# VBT-75 S2

## VACUUM BOTTLE TESTER

## USER'S MANUAL


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**July 7, 2017**
**Revision 1**

# SAFETY SUMMARY

## FOLLOW EXACT OPERATING PROCEDURES

Any deviation from the procedures described in this operator's manual may create one or more safety hazards, damage the VBT-75 S2, or cause errors in the test results; Vanguard Instruments Co., Inc. assumes no liability for unsafe or improper use of the VBT-75 S2. The following safety precautions must be observed during all phases of test set up, test hookups, testing, and test-lead disconnects.

## SAFETY WARNINGS AND CAUTIONS

This device 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 VBT-75 S2 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 VBT-75 S2 has an IP rating of 32.

**Pollution Degree:** The VBT-75 S2 has a pollution rating of 2.

**Operating Voltage:** The VBT-75 S2 is rated for use with an operating voltage of 120V or 240V, auto-ranging ±10% of selected voltage.

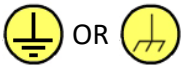
**Power Cord**: The VBT-75 S2 is supplied with a 16 AWG, 16A power cord with a NEMA 5-15P plug. Replacement cable shall have the same or better rating and is available through the manufacturer.

## VENTILATION REQUIREMENTS

The VBT-75 S2 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 VBT-75 S2:

- 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.

# TABLE OF CONTENTS

CONVENTIONS USED IN THIS DOCUMENT ..... 1
1.0 INTRODUCTION ..... 2
1.1 General Description and Features ..... 2
1.2 Technical Specifications ..... 3
1.3 VBT-75 S2 Controls and Indicators ..... 4
2.0 CABLE CONNECTIONS ..... 6
3.0 OPERATING PROCEDURES ..... 7
3.1 Set the Date and Time ..... 7
3.2 Changing the LCD Screen Contrast ..... 8
3.3 Performing a Test ..... 9
3.4 Updating Firmware ..... 11

# LIST OF TABLES

Table 1. VBT-75 S2 Technical Specifications ..... 3
Table 2. Functional Descriptions of VBT-75 S2 Controls and Indicators ..... 5

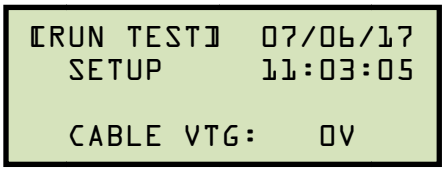
# LIST OF FIGURES

Figure 1. VBT-75 S2 Controls and Indicators ..... 4
Figure 2. VBT-75 S2 Connection Diagram ..... 6

# CONVENTIONS USED IN THIS DOCUMENT

This document uses the following conventions:

- A key or switch on the VBT-75 S2 is indicated as **[KEY]** and **[SWITCH]**.
- Screen and menu names are referenced as "SCREEN/MENU NAME".
- VBT-75 S2 LCD screen output is shown as:




  Note that the selected item on the screen is enclosed in brackets ("[RUN TEST]", in the example above).

- 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 VBT-75 S2 is Vanguard's second generation microprocessor-based, portable, 75kV dc vacuum bottle tester. This lightweight, portable tester is designed for testing circuit-breaker vacuum bottles in the field and at the shop.

Test voltages can be selected from 10 kV dc to 75 kV dc in 5 kV steps. The high-voltage test time can be set from 5 seconds to 2 minutes. The test voltage is raised to the selected voltage and held for the test time duration. The test voltage and leakage current are displayed on the LCD during testing. After the test time duration has elapsed and the leakage current did not pass the pre-set value of 100 µA, 200 µA, or 300 µA, the test voltage is returned to zero and a "Pass" message is displayed. If a flash-over condition occurs, such as bottle failure, the test voltage is immediately turned off, a "Failure" message is displayed on the LCD screen, and the "TEST FAIL" LED light on the unit is also illuminated.

The presence of high voltage is indicated by an audible tone and an illuminated "HIGH VOLTAGE" LED light. For additional operator safety, an "ARM" switch must be held down during testing.

The VBT-75 S2 features a back-lit LCD screen (20 characters by 4 lines) that is viewable in both bright sunlight and low-light levels. A turn-and-press knob is used to control the unit. The VBT-75 S2's firmware can be updated in the field via the unit's built-in USB Flash drive port.

The VBT-75 S2 is furnished with a 10-foot test cable that is terminated with a quick-disconnect test clip. A transportation case is also included.

## 1.2 Technical Specifications

**Table 1. VBT-75 S2 Technical Specifications**

| | |
|---|---|
| ***TYPE*** | Portable 75 kV vacuum bottle tester |
| ***PHYSICAL SPECIFICATIONS*** | **Dimensions:** 17"W x 10.5"H x 6.5" D (42.7 cm x 26.9 cm x 16.5 cm)<br>**Weight:** 10 lbs. (4.53 Kg) |
| ***INPUT POWER*** | 90 – 240 Vac, 2A, 50/60 Hz |
| ***OUTPUT VOLTAGE*** | 10kV – 75 kV dc in 5 kV steps; accuracy: 1.5% |
| ***OUTPUT RIPPLE VOLTAGE*** | 3% max |
| ***DISCHARGE TIME*** | Maximum discharge time for internal high voltage is 3 seconds |
| ***DISPLAY*** | Back-lit LCD (20 characters x 4 lines);<br>Viewable in bright sunlight and low-light levels |
| ***CONTROL*** | Single turn-and-press knob |
| ***INDICATORS*** | **Failure Indicator:** LED illuminates when test current exceeds 100 µA, 200 µA, or 300 µA (programmable)<br>**High Voltage Indicator:** LED illuminates when high voltage is present |
| ***FIRMWARE UPDATES*** | firmware can be updated in the field via the unit's built-in USB Flash drive interface |
| ***ENVIRONMENT*** | Operating: -10˚ to 50˚ C (15˚ to +122˚ F);<br>Storage: -30˚ C to 70˚ C (-22˚ to +158˚ F) |
| ***HUMIDITY (MAX)*** | 90% RH @ 40˚ C (104˚ F) non-condensing |
| ***ALTITUDE (MAX)*** | 2000m (6562 ft) to fully safety specifications |
| ***CABLES*** | one 10-foot (3.05m) high-voltage cable, one 10-foot (3.05m) high voltage return cable, one ground cable, one power cord |
| ***SHIPPING CASE*** | Shipping case is included |
| ***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 VBT-75 S2 Controls and Indicators

The VBT-75 S2's controls and indicators are shown in Figure 1 below. A leader line with an index number points to each control and indicator, which is cross-referenced to a functional description in Table 2. The table describes the function of each item on the control panel. The purpose of the controls and indicators may seem obvious, but users should become familiar with them before using the VBT-75 S2. Accidental misuse of the controls will usually cause no serious harm. Users should also be familiar with the safety summary found on the front page of this User's Manual.

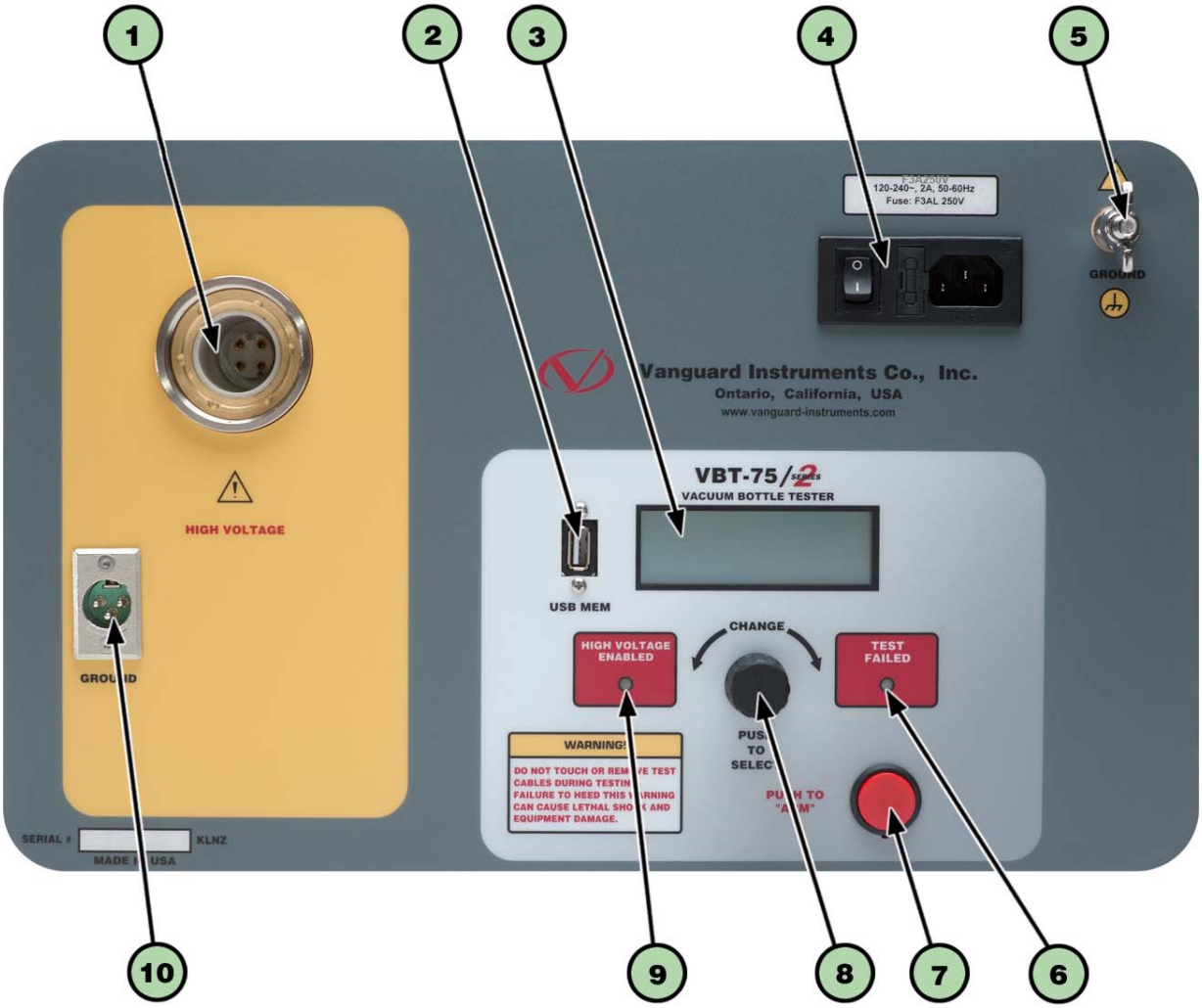



**Figure 1. VBT-75 S2 Controls and Indicators**

**Table 2. Functional Descriptions of VBT-75 S2 Controls and Indicators**

| Item Number | Panel Markings | Functional Description |
|---|---|---|
| **1** | HIGH VOLTAGE | High voltage cable connector |
| **2** | USB MEM | USB flash drive interface for firmware updates |
| **3** | | Back-lit LCD screen (4 lines x 20 characters).<br>Viewable in bright sunlight and low-light levels. |
| **4** | 120/240 Vac, 2A,<br>50-60 Hz<br>F3AL 250V | Input power connector with built-in fuse holder and power switch |
| **5** | GROUND | VBT ground stud. Connect ground stud to substation ground using the provided cable. |
| **6** | TEST FAILED | Test failure indicator. This indicator turns on if the test current exceeds the present current threshold (100, 200, or 300 μA). |
| **7** | PUSH TO<br>"ARM" | Arm switch; press and hold during testing. |
| **8** | CHANGE | VBT turn-and-press control knob. |
| **9** | HIGH VOLTAGE<br>ENABLED | This indicator turns on when high test voltage is present at the test leads. |
| **10** | GROUND | High voltage return cable connector |

## 2.0 CABLE CONNECTIONS

The VBT-75 S2 comes furnished with one 10-foot (3.05m) high voltage cable and one 10-foot voltage return cable. Both cables are terminated with alligator clamps that are used to connect to the vacuum bottle being tested. A typical cable connection is shown in Figure 2 below.

**WARNING**

- To protect the VBT-75 S2 against static discharge in the substation, always connect the unit's ground stud to the substation ground.
- The circuit breaker must be off-line and completely isolated.
- The vacuum bottle under test should be in the OPEN position.

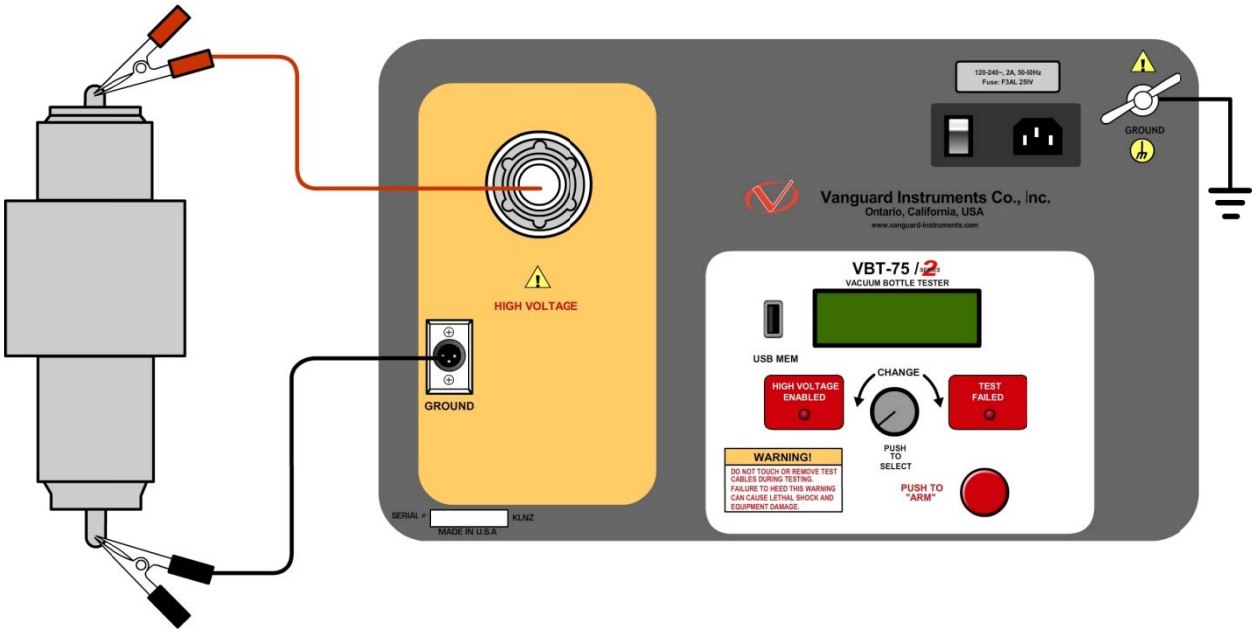


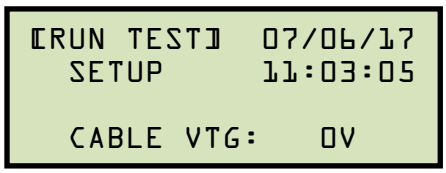

**Figure 2. VBT-75 S2 Connection Diagram**

# 3.0 OPERATING PROCEDURES

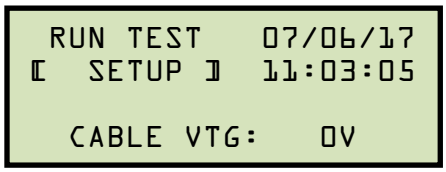
## 3.1 Set the Date and Time

Follow the steps below to set the date and time for the VBT-75 S2's internal clock:

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

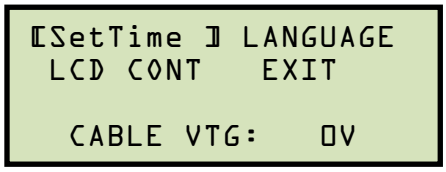



Turn the **[CONTROL KNOB]** until the *SETUP* option is enclosed in brackets as shown below:



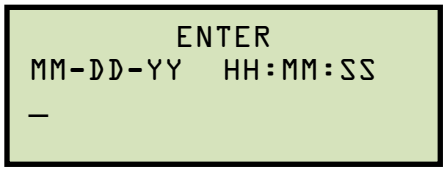

Press the **[CONTROL KNOB]**.

b. The following screen will be displayed:




The *SetTime* option should be enclosed in brackets. Press the **[CONTROL KNOB]**.

c. The following screen will be displayed:

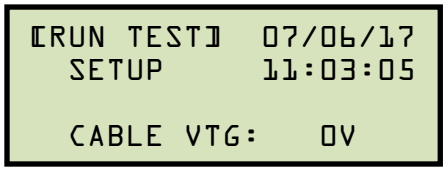



Turn the **[CONTROL KNOB]** to select the first digit of the month and then press the **[CONTROL KNOB]**. The cursor will move over to the second digit of the month. Continue this process to enter the date and time. When you press the **[CONTROL KNOB]** for the last time to set the second digit of the current minute, the date and time will be set and you will be returned to the "START-UP" menu.

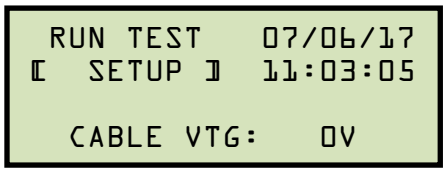
## 3.2 Changing the LCD Screen Contrast

Follow the steps below to adjust the VBT-75 S2's LCD screen contrast:

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

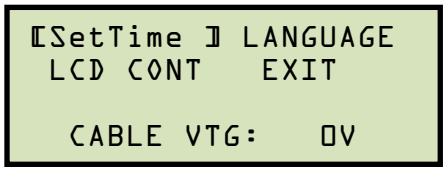



Turn the **[CONTROL KNOB]** until the *SETUP* option is enclosed in brackets as shown below:

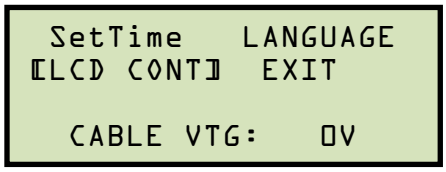



Press the **[CONTROL KNOB]**.

b. The following screen will be displayed:

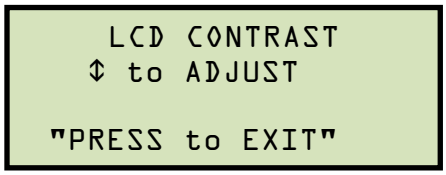



Turn the **[CONTROL KNOB]** until the LCD CONT option is enclosed in brackets as shown below:




Press the **[CONTROL KNOB]**.

c. The following screen will be displayed:

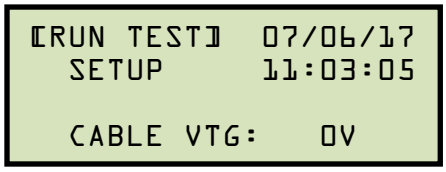



Turn the **[CONTROL KNOB]** clock-wise or counter-clockwise to adjust the screen contrast. Press the **[CONTROL KNOB]** when the contrast is to your liking. You will be returned to the "START-UP" menu.

## 3.3 Performing a Test

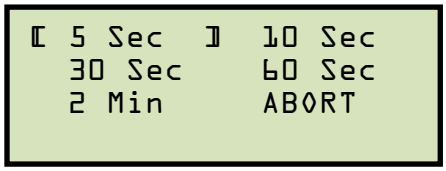
Follow the steps below to perform a test:

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



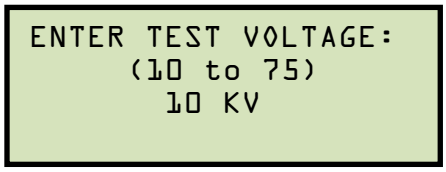

The RUN TEST option should be enclosed in brackets. Press the **[CONTROL KNOB]**.

b. The following screen will be displayed:



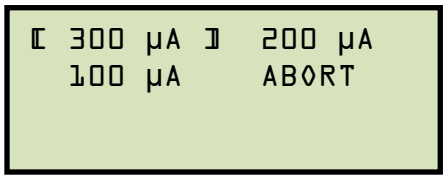

Turn the **[CONTROL KNOB]** to select the desired test duration and then press the **[CONTROL KNOB]**.

c. The following screen will be displayed:



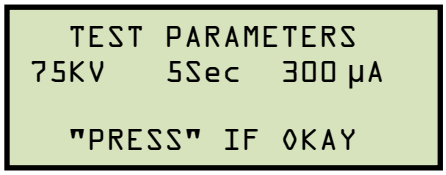

Turn the **[CONTROL KNOB]** clock-wise or counter-clockwise to increase or decrease the test voltage by 5 KV increments, respectively (10 KV to 75 KV). When the desired test voltage is displayed, press the **[CONTROL KNOB]**.

d. The following screen will be displayed:




Turn the **[CONTROL KNOB]** to select the flash-over threshold (*300 µA*, *200 µA*, or *100 µA*), and then press the **[CONTROL KNOB]**.

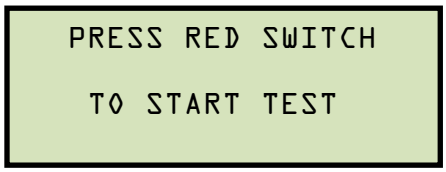
e. The following summary screen will be displayed:




If you need to make changes, turn the **[CONTROL KNOB]** either clock-wise or counter-clockwise and you will be returned to step b.

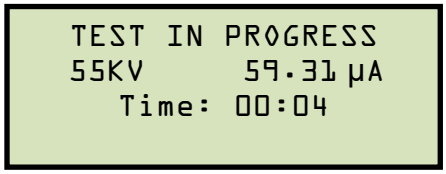
If the test parameters are correct, press the **[CONTROL KNOB]**.

f. The following screen will be displayed:

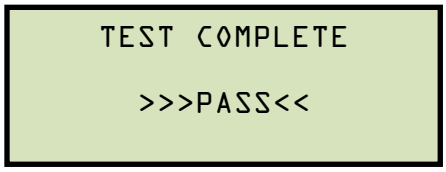



Press the red **[PUSH TO "ARM"]** switch.

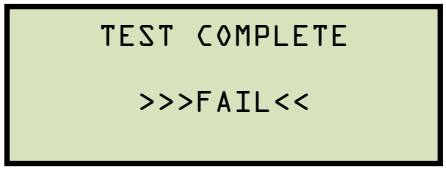
g. The VBT-75 S2 will initiate the test and start the timer based on the test duration selected. The screen will be updated with the test voltage and the leakage current as shown below:




h. After the test time duration has elapsed, the test results will be displayed. If the leakage current did not pass the preset value set in step d, the test voltage is returned to zero and a "PASS" message is displayed as shown below:




However, if a flash-over condition occurred, such as bottle failure, the test voltage is immediately turned off and a "FAIL" message is displayed as shown below:



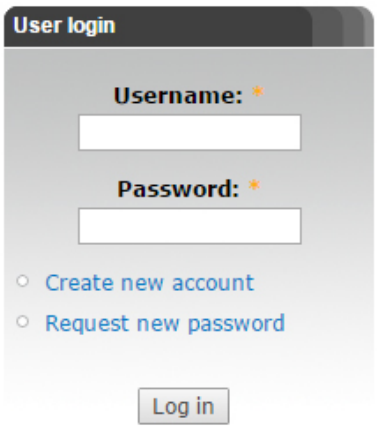

The "TEST FAIL" LED on the front panel will also be illuminated to indicate a test failure.

Press the **[CONTROL KNOB]** to return to the "START-UP" menu.

## 3.4 Updating Firmware

The VBT-75 S2' firmware is user-upgradeable. The firmware version is displayed on the LCD screen during the start-up sequence when the unit is powered one. Follow the steps below to download and install the latest VBT-75 S2 firmware:

a. Visit the Vanguard web site at http://www.vanguard-instruments.com. Login to your account using the login form on the left side of the page:




If you do not have an account, click on the "Create new account" link below the login area to create your free account. Please note that your account will need to be approved first before it can be used to download any software or firmware. This is usually done within 30 minutes of creating your account.

b. After logging in to your account, hover your mouse over the "Downloads" link at the top of the page and click on the "Software/Firmware Downloads" link:


c. All Vanguard products will be listed along with any compatible firmware and software. Scroll down the page to find the VBT-75 S2 listing and then click on the firmware link to save the firmware file.

d. Once the download is complete, navigate to the folder where the file was downloaded and extract the compressed ZIP file (you may need to use a ZIP extraction application such as WinZip, 7-Zip, etc.). Once extracted, you should see the file "vbt75s2.hex". This is the firmware file.

e. Copy the file "vbt75s2.hex" to the root folder of a USB Flash drive.

**NOTES**

- Please use an empty flash drive. Please backup any existing files and then delete them from the drive.
- We recommend using a flash drive with a capacity of 8GB or less.

f. With the VBT-75 S2 turned off, insert the USB Flash drive into the VBT-75 S2's USB Flash drive port.

g. While holding down the **[CONTROL KNOB]**, turn on the power.

h. The VBT-75 S2 will go through the initial starting sequence and then will start the firmware upgrade process. The "START-UP" menu will be displayed once the upgrade process is complete.

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