SGT-600
SAFETY GROUND TESTER

USER'S MANUAL

Vanguard Instruments Company, Inc.

1520 S. Hellman Ave.
Ontario, California 91761, USA

SAFETY SUMMARY

FOLLOW EXACT OPERATING PROCEDURES

Any deviation from the procedures described in this user's manual may create one or more safety hazards, damage the SGT-600, or cause errors in the test results. Vanguard Instruments Co., Inc. assumes no liability for unsafe or improper use of the SGT-600. The following safety precautions must be observed during all phases of test setup, test hookups, testing, and test lead disconnection.

SAFETY WARNINGS AND CAUTIONS

The SGT-600 shall be used only by trained operators. All circuit breakers under test shall be off-line and fully isolated.

SERVICE AND REPAIR

- Do not install substitute parts or perform any unauthorized modification to any SGT-600 test unit.
- Repairs must be performed only by Vanguard Instruments Company factory personnel or by an authorized repair service provider. Unauthorized modifications can cause safety hazards and will void the manufacturer's warranty.

EQUIPMENT RATINGS

IP Rating: The enclosure for the SGT-600 has an IP rating of 32.

Pollution Degree: The SGT-600 has a pollution rating of 2.

Operating Voltage: The SGT-600 is rated for use with an operating voltage of 120V or 240V, auto-ranging ±10% of selected voltage.

Power Cord: The SGT-600 is supplied with a 16 AWG, 16A power cord with a NEMA 5-15P plug. Replacement cable shall have the same or better rating and is available through the manufacturer.

VENTILATION REQUIREMENTS

The SGT-600 must be operated with the enclosure lid open.

SAFETY SYMBOLS

Indicates that caution should be exercised

Indicates location of chassis ground terminal

CLEANING

To clean the SGT-600:
- Disconnect all cables and turn the unit off.
- Use a soft, lint-free cloth to wipe all surfaces clean.
- Avoid getting moisture in openings and connectors.
- Don't use any cleaning products or compressed air.

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CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- A key, switch, or knob on the SGT-600 is indicated as **[KEY], [SWITCH], [KNOB]**.

- Menu names are referenced as "MENU NAME"

- SGT-600 screen output is shown as:

```
1. OPTION 1
2. OPTION 2
3. OPTION 3
4. OPTION 4
5. OPTION 5
```

- When instructions are provided, the menu item that should be selected is shown in **bold** (option 3 should be selected):

```
1. OPTION 1
2. OPTION 2
3. OPTION 3
4. OPTION 4
5. OPTION 5
```

- Warning messages are indicated as:

Warning message

WARNING

- Important notes are indicated as:

Note details

NOTE

1.0 INTRODUCTION

## 1.1 General Description and Features

The SGT-600 is a 600 ampere micro-ohm meter designed for testing utility safety ground cables. The SGT-600 features microprocessor-controlled highly accurate measuring of very low resistances ranging from 1 micro-ohm to 450 milliohms. The SGT-600 is field-portable, rugged, and easily operated by first-time users with a minimum training. It features a 44-key "QWERTY"-style keypad for entering test parameters and controlling the unit and a back-lit LCD screen (128 x 64 pixels) for displaying menus, measured resistance values, and related identifying data. The SGT-600 also features a built-in thermal printer used to print test data on 2.5" wide thermal paper. Operating the unit requires little more than connecting the safety leads to the SGT-600 terminals, enter the test cable size, cable length, cable temperature, and the test current. The SGT-600 will measure the cable resistance and compare this reading against the maximum allowable resistance value (defined by ASTM F2249). The resistance reading along with the Pass or Fail results can be printed using the built-in thermal printer.

Test current is selectable from 10 to 600 amperes. The SGT-600 can also store 100 test records in internal FLASH EEPROM memory. Stored resistance measurements and related data can be recalled at a later time for review and printing and can also be transferred to a USB Flash drive using the unit's built-in Flash drive port.

Windows®-based analysis software is provided with each unit. The software can be used to retrieve test records from the unit's internal memory or from a computer hard drive, analyze test results, and print test results on a desktop printer. Test results can also be exported to PDF, Excel and XML formats.

The SGT-600 measures the total resistance value of the cable under test and then compares it to the calculated value to determine the Pass or Fail result. In order to calculate the total resistance value, the user is first prompted for the cable size, cable length, and cable temperature. Total resistance (*Rm*) is calculated in accordance with the ASTM F2249-03 standard using the formula below:

Rm = 1.05 RL + 2Y = 1.05 RL + 320 µΩ*
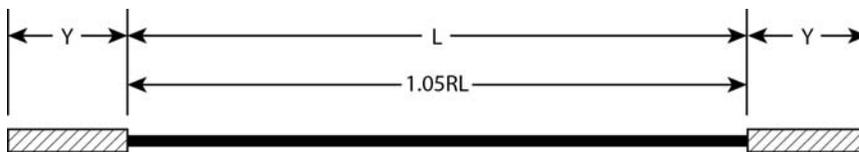
Where:

Y = Resistance of clamps, ferrule, and portions of the cable inside the ferrule, in milliohms*
L = Cable length in feet (ferrule to ferrule measurement to the nearest inch)
R = Cable resistance, in milliohms/foot
NOTE: The clamp and ferrule resistance value of 160 µΩ is used per the ASTM-F2249-03 standard.

The SGT-600 will calculate the maximum resistance value of the cable under test, measure the resistance value and compare this value against the limit. The resistance value and a PASS or FAIL result can be printed on the thermal printer.

1.2   SGT-600 Technical Specifications

TYPE	Portable Micro-Ohmmeter
PHYSICAL SPECIFICATIONS	**Dimensions:** 16.75"W x 12.5"H x 12" D (42.7 cm x 32 cm x 30.5 cm) **Weight:** 19.8 lbs. (8.9 Kg)
INPUT POWER	100 – 240 Vac, 50/60 Hz
RESISTANCE READING RANGE	1 micro-ohm to 1000 milliohms (max 1.5 milliohms @ 600A, 450 milliohms @ 10A, 1000 milliohms @ 1A)
TEST CURRENT RANGE	10A – 600A (selectable in 1A steps); thermally protected DC power supply
ACCURACY	10A – 49.9A: 1% ±2 micro-ohms, 50A – 600A: 1% ±1 micro-ohm
TEST VOLTAGE	5 Vdc
DISPLAY	back-lit LCD screen (128 x 64 pixels) viewable in bright sunlight and low-light levels
KEYPAD	rugged, 44-key "QWERTY"-style membrane keypad
INTERNAL TEST RECORD STORAGE	100 test records
EXTERNAL TEST RECORD STORAGE	up to 999 test records on external USB flash drive
PC SOFTWARE	Windows®-based analysis software is included with purchase price
COMPUTER INTERFACES	one RS-232C PC interface, one USB flash drive interface
PRINTER	built-in 2.5" wide thermal printer
SAFETY	designed to meet IEC 61010 (1995), UL 61010-a, and CAS-C22.2 standards
TEMPERATURE	**Operating:** -10°C to +50°C (+15°F to +122°F) **Storage:** -30°C to +70°C (-22°F to +158°F)
HUMIDITY	90% RH @ 40°C (104°F) non-condensing
ALTITUDE	2,000 m (6,562 ft) to full safety specifications
CONNECTION POSTS	Two 2"/3" diameter posts
CABLES	sensing leads, hand probes, power cord, ground cable
OPTIONS	shipping case
WARRANTY	one year on parts and labor

NOTE

The above specifications are valid at nominal operating voltage and at a temperature of 25°C (77°F). Specifications may change without prior notice.

1.3   SGT-600 Controls and Indicators

The SGT-600's controls and indicators are shown in Figure 1. The purpose of the controls and indicators may seem obvious, but users should familiarize themselves with them before using the SGT-600. Accidental misuse of the controls will usually cause no serious harm. Users should also familiarize themselves with the safety summary information found on the front page of this User's Manual.
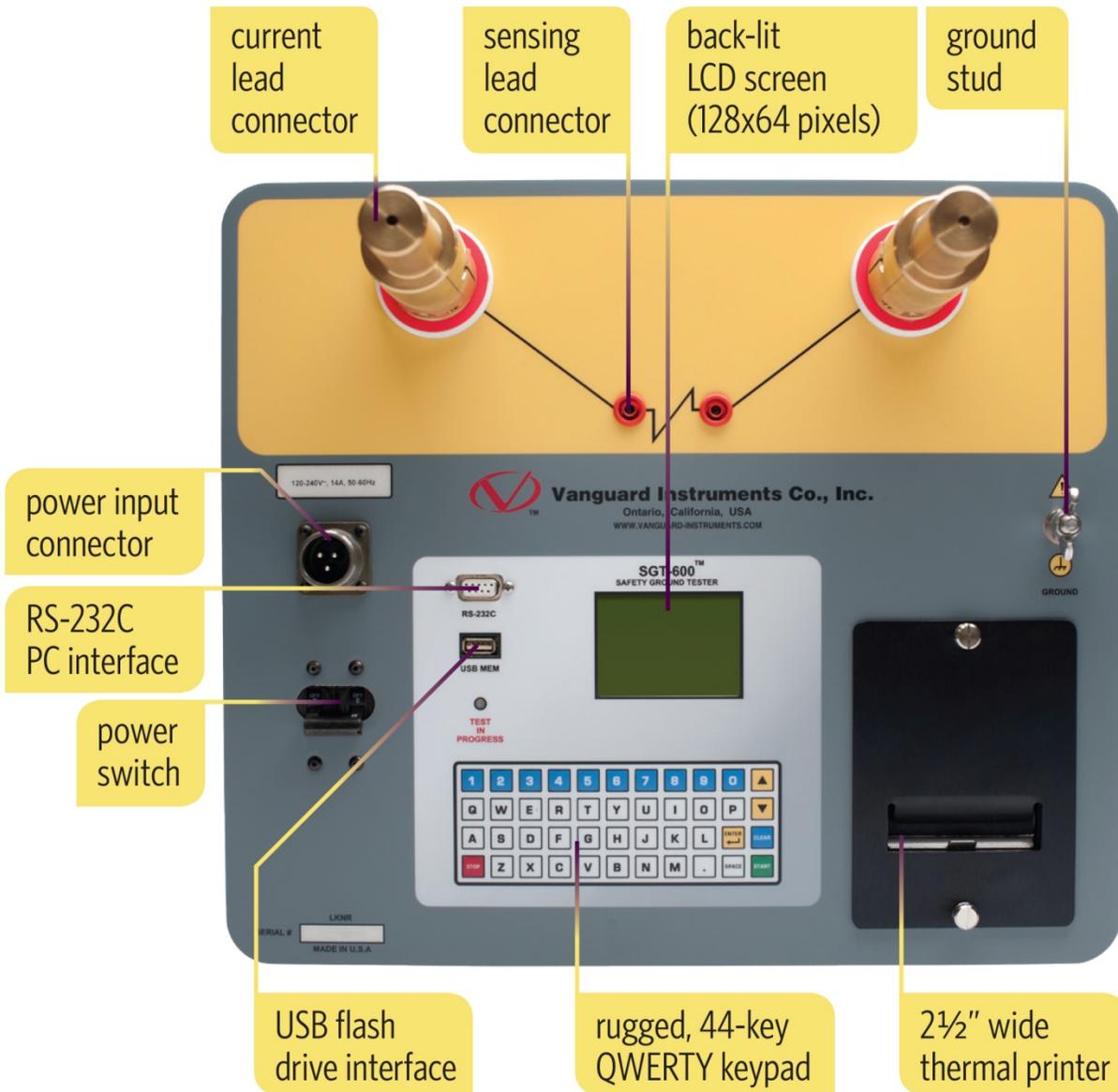
Figure 1. SGT-600 Controls and Indicators

2.0   PRE-TEST SETUP

2.1   Operating Voltages

The SGT-600 operate on voltages between 120-240 Vac, 50/60 Hz.

2.2   LCD Screen Contrast Control

To increase the LCD screen contrast, press and hold the **[▲]** key for two seconds. Release the button when the desired contrast level has been reached.

To decrease the LCD screen contrast, press and hold the **[▼]** key for two seconds. Release the button when the desired contrast level has been reached.

2.3   Safety Ground

Always ground the SGT-600 to the substation ground before connecting cables to the unit.

2.4   Printer Paper

The SGT-600's built-in thermal printer uses 2.5" wide thermal paper for printing test results. To maintain the highest print quality and to avoid paper jams, the use of thermal paper supplied by Vanguard Instruments Company is highly recommended. Additional paper can be ordered from the following sources:

Vanguard Instruments Co, Inc.
1520 S. Hellman Avenue
Ontario, CA 91761
Tel: 909-923-9390
Fax: 909-923-9391
Part Number: TP3-CS

BG Instrument Co.
13607 E. Trent Avenue
Spokane, WA 99216
Tel: 509-893-9881
Fax: 509-893-9803
Part Number: VIC TP-3 paper

3.0 OPERATING PROCEDURES

3.1 Connection Diagrams
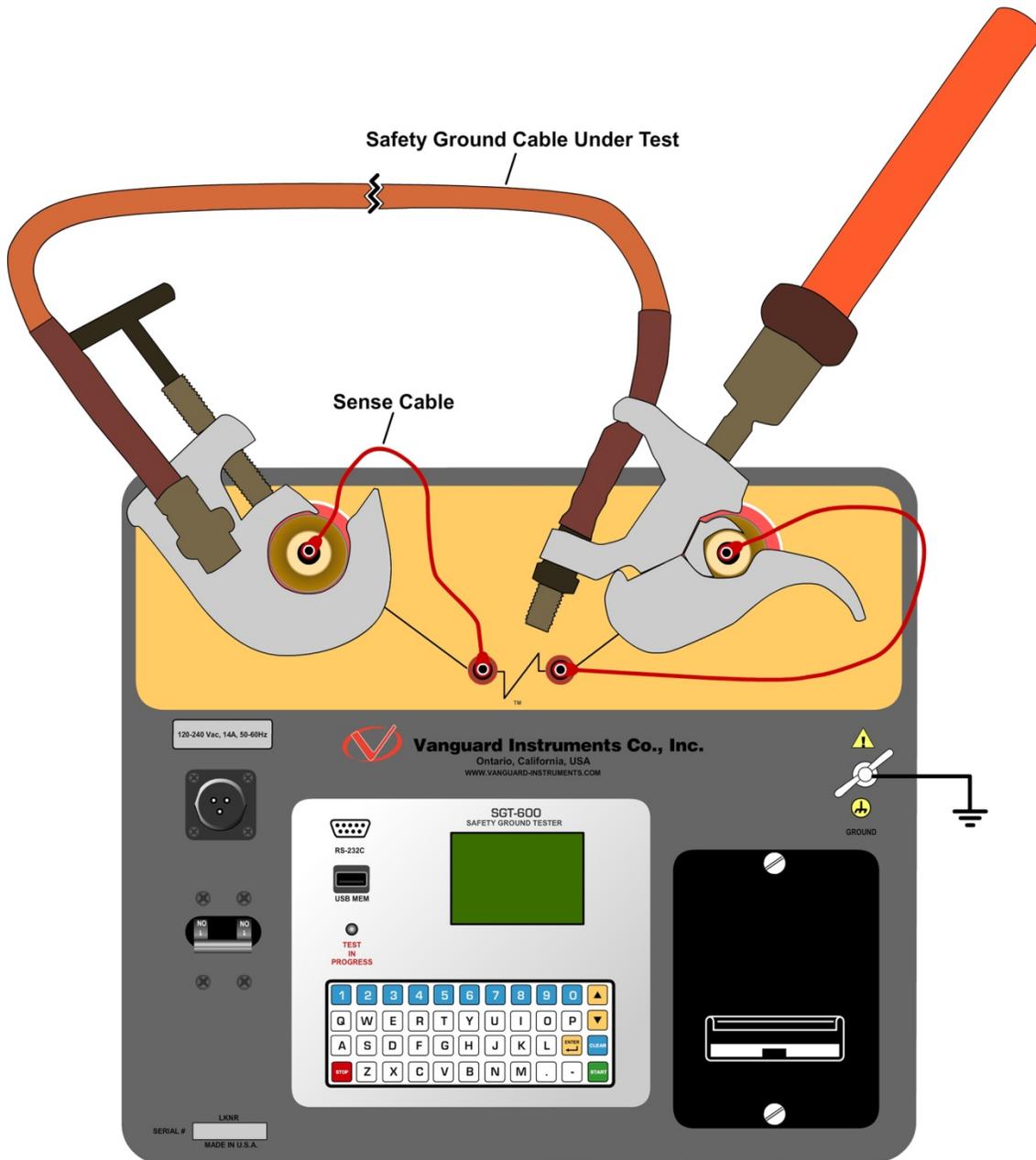
Figure 2. Typical SGT-600 Connection Diagram

3.2   Setting the Date and Time

To set the date and time:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:   10:11:12    23°C
DATE:   04/01/15    73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[4]** key (*SET TIME*)

c. The following screen will be displayed:

```
        ENTER DATE

         MM-DD-YY
```

Type in the date using the keypad. The following screen will be displayed:

```
        ENTER TIME

         HH:MM:SS
```

Enter the time using the keypad. When the time has been entered, you will be immediately returned to the "START-UP" menu.

3.3   Setting the Interface Language

Follow the steps below to set the interface language (English):

a.   Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP


TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b.   The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[5]** key (*SET LANGUAGE*).

c.   The following screen will be displayed:

```
1. ENGLISH
2. TURKISH
3. SPANISH
```

Select the preferred interface language by pressing the corresponding key on the keypad (**[1]**, **[2]**, or **[3]**). The interface language will be set and a confirmation screen will be displayed as shown below:

```
       ENGLISH SET
```

Press any key to return to the "START-UP" menu.

3.4 Setting the Option to Print the Calibration Expiration Date

The SGT-600 can print the unit's factory calibration expiration date at the bottom of test reports if desired. Follow the steps below to configure this option:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[6]** key (*CAL NOTICE ON/OFF*)

c. The following screen will be displayed:

```
CAL DATE PRINTING:

1. ENABLE
2. DISABLE
```

1. Press the **[1]** key to enable to option. The following screen will be displayed:

```
CAL DATE PRINTING
ENABLED.
```

The calibration date printing option will be enabled and you will be returned to the "START-UP" menu. Figure 3 shows a sample test report with the calibration expiration date printed at the bottom.

2. Press the **[2]** key to disable the option. The following screen will be displayed:

```
CAL DATE PRINTING
DISABLED.
```

Press any key to return to the "START-UP" menu.

```
CABLE TEMP:      25.0 C

            RESULTS:

CURRENT:        10.02 AMPS

RESISTANCE:      4.565 mOhms [P]

UPPER RES LIMIT:  5.842 mOhms

NOTES: _____


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ONTARIO, CA, 91761, USA
TEL:(909) 923-9390  FAX: (909) 923-9391
WWW.VANGUARD-INSTRUMENTS.COM
SERIAL NUMBER: 320003

CAL VALID UNTIL: 03/09/2016
```

Figure 3. Sample Test Report Printout with Calibration Expiration Date

3.5   Testing Procedures

3.5.1. Entering Test Record Header Information

You can enter the test record header information before performing tests. The record header includes identifying information such as the company, station, circuit, manufacturer, etc. Once the header information has been set, it will apply to all subsequent test records. Follow the steps below to enter the test header information:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP


TIME:   10:11:12    23°C
DATE:   04/01/15    73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[1]** key (*RECORD ID*).

c. The following screen will be displayed:

```
COMPANY:

_

 ↑/↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the company name using the keypad. Press the **[ENTER]** key when you are done typing the company name.

d. The following screen will be displayed:

```
LOCATION:

_

 ↑∕↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the location name using the keypad and then press the **[ENTER]** key.

e. The following screen will be displayed:

```
MANUFACTURER:

_

 ↑∕↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the manufacturer name using the keypad and then press the **[ENTER]** key.

f. The following screen will be displayed:

```
MODEL:

_

 ↑∕↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the safety ground cable's model information using the keypad and then press the **[ENTER]** key.

g. The following screen will be displayed:

```
SERIAL NUMBER:

_

 ↑∕↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the safety ground cable's serial number using the keypad and then press the **[ENTER]** key.

h. The following screen will be displayed:

```
RATING:

 _

 ↑⁄↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the safety ground cable's rating using the keypad and then press the [**ENTER**] key.

i.   The following screen will be displayed:

```
OPERATOR:

 _

 ↑⁄↓ TO POSITION
"ENTER" TO ACCEPT
```

Type the operator's name using the keypad and then press the **[ENTER]** key.

j.   The following screen will be displayed:

```
NOTE:

 _

 ↑⁄↓ TO POSITION
"ENTER" TO ACCEPT
```

Type any additional notes regarding the test and then press the **[ENTER]** key. All header information will be saved, and you will be returned to the "START-UP" menu.

3.5.2. Performing a Test

Follow the steps below to perform a test:

   a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP


TIME:   10:11:12    23°C
DATE:   04/01/15    73°F
```

       Press the **[1]** key (*RUN TEST*).

   b. The following screen will be displayed:

```
1. FULL CABLE TEST
2. DIAGNOSTIC PROBE




```

       Press the **[1]** key (*FULL CABLE TEST*).

   c. The following screen will be displayed:

```
SELECT TEST CURRENT
1.  10A        2.  25A
3.  50A        4.  100A
5.  200A       6.  400A
7.  600A
8.  CUSTOM
```

       Select the test current by pressing the corresponding key on the keypad. Press the **[8]** key if you would like to enter a custom test current value. You will be able to enter a test current value between 10A and 600A.

   d. The following screen will be displayed:

```
        CABLE GAUGE

1.  AWG 2
2.  AWG 1/0
3.  AWG 2/0
4.  AWG 4/0
```

       Select the cable gauge by pressing the corresponding key on the keypad.

e. The following screen will be displayed:

```
      CABLE LENGTH:

33.00 FT       10.058 M
(33'0")


↑/↓ TO ADJUST LENGTH
"ENTER" TO ACCEPT
```

You can adjust the cable length by 3" (0.0762 m) increments. Press the **[▲]** key to increase the cable length or the **[▼]** key to decrease the cable length. The screen will be updated showing the new length. Press the **[ENTER]** key when the correct length is displayed.

f. The following screen will be displayed:

```
       CABLE TEMP:

    25.0°C    77.0°F



↑/↓ TO ADJUST LENGTH
"ENTER" TO ACCEPT
```

You can adjust the cable temperature by 0.5°C increments. Press the **[▲]** key to increase the cable temperature or the **[▼]** key to decrease the cable temperature. Press the **[ENTER]** key when the correct cable temperature is displayed.

g. A summary of the test parameters will be displayed as shown below:

```
     TEST PARAMETERS

  CURRENT:    10 AMPS
  GAUGE:      AWG 2
  LENGTH:     33.00 FT
  TEMP:       25.0°C


"START" TO RUN TEST
```

Press the **[START]** key to run the test.

h. The unit will start ramping the current till the selected current is reached. The screen will be updated as shown below:
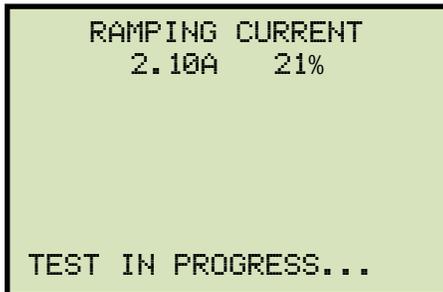
```
      RAMPING CURRENT
         2.10A    21%




      TEST IN PROGRESS...
```

Once the test current has been reached, the SGT-600 will measure the resistance and update the screen as shown below:
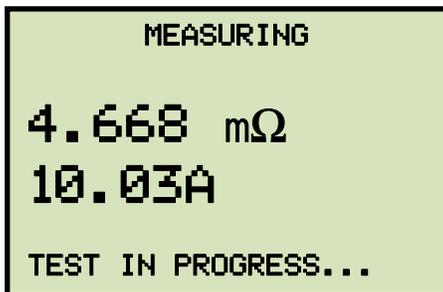
```
         MEASURING

      4.668 mΩ
      10.03A

      TEST IN PROGRESS...
```

The unit will then ramp down the current to zero and display the final test results as shown below:
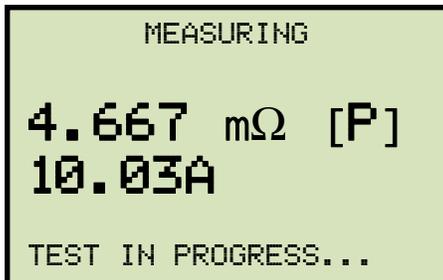
```
         MEASURING

      4.667 mΩ [P]
      10.03A

      TEST IN PROGRESS...
```

If the cable under test passed the test, "[P]" will be displayed as shown in the example above. If it failed, "[F]" will be displayed next to the test results.

Press any key to continue.

i. The following screen will be displayed:
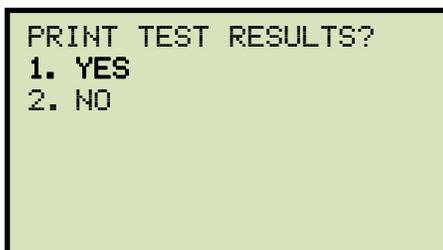
```
   PRINT TEST RESULTS?
   1. YES
   2. NO




```

Press the **[1]** key to print the test results. Figure 4 shows sample test results printouts.

j.   The following screen will be displayed:

```
SAVE THIS RECORD?
1. YES
2. NO
```

Press the **[1]** key to save the test record.

k.   The following screen will be displayed:

```
RECORD NUMBER 5
HAS BEEN SAVED!
```

NOTES   If a USB flash drive is connected to the unit, the following screen will be displayed instead:

```
1.SAVE INTERNALLY
2.SAVE TO THUMB DRIVE
```

1. *SAVE INTERNALLY*

    Press the **[1]** key (*SAVE INTERNALLY*) to save the test record to the unit's Flash EEPROM. The following screen will be displayed:

```
RECORD NUMBER 5
HAS BEEN SAVED!
```

2. *SAVE TO THUMB DRIVE*

    Press the **[2]** key (*SAVE TO THUMB DRIVE*) to save the test record to the connected USB Flash drive. The following screen will be displayed:

```
REC_000 SAVED TO
THUMB DRIVE.
```
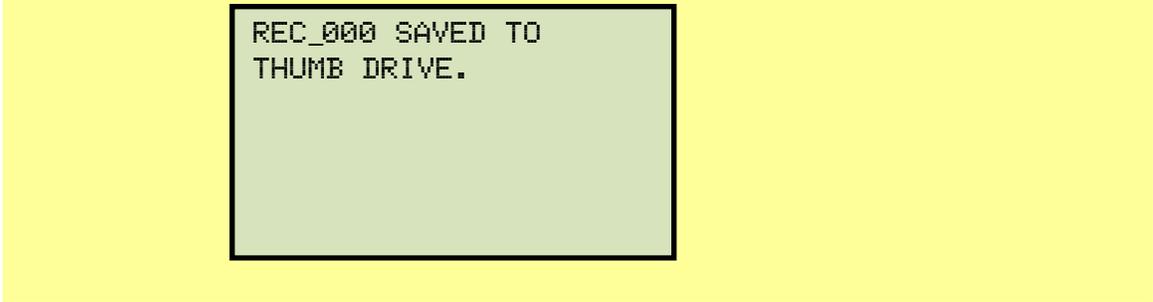
Press any key to continue to return to the "START-UP" menu.

```
       TEST  RESULTS                TEST  RESULTS

DATE:03/30/15   TIME:12:49:59   DATE:03/30/15    TIME:12:42:33

COMPANY:    VANGUARD INST       COMPANY:     VANGUARD INST
LOCATION:   ONTARIO             LOCATION:    ONTARIO
MFR:                            MFR:
MODEL:                          MODEL:
S/N:        12051               S/N:         60398
RATING:                         RATING:
OPERATOR:   HAI                 OPERATOR:    HAI
NOTE:                           NOTE:        BAD CABLE


TEST CURRENT: 200 AMPS          TEST CURRENT: 200 AMPS
CABLE GAUGE:  AWG 2/0           CABLE GAUGE:  AWG 2/0
CABLE LENGTH: 34.75 FT / 10.592M  CABLE LENGTH: 10.00 FT / 3.048M
CABLE TEMP:   25.0 C            CABLE TEMP:   25.0 C

         RESULTS:                        RESULTS:

CURRENT:      200.00 AMPS       CURRENT:      200.00 AMPS
RESISTANCE:   2.944 mOhms [P]   RESISTANCE:   3.467 mOhms [F]

UPPER RES LIMIT:  3.218 mOhms   UPPER RES LIMIT:  1.154 mOhms

NOTES: _____        NOTES: _____
```

Figure 4. Sample SGT-600 Test Results Printouts

("PASSED" test on the left, "FAILED" test on the right)

3.5.3. Performing Diagnostic Tests

The SGT-600 can be used to test particular sections of a safety ground cable and help diagnose a faulty cable. When performing a diagnostic test, the safety ground cable is connected to the unit and the hand probes are used to measure the resistance between various two points on the ground cable as shown in the figure below:
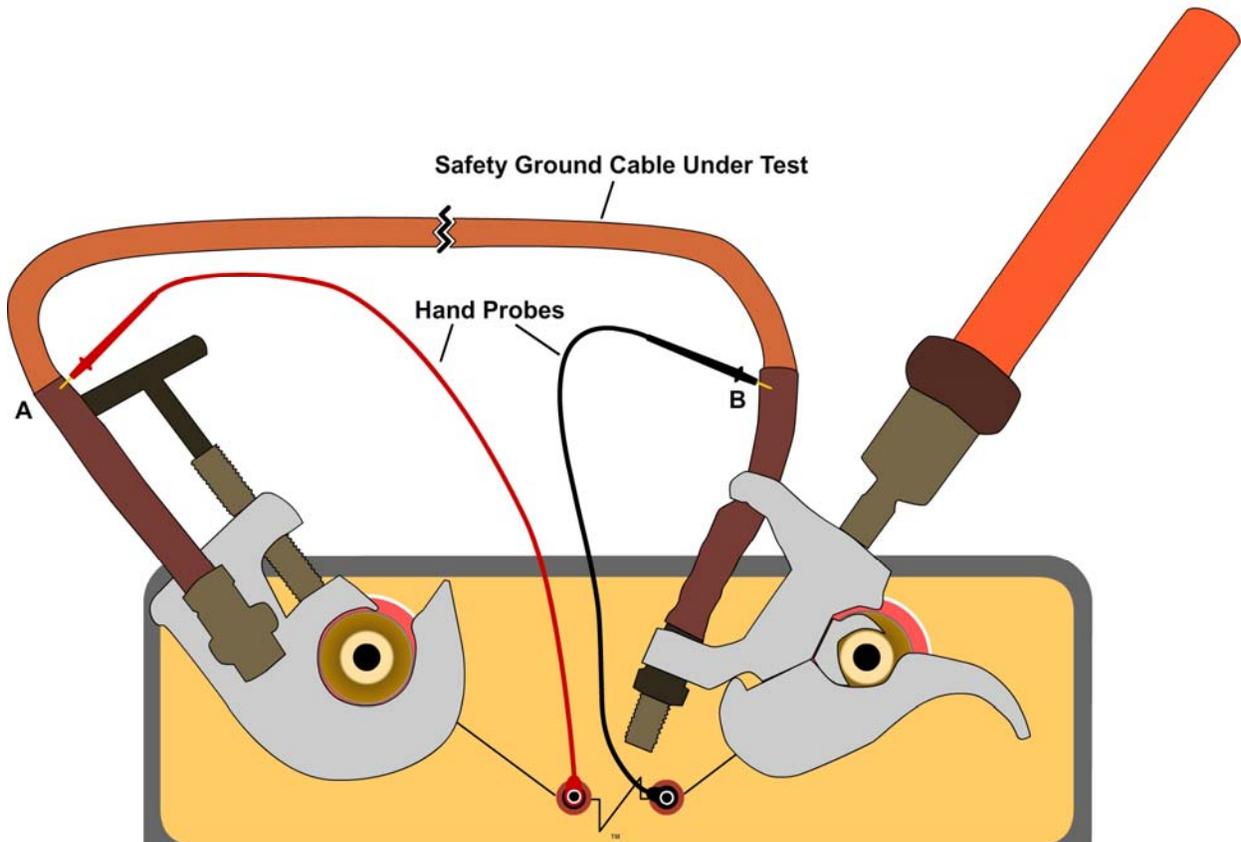
Figure 5. Performing a Diagnostic Test Between Points A and B

Follow the steps below to perform a diagnostic test:

a. Start from the "START-UP" menu:

Press the **[1]** key (*RUN TEST*).

b. The following screen will be displayed:

```
1. FULL CABLE TEST
2. DIAGNOSTIC PROBE
```

Press the **[2]** key (*DIAGNOSTIC PROBE*).

c. The following screen will be displayed:

```
SELECT TEST CURRENT
1.  10A        2.  25A
3.  50A        4.  100A
5.  200A       6.  400A
7.  600A
8.  CUSTOM
```

Select the test current by pressing the corresponding key on the keypad. Press the **[8]** key if you would like to enter a custom test current value. You will be able to enter a test current value between 10A and 600A.

d. The following screen will be displayed:

```
    "START" TO RUN TEST
```

Position the ends of the sense leads at the two points on the cable where you would like to measure the resistance (see Figure 5) and then press the **[START]** key.

e. The unit will start ramping the current to the selected current value. The screen will be updated as shown below:

```
    RAMPING CURRENT
       2.10A    21%




    TEST IN PROGRESS...
```

Once the test current has been reached, the SGT-600 will measure the resistance between the two points and update the screen as shown below:
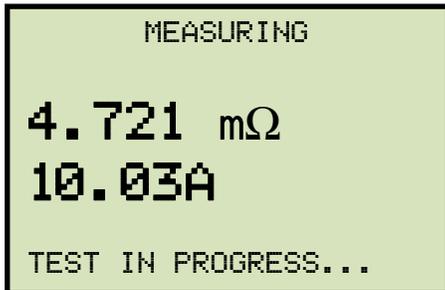
```
        MEASURING


   4.721 mΩ
   10.03A

   TEST IN PROGRESS...
```

The unit will then ramp down the current to zero and display the final test results as shown below:

```
      PLACE PROBES NOW


   4.743 mΩ
   10.03A


```

The test results will be printed on the thermal printer.

You can now place the sense cables at different points on the ground cable and the SGT-600 will start measuring the resistance between the two points. The test results will be displayed and printed on the printer after each test. Once you are done testing, press the **[STOP]** key. Figure 6 shows a sample diagnostic test results printout.

```
DIAG RESULTS
DATE:04/03/15    TIME:07:50:44

COMPANY:     VANGUARD INST
LOCATION:    ONTARIO
MFR:
MODEL:
S/N:         60398
RATING:
OPERATOR:    HAI
NOTE:


CURRENT:        100.00 AMPS
RESISTANCE:     13.3 uOhms

NOTES: _____


CURRENT:        100.01 AMPS
RESISTANCE:     4.564 mOhms

NOTES: _____


CURRENT:        100.01 AMPS
RESISTANCE:     5.001 mOhms

NOTES: _____


CURRENT:        100.01 AMPS
RESISTANCE:     4.940 mOhms

NOTES: _____
```

Figure 6. Sample Diagnostic Test Results Printout

3.6   Working With Test Records

3.6.1. Viewing the Contents of the Working Memory

Whenever a test is performed and the reading is kept, the data is temporarily stored in the SGT-600's working memory. You can view the test reading in the unit's working memory using the steps below:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:   10:11:12    23°C
DATE:   04/01/15    73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[2]** key (*REVIEW RECORD*).

c. The following screen will be displayed:

```
      PRINT RECORD
1. PRINT TO LCD
2. PRINT TO PRINTER
```

1. *PRINT TO LCD*

   Press the **[1]** key (*PRINT TO LCD*) to display the test results on the unit's LCD screen. The test record's header information will be displayed as shown below:

```
04/02/15   12:40:22
VANGUARD INST
ONTARIO
```

Press any key to continue. The test record details will be displayed as shown below:

```
TEST CURRENT:  10A
CABLE GAUGE:   AWG 2
CABLE LENGTH: 33.00'
CABLE TEMP:    25.0°C
 CUR: 10.02 A
 RES: 4.669 mΩ
(LIMIT: 5.842 mΩ)
```

Press any key to return to the "START-UP" menu.

2. *PRINT TO PRINTER*

   Press the **[2]** key (*PRINT TO PRINTER*) to print the test results on the unit's built-in thermal printer. The test results will be printed and you will be returned to the "START-UP" menu.

3.6.2. Saving Test Results to a Test Record

After performing a test, the user is presented the option to save the test results to the unit's Flash EEPROM or to a USB Flash drive. If the test results are not saved immediately after performing a test, they will still remain in the working memory and can be saved later, as long as a new test has not been performed and the unit has not been turned off. Follow the steps below to save the test results from the working memory to a test record (the following procedure can also be used to re-save a restored test record to a new memory location or to a USB Flash Drive):

    a. Perform a test or restore a test record to the working memory (see section 3.6.3 and 3.6.4), and then start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP


TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

        Press the **[2]** key (*SETUP*).

    b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

        Press the **[3]** key (*SAVE/RESTORE RECORD*)

    c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

> Option 5 (*COPY TO THUMB DRIVE*) will be listed only if a USB Flash drive is connected to the SGT-600.
>
> **NOTE**

        Press the **[2]** key (*SAVE RECORD*).

If a USB Flash drive is connected to the unit, continue to step d.

If a USB Flash drive is NOT connected to the unit, continue to step e.

d. The following screen will be displayed:

```
1. SAVE INTERNALLY
2. SAVE TO THUMB DRIVE
```
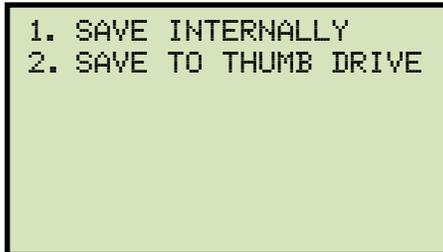
1. SAVE INTERNALLY

Press the **[1]** key (*SAVE INTERNALLY*) to save the test record to the unit's Flash EEPROM. **Continue to step e.**

2. SAVE TO THUMB DRIVE

Press the **[2]** key (*SAVE TO THUMB DRIVE*) to save the test record to the connected USB Flash drive. The following screen will be displayed:
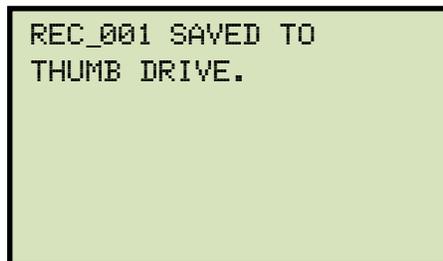
```
REC_001 SAVED TO
THUMB DRIVE.
```

Press any key to return to the "START-UP" menu.

e. The following screen will be displayed:
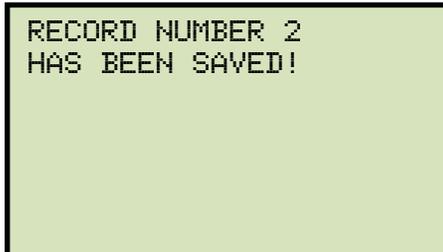
```
RECORD NUMBER 2
HAS BEEN SAVED!
```

Press any key to return to the "START-UP" menu.

3.6.3. Restoring a Test Record From Flash EEPROM

Use the steps below to restore a test record from the SGT-600's internal Flash EEPROM to the working memory:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*).

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

> Option 5 (*COPY TO THUMB DRIVE*) will be listed only if a USB Flash drive is connected to the unit.
>
> **NOTE**

Press the **[1]** key (*RESTORE RECORD*).

d. The following screen will be displayed:

```
        RESTORE RECORD
1.ENTER RECORD NUMBER
2.SCROLL TO SELECT
```

NOTE

If you have a USB Flash drive inserted in the unit's "USB MEM" port, the following screen will be displayed instead of the above screen:

```
1.INTERNAL STORAGE
2.THUMB DRIVE
```

Press the **[1]** key (*INTERNAL STORAGE*).

The following screen will be displayed:

```
      RESTORE RECORD
1.ENTER RECORD NUMBER
2.SCROLL TO SELECT
```

Continue with the steps below.

1. *ENTER RECORD NUMBER*

    Press the **[1]** key (*ENTER RECORD NUMBER*) if you know the record number that you would like to restore.

    1.1. The following screen will be displayed:

    ```
        RESTORE RECORD
          NUMBER:
    ```

    Type the record number using the alpha-numeric keypad and then press the **[ENTER]** key.

1.2.   The following screen will be displayed:

```
   RECORD RESTORED!
    PRINT RECORD?
1.YES
2.NO
```

1. YES

Press the **[1]** key (*YES*) to review the test record on the screen or to print it. The following screen will be displayed:

```
      PRINT RECORD
1.PRINT TO LCD
2.PRINT TO PRINTER
```

1.   PRINT TO LCD

Press the **[1]** key (*PRINT TO LCD*) to review the restored test record on the unit's LCD screen. The test record's header information will be displayed as shown below:

```
04/02/15  12:40:22
VANGUARD INST
ONTARIO
```

Press any key to continue. The test record details will be displayed as shown below:

```
TEST CURRENT:  10A
CABLE GAUGE:   AWG 2
CABLE LENGTH: 33.00'
CABLE TEMP:    25.0°C
 CUR: 10.02 A
 RES: 4.669 mΩ
(LIMIT: 5.842 mΩ)
```

Press any key to return to the "START-UP" menu. The restored test record will remain in the unit's working memory.

2. *PRINT TO PRINTER*

Press the **[2]** key (*PRINT TO PRINTER*) to print the restored test record on the unit's built-in thermal printer. The rest results will be printed on the printer and you will be returned to the "START-UP" menu. The restored test record will remain in the unit's working memory.

2. *NO*

Press the **[2]** key (*NO*) if you do not want to review or print the restored test record. The test record will be restored to the working memory and you will be returned to the "START-UP" menu.

2. *SCROLL TO SELECT*

Press the **[2]** key (*SCROLL TO SELECT*) to scroll through a directory of the stored test records.

2.1. The following screen will be displayed:

```
 RECORDS DIRECTORY

"UP" TO SCROLL FWD
"DWN" TO SCROLL RVS
```

Press the **[▲]** key or the **[▼]** key to display the next or previous test record, respectively.

The test record's header information will be displayed as shown below:

```
#1     03/09/15    09:55
VIC
LAB
```

When you have located the test record that you would like to restore, press the **[ENTER]** key.

3.6.4. Restoring a Test Record From a USB Flash Drive

Use the steps below to restore a test record from a USB Flash drive to the SGT-600's working memory:

a. Make sure the USB Flash drive containing the test record(s) is inserted in the unit's USB Flash drive port ("USB MEM" port). Then start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP


TIME:   10:11:12    23°C
DATE:   04/01/15    73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*)

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

Press the **[1]** key (*RESTORE RECORD*).

d. The following screen will be displayed:

```
1.INTERNAL STORAGE
2.THUMB DRIVE
```

Press the **[2]** key (*THUMB DRIVE*).

e. The following screen will be displayed:

```
RESTORE THUMB DRIVE

        REC_
```

Type the record number that you would like to restore using the alpha-numeric keypad and then press the **[ENTER]** key.

f. The test record will be restored to the unit's working memory and the following screen will be displayed:

```
REC_001 RESTORED!
     PRINT RECORD?
1.YES
2.NO
```

Continue to step 1.2 on page 30.

3.6.5. Copying Test Records to a USB Flash Drive

Use the steps below to copy one or all test records from the unit's Flash EEPROM to a connected USB Flash drive:

a. Make sure a USB Flash drive is connected to the unit's "USB MEM" port, and then start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*).

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

Press the **[5]** key (*COPY TO THUMB DRIVE*).

d. The following screen will be displayed:

```
COPY REC TO THUMB DRV

1.COPY SINGLE RECORD
2.COPY ALL RECORDS
```

1. *COPY SINGLE RECORD*

Press the **[1]** key (*COPY SINGLE RECORD*) to copy a single test record from the unit's Flash EEPROM to the connected USB Flash drive. The following screen will be displayed:

```
 ENTER RECORD NUMBER
TO COPY TO FLASH DRV

    NUMBER:
```

Type the record number using the alpha-numeric keypad and then press the **[ENTER]** key. The test record will be copied to the USB Flash drive and the following screen will be displayed:

```
REC_013 SAVED TO
THUMB DRIVE
```

Press any key to return to the "START-UP" menu.

2. *COPY ALL RECORDS*

Press the **[2]** key (*COPY ALL RECORDS*) to copy all test records from the SGT-600's Flash EEPROM to the connected USB Flash drive. All test records will be copied from the unit to the connected USB Flash drive. The following screen will be displayed when the process is finished:

```
ALL RECORDS HAVE BEEN
TRANSFERRED TO THUMB
DRIVE!
```

Press any key to return to the "START-UP" menu.

3.6.6. Printing the Test Record Directory

Use the steps below to print a directory of the test records stored in the SGT-600's Flash EEPROM or on a connected USB Flash drive:

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*).

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```
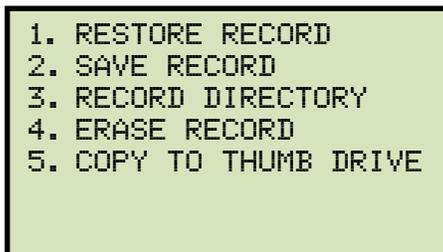
> **NOTE** Option 5 (*COPY TO THUMB DRIVE*) is listed only if a USB Flash drive is connected to the unit.

Press the **[3]** key (*RECORD DIRECTORY*).

If a USB Flash drive is connected to the unit, continue to step d.

If a USB Flash drive is not connected to the unit, continue to step e.

d. The following screen will be displayed:

```
1. INTERNAL DIRECTORY
2. THUMB DRIVE DIR
```
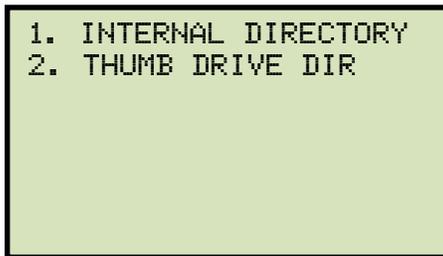
1. *INTERNAL DIRECTORY*

    Press the **[1]** key (*INTERNAL DIRECTORY*) to print a directory of the test records stored in the unit's internal memory. **Continue to step e.**

2. *THUMB DRIVE DIR*

    Press the **[2]** key (*THUMB DRIVE DIR*) to print a directory of the test records stored on the connected USB Flash drive. The directory will be printed on the built-in thermal printer and you will be returned to the "START-UP" menu. A sample thumb drive directory printout is shown in Figure 7.

e. The following screen will be displayed:

```
     PRINT DIRECTORY

1. FULL DIRECTORY
2. SHORT DIRECTORY
```
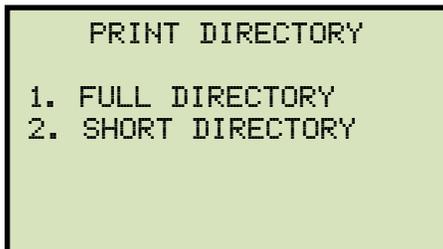
Press the **[1]** key (*FULL DIRECTORY*) to print a complete directory of all test records stored in the unit's internal memory. The directory will be printed on the thermal printer and you will be returned to the "START-UP" menu. A sample internal test record directory printout is shown in Figure 8.

Press the **[2]** key (*SHORT DIRECTORY*) to print a directory of the last 10 test records stored in the unit's internal memory. The directory will be printed on the thermal printer and you will be returned to the "START-UP" menu.

```
┌─────────────────────────────────┐
│       THUMB DRV DIR             │
├─────────────────────────────────┤
│ THUMB DRV FILENAME: REC_001     │
│ DATE/TIME: 04/02/15   12:40:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ THUMB DRV FILENAME: REC_000     │
│ DATE/TIME: 04/02/15   12:40:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ THUMB DRV FILENAME: REC_002     │
│ DATE/TIME: 04/02/15   12:14:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ THUMB DRV FILENAME: REC_003     │
│ DATE/TIME: 04/02/15   12:00:34  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ THUMB DRV FILENAME: REC_004     │
│ DATE/TIME: 03/30/15   12:49:59  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
└─────────────────────────────────┘
```

Figure 7. Sample Thumb Drive Directory Printout

```
┌─────────────────────────────────┐
│       TEST DIRECTORY            │
├─────────────────────────────────┤
│ RECORD NUMBER: 8               │
│ DATE/TIME: 04/02/15   12:40:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ RECORD NUMBER: 7               │
│ DATE/TIME: 04/02/15   12:40:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ RECORD NUMBER: 6               │
│ DATE/TIME: 04/02/15   12:14:22  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ RECORD NUMBER: 5               │
│ DATE/TIME: 04/02/15   12:00:34  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
├─────────────────────────────────┤
│ RECORD NUMBER: 4               │
│ DATE/TIME: 03/30/15   12:49:59  │
│ NUMBER OF TESTS: 1              │
│ LOCATION: ONTARIO              │
│ MFR:                           │
│ MODEL:                         │
│ S/N:        60398              │
│ RATING:                        │
│ NOTE:                          │
└─────────────────────────────────┘
```

Figure 8. Sample Internal Test Record Directory Printout

3.6.7. Erasing Test Records from the Unit's Flash EEPROM

Follow the steps below to erase test records from the unit's Flash EEPROM

a. Start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*).

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

Press the **[4]** key (*ERASE RECORD*).

d. The following screen will be displayed:

```
     ERASE RECORD

1.ERASE SINGLE REC.
2.ERASE ALL RECORDS

    "STOP" TO EXIT
```

NOTE

If you have a USB Flash drive inserted in the unit's "USB MEM" port, the following screen will be displayed instead of the above screen:

```
1.ERASE INTERNAL REC
2.ERASE THUMB DRV REC
```

Press the **[1]** key (*ERASE INTERNAL REC*).

The following screen will be displayed:

```
     ERASE RECORD

1.ERASE SINGLE REC.
2.ERASE ALL RECORDS

    "STOP" TO EXIT
```

Continue with the steps below.

1. *ERASE SINGLE REC.*

    Press the **[1]** key (*ERASE SINGLE REC.*) to erase a single test record from the unit's internal Flash EEPROM. The following screen will be displayed:

```
     ERASE RECORD

1.ENTER RECORD NUMBER
2.SCROLL TO SELECT
```

1. *ENTER RECORD NUMBER*

    Press the **[1]** key (*ENTER RECORD NUMBER*) if you know the record number that you would like to erase. The following screen will be displayed:

```
    ERASE RECORD
    NUMBER:
```

> You can cancel the process and return to the "START-UP" menu by pressing the **[STOP]** key.
>
> **NOTE**

Type the record number that you would like to erase using the alpha-numeric keypad and then press the **[ENTER]** key. If you do not know the test record number, you can first view the test record directory using the instructions in section 3.6.6.

The following screen will be displayed while the record is being erased:

```
    ERASING RECORD
    PLEASE WAIT...
```

The following screen will be displayed when the test record has been completely erased:

```
RECORD NUMBER 8
ERASED!
```

Press any key to continue. You will be returned to the beginning of step d.

2. *SCROLL TO SELECT*

Press the **[2]** key (*SCROLL TO SELECT*) to scroll through the test record directory and locate the test record that you would like to erase. The following screen will be displayed:

```
    RECORDS DIRECTORY

"UP" TO SCROLL FWD
"DWN" TO SCROLL RVS
```

Press the **[▲]** or **[▼]** key to scroll through the test record directory. The test record header will be displayed as shown:

```
#1     03/09/15    09:55
VIC
LAB
```

You can continue to scroll through the record directory by pressing the **[∧]** and **[∨]** keys. Once you have located the test record you would like to erase, press the **[ENTER]** key. The selected test record will be erased and the following screen will be displayed:

```
RECORD NUMBER 9
ERASED!
```

Press any key to continue. You will be returned to the beginning of step d.

2. *ERASE ALL RECORDS*

Press the **[2]** key (*ERASE ALL RECORDS*) to erase all the test records from the unit's internal Flash EEPROM. The following warning screen will be displayed:
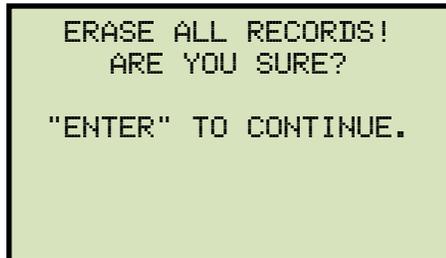
```
   ERASE ALL RECORDS!
     ARE YOU SURE?

  "ENTER" TO CONTINUE.
```

You can press the **[STOP]** key to cancel the process and return to the "START-UP" menu.

Press the **[ENTER]** key to proceed with deleting all the test records from the unit's Flash EEPROM. The following screen will be displayed during the erasure process:

```
   ERASING RECORDS

    PLEASE WAIT...
```

The following screen will be displayed when all test records have been completely erased:

```
   RECORDS ERASED!
```

Press any key to return to the "START-UP" menu.

3.6.8. Erasing Test Records from a USB Flash Drive

Follow the steps below to erase test records from a connected USB Flash drive:

a. Make sure a USB Flash drive is connected to the unit's "USB MEM" port, and then start from the "START-UP" menu:

```
1.RUN TEST
2.SETUP

TIME:  10:11:12   23°C
DATE:  04/01/15   73°F
```

Press the **[2]** key (*SETUP*).

b. The following screen will be displayed:

```
1. RECORD ID
2. REVIEW RECORD
3. SAVE/RESTORE RECORD
4. SET TIME
5. SET LANGUAGE
6. CAL NOTICE ON/OFF
```

Press the **[3]** key (*SAVE/RESTORE RECORD*).

c. The following screen will be displayed:

```
1. RESTORE RECORD
2. SAVE RECORD
3. RECORD DIRECTORY
4. ERASE RECORD
5. COPY TO THUMB DRIVE
```

Press the **[4]** key (*ERASE RECORD*).

d. The following screen will be displayed:

```
1.ERASE INTERNAL REC
2.ERASE THUMB DRV REC
```
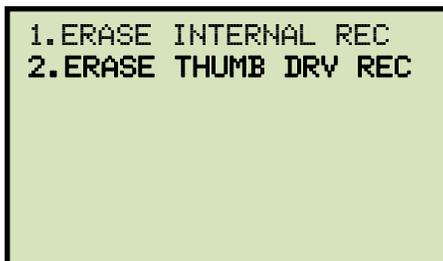
Press the **[2]** key (*ERASE THUMB DRV REC*).

e. The following screen will be displayed:

```
      ERASE RECORD

 1.ERASE SINGLE REC.
 2.ERASE ALL RECORDS

    "STOP" TO EXIT
```

1. *ERASE SINGLE REC.*

   Press the **[1]** key (*ERASE SINGLE REC.*) to erase a single test record from the connected USB Flash drive. The following screen will be displayed:

```
   ERASE THUMB DRIVE

     REC_
```

   Type the record number that you would like to erase using the alpha-numeric keypad and then press the **[ENTER]** key. The test record will be erased from the USB Flash drive and the following screen will be displayed:

```
 THUMB DRIVE RE001
 ERASED!
```

   Press any key to continue. You will be returned to the beginning of step e. Press the **[STOP]** key to return to the "START-UP" menu.

2. *ERASE ALL RECORDS*

   Press the **[2]** key (*ERASE ALL RECORDS*) to delete all test records from the connected USB Flash drive. The following warning screen will be displayed:

```
 ERASE ALL THUMB DRIVE
 RECORDS!

        ARE YOU SURE?

   "ENTER" TO CONTINUE.
```

Press the **[STOP]** key if you do not want to erase all the test records. You will be returned to the "START-UP" menu.

Press the **[ENTER]** key to proceed with deleting all the test records from the connected USB Flash drive. The following screen will be displayed when all the records have been erased:

```
ALL THUMB DRIVE
RECORDS ERASED!
```

Press any key to return to the "START-UP" menu.

4.0   Getting the Latest Firmware, Software, and Manuals

The latest firmware, software, and user's manuals can be downloaded from the Vanguard Instruments Company's web site at http://www.vanguard-instruments.com. In order to download these items from our site, you will first need to sign up for a FREE user account on our site. Also, your account must be approved before it can be used to download firmware, software, and user's manuals. Follow the steps below to sign up for an account and download the latest firmware, software and user's manuals:

a. Visit our site at http://www.vanguard-instruments.com.

b. On the left hand side of the page, click on the "Create new account" link:

c. You will be presented with a sign-up form. Please complete all the required fields on the form and click on the "Create new account" button at the bottom of the page.

d. Once your account has been created, it will be reviewed by our staff and usually approved within the hour during regular business hours.

e. Once you have received the account approval email, visit our site again at http://www.vanguard-instruments.com and login to your account using your username and password.

f. Click on the "Downloads" link at the top of the page:
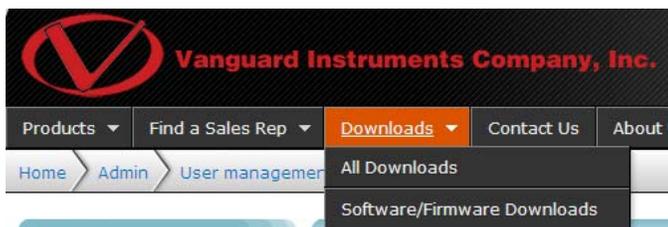
g. The "Downloads" page will be displayed listing all Vanguard products along with the related firmware, software, and user's manuals. Click on any of these items to download them.

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