MORE -|
```

Wrong Trip Unit type display.

However, the Test Kit is not always capable of distinguishing among some Trip Unit types.

NOTE: Selecting the wrong type of Trip Unit (when not detected) will cause incorrect test results.

NOTE: Une mauvaise selection du déclencheur peut entrainer des résultats incorrects du test.

Figures 8–11 show the various Trip Unit types that can be tested by the Test Kit, with their reference names as shown on the Test Kit display.

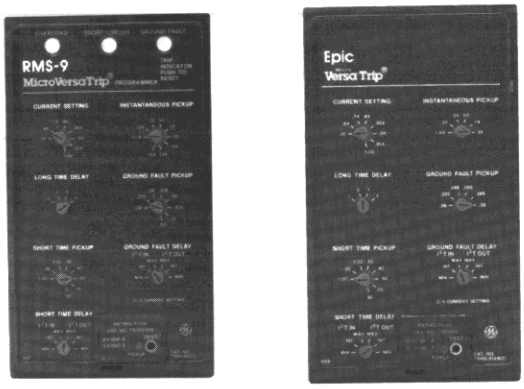

Figure 8. TS-style Trip Unit (RMS-9 and Epic).

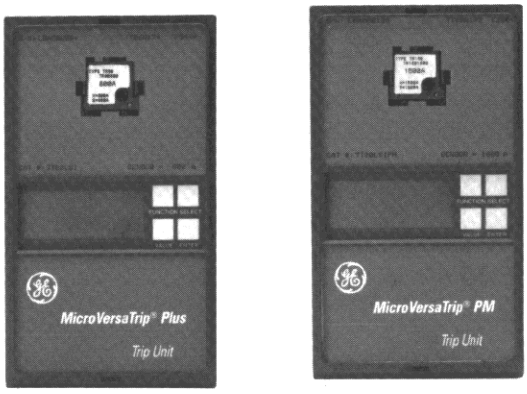

Figure 9. TT-style Trip Unit (MicroVersaTrip® Plus and MicroVersaTrip® PM).

Figure 10. A-, B-, or C-style Trip Unit (enhanced MicroVersaTrip® Plus and MicroVersaTrip® PM).

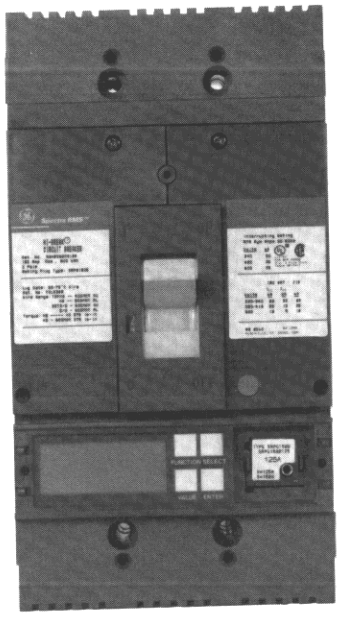

Figure 11. MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units in Spectra RMS™ molded-case circuit breakers.

3-4 Test Selection Sequence

After the Trip Unit type has been selected, the Test Kit verifies that a Trip Unit is connected through the communication link. If no Trip Unit is connected, the following message appears:

```
Digital Link Open; Check Connection
|- MORE -|
```

Display indicating that Trip Unit is not connected.

A Trip Unit must be properly connected before the test sequence can continue. When this has been done, press F1 (MORE) to return to the main Trip Unit selection menu. If the Trip Unit is properly connected, the Test Kit displays the main test-selection menu:

```
Press F1,F2, or F3 for test selection
|FUNCTION |HICURRENT|  QUICK  |
```

Main test-selection menu.

If the following message appears while any test is being run, press MORE (F1) to restart the test.

```
Program interrupted; restart test
|-  MORE -|
```

Message indicating that test should be restarted.

If a TS-type (RMS-9 or Epic) Trip Unit is to be tested, see Chapter 4 for detailed instructions.

If a TT-, A-, B-, or C-type (MicroVersaTrip Plus or MicroVersaTrip PM) or Spectra (MicroVersaTrip Plus or MicroVersaTrip PM in a Spectra RMS™ molded-case circuit breaker) Trip Unit is to be tested, see Chapter 5 for detailed instructions.

4-1 Test Structure (RMS-9 and Epic)

Figure 12 shows the test-selection structure for RMS-9 and Epic Trip Units. Each test sequence is described in detail below.

Selecting FUNCTION from the main menu displays the function test menu:

```
Press F1 or F3 (F4 to EXIT)
|- TESTS -|          |-SETTNGS-|- EXIT -|
```

Function test menu.

Press SETTNGS (F3) to enter the switch settings test mode (described in the Switch Settings Test section), EXIT (F4) to return to the main menu, or TESTS (F1) to display the Trip Unit tests menu:

```
Press F1 or F3 (F4 to EXIT)
|TRIP TEST|          |SELF TEST|- EXIT -|
```

Trip Units tests menu.

Trip Test mode is described in section *4-5 Overcurrent Simulation* and Self-Test is described in section *4-4 Self-Test Report.* Press EXIT (F4) to return to the function test menu.

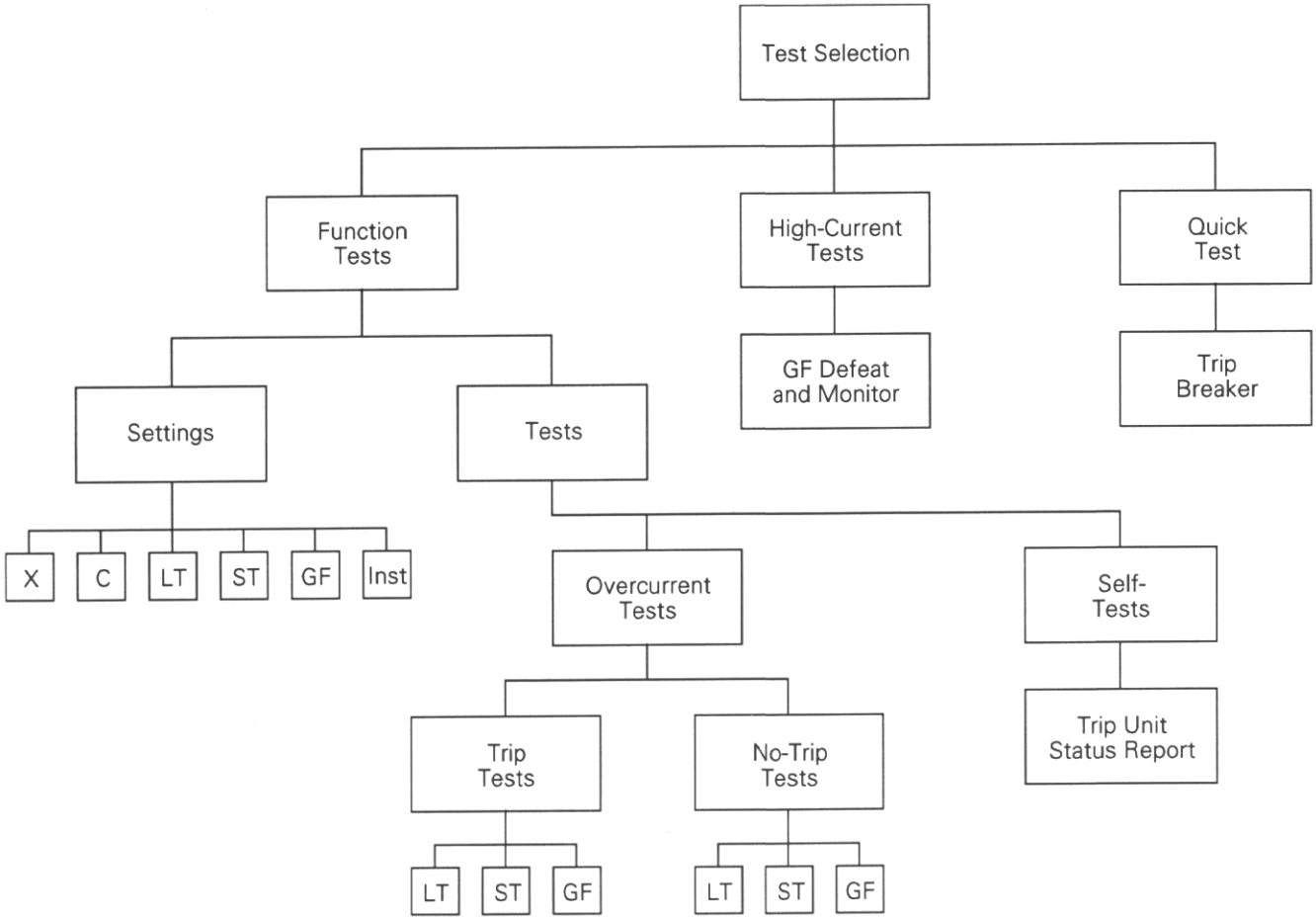

Figure 12. Test-selection structure for RMS-9 and Epic Trip Units.

4-2 Switch Settings Test

This test checks the settings stored in the Trip Unit to verify that they correspond to the values indicated by the rotary knobs.

NOTE: Settings of MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units should be verified at the Trip Unit display. **The Trip Unit LCD always displays the correct stored settings**. The Test Kit is not designed to read the settings of these Trip Units.

NOTE: Les réglages des MicroVersaTrip® Plus et MicroVersaTrip® PM sont vérifiés sur l'écran des déclencheurs. **Cet écran indique les réglages memorisés**. Ces valeurs ne peuvent pas être visualisées avec l'écran du Test Kit.

The Test Kit reports on the following RMS-9 or Epic function switches and settings:

- Rating plug value
- Current setting
- Long Time Delay
- Short Time Pickup
- Short Time Delay and slope (I^2t IN or OUT)
- Ground Fault Pickup
- Ground Fault Delay and slope (I^2t IN or OUT)
- Instantaneous Pickup
- Zone Selective Interlock input

Selecting SETTNGS (F3) from the function test menu displays the first Settings menu:

```
Select Setting  (F3 for MORE choices)
|-   X   -|-   C   -|-  MORE -|- EXIT -|
```

Settings menu #1.

Select MORE (F3) to display the other settings choices:

```
Select Setting  (F3 for MORE choices)
|-   LT  -|-   ST  -|-  MORE -|- EXIT -|
```

Settings menu #2.

```
Select Setting  (F3 for MORE choices)
|-   GF  -|-  INST -|-  MORE -|- EXIT -|
```

Settings menu #3.

Select EXIT (F4) on any of these menus to return to the function test menu. Each of the settings tests is described below.

Rating Plug Value (X)

Select X on Settings menu #1 to display the rating plug value, as illustrated below for a 1600 A plug.

```
Rating Plug = 1600 Amps
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Rating plug display.

For some special applications, a noninterchangeable rating plug with a catalog number of TR2SX or TR4SX is installed in the Trip Unit. The Test Kit should display the following values for these rating plugs:

TR2SX: 150 A

TR4SX: 4000 A

These values are not the actual breaker current rating, which can be found on the breaker nameplate.

For example, if the current sensor rating is 1600 A and a TR2SX rating plug is installed, the Test Kit will read 150 A. However, the actual rating is 1600 A and not 150 A.

Press AGAIN (F1) to repeat the test. Press MORE (F3) to return to settings menu #1 or EXIT (F4) to return to the function test menu.

Current Setting (C)

Select C (F2) on Settings menu #1 to display the current setting, as illustrated below for a setting of .9X.

```
Current Setting =  .90X
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Current setting display.

Press AGAIN (F1) to repeat the test at a different switch setting. Press MORE (F3) to return to settings menu #1 or EXIT (F4) to return to the function test menu.

Long Time Delay

Select LT (F1) on Settings menu #2 to display the Long Time Delay setting, as illustrated below:

```
Long Time Delay Band = 2 (4.6 sec at 6C)
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Long Time Delay band setting display.

There are four Long Time Delay bands numbered 1 through 4. The corresponding minimum delay times are 2.4, 4.6, 9.5, and 20 seconds.

Press AGAIN (F1) to repeat the test at a different switch setting. Press MORE (F3) to return to settings menu #2 or EXIT (F4) to return to the function test menu.

Short Time Pickup and Delay

If ST (F2) is selected from Settings menu #2, the Test Kit first determines whether the Trip Unit has the Short Time function. If this option was not installed, the display contains the message:

```
Short Time Option Not Included
                    |- MORE -|- EXIT -|
```

Display when Short Time Pickup is not installed in the Trip Unit.

Press MORE (F3) to return to Settings menu #2 or EXIT (F4) to return to the function test menu.

If the Trip Unit has the Short Time function, the first display contains the Short Time Pickup value:

```
Short Time Pickup = 2.0C
|- AGAIN -|        |- MORE -|- EXIT -|
```

Short Time Pickup setting display.

Press AGAIN (F1) to repeat the test at a different switch setting. Press MORE (F3) to display the Short Time Delay setting:

```
Short Time Delay  =  I2T  IN, MIN Band
                    |- MORE -|- EXIT -|
```

Short Time Delay setting display.

This display shows the delay slope (I2T IN or I2T OUT) and the delay length (MIN, INT, or MAX). This display shows the actual setting of the Short Time Delay switch, which is not affected by the Zone Selective Interlock input.

Pressing MORE (F3) causes the Test Kit to check for the Zone Selective Interlock option for Short Time. If it is not installed, the display contains the message:

```
Zone Interlock not included
                    |- MORE -|- EXIT -|
```

Display when Zone Selective Interlock is not installed.

If this option is installed in the Trip Unit, the present state (ON or OFF) is displayed, along with the modified value of the Short Time Delay band, as illustrated below:

```
Zone Interlock ON (Delay Band = MAX)
|- AGAIN -|        |- MORE -|- EXIT -|
```

Zone Selective Interlock status display.

If the Zone Selective Interlock option is installed and the input is active, the delay band is the same as set by the switch setting. If the Zone Selective Interlock input is off, then the delay band is set to minimum (MIN) delay

Press MORE (F3) to return to settings menu #2 or EXIT to return to the function test menu.

Instantaneous Pickup (INST)

When INST (F2) is selected from settings menu #3, the Test Kit first checks whether the Instantaneous option is installed in the Trip Unit. If it is not installed, or if the switch is set to OFF, the display contains the message:

```
Instantaneous Pickup is OFF
|- AGAIN -|        |- MORE -|- EXIT -|
```

Instantaneous Pickup off display.

If the Instantaneous option is installed, the pickup setting is displayed:

```
Instantaneous Pickup =  0.8H
|- AGAIN -|        |- MORE -|- EXIT -|
```

Instantaneous Pickup setting display.

The Instantaneous Pickup is displayed as a multiple of X (the rating plug value) for the standard Instantaneous option. If the high-range Instantaneous option is installed, the pickup setting is displayed as a multiple of H, the Short Time frame rating of the breaker. H cannot be read by the Test Kit, but is shown on the circuit breaker rating label.

Press MORE (F3) to return to settings menu #3 or EXIT (F4) to return to the function test menu.

Ground Fault

When GF (F1) is selected from Settings menu #3, the Test Kit first determines whether the Ground Fault option is installed in the Trip Unit. If it is not present, the display contains the message:

```
Ground Fault Option not included
                    |- MORE -|- EXIT -|
```

Display when Ground Fault is not installed in the Trip Unit.

Press MORE (F3) to return to Settings menu #3 or EXIT (F4) to return to the function test menu.

If the Ground Fault option is included and the Ground Fault Pickup switch is set to OFF, the display contains the message:

```
Ground Fault Pickup is OFF
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Ground Fault off display.

Otherwise, the Ground Fault Pickup setting is displayed:

```
Ground Fault Pickup  = .25S
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Ground Fault Pickup setting display.

Ground Fault Pickup is always displayed as a multiple of S, the current sensor rating. This value is found on the faceplate of the Trip Unit rating plug and on the circuit breaker nameplate.

Press AGAIN (F1) to repeat the test at a different switch setting. Press MORE (F3) to display the Ground Fault Delay setting:

```
Ground Fault Delay = I2T  IN, MAX Band
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Ground Fault Delay setting display.

This display shows the delay slope (I2T IN or I2T OUT) and the delay length (MIN, INT, or MAX). This display shows the actual setting of the Ground Fault Delay switch, which is not affected by the Zone Selective Interlock input.

Pressing MORE (F3) causes the Test Kit to check for the Zone Selective Interlock option for Ground Fault. If it is not installed, the display contains the message:

```
Zone Interlock not included
                    |-  MORE -|- EXIT -|
```

Display when Zone Selective Interlock is not installed.

If this option is installed in the Trip Unit, the present state (ON or OFF) is displayed, along with the modified value of the Short Time Delay band, as illustrated below:

```
Zone Interlock ON (Delay Band = MAX)
|- AGAIN -|          |-  MORE -|- EXIT -|
```

Zone Selective Interlock status display.

If the Zone Selective Interlock option is installed and the input is active, the delay band is the same as set by the switch setting. If the Zone Selective Interlock input is off, then the delay band is set to minimum (MIN) delay

Press MORE (F3) to return to settings menu #3 or EXIT (F4) to return to the function test menu.

Failures

If any switch setting is not read properly during the test, first verify that the switch is properly seated by turning it to a different setting, then back to the desired setting. Press AGAIN (F1) to repeat the test. If the switch is still not read properly, the Trip Unit under test should be replaced and referred to an authorized GE service representative.

If the rating plug value read by the Test Kit does not match the value shown on the front of the rating plug, de-energize the breaker, remove and then reinstall the rating plug. If the value read by the Test Kit still does not match, the rating plug should be replaced.

4-3 Self-Test Report

Select SELF TEST (F3) from the Trip Unit tests menu to initiate the Trip Unit self-test. The test verifies the operation of the following:

- Analog-to-digital converter
- Read-only memory (ROM)
- Random-access memory (RAM)
- Nonvolatile memory

If all modules pass the self-test, the following message is displayed:

```
Trip Unit is OK
                    |-  MORE -|- EXIT -|
```

Trip Unit self-test display.

Press the MORE (F3) key to return to the Trip Unit test menu or EXIT (F4) to return to the function test menu.

If the Trip Unit fails the self-test, a failure message is displayed for each of the subunits that failed. If more than one subunit failed, press the MORE (F3) key to display them all. The failure messages are displayed as follows:

```
A/D Converter Failed
                    |-  MORE -|- EXIT -|
```

A/D converter failure message.

```
RAM Failed
                    |-  MORE -|- EXIT -|
```

RAM failure message.

```
ROM Failed
                    |-  MORE -|- EXIT -|
```

ROM failure message.

```
Non-volatile Memory Failed
                    |-  MORE -|- EXIT -|
```

Nonvolatile memory failure message.

Press the MORE (F3) key after the last failure message to return to the Trip Unit test menu, or EXIT (F4) to return to function test menu.

In the event of any subunit failure, remove the breaker from service and refer the Trip Unit to an authorized GE service representative.

4-4 Overcurrent Simulation

The Test Kit can simulate a time-overcurrent condition for each of the following fault types:

- Long Time fault
- Short Time fault
- Ground Fault

The Test Kit first determines whether or not the breaker is to be allowed to trip with the message:

```
Do you want the breaker to trip?
|-  YES  -|          |-  NO  -|- EXIT -|
```

Trip query display.

If YES (F1) is selected, the TRIP TEST LED begins to flash. If NO (F3) is selected, the NO TRIP TEST LED activates. The next menu lists the available tests:

```
Select Test (F4 to EXIT)
|-   LT  -|-   ST  -|-   GF  -|- EXIT -|
```

Overcurrent test selection menu.

If ST (F2) or GF (F3) is selected, the Test Kit first verifies that the option is installed in the Trip Unit. If that option is not installed, the appropriate message is displayed, as illustrated above in the Short Time and Ground Fault settings tests.

Long Time Test

If LT (F1) is selected, the Test Kit displays the message:

```
Set Current Setting and press F3
                    |-  CONT -|- EXIT -|
```

Long Time current setting display.

Select the desired current setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
LONG TIME TEST  WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Long Time test verification display.

Press CONT (F3) to initiate the test or EXIT (F4) to return to the function test menu.

Short Time Test

If ST (F2) is selected from the overcurrent test selection menu, the Test Kit displays the message:

```
Set Short Time Pickup and press F3
                    |-  CONT -|- EXIT -|
```

Short Time Pickup setting display.

Select the desired Short Time Pickup setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
SHORT TIME TEST WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Short Time test verification display.

Press CONT (F3) to initiate the test or EXIT (F4) to return to the function test menu.

Ground Fault Test

If GF (F3) is selected from the overcurrent test selection menu, the Test Kit displays the message:

```
Set Ground Fault Pickup and press F3
                    |-  CONT -|- EXIT -|
```

Ground Fault Pickup setting display.

Select the desired Ground Fault Pickup setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
GND FAULT TEST  WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Ground Fault test verification display.

Overcurrent Simulation Test

During the simulation for any of the three types of test, the Test Kit first ramps up the simulation current, starting from less than .9 times the pickup current and continuing until pickup is reached. At that point, the display contains the message:

```
Input Current =  1.00C IN PICKUP
<Press any key to test at current shown>
```

Overcurrent simulation pickup display.

The current continues to ramp up until either one of the function keys is pressed or 15.00C (or 15.00S for Ground Fault) is reached. In either case, the simulated current is held constant and a message similar to the following is displayed:

```
Current = 15.00C (Press F3 to run test)
                    |-  CONT -|- EXIT -|
```

Overcurrent test current display.

Pressing CONT (F3) starts the test and initiates a countdown timer, which is displayed until the Trip Unit "trips":

```
IN PICKUP: Approx time left =  250 secs
|-    <Press any key to abort test>    -|
```

Overcurrent in pickup display.

The simulation can be aborted at any time during the test by pressing any function key, which displays the following message:

```
          ---TEST ABORTED---
                    |-  MORE -|- EXIT -|
```

Test aborted display.

When the simulated trip occurs the Test Kit display contains a message similar to the following:

```
Time = 262.64 secs; Current =  1.25C
                    |-  MORE -|- EXIT -|
```

Trip parameters display.

If a trip test was selected, the Test Kit sends a trip command to the Trip Unit and activates the (flashing) BREAKER TRIPPED LED.

Press MORE (F3) to return to the trip query display or EXIT (F4) to return to the function test menu.

NOTE: The Pickup LED on RMS-9 and Epic Trip Units is not lit and the Fault Trip annunciators do not pop out during a time-overcurrent trip simulation, since the Trip Unit is not actually experiencing an overcurrent condition.

NOTE: Sur le déclencheur RMS-9 ou Epic, la LED Pickup ne s'illumine pas et le temoin mécanique de déclenchement ne sort pas pendant une simulation de surcharge (à moins que le disjoncteur ne soit reéllement dans ces conditions).

4-5 High-Current Primary Injection

The Test Kit can also monitor Trip Units during primary current injection or "high-current" tests. While in monitor mode, the Test Kit display indicates whether the Trip Unit has "picked up" (detected an overcurrent condition) and, if so, the type of overcurrent condition (Long Time, Short Time, or Ground Fault). If the Trip Unit trips the breaker while the Test Kit is monitoring it, the type of trip and time to trip (the time between pickup and trip) are displayed.

The Ground Fault function, if included, must be temporarily defeated when performing high-current primary (single-pole) injection. The Test Kit can perform the Ground Fault defeat function; a separate Ground Fault defeat cable is not available.

Trip Unit Ground Fault Defeat

To initiate high-current testing, select HICURRENT (F2) from the main test selection menu. The Test Kit first verifies that it is connected to a Trip Unit with a digital communication port; if not, the Digital Link Open message is displayed. Press MORE (F3) at this point to return to the main test selection menu.

If the Test Kit is connected to a Trip Unit with a communication port, the HI CURRENT TEST LED is activated and the Trip Unit options are checked. If the Ground Fault option is installed, the Test Kit displays the message:

```
Defeat Ground Fault Protection?
|-  YES  -|          |-  NO  -|- EXIT -|
```

Ground Fault defeat query.

If the Trip Unit under test does not have the Ground Fault option, the Test Kit goes immediately to monitor mode.

If YES (F1) is selected in response the Ground Fault defeat query, the Test Kit attempts to suppress the Ground Fault option in the Trip Unit, after which it again checks the Trip Unit options to ensure that Ground Fault protection was defeated. If Ground Fault protection is still active, the Test Kit displays the message:

```
Ground Fault not defeated; try again?
|- YES -|          |- NO -|- EXIT -|
```

Ground Fault defeat failure message.

Press YES (F1) to try again; press NO (F3) to send the Test Kit to monitor mode. If Ground Fault protection is successfully defeated, the Test Kit displays the message:

```
Ground Fault temporarily defeated
                    |- CONT -|- EXIT -|
```

Ground Fault defeated message.

Press CONT (F3) to send the Test Kit to monitor mode. Press EXIT (F4) at any time in the process to re-enable Ground Fault protection. The Test Kit then displays the message:

```
WRONG TRIP UNIT; Verify Selection
|- MORE -|
```

Ground Fault restored message.

Press CONT (F3) to return to the main test-selection menu. Press EXIT (F4) to return to the Trip Unit selection menu.

Trip Unit Pickup and Trip Monitor

When the Test Kit is in monitor mode, it displays the message:

```
Press F1 to exit when test is complete
|- EXIT -|
```

Monitor mode display.

While this message is displayed, the Test Kit is constantly monitoring the status of the Trip Unit.

When the Trip Unit signals that it has entered pickup, the Test Kit displays a message indicating the type(s) of pickup, as in the illustration:

```
TU in pick-up: LT ST
|- EXIT -|
```

Sample Trip Unit pickup message.

The Test Kit continues to display the pickup message until the Trip Unit signals that it is no longer in pickup.

If the Trip Unit initiates a trip, the Test Kit displays a message showing the type of trip and the time to trip, as in the example:

```
LONG TIME: CURRENT= 1.25C TIME= 575.75s
|- MORE -|
```

Sample display for Long Time trip.

Press MORE (F1) to return the Test Kit to monitor mode.

4-6 Trip Unit Quick Test

The Trip Unit quick test is a one-step test to verify that the Trip Unit can trip the breaker. Since this test actually causes the breaker to trip, suitable precautions should be made before this test is performed.

Selecting QUICK (F3) from the main test selection menu starts the TRIP TEST LED flashing and displays the message:

```
Press F1 to trip breaker
|- TRIP -|                  |- EXIT -|
```

Breaker trip query.

Press EXIT (F4) to return to the main test selection menu or TRIP (F1) to send a trip command to the Trip Unit. When the trip command is issued, the Test Kit displays the message:

```
Breaker should now be tripped
|- EXIT -|
```

Breaker tripped display.

Press EXIT (F1) to return to the breaker trip query.

If the Trip Unit fails to trip the breaker in this test, remove the breaker from service and refer the Trip Unit to an authorized GE service representative.

5-1 Test Structure (MicroVersaTrip® Plus and MicroVersaTrip® PM)

Figure 13 shows the test-selection structure for MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units. Each test sequence is described in detail below.

If an A, B, C, or TT Trip Unit or Spectra breaker is selected, the Test Kit immediately displays the main test-selection menu:

```
Press F1,F2, or F3 for test selection
|FUNCTION |HICURRENT|  QUICK  |
```

Main test-selection menu.

With some versions of A, B, or C type Trip Units, the Test Kit displays the following menu:

```
Is the GF option included?
|-  YES  -|          |-   NO  -|- EXIT -|
```

Ground Fault option query menu.

If the Ground Fault option is included in the Trip Unit, press YES (F1). Otherwise, press NO (F3) to go to the main test selection menu. Press EXIT (F4) at any time to return to the Trip Unit selection menu.

Selecting FUNCTION (F1) from the main test-selection menu displays the Trip Units tests menu:

```
Press F1 or F3 (F4 to EXIT)
|TRIP TEST|          |SELF TEST|- EXIT -|
```

Trip Units tests menu.

Trip Test mode is described in section *5-3 Overcurrent Simulation* and Self-Test is described in section *5-2 Self-Test Report.* Press EXIT (F4) to return to the function test menu.

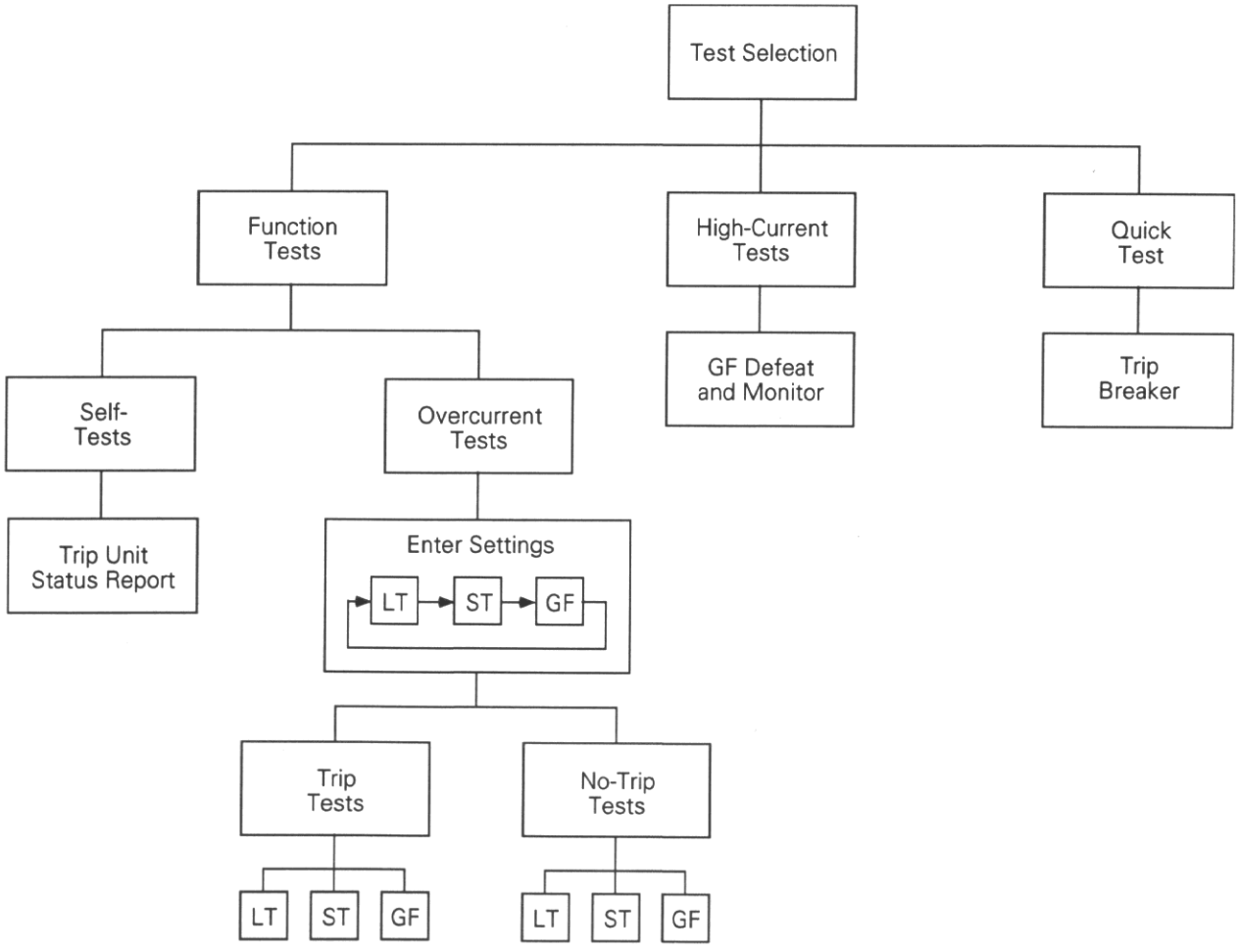

Figure 13. Test-selection structure for MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units.

5-2 Self-Test Report

Select SELF TEST (F3) from the Trip Unit tests menu to initiate the Trip Unit self-test. The test verifies the operation of the following:

- Analog-to-digital converter
- Read-only memory (ROM)
- Random-access memory (RAM)
- Nonvolatile memory

If all modules pass the self-test, the following message is displayed:

```
Trip Unit is OK
                    |-  MORE -|- EXIT -|
```

Trip Unit self-test display.

Press the MORE (F3) key to return to the Trip Unit test menu or EXIT (F4) to return to the function test menu.

If the Trip Unit fails the self-test, a failure message is displayed for each of the subunits that failed. If more than one subunit failed, press the MORE (F3) key to display them all. The failure messages are displayed as follows:

```
A/D Converter Failed
                    |-  MORE -|- EXIT -|
```

A/D converter failure message.

```
RAM Failed
                    |-  MORE -|- EXIT -|
```

RAM failure message.

```
ROM Failed
                    |-  MORE -|- EXIT -|
```

ROM failure message.

```
Non-Volatile Memory Failed
                    |-  MORE -|- EXIT -|
```

Nonvolatile memory failure message.

Press the MORE (F3) key after the last failure message to return to the Trip Unit test menu, or EXIT (F4) to return to function test menu.

In the event of any subunit failure, remove the breaker from service and refer the Trip Unit to an authorized GE service representative.

5-3 Overcurrent Simulation

The Test Kit can simulate time-overcurrent conditions for each of the following fault types:

- Long Time fault
- Short-time fault
- Ground fault

However, overcurrent simulations for MicroVersaTrip® Plus and MicroVersaTrip® PM Trip Units may require that the Long Time current, Short Time Pickup, and Ground Fault Pickup settings be entered manually into the Test Kit. The following sequence should be followed in order to perform an overcurrent simulation with one of these Trip Units:

1. Connect the TVRMS2 Test Kit to the MicroVersaTrip Plus or MicroVersaTrip PM Trip Unit and turn on the Test Kit.
2. Select the Trip Unit on the appropriate Trip Unit selection menu, then select FUNCTION (F1) from the main test-selection menu and TRIP TEST (F1) from the Trip Unit tests menu.
3. The Test Kit displays a Long Time Pickup value, as shown:

```
LT Pickup   .90X
|-  MORE -|- VALUE -|- ENTER -|- EXIT -|
```

Long Time Pickup setting display #1.

In Setup mode on the Trip Unit, read the Long Time Pickup setting from the Trip Unit display.

4. If the Long Time Pickup setting on the Test Kit display does not match the value on the Trip Unit display, press the VALUE (F2) key on the Test Kit until the value displayed on the Test Kit matches the value displayed on the Trip Unit.
5. Press ENTER (F3) on the Test Kit to store the correct Long Time Pickup value in the Test Kit.
6. Press MORE (F1) to display the next Long Time Pickup setting display:

```
LT Pickup   .90X
|-  NEXT -|-  PREV -|-  TEST -|- EXIT -|
```

Long Time Pickup setting display #2.

Select PREV (F2) to return to the previous display. Select NEXT (F1) to display the Short Time Pickup setting:

```
ST Pickup   3.00C
|-  MORE -|- VALUE -|- ENTER -|- EXIT -|
```

Short Time Pickup setting display #1.

(If Short Time trip is not an option on the Trip Unit under test, the next parameter displayed is Ground Fault Pickup.)

7. In Setup mode on the Trip Unit, read the Short Time Pickup setting from the Trip Unit display. If it does not match the value shown on the Test Kit display, press the VALUE (F2) key on the Test Kit until it matches the Trip Unit setting.
8. Press the ENTER (F3) key on the Test Kit to store the correct Short Time Pickup value in the Test Kit.
9. Press MORE (F1) to display the second Short Time Pickup display:

```
ST Pickup  3.00C
|-  NEXT -|-  PREV -|-  TEST -|- EXIT -|
```

Short Time Pickup setting display #2.

10. Press NEXT (F1) to move to the Ground Fault Pickup value:

```
GF Pickup   0.2S
|-  MORE -|- VALUE -|- ENTER -|- EXIT -|
```

Ground Fault Pickup setting display #1.

11. In Setup mode on the Trip Unit, read the Ground Fault Pickup setting from the Trip Unit display. If it does not match the value shown on the Test Kit display, press the VALUE (F2) key on the Test Kit until it matches the Trip Unit setting.
12. Press ENTER (F3) to store the correct Ground Fault Pickup value in the Test Kit.
13. Press MORE (F1) followed by TEST (F3) to initiate the test sequence.

NOTE: Hitting the EXIT key at any time after entering values will reset all set points to their default values.

NOTE: A tout moment, si vous appuyez sur le touche EXIT, les réglages sont réinitialisés avec les valeurs par défaut.

The Test Kit first determines whether or not the breaker is to be allowed to trip with the message:

```
Do you want the breaker to trip?
|-  YES  -|          |-  NO  -|- EXIT -|
```

Trip query display.

If YES (F1) is selected, the TRIP TEST LED begins to flash. If NO (F3) is selected, the NO TRIP TEST LED activates. The next menu lists the available tests:

```
Select Test (F4 to EXIT)
|-  LT  -|-  ST  -|-  GF  -|- EXIT -|
```

Overcurrent test selection menu.

If ST (F2) or GF (F3) is selected, the Test Kit first verifies that the option is installed in the Trip Unit. If that option is not installed, the appropriate message is displayed, as illustrated above in the Short Time and Ground Fault settings tests.

Long Time Test

If LT (F1) is selected, the Test Kit displays the message:

```
Set Current Setting and press F3
                    |-  CONT -|- EXIT -|
```

Long Time current setting display.

Select the desired current setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
LONG TIME TEST  WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Long Time test verification display.

Press CONT (F3) to initiate the test or EXIT (F4) to return to the function test menu.

Short Time Test

If ST (F2) is selected from the overcurrent test selection menu, the Test Kit displays the message:

```
Set Short Time Pickup and press F3
                    |-  CONT -|- EXIT -|
```

Short Time Pickup setting display.

Select the desired Short Time Pickup setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
SHORT TIME TEST WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Short Time test verification display.

Press CONT (F3) to initiate the test or EXIT (F4) to return to the function test menu.

Ground Fault Test

If GF (F3) is selected from the overcurrent test selection menu, the Test Kit displays the message:

```
Set Ground Fault Pickup and press F3
                    |-  CONT -|- EXIT -|
```

Ground Fault Pickup setting display.

Select the desired Ground Fault Pickup setting on the Trip Unit, then press CONT (F3), which displays the verification message:

```
GND FAULT TEST  WITHOUT BREAKER TRIP
                    |-  CONT -|- EXIT -|
```

Ground Fault test verification display.

Overcurrent Simulation Test

During the simulation for any of the three types of test, the Test Kit first ramps up the simulation current, starting from less than .9 times the pickup current and continuing until pickup is reached. At that point, the display contains the message:

```
Input Current =  1.00C IN PICKUP
<Press any key to test at current shown>
```

Overcurrent simulation pickup display.

The current continues to ramp up until either one of the function keys is pressed or 15.00C (or 15.00S for Ground Fault) is reached. In either case, the simulated current is held constant and a message similar to the following is displayed:

```
Current = 15.00C (Press F3 to run test)
                    |-  CONT -|- EXIT -|
```

Overcurrent test current display.

Pressing CONT (F3) starts the test and initiates a countdown timer, which is displayed until the Trip Unit "trips":

```
IN PICKUP: Approx time left =  250 secs
|-    <Press any key to abort test>   -|
```

Overcurrent in pickup display.

The simulation can be aborted at any time during the test by pressing any function key, which displays the following message:

```
---TEST ABORTED---
                |-  MORE -|- EXIT -|
```

Test aborted display.

When the simulated trip occurs the Test Kit display contains a message similar to the following:

```
Time = 262.64 secs; Current =  1.25C
                |-  MORE -|- EXIT -|
```

Trip parameters display.

If a trip test was selected, the Test Kit sends a trip command to the Trip Unit and activates the (flashing) BREAKER TRIPPED LED.

Press MORE (F3) to return to the trip query display or EXIT (F4) to return to the function test menu.

CAUTION: When an overcurrent test with breaker trip is performed, the pickup indicator and the trip targets are not illuminated on the Trip Unit display, since the breaker is not actually experiencing an overcurrent condition. The only indication is that OVERLOAD flashes on TT-type Trip Unit displays, while FAULT illuminates on A-, B-, or C-type Trip Unit displays.

ATTENTION: Quand un test de surcharge avec déclenchement est effetué, les indicateurs de déclenchement et pickup ne sont pas allumés sur l'écran de déclencheur (le disjoncteur n'étant pas reéllement en condition de surcharge). La seule indication est le clignotement du segment OVERLOAD pour les déclencheurs de types TT et l'illumination du segment FAULT pour les types A, B, ou C.

5-4 High Current Primary Injection

The Test Kit can also monitor Trip Units during primary current injection or "high-current" tests. While in monitor mode, the Test Kit display indicates whether the Trip Unit has "picked up" (detected an overcurrent condition) and, if so, the type of overcurrent condition (Long Time, Short Time, or Ground Fault). If the Trip Unit trips the breaker while the Test Kit is monitoring it, the type of trip and time to trip (the time between pickup and trip) are displayed.

Trip Unit Ground Fault Defeat

The Ground Fault function, if included, must be temporarily defeated when performing high-current primary (single-pole) injection. The Test Kit can per-

form the Ground Fault defeat function; a separate Ground Fault defeat cable is not required.

CAUTION: When using the TVRMS2 Test Kit to defeat the Ground Fault function of a TT-type Trip Unit or a Spectra RMS™ circuit breaker, *DO NOT* change the Trip Unit's line-to-line or line-to-neutral voltage configuration unless the main test selection menu is displayed on the Test Kit.

Failure to follow this procedure can result in permanent deactivation of the Trip Unit's Ground Fault protection.

Always verify that Ground Fault protection is active immediately after changing the line-to-line or line-to-neutral voltage configuration. With the Trip Unit in Setup mode, check the trip-time set points. If a set point is displayed for Ground Fault Pickup, then the function is operating correctly.

ATTENTION: Quand on utilise le TVRMS2 Test Kit pour annuler la fonction protection défault terre pour les déclencheurs de types TT et les disjoncteurs Spectra, NE PAS CHANGER la configuration de la tension phase-phase ou phase-neutre à moins que le menu de sélection soit indiqué sur l'écran du Test Kit.

Le non respect de cette procedure peut entrainer une desactivation permanente de la protection défault terre.

Toujours verifier que la protection défault terre est active immédiatement après avoir changé la configuration de la tension. Dans la mode Setup du déclencheur, verifier les réglages. Si une valeur de réglage est indiquée pour le "Ground Fault Pickup," alors la protection défault terre est activée.

To initiate high-current testing, select HICURRENT (F2) from the main test-selection menu. The Test Kit first verifies that it is connected to a Trip Unit with a digital communication port; if not, the Digital Link Open message is displayed. Press MORE (F1) at this point to return to the main test selection menu.

If the Test Kit is connected to a Trip Unit with a communication port, the HI CURRENT TEST LED is activated and the Trip Unit options are checked. If the Ground Fault option is installed, the Test Kit displays the message:

```
Defeat Ground Fault Protection?
|-  YES  -|          |-   NO  -|- EXIT -|
```

Ground Fault defeat query.

If the Trip Unit under test does not have the Ground Fault option, the Test Kit goes immediately to monitor mode.

If YES (F1) is selected in response the Ground Fault defeat query, the Test Kit attempts to suppress the Ground Fault option in the Trip Unit, after which it again checks the Trip Unit options to ensure that Ground Fault protection was defeated. If Ground Fault protection is still active, the Test Kit displays the message:

```
Ground Fault not defeated; try again?
|-  YES  -|          |-   NO  -|- EXIT -|
```

Ground Fault defeat failure message.

Press YES (F1) to try again; press NO (F3) to send the Test Kit to monitor mode. If Ground Fault protection is successfully defeated, the Test Kit displays the message:

```
Ground Fault temporarily defeated
                    |-  CONT -|- EXIT -|
```

Ground Fault defeated message.

Press CONT (F3) to send the Test Kit to monitor mode. Press EXIT (F4) at any time in the process to re-enable Ground Fault protection. The Test Kit then displays the message:

```
Ground Fault Protection is RESTORED
                    |-  CONT -|- EXIT -|
```

Ground Fault restored message.

Press CONT (F3) to return to the main test-selection menu. Press EXIT (F4) to return to the Trip Unit selection menu.

NOTE: When the TVRMS2 Test Kit is used to defeat Ground Fault protection on MicroVersaTrip® Plus or MicroVersaTrip PM Trip Units, the following warning message will flash repeatedly on the display:

```
CAUTION...Exit BEFORE changing settings!
```

The message will stop flashing when Ground Fault protection is re-enabled.

NOTE: Quand le Test Kit TVRMS2 est utilisé pour annuler la protection défault terre sur les déclencheurs MicroVersaTrip® Plus ou MicroVersaTrip PM, le message suivant dignote sur le display:

```
CAUTION...Exit BEFORE changing settings!
```

Le message s'arrête de dignoter quand la protection défault terre est rétablie.

Trip Unit Pickup and Trip Monitor

When the Test Kit is in monitor mode, it displays the message:

```
Press F1 to exit when test is complete
|- EXIT -|
```

Monitor mode display.

While this message is displayed, the Test Kit is constantly monitoring the status of the Trip Unit. Press any key at any time in this procedure to return to the main test-selection menu.

When the Trip Unit signals that it has entered pickup, the Test Kit displays a message indicating the type(s) of pickup, as in the illustration:

```
TU IN PICKUP: LT
|- EXIT -|
```

Sample Trip Unit pickup message.

The Test Kit continues to display the pickup message until the Trip Unit signals that it is no longer in pickup.

If the Trip Unit initiates a trip, the Test Kit displays a message showing the type of trip and the time to trip, as in the example:

```
LONG TIME:  TIME = 575.75s
|- MORE -|
```

Sample display for Long Time trip.

Press MORE (F1) to return the Test Kit to monitor mode.

5-5 Trip Unit Quick Test

The Trip Unit quick test is a one-step test to verify that the Trip Unit can trip the breaker. Since this test actually causes the breaker to trip, suitable precautions should be made before this test is performed.

Selecting QUICK (F3) from the main test selection menu starts the TRIP TEST LED flashing and displays the message:

```
Press F1 to trip breaker
|-  TRIP -|                    |- EXIT -|
```

Breaker trip query.

Press EXIT (F4) to return to the main test selection menu or TRIP (F1) to send a trip command to the Trip Unit. When the trip command is issued, the Test Kit displays the message:

```
Breaker should now be tripped
|- EXIT -|
```

Breaker tripped display.

Press EXIT (F1) to return to the breaker trip query.

If the Trip Unit fails to trip the breaker in this test, remove the breaker from service and refer the Trip Unit to an authorized GE service representative.

GE Electrical Distribution & Control

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

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