HVI®

DTS-60A
DTS-100A
Dielectric Oil Test Set
Operator's Manual

Manual Version 2.01

High Voltage *INC.*

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© HIGH VOLTAGE, INC.
31 County Route 7A
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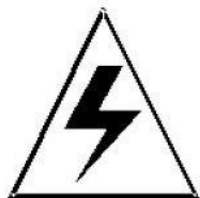
Phone : (518) 329-3275
Fax   : (518) 329-3271
Web   : http://www.hvinc.com
e-mail: service@hvinc.com

Icons & Notation

Danger!

This icon indicates danger conditions!

Warning!

This icon indicates warnings!

Note!

This icon indicates a hint or a tip!
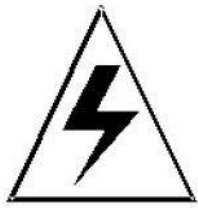
This Operator manual contains instructions for the operation of a High Voltage power source. The operator of this equipment must use good judgement and follow all safety precautions noted in this guide to ensure the protection of themselves and others in close proximity to the test area. Failure to follow the instruction could result in injury or death.
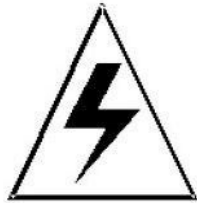
Proper grounding of the test set must be done prior to connecting this unit to a power source.

Table of Contents

1
Specifications and Controls

This section describes the specifications, controls, and features of the DTS-60A & DTS-100A AC Dielectric Oil Test Sets.

Included in this section is a brief introduction about the equipment's set up and start up.

1.1 Features and Specifications

The DTS-60A & DTS-100A AC Dielectric Oil Test Sets provide automatic, programmable, and accurate measurement of breakdown voltage for insulating oils used in high-voltage electrical equipment.

Main features of the DTS-60A & DTS-100A Series of AC Dielectric Oil Test Sets

User Interface
- ❑ Dot Matrix Liquid Crystal Display (128x64)
- ❑ Compact 5-key keypad for operation
- ❑ User friendly, menu driven functionalities
- ❑ Large output voltage display

Functionalities
- ❑ Test Result storage and reporting
- ❑ Real Time Clock
- ❑ Ambient Temperature measurement
- ❑ International Standard Tests
- ❑ User Defined Tests
- ❑ Language selection

Measurements and Control
- ❑ High accuracy of High Voltage measurement (0.5%)
- ❑ Digitally selected Voltage rate of rise (0.1kV/s step)
- ❑ Arc detection with less than 5 milliseconds shutdown
- ❑ Digital Closed-Loop for voltage control

Equipment Case
- ❑ Rugged aluminum case
- ❑ Window for observation of oil test

Table 1.1 - Specifications

	DTS-60A & DTS-100A unless otherwise indicated
Input	120V, 50/60 Hz, 5 amps, single phase
	230V, 50/60 Hz, 3 amps, single phase
Output	DTS-60A: 0 – 60kVac, 800VA resistive load, between bushings
	DTS-100A: 0 – 100kVac, 800VA resistive load, between bushings
Output Termination	Dual Capacitively Graded Bushings
Display	Dot-Matrix 128x64
Keypad	5 keys for equipment's functionalities
Printer	40 column dot-matrix
Remote Operation	RS-232 Serial Interface or USB HID Serial Interface
Breakdown Shutdown	Less than 5 ms
Accuracy	0.5%
Operating Temperature	-14°F to 104°F (-10°C to 40°C)
Case Size	14.75w x 14d x 11.5h in (36.88w x 35d x 28.75h mm)
H.V. Tank	High Voltage Tank Included
Weight	60 lbs.

1.2 Control Panel

The equipment's Control Panel is depicted in Figure 1.1. It consists of the following:

❑ **Input Power Connector**

The Input Power connector accepts most standard electrical equipment type cords. The power supplied to the input connector must be from a grounded source rated to match the input power specifications noted in Table 1.1.

❑ **Main Power Switch**

The Main Power switch provides the power to the control and power circuits. The neon lamp will light when power is on and voltage is available through the input line cord. The Input Power Fuse, located electrically before the Main Power switch, provides line fault protection for the unit.

❑ **Fuse Socket**

❑ **LCD Display**

The Liquid Crystal Display guides the user to the system's functionalities.

❑ **Keypad**

Compact 5-key keypad for equipment operation.

❑ **Printer**

Dot Matrix printer for optionally outputting results from the current test, or from the stored history of the last fifty tests performed.

Figure 1.1 – DTS-60A / DTS100A Control Panel

1.3 User Interface

The Equipment User Interface is based on a dot-matrix Liquid Crystal Display (LCD) and a compact 5-key keypad, shown in Figure 1.2. The user-friendly graphical interface makes the equipment's operation simple and attractive.


```
...SELF TEST 1



HIGH VOLTAGE



12:10  01/08/05  65 °F

MENU  BACK  UP  DOWN  ENTER
```
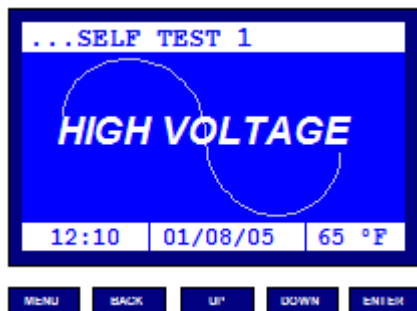
Figure 1.2 – Equipment User Interface

1.3.1 Menu Overview

The equipment operation is based on a user friendly structure of menu/submenu driven functions. An overview of the menu/submenu selections is summarized in Figure 1.3.
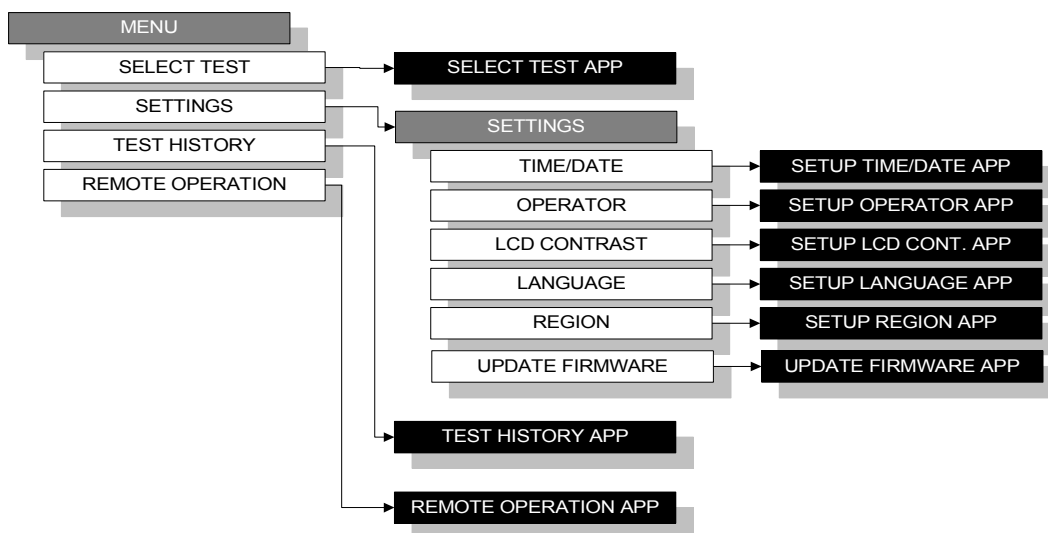
Figure 1.3 – DTS-60A & DTS-100A User Interface

1.3.2 Keypad Operations

The DTS-60A and DTS-100A use a typical lcd/keypad interface in which the actions of the keys are defined by the type of menu or application dialog that is active. The most common types are listed below. Any special key functionality for a given dialog are detailed later in the manual.

Simple Test Operations
- **MENU** Proceed to the Main Menu before/after test
- **BACK** Enable/Disable Stirrer (before stage begins)
            Select "No" for prompt
- **UP** Increase Voltage Rate of Rise
          Pick "Yes" prompt
- **DOWN** Decrease Voltage Rate of Rise
            Pick "No" prompt
- **ENTER** On Entry, Execute Simple Test
             Begin Test Stage with chosen voltage rate
             Select "Yes/No" prompt
- **ANY** After Starting the Test ANY key interrupts the process

Standard and User Defined Test Operations
- **MENU** Proceed to the Main Menu before/after test
- **BACK** Select "No" for prompt
- **UP** Pick "Yes" prompt
- **DOWN** Pick "No" prompt
- **ENTER** Execute Standard or User Defined Test Test
             Select "Yes/No" prompt
- **ANY** After Starting the Test ANY key interrupts the process

Main Menu and Submenu Operations
- **BACK** Exit from Main Menu to Test Operations
            Exit from Submenu to Main Menu
- **UP** Move Up to the previous selection
- **DOWN** Move Down to the next selection
- **ENTER** Proceed to the selection

Number Edit Operations
- **BACK** Discard changes and return
- **UP** Increase the current value
- **DOWN** Decrease the current value
- **ENTER** Enter the value

Operator String Edit Operations
- **MENU** Choose Character Set: upper case; lower case; numbers; symbols
- **BACK** Delete Character
- **UP** Select previous character, wait 3 seconds to enter individual character
- **DOWN** Select next character, wait 3 seconds to enter individual character
- **ENTER** Enter the completed string

Figure 1.4 illustrates the Operator String Edit Operation. The example refers to a string entry for the Operator Name (see section 2.3.2).

STEP 1		ENTER	Press the ENTER key in order to enable the String Entry keyboard operation for the Name
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **12:10 01/08/16 25 C**		

STEP 2			The String Entry Cursor is displayed. This indicates the current position of the editable character.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **_** **12:10 01/08/16 25 C**		

STEP 3		UP / DOWN	Use the UP and DOWN keys to select the desired character. Dont leave more than 3 seconds between key pressings. After every UP key pressing the next character of the alphabet will be displayed. In contrast, after every DOWN key pressing the previous character of the alphabet will be displayed. The character sequence is circular.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **O** **12:10 01/08/16 25 C**		

STEP 4			Stop pressing the UP and DOWN keys for more than 3 seconds. The character will be entered and the cursor will be displayed in the next possition.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **O_** **12:10 01/08/16 25 C**		

STEP 5		BACK	A mistake occured! Press the BACK Key in order to delete the last entried character.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **_** **12:10 01/08/16 25 C**		

STEP 6			Select the correct character according STEP 3 instructions. Then wait 3 seconds, until the cursor is displayed at the next position.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **P_** **12:10 01/08/16 25 C**		

STEP 7			Repeat the character entry operation for the whole string.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **PETER_** **12:10 01/08/16 25 C**		

STEP 8		MENU	Press the MENU key twice, in order to choose the numeric character set. The character sets rotate in order: upper case lower case numbers symbols
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **PETER_0** **12:10 01/08/16 25 C**		

STEP 9		ENTER	Press the ENTER key in order to enter the edited sting and return.
	OPERATOR **COMPANY** **NAME** **CONTACT INFO** **OTHER INFO** **PETER_007** **12:10 01/08/16 25 C**		

Figure 1.4 – String Entry Keypad Operation

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1.3.3 Warning Messages

The LCD display will show a warning message in the following cases:

1. **Lid is Open**, Figure 1.5.

   This warning message is displayed when the Lid of the equipment is open while a test is running. The current operation (i.e. test execution) will be restarted when the lid is closed.
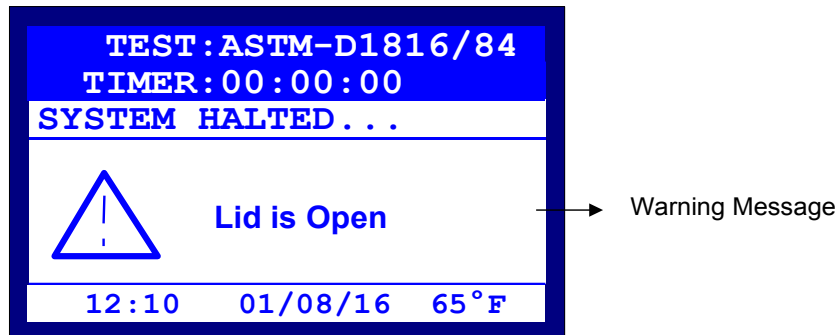
→ Warning Message

Figure 1.5 – 'Lid is open' Warning Message for Standard Test ASTM-D1816/84

If the Warning Message "Lid is Open" is depicted when the Lid is closed, contact the distributor or the manufacturer.

2. **Verify Electrode/Gap Spacing**, Figure 1.6a/b.

This warning message is displayed at the startup of every test procedure, in order to remind the user to check the electrodes type and spacing, according to the selected test. If the selected test is a Standard Test or User Defined Test one (where the spacing and the type of the electrodes is specific) the message will inform the user for the appropriate settings (type, spacing), Figure 1.6a. The user may proceed by pressing the **'ENTER'** key.

→ Warning Message

```
TEST:ASTM-D1816/84
TIMER:00:00:00
TEST READY...

    /!\    Electrodes:--●
           Spacing:0.04in

ENTER > PROCEED TEST
```
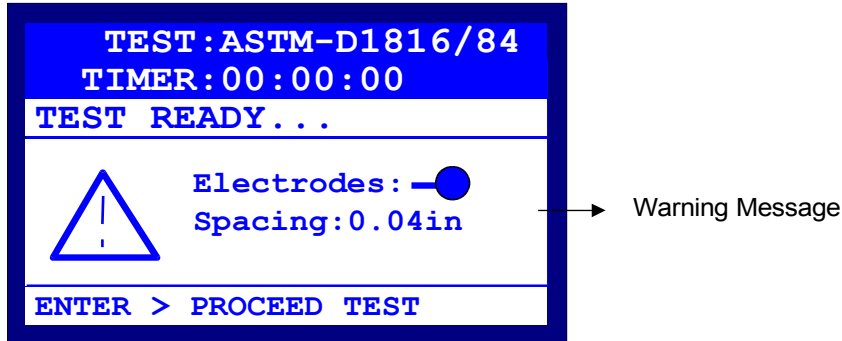
Figure 1.6a – 'Electrodes/ Space' Warning Message

If the selected test is the Simple Test (where the spacing and the type of the electrodes is not specified) the message will remind the user to verify the desired electrode type and spacing, Figure 1.6b. The user may proceed by pressing the **'ENTER'** key.

→ Warning Message

```
TEST:SIMPLE TEST
TIMER:00:00:00
VOLTAGE: 0.5 kV/s

    /!\    Verify Electrodes

MENU  > GO TO MENU
```
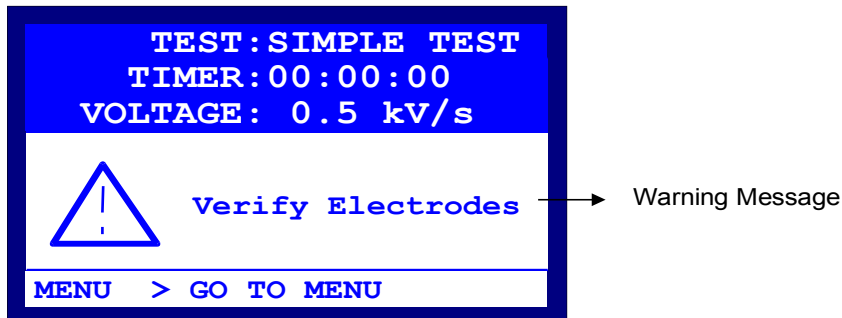
Figure 1.6b – Verify Electrode/Gap Spacing' Warning Message

1.3.4 Question Messages

The unit may display the following Question Messages.

1. **Continue Test?**, Figure 1.7.

   This question message is displayed during the Simple Test after a breakdown has been detected. The operator is prompted with a "Yes/No" prompt. Use the **'UP'** key to select the "Yes" icon or use the **'DOWN'** key to select the "No" icon.

   In this dialog, choosing the "Yes" icon will set up a new test stage and choosing the "No" icon will stop the Simple Test and proceed to the Print Results Question Message.

   Press the **'ENTER'** key to make your choice.

```
TEST:SIMPLE TEST
 TIMER:00:00:00
VOLTAGE: 0.5 kV/s

  ?    Continue      YES
             Test?    ✓

 12:10    01/08/16   65°F
```
→ Question Message Showing "Yes" Icon Selected

Figure 1.7 – 'Continue Test?' Question Message

2. **Print Results?**, Figure 1.8.

   This question message prompts the user for printing the test results after a test is finished. Similar to the "Continue Test" message, use the **'UP'** and **'DOWN'** keys to choose the "Yes" icon or the "No" icon.

   Press the **'ENTER'** key to make your choice.

```
   TEST RESULTS
 TEST:SIMPLE TEST
NUM. BD: 5

  ?    Print         X
         Results?    NO

 12:10    01/08/16   65°F
```
→ Question Message Showing "No" Icon Selected

Figure 1.8 – 'Print Results?' Question Message

1.3.5 Error Messages

Error messages indicate serious equipment malfunction. The system can display the following **Error Code/Messages,** Figure 1.9:

Error 100, **Error 101**, **Error 102, Error 110**, **Error 111**
Error 112, **Error 113, Error 120**, **Error 121**, **Error 122**

```
ERROR: 102

        Contact
        High Voltage Inc.
  ──    for more information...
        +1 518-329-3275


  12:10    01/08/16    65°F
```

→ Error Code

→ Error Message

→ User Interface Help Message
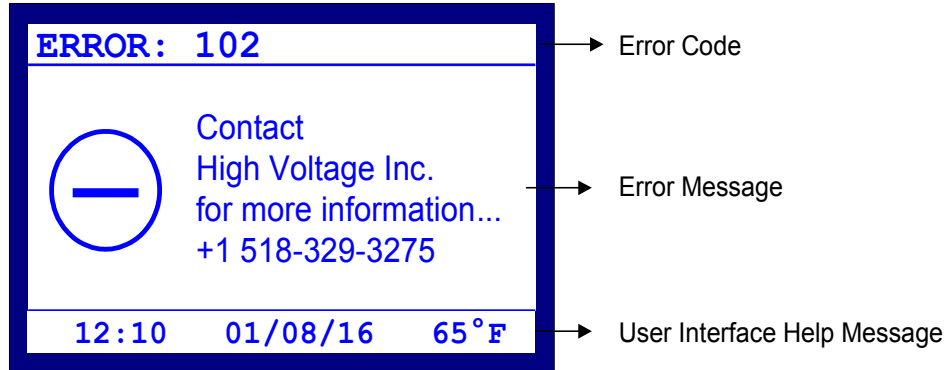
Figure 1.9 – Error Message

Whenever you see an ERROR message, contact the distributor or High Voltage, Inc.

1.3.6 Indicators

Display shows the following **Indicators**, in the following cases, Figure 1.12a/b.

1. **Current Stage Indicator**
   This indicator notifies the user for the current stage of a test procedure.
2. **High Voltage On/Off Indicator**
   This indicator notifies the user for the status of the high voltage tank.
   If the indicator is displayed, the high voltage is ON.
3. **Stirrer Indicator**
   This indicator notifies the user for the status of the stirrer.
   If the indicator is displayed the stirrer is ON.
4. **Breakdown Blinking Indicator**
   After a test stage, this blinking indicator notifies the user that a breakdown was detected.
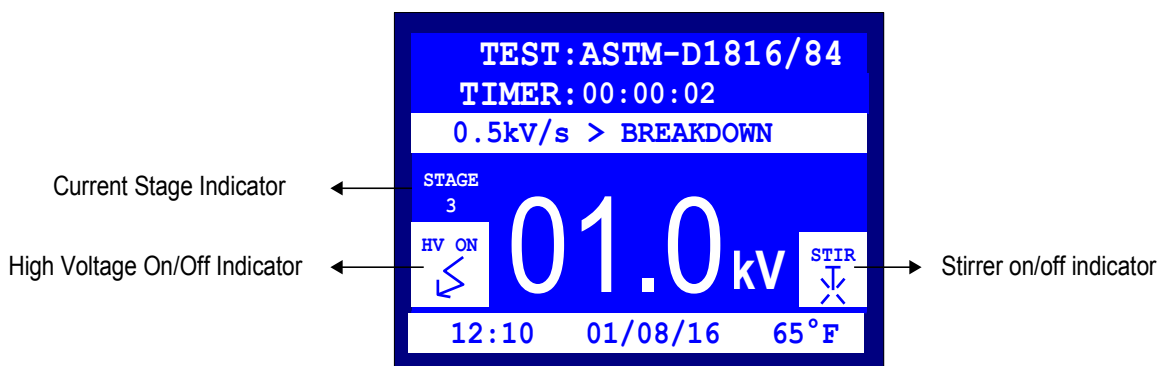
Figure 1.12 – Indicators during a test stage: high voltage ON; stirrer ON; test stage 3
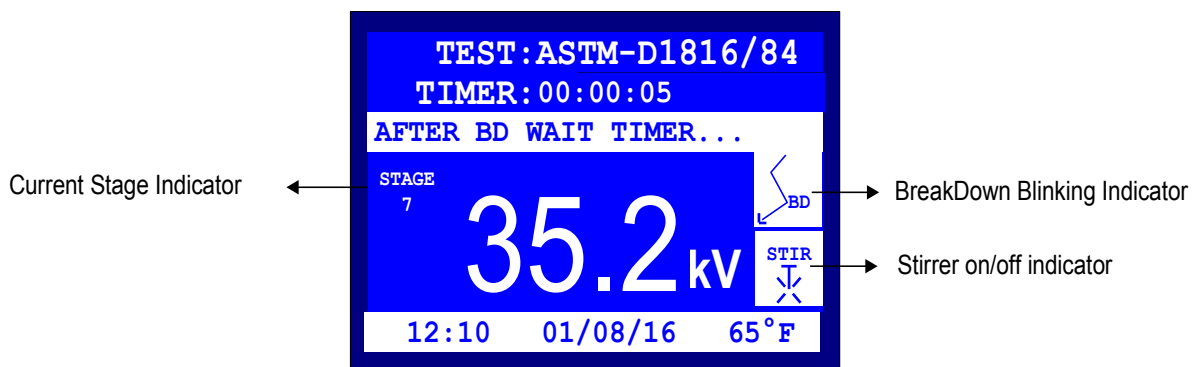
Figure 1.12 – Indicators after breakdown detected: high voltage OFF, stirrer ON; BreakDown detected; test stage 7; After BreakDown Timer counting down.

1.4 Setup the Equipment

The setup of this equipment has been minimized by careful consideration of the operator during design. The DTS-60A and DTS-100A one-piece construction permits convenient portability. The test set requires that the unit is operated with the control panel in the horizontal position, in order to keep oil level over high voltage transformer in the high voltage tank.

1. **Select a location** for the unit that will allow easy viewing of the LCD display
2. **Be sure that all the controls are off**, in their de-energized state.
3. **Remove all components** and oil vessels from the test chamber
4. **Install the input line cord** into the **Input Power** receptacle
5. **Connect the line cord to a suitable (120V or 230V, see Specifications Table) grounded power source.**
6. **Select the desired Test cell**. Fill in with sufficient oil for the testing to be performed.
7. **Clean the Test Cell and Electrodes** thoroughly and adjust the electrodes to conform with the proper ASTM Specification. Be sure the electrodes are securely tightened on the adjustment posts inside the oil vessel.

Use Isolation transformer (1/1) if the electrical installation has neutral earthing.

All the oil vessels designed and made by High Voltage Inc. have interchangeable posts and electrodes. These oil vessels were designed to conform to the ASTM test specifications requiring simple disassembly for cleaning. This design greatly reduces the time and effort required keeping your oil vessels in top operating condition.
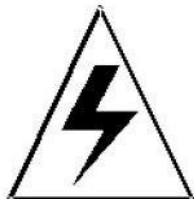
The operator of this equipment must use good judgement and follow all safety precautions noted in this guide to ensure the protection of himself and others in close proximity to the test area. Failure to follow the instructions could result in injury or death.

1.5 Startup the Equipment

1. Ensure that setup has been completed as described in section 1.4, Setup the Equipment.
2. Turn on **Main Power**.
3. The equipment initiates a self-test, Figure 1.13. The Firmware Version is shown, then the Self Tests begin executing. In case of malfunction, an error message is displayed and the system will be halted (see section 1.3.5).
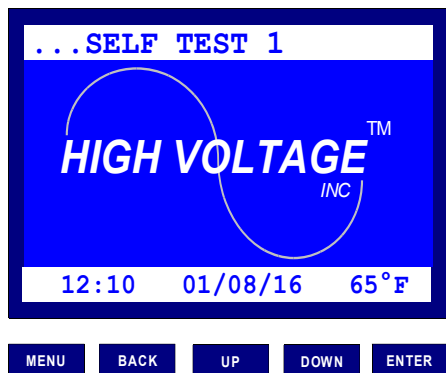
Figure 1.13 – Startup and Self Test

4. After the self-tests are completed, the last selected test is presented: Simple Test; Standard Test; or User-Defined Test.
5. The unit will display the Electrode Warning message and will wait for **'ENTER'** to be pressed to start the test(see section 1.3.3).
6. Before starting a test the user may open the lid, check the electrodes (type and spacing) and finally fill the appropriate test vessel with insulating oil. After closing the lid, the user should press the **'ENTER'** key to start the test.

Whenever you see an ERROR message contact the distributor or High Voltage Inc. directly.

2
Menu/Submenus and Settings

This section describes the equipment's Menus and Submenus.

The interface supports a simple menu/submenu structure in order to provide user- friendly operation.

2.1 Menu Operation Overview

In every menu/submenu screen, the first line indicates the title and the following lines indicate the possible selections, Figure 2-1.

The guide uses a selector for pointing to the current selection and the selection title becomes highlighted.

The keypad usage is very simple with the '↑', '↓', 'BACK' and 'ENTER' keys:

- ❑ **BACK**   Exit from Main Menu to Test Operations
                                         Exit from Submenu to Main Menu
- ❑ **↑ (UP)**   Move Up to the previous selection
- ❑ **↓ (DOWN)**   Move Down to the next selection
- ❑ **ENTER**   Proceed to the selection

Finally, the last line indicates the current time and date, as well as the temperature.

First Line Displays the MENU TITLE
Following Lines Display the MENU ITEMS
Last Line Displays the TIME/DATE/TEMP.
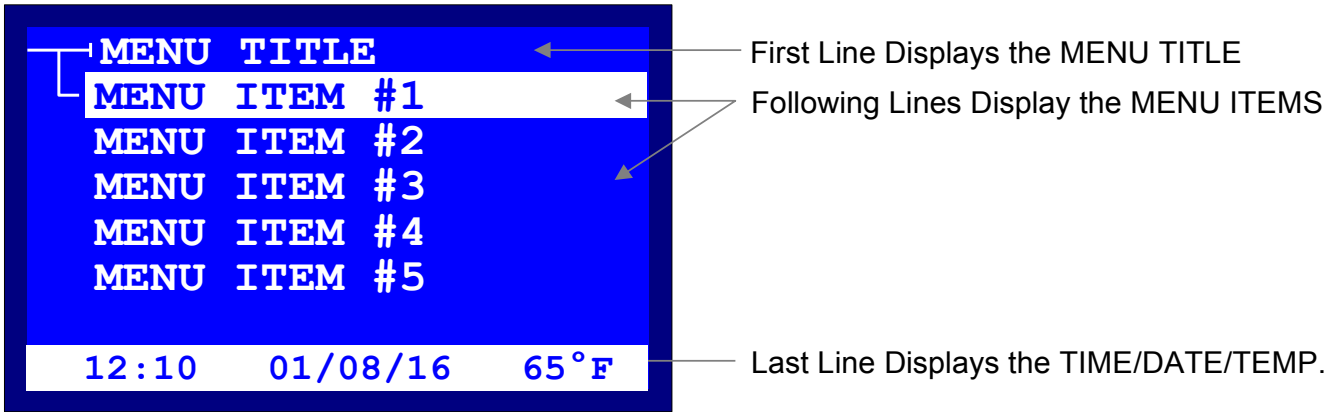
Figure 2.1 – Menu Setup

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2.2 Main Menu

The Main Menu is displayed by pressing the **'MENU'** key, Figure 2.2. The possible selections are the following:

Select Test

Go to the Select Test Submenu.

Settings

Go to the System Settings Submenu. The latter includes the basic system settings, which are the Time/Date setup, Operator setup, LCD Contrast setup, Language setup, Region setup, and the application to Update Firmware.

Test History

Run the Results History Application (see section 6). This can be used for browsing the results of previously executed test programs.

Remote Operation

Run the Remote Operation Application (see section 8). This activates RS-232 operation and allows download of test results to a computer.

MENU	No operation
BACK	Exit from Main Menu to Test Operations Exit from Submenu to Main Menu
UP	Move Up to the previous selection
DOWN	Move Down to the next selection
ENTER	Proceed to the selection

```
MENU
SELECT TEST
SETTINGS
TEST HISTORY
REMOTE OPERATION


 12:10    01/08/16    65°F
```
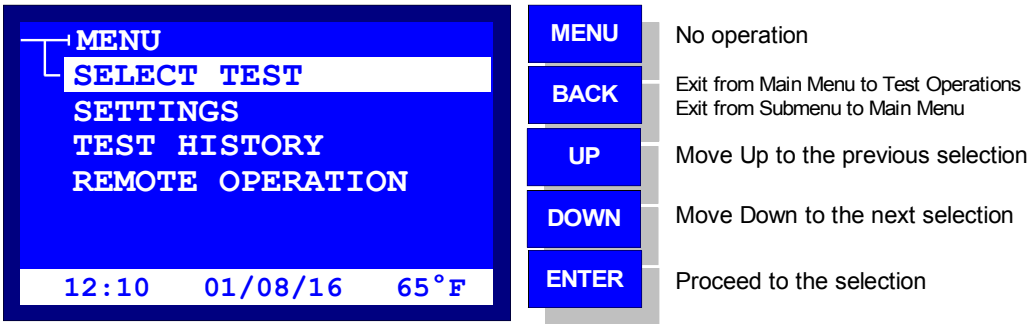
Figure 2.2 – Main Menu

2.3 Settings Submenu

The Settings Submenu is displayed upon the Settings Selection from the Main Menu, Figure 2.3. The possible selections are the following:

Time/Date

Dialog for setting time and date

Operator

Dialog for assigning operator and company info for use on print outs and test reports

LCD Contrast

Dialog for adjusting the LCD Contrast

Language

Dialog for changing the User Interface's language

Region

Dialog for choosing the time/date/temp format:

European - DD/MM/YY °C

American - MM/DD/YY °F

Update Firmware

Dialog for loading new firmware into the system. Contact High Voltage to see if a new version is available.

SETTINGS		
TIME/DATE	MENU	No operation
OPERATOR	BACK	Return to MAIN MENU
LCD CONTRAST	DOWN	Move selector down
LANGUAGE	UP	Move selector up
REGION		
UPDATE FIRMWARE	ENTER	Enter to the selection
12:10 01/08/16 65°F		
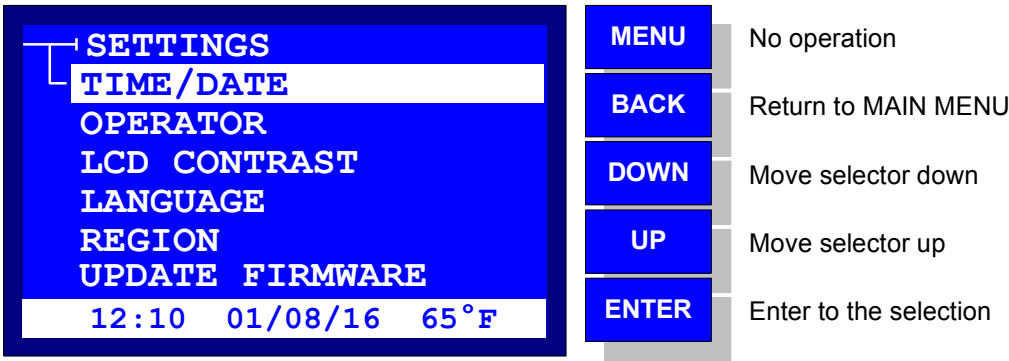
Figure 2.3 - Settings Submenu

2.3.1 Time/Date Dialog

The Time/Date dialog provides the ability to set the date and time. A step-by-step Time and Date setup procedure is depicted in Figure 2.4.

STEP 1	SETTINGS TIME/DATE OPERATOR LCD CONTRAST LANGUAGE REGION UPDATE FIRMWARE 12:10 01/08/16 65°F	ENTER	Press the ENTER key while the selector points to the TIME/DATE item
STEP 2	TIME/DATE SETUP 09:54 12.02.16 ENTER > SET VALUE		The application highlights the hours
STEP 3	TIME/DATE SETUP 10:54 12.02.16 UP > INCREASE VALUE	UP DOWN	Use the UP and DOWN keys for selecting the appropriate hours. The setting can be 0-23.
STEP 4	TIME/DATE SETUP 10:54 12.02.16 DOWN > DECREASE VALUE	ENTER	Press the ENTER key to enter the hours in time and go to the minutes selection.
STEP 5	TIME/DATE SETUP 10:54 12.02.16 BACK > EXIT SETUP		Repeat the above for all the Time and Date tags. After entering the year tag, the time and date will be set. The Settings Menu will return, showing the updated time and date.
NOTE	SETTINGS TIME/DATE OPERATOR LCD CONTRAST LANGUAGE REGION 12:10 01/08/16 65°F	BACK	If the BACK key is pressed when updating any of the time/date tags, the system discards any changes and return to the Settings menu.

Figure 2.4 – Set-up Time and Date

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2.3.2 Operator Dialog

The Operator dialog is used for assigning labels for operator and company info, that is then used on printouts and test history information extracted by a computer. The header information contains the following items:

1. **Company**
2. **Name**
3. **Contact Info**
4. **Other Info**

The Operator dialog uses the Operator String Edit Operation as described in section 1.3.2. Another example of usage is shown below in in Figure 2-5. This method is the same for all four labels.

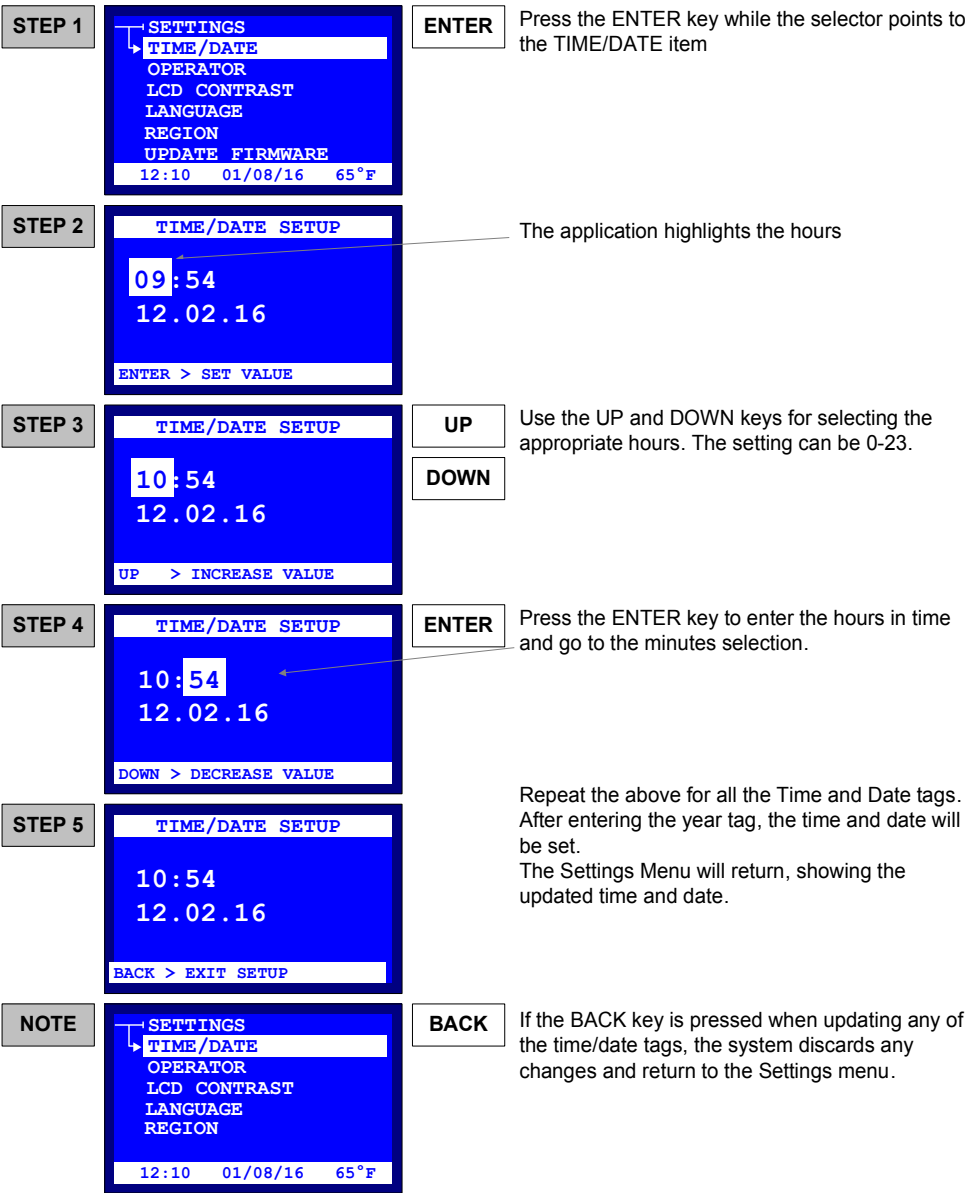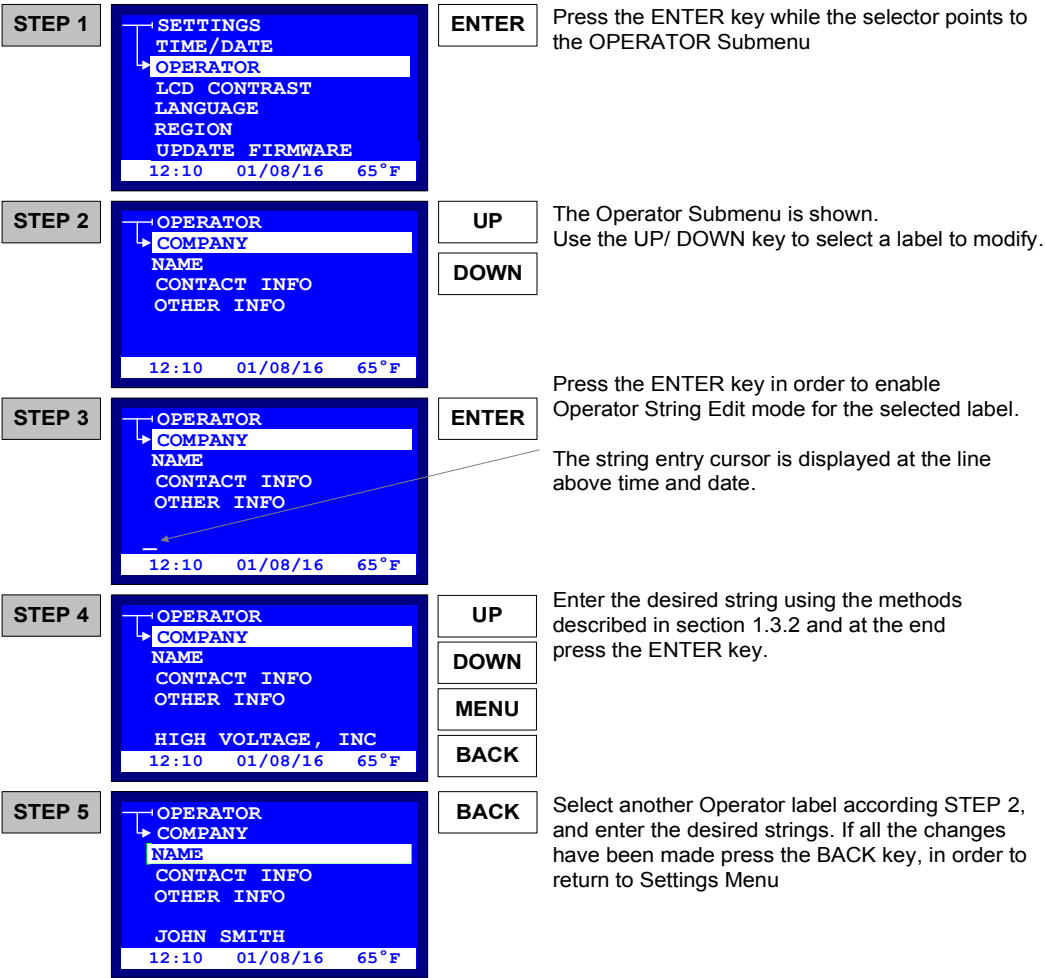| STEP 1	SETTINGS TIME/DATE OPERATOR LCD CONTRAST LANGUAGE REGION UPDATE FIRMWARE 12:10 01/08/16 65°F	ENTER	Press the ENTER key while the selector points to the OPERATOR Submenu
STEP 2	OPERATOR COMPANY NAME CONTACT INFO OTHER INFO 12:10 01/08/16 65°F	UP DOWN	The Operator Submenu is shown. Use the UP/ DOWN key to select a label to modify.
STEP 3	OPERATOR COMPANY NAME CONTACT INFO OTHER INFO _ 12:10 01/08/16 65°F	ENTER	Press the ENTER key in order to enable Operator String Edit mode for the selected label. The string entry cursor is displayed at the line above time and date.
STEP 4	OPERATOR COMPANY NAME CONTACT INFO OTHER INFO HIGH VOLTAGE, INC 12:10 01/08/16 65°F	UP DOWN MENU BACK	Enter the desired string using the methods described in section 1.3.2 and at the end press the ENTER key.
STEP 5	OPERATOR COMPANY NAME CONTACT INFO OTHER INFO JOHN SMITH 12:10 01/08/16 65°F	BACK	Select another Operator label according STEP 2, and enter the desired strings. If all the changes have been made press the BACK key, in order to return to Settings Menu

Figure 2-5 – Operator Set-up

2.3.3 LCD Contrast Dialog

The LCD Contrast dialog is used for optimizing the viewing of the display. When the user presses the **'ENTER'** key for entering the LCD Contrast Setting a bar graph representing the current contrast is displayed, Figure 2-6. Using the **'UP'** and the **'DOWN'** keys the user can adjust the LCD contrast. Using the **'ENTER'** key, the new adjustment is saved and the LCD contrast bar graph disappears. Figure 2-6 illustrates the LCD Contrast setup procedure.
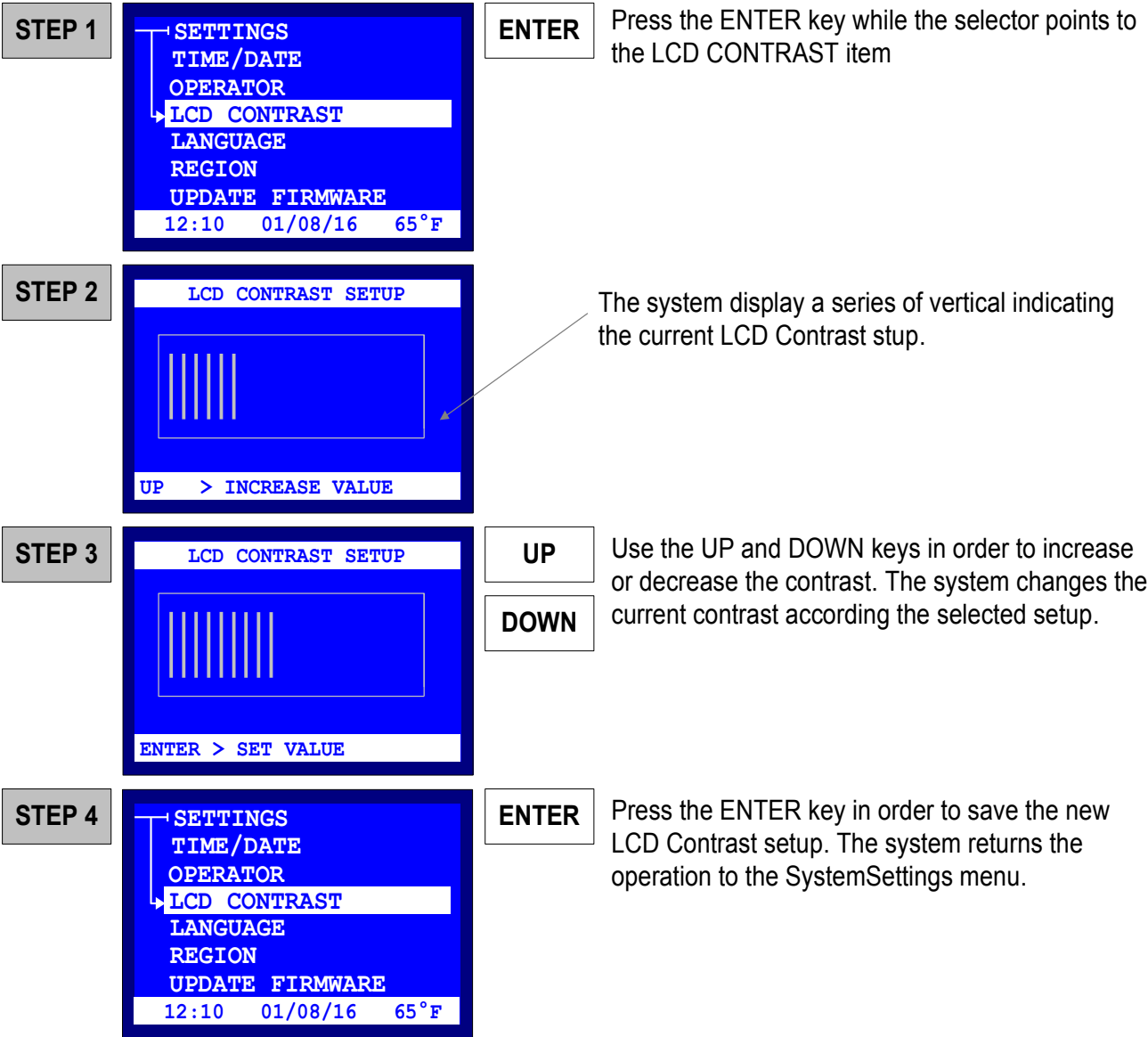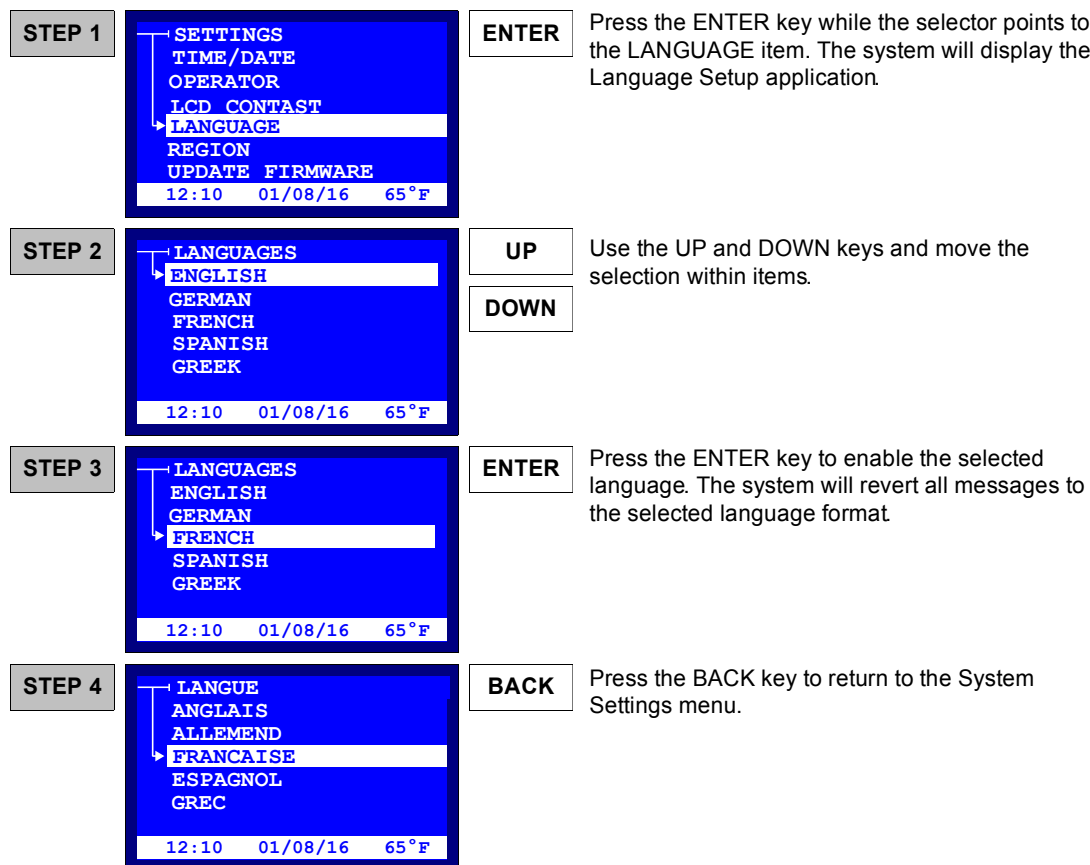
| STEP 1 | SETTINGS
TIME/DATE
OPERATOR
LCD CONTRAST
LANGUAGE
REGION
UPDATE FIRMWARE
12:10   01/08/16   65°F | **ENTER** | Press the ENTER key while the selector points to the LCD CONTRAST item |

| STEP 2 | LCD CONTRAST SETUP

‖‖‖

UP   > INCREASE VALUE | | The system display a series of vertical indicating the current LCD Contrast stup. |

| STEP 3 | LCD CONTRAST SETUP

‖‖‖‖‖

ENTER > SET VALUE | **UP**

DOWN | Use the UP and DOWN keys in order to increase or decrease the contrast. The system changes the current contrast according the selected setup. |

| STEP 4 | SETTINGS
TIME/DATE
OPERATOR
LCD CONTRAST
LANGUAGE
REGION
UPDATE FIRMWARE
12:10   01/08/16   65°F | **ENTER** | Press the ENTER key in order to save the new LCD Contrast setup. The system returns the operation to the SystemSettings menu. |

Figure 2-6 – LCD Contrast Set-up

2.3.4 Language Dialog

The Language dialog is used for changing the language of the user interface. As of this time, the following languages are available: English; German; French; Spanish; and Greek. Figure 2-7 illustrates how to change the language from English to Spanish. Using the **'UP'** and **'DOWN'** keys the user selects a language. Using the **'ENTER'** key the new language is selected and LCD immediately updates to the newly chosen language.

STEP 1	SETTINGS TIME/DATE OPERATOR LCD CONTAST LANGUAGE REGION UPDATE FIRMWARE 12:10　01/08/16　65°F	ENTER	Press the ENTER key while the selector points to the LANGUAGE item. The system will display the Language Setup application.
STEP 2	LANGUAGES ENGLISH GERMAN FRENCH SPANISH GREEK 12:10　01/08/16　65°F	UP DOWN	Use the UP and DOWN keys and move the selection within items.
STEP 3	LANGUAGES ENGLISH GERMAN FRENCH SPANISH GREEK 12:10　01/08/16　65°F	ENTER	Press the ENTER key to enable the selected language. The system will revert all messages to the selected language format.
STEP 4	LANGUE ANGLAIS ALLEMEND FRANCAISE ESPAGNOL GREC 12:10　01/08/16　65°F	BACK	Press the BACK key to return to the System Settings menu.

Figure 2-7 – Language Set-up
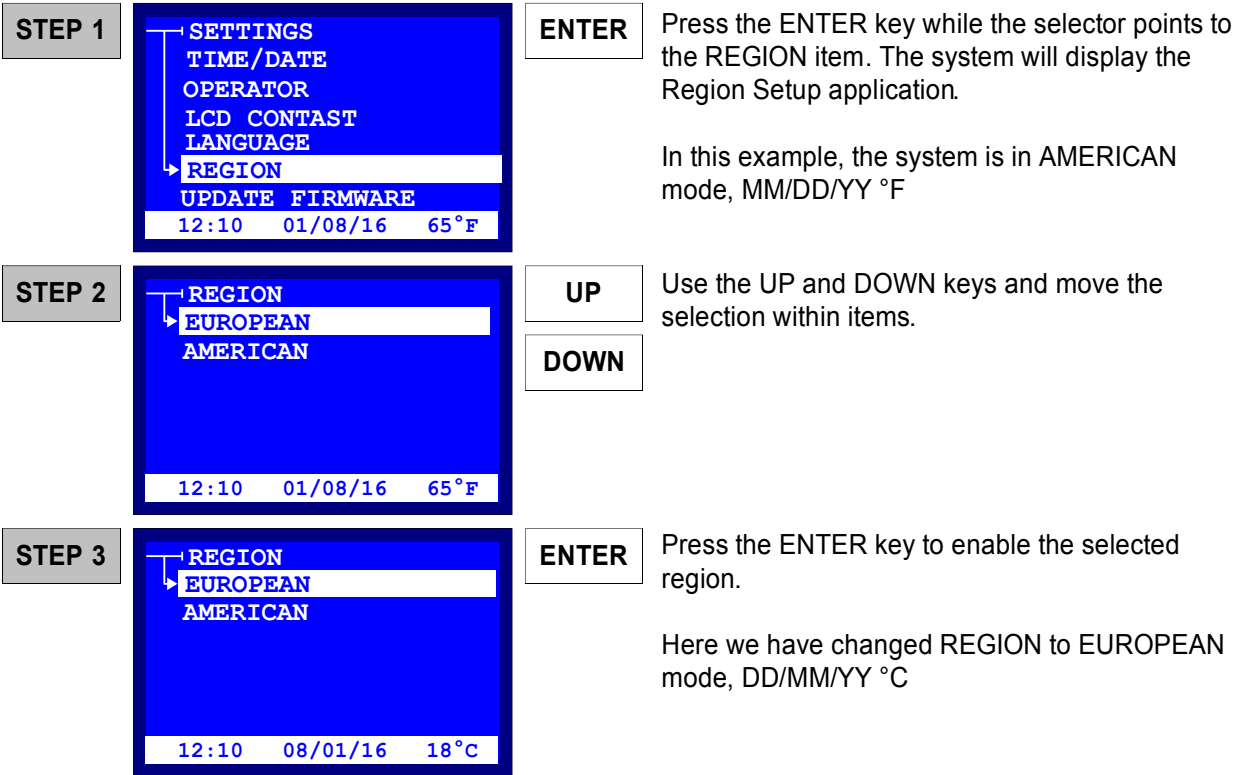
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2.3.5 Region Dialog

The Region dialog is used to select the date, time, and temperature format.

The formats are as follows:

EUROPEAN - DD/MM/YYYY °C

AMERICAN - MM/DD/YYYY °F

Figure 2.8 illustrates the process of changing format from EUROPEAN to AMERICAN.

STEP 1	SETTINGS TIME/DATE OPERATOR LCD CONTAST LANGUAGE REGION UPDATE FIRMWARE 12:10 01/08/16 65°F	ENTER	Press the ENTER key while the selector points to the REGION item. The system will display the Region Setup application. In this example, the system is in AMERICAN mode, MM/DD/YY °F
STEP 2	REGION EUROPEAN AMERICAN 12:10 01/08/16 65°F	UP DOWN	Use the UP and DOWN keys and move the selection within items.
STEP 3	REGION EUROPEAN AMERICAN 12:10 08/01/16 18°C	ENTER	Press the ENTER key to enable the selected region. Here we have changed REGION to EUROPEAN mode, DD/MM/YY °C

Figure 2-8 – Region Set-up

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2.3.6 Update Firmware Dialog

This dialog is used to prepare the system to update the firmware.
Appendix III provides details on using a PC to fetch and load new firmware.
Contact your distributor or High Voltage, Inc. directly for support.

Figure 2.8 illustrates the preparing the system for a firmware update.

STEP 1	SETTINGS TIME/DATE OPERATOR LCD CONTAST LANGUAGE REGION UPDATE FIRMWARE 12:10 01/08/16 65°F	ENTER	Press the ENTER key while the selector points to the UPDATE FIRMWARE item. The system will display a Question Message asking to proceed.
STEP 2	UPDATE FIRMWARE? ? YES 12:10 01/08/16 65°F	UP DOWN	Use the UP and DOWN keys to toggle the "YES" and "NO" icons
STEP 3	Ready for New Firmware!	ENTER	Press the ENTER key to prepare the system for the upgrade. If no contact is made by the Upgrade Software running on a Computer, the system will reboot after about 30 seconds.

Figure 2-8 – Update Firmware

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3

Simple Test

This section describes the operations of the Simple Test procedure.

3.1 Simple Test Operations

The Simple Test provides an easy and quick method to verify basic operation of the system before running a longer duration Standard or User Defined Test.

The Simple Test generates an high voltage ramp until a breakdown happens.

The user is prompted for the voltage rate in kv/S before every stage so that different rates can be tested efficiently.

The user may run up to 30 stages and may repeat the procedure for one insulator-oil filling any number of times and that will be considered as a single test.

Before every new high voltage stage, the operator can modify the voltage rate and turn the stirrer on or off.

At the end of the test the system will prompt the user for a printout and the test results will be also stored in the system's memory for later retrieval.

The flowchart in figure 3-1 depicts the operations of the Simple Test.
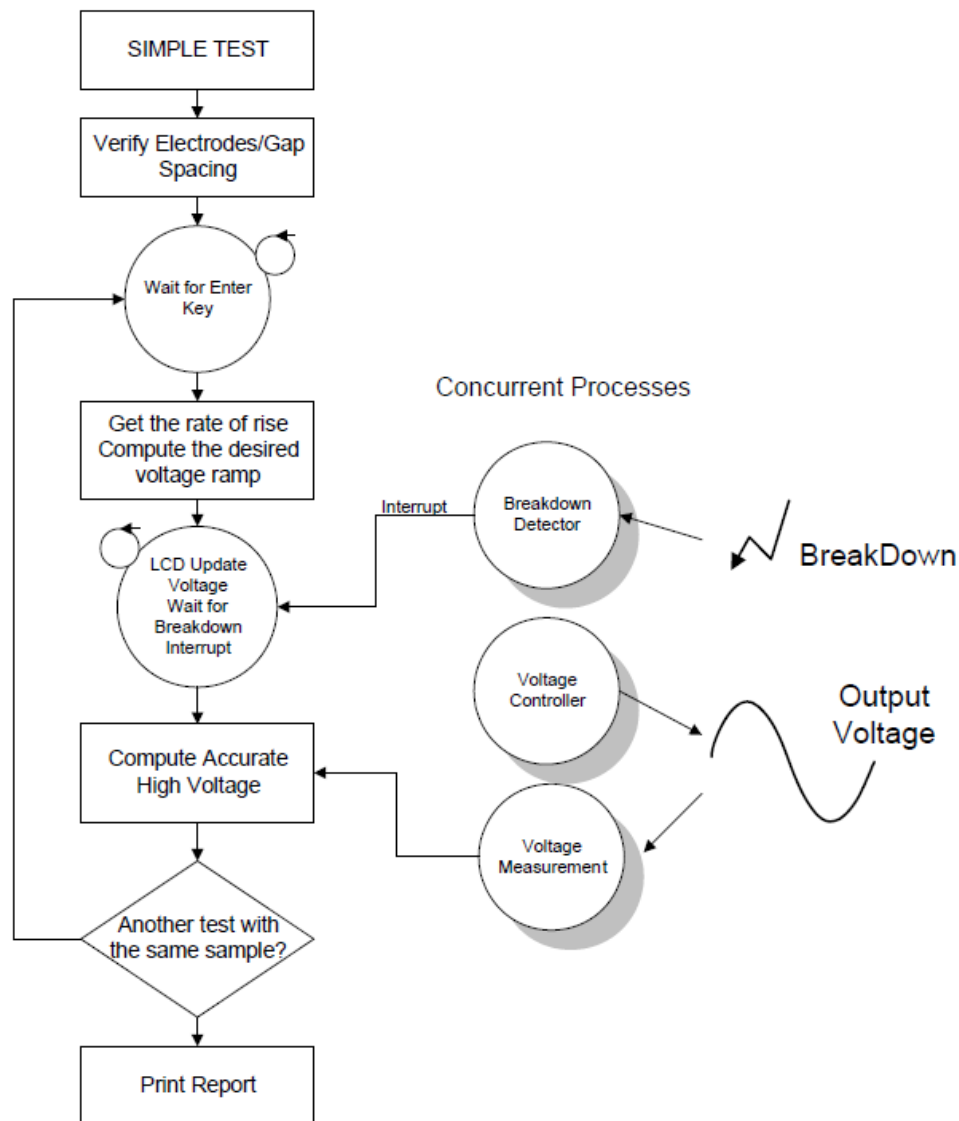
Figure 3-1 – Simple Test Flowchart

3.2 Simple Test Initialization

After the user selects Simple Test, the system displays a warning message for the electrodes spacing and the system is halted, Figure 3-2.
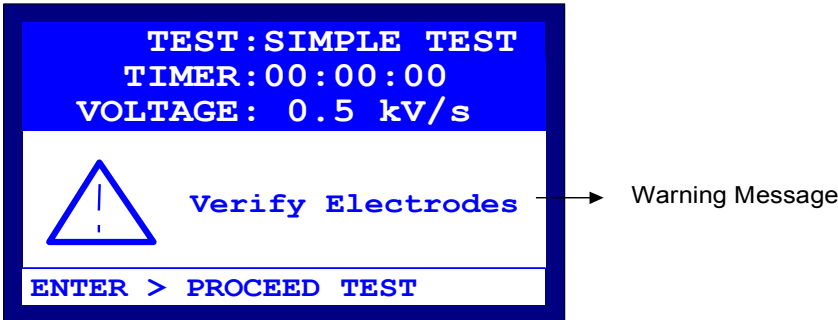
Figure 3-2 – Simple Test - Electrodes Spacing Warning Message

If the electrodes are checked before starting the test, the lid will be opened, in order to have access to the electrodes in the oil cup.

If the lid is opened after the Simple Test has started, a warning message is displayed, Figure 3-3.
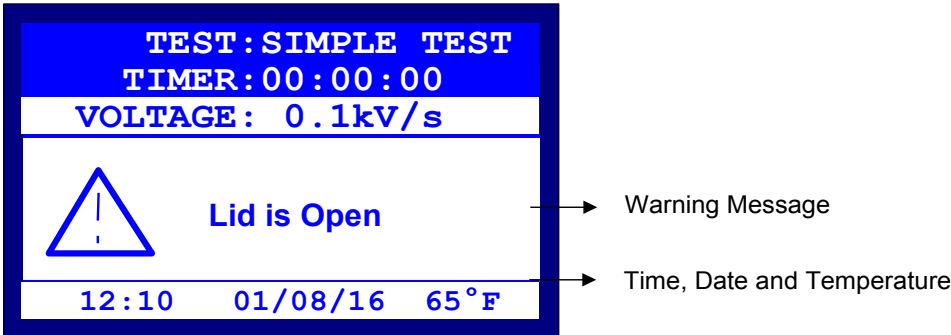
Figure 3-3 – Open Lid Warning Message

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3.3 Simple Test Controls

After adjusting the electrodes and closing the lid, the system will still be halted until the user presses the **'ENTER'** key.

Then the system proceeds to the Simple Test Main Screen in which the user is expected to set the voltage ramp for this next test stage.

This screen displays the following information (as shown in Figure 3-4):

1st line: Test Name
2nd line: Adjustable voltage ramp (blinking)
3rd line: Stage Count for this test run
             Current high voltage output (large digits in kV)
             Stirrer icon (if enabled)
Last line: Current time, date and temperature or test messages
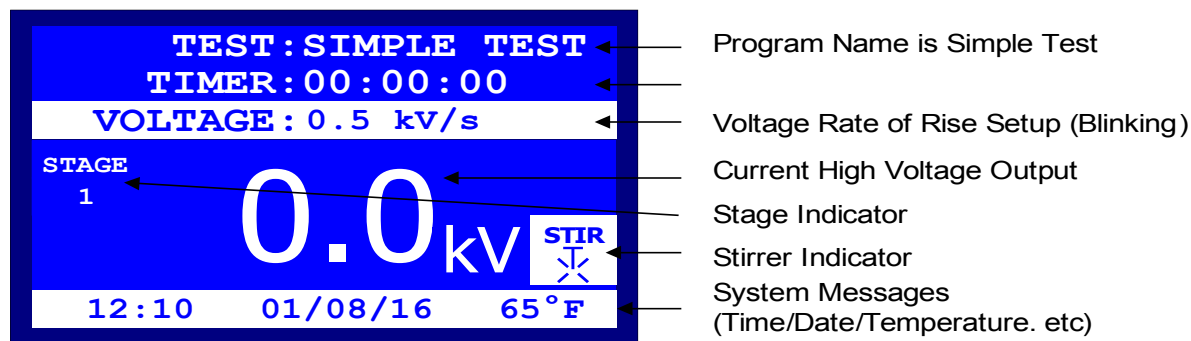
Figure 3-4 – Simple Test Main Screen

The following controls are active:

1. Use the **'UP'** and **'DOWN'** keys to change the voltage rate of rise setup for the next test stage
2. Use the **'BACK'** key for enabling/ disabling the Stirrer in between test stages
3. Use the **'ENTER'** key for choosing the voltage ramp and starting the Simple Test
4. Use the **'MENU'** key to end the Simple Test and proceed to the Main Menu.

3.4 Simple Test Execution

Pressing the **'ENTER'** starts the Simple Test. While the test is running, it can be stopped by pressing any key and the test will be stopped.

The Simple Test will continue increasing the voltage until a breakdown is detected, as shown in Figure 3-5.

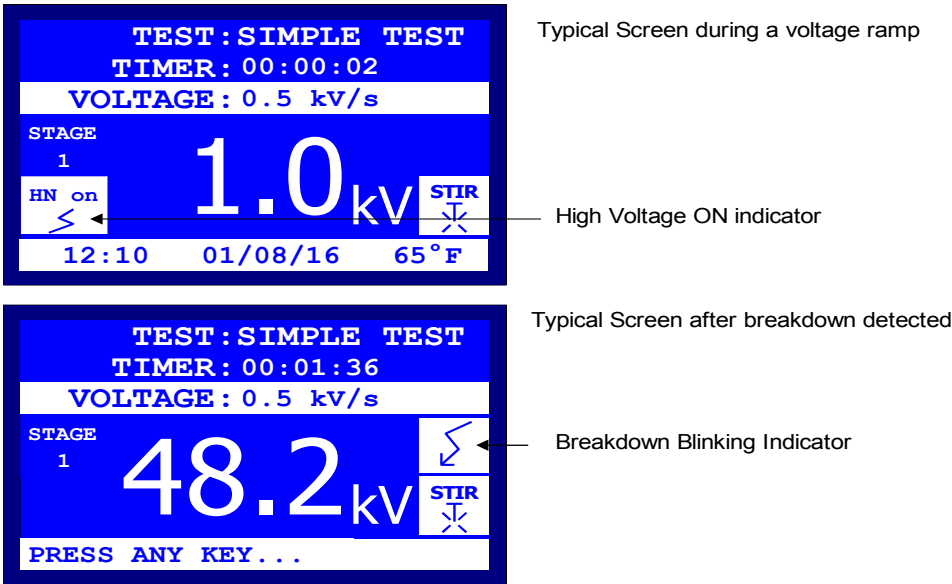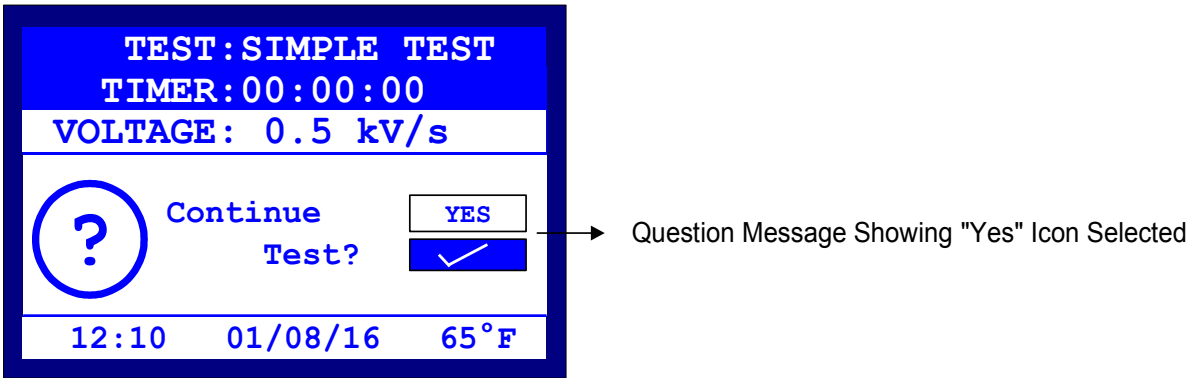After a breakdown is detected, the system is halted and prepared for the next test stage.

Typical Screen during a voltage ramp

High Voltage ON indicator

Typical Screen after breakdown detected

Breakdown Blinking Indicator

Figure 3-5 – Simple Test Execution

3.5 Simple Test Completion

At the end of each test stage, the user will be prompted with a Question Message with option to "Continue Test? " as shown in Figure 3-6.

The user is presented with a "YES" icon. If the user presses the **'ENTER'** key the Simple Test will proceed to start the next stage by first waiting and prompting the user to verify the voltage ramp in kV/s as described in sections 3.3 and 3.4

To stop the Simple Test process, use the **'DOWN'** key to choose the "No" icon and press the **'ENTER'** key. The user can also use the **'BACK'** to stop the Simple Test process.

```
 TEST:SIMPLE TEST
  TIMER:00:00:00
VOLTAGE: 0.5 kV/s

  ?    Continue      YES
            Test?     ✓

  12:10   01/08/16   65°F
```
→ Question Message Showing "Yes" Icon Selected

Figure 3-6 – Continue Test? Question Message shown after a Simple Test stage

If the Simple Test has been halted, Test Results are shown on the LCD, and the system waits for any key to be pressed, as shown in Figure 3-7.

```
   TEST RESULTS
 TEST: SIMPLE TEST
NUM. BD: 10
   MEAN: 34.72kV
    STD: 02.42kV



PRESS ANY KEY...
```
← Number of Detected Breakdowns
← Mean Value of Breakdown Voltages
← Standard Deviation of Breakdown Voltages
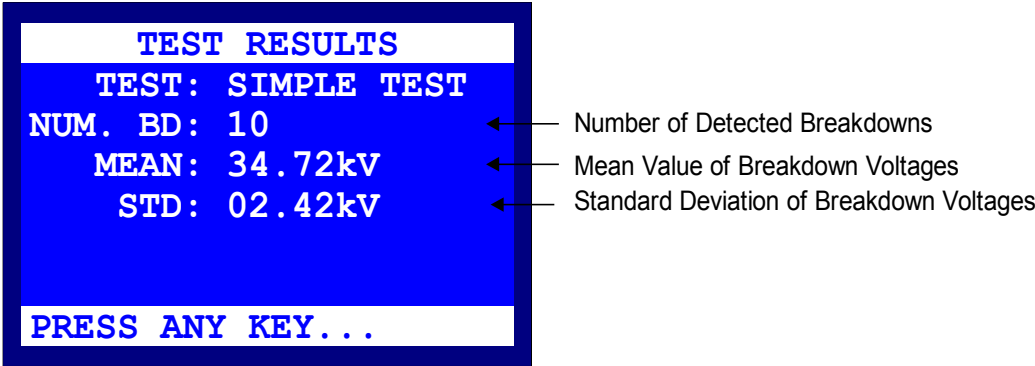
Figure 3-7 – Simple Test results

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The user is then prompted with a "Printer Results?" Question Message, as shown in Figure 3-8.

Figure showing:

```
TEST RESULTS
TEST:SIMPLE TEST
NUM. BD: 5

?        Print        X
        Results?      NO

12:10    01/08/16    65°F
```

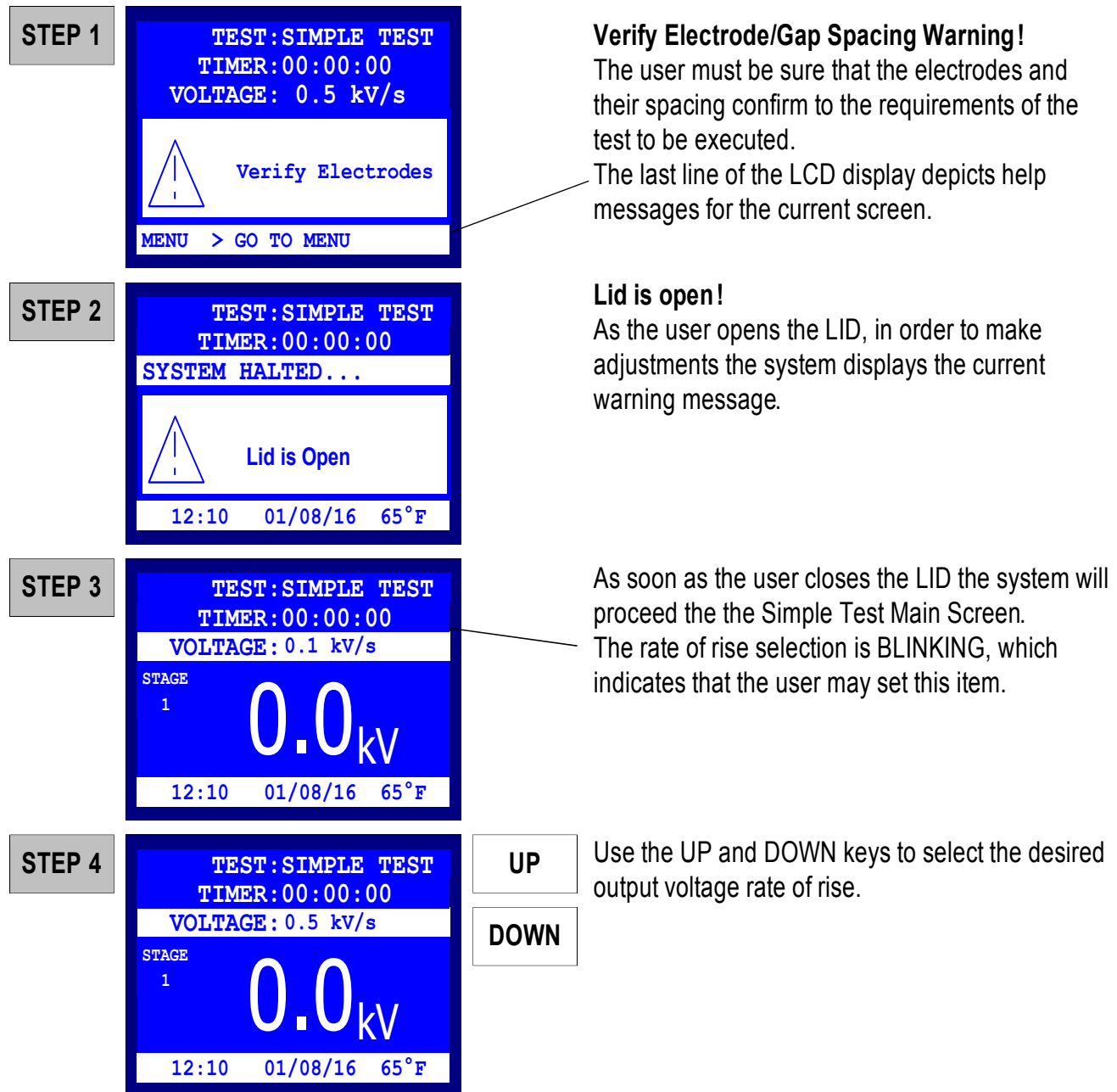→ Question Message Showing "No" Icon Selected
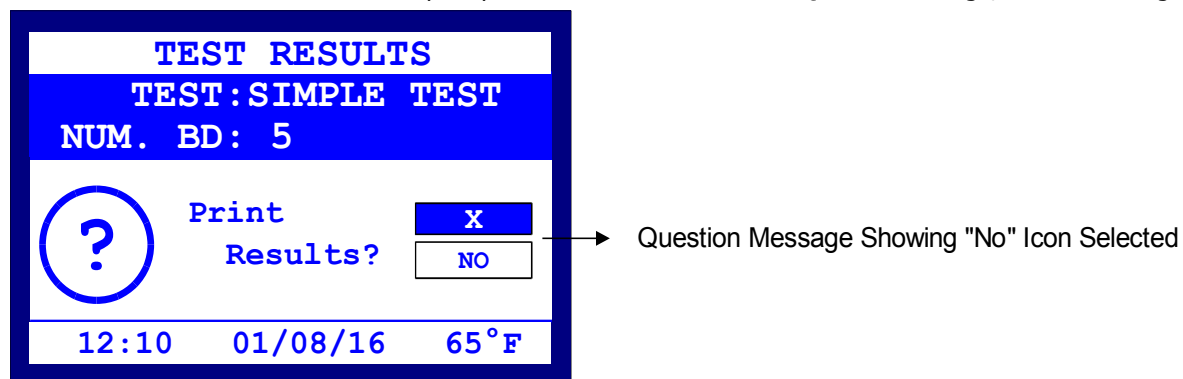
Figure 3-8 – Print Results? Question Message shown after the Simple Test process has been halted

If the "Yes" icon is chosen and the user presses the **'ENTER'** key a test receipt will be printed.

After the printout is completed, the begining of the Simple Test process will be presented, giving the user the option of running another series of Simple Tests or entry into the Main Menu.

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3.6 Simple Test Example

A detailed walk through of Simple Test example is illustrated in the figures 3-8 a/b/c/d.

STEP 1

```
    TEST:SIMPLE TEST
    TIMER:00:00:00
  VOLTAGE: 0.5 kV/s

  ⚠    Verify Electrodes

MENU  > GO TO MENU
```

Verify Electrode/Gap Spacing Warning!
The user must be sure that the electrodes and their spacing confirm to the requirements of the test to be executed.
The last line of the LCD display depicts help messages for the current screen.

STEP 2

```
    TEST:SIMPLE TEST
    TIMER:00:00:00
SYSTEM HALTED...

  ⚠    Lid is Open

  12:10    01/08/16   65°F
```

Lid is open!
As the user opens the LID, in order to make adjustments the system displays the current warning message.

STEP 3

```
    TEST:SIMPLE TEST
    TIMER:00:00:00
  VOLTAGE: 0.1 kV/s
STAGE
  1        0.0kV

  12:10    01/08/16   65°F
```

As soon as the user closes the LID the system will proceed the the Simple Test Main Screen.
The rate of rise selection is BLINKING, which indicates that the user may set this item.

STEP 4

```
    TEST:SIMPLE TEST
    TIMER:00:00:00
  VOLTAGE: 0.5 kV/s
STAGE
  1        0.0kV

  12:10    01/08/16   65°F
```

UP

DOWN

Use the UP and DOWN keys to select the desired output voltage rate of rise.

Figure 3-8a – Simple Test Example

STEP 5

```
TEST:SIMPLE TEST
TIMER:00:00:00
VOLTAGE: 0.5 kV/s
STAGE
1
            0.0 kV   STIR
12:10    01/08/16  65°F
```

BACK

By pressing the BACK key the STIRRER is enabled or disabled. While enabled the system displays the STIRRER ICON.

STEP 6

```
TEST:SIMPLE TEST
TIMER:00:00:00
VOLTAGE: 0.5 kV/s
STAGE
1
            0.0 kV   STIR
12:10    01/08/16  65°F
```

ENTER

Press the ENTER key to start the test.

STEP 7

```
TEST:SIMPLE TEST
TIMER:00:00:02
VOLTAGE: 0.5 kV/s
STAGE
1
HN on       1.0 kV   STIR
12:10    01/08/16  65°F
```

The High Voltage On indicator is depicted. Voltage is increasing at the rate of 0.5kV/s and the stage has been running for two seconds. The voltage measurement in kV is updated continuously.

STEP 8

```
TEST:SIMPLE TEST
TIMER:00:01:36
VOLTAGE: 0.5 kV/s
STAGE
1
            48.2 kV  STIR
PRESS ANY KEY...
```

Breakdown Detection occured!
The Breakdown icon is blinking.
The High Voltage On indicator is off.
The voltage at which breakdown occurred is shown.

Figure 3-8b – Simple Test Example

STEP 9	TEST:SIMPLE TEST TIMER:00:01:36 VOLTAGE: 0.5 kV/s ? Continue YES ✓ Test? 12:10 01/08/16 65°F	ENTER	The system ask for another test for the same oil sample. If this is desired the user should press the ENTER key.
STEP 10	TEST:SIMPLE TEST TIMER:00:00:00 VOLTAGE: 0.5 kV/s STAGE 2 0.0kV 12:10 01/08/16 65°F	UP DOWN BACK ENTER	The system returns to STEP 3. Using the UP and DOWN keys the user will choose the voltage rate of rise. The BACK key enables/ disables the stirrer. The ENTER key starts the next stage the of test.
STEP 11	TEST:SIMPLE TEST TIMER:00:02:00 VOLTAGE: 0.5 kV/s STAGE 2 60.0kV STIR PRESS ANY KEY...	ENTER	Example of stage where Breakdown does NOT occur! The system will stop updating the voltage and the timer, and will prepare for the next stage. The user must press any key to continue.
STEP 12	TEST:SIMPLE TEST TIMER:00:02:00 VOLTAGE: 0.5 kV/s ? Continue YES ✓ Test? 12:10 01/08/16 65°F	ENTER	The system ask for another test for the same oil sample. If the user presses the BACK key the test is terminated.

Figure 3-8c – Simple Test Example

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STEP 13

```
        TEST RESULTS
    TEST:SIMPLE TEST
NUM. BD: 10
    MEAN: 48.24kV
     STD: 02.49kV


PRESS ANY KEY...
```

The Simple Test Results are shown.

The number of breakdowns, mean breakdown voltage, and standard deviation are displayed

STEP 14

```
        TEST RESULTS
    TEST:SIMPLE TEST
NUM. BD: 10

  ?    Print        YES
       Results?     ✓

  12:10    01/08/16    65°F
```

A Question Message is shown asking if a printout is desired.
After the printout operation the system will return to STEP 1 to allow another Simple Test or entry into the Main Menu.

NOTE

```
    TEST:SIMPLE TEST
    TIMER:00:00:10
  VOLTAGE: 0.5 kV/s
STAGE
 1         5.0kV
HN on              STIR
  12:10    01/08/16    65°F
```

While the test process is enabled the user must not open the LID. If this happens...

```
    TEST:SIMPLE TEST
    TIMER:00:00:10
  VOLTAGE: 0.5 kV/s

  ⚠    Lid is Open!

  12:10    01/08/16    65°F
```

...the system detect it and immediately cuts off the output voltage.

The Lid open warning is displayed.
After closing the Lid, the current test is discarded and the system will continue from STEP 3.

Figure 3-8d – Simple Test Example

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4
Standard Tests

This section describes the operations of the Standard Tests procedure.

4.1 Standard Test Description

The DTS60A includes the most common international standards for testing insulating oil. Upon selecting a standard test from the Test Menu, the user interface proceeds to the start screen for the test, awaiting user interaction to proceed.

When the test is finished, the system prompts the user for a printout of the results. The results are also stored in the history memory for download at a later time. The system retains the results for the last 50 tests.

All of the tests follow the following format, including the acronym for each step in parentheses:
1. User verification of electrode spacing and electrode type
2. Initial wait period to let oil settle (Start Up Wait Time - SWT)
3. Initial stirrer active period during the initial wait period (Start Up Stir Time - SST)
4. Individual Test Stage
    1. Predefined increase of voltage
    2. Breakdown Detection Enabled (or time out with no breakdown at max voltage)
    3. After Breakdown Detect Wait Time period (ABDWT)
    4. After Breakdown Detect Stirrer Time period (ABDST)
    5. After Breakdown Next Stage Type (ABDSTG)
    6. Store Stage Breakdown Voltage

The following standards are included with the instrument:
1. ASTM D1816/12 - USA
2. ASTM D877/13 - USA
3. IEC 156/95 - International
4. IEC 156/63 - International
5. ASTM D1816/84 - USA
6. ASTM D877/87 - USA
7. UTE C27-221/74 - France
8. CEI 10-1/73 - Italy
9. VDE 370 – P5/92 - Germany
10. IRAM 2341/72 - Argentina
11. RVHP 1985 - Russia
12. PN-77/ED4408 - Poland

4.2 Select a Standard Test

The Select Test dialog allows the operator to choose between: Simple Test; The Standard Tests; any User Defined Test, as shown in Figure 4-3.

An arrow at the right side of a test name indicates that this is the last selected test.

This is the test that will be started after turning-on the equipment.
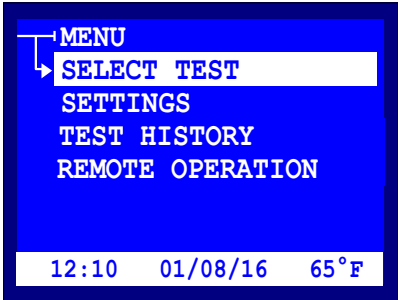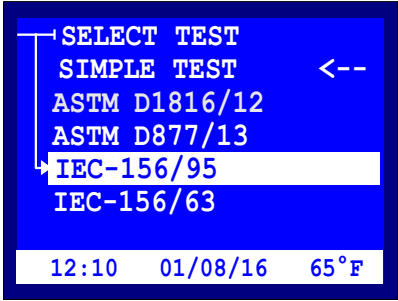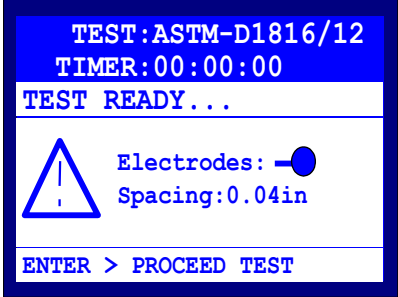
STEP 1	MENU **SELECT TEST** SETTINGS TEST HISTORY REMOTE OPERATION 12:10 01/08/16 65°F	**ENTER**	From the Main Menu, point to SELECT TEST. Then press the ENTER key.
STEP 2	SELECT TEST SIMPLE TEST <-- ASTM D1816/12 ASTM D877/13 **IEC-156/95** IEC-156/63 12:10 01/08/16 65°F	**UP** **DOWN**	The system displays all the available tests. The default test is indicated with an arrow. Use the UP and DOWN keys to select a test for execution.
STEP 3	TEST:ASTM-D1816/12 TIMER:00:00:00 TEST READY... ⚠ Electrodes: ─● Spacing:0.04in ENTER > PROCEED TEST	**ENTER**	Press the ENTER key to execute the selected test. From now on this test will be the default test.

F

igure 4-3 – Select Program Menu

4.3 Standard Test Execution

If a standard test is selected for execution, the system will proceed with the test initialisations and furthermore it will display the **Electrode Spacing** warning message, Figure 4-7. The user must be sure for the current Electrode Spacing; if not he must check and adjust it according to the warning message indication. The only active keys are the **'MENU'** key and the **'ENTER'** key.

TEST:ASTM-D1816/84	→ Test Name
TIMER:00:00:00	→ Timer Information
TEST READY...	→ Test Ready to start with **'ENTER'** key
Electrodes: ● **Spacing:0.04in**	→ Electrode Spacing Warning Message!
ENTER > PROCEED TEST	→ User Interface Help Message
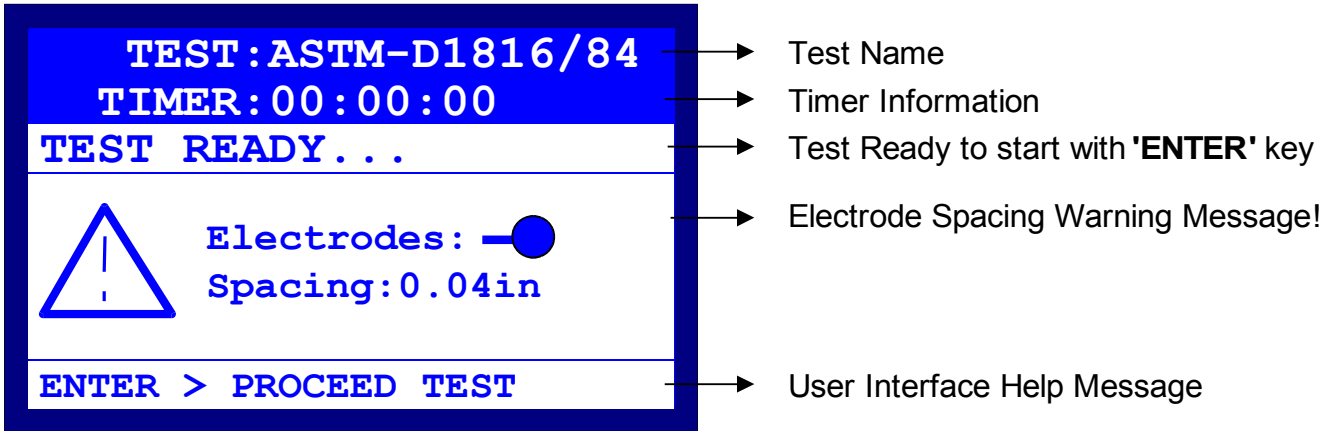
Figure 4-7 – Electrode Spacing Warning Message

Start the selected test by pressing the **'ENTER'** key

TEST:ASTM-D1816/84	→ Test Program Name
TIMER:00:00:00	→ Count Down Timer
STARTUP WAIT TIMER...	→ Test Messages
STAGE 1 **0.0**kV	→ Current High Voltage Output
	→ Stage Indicator
STIR	→ Stirrer Indicator
12:10 01/08/16 65°F	→ System Messages (Time/Date/Temperature. etc)
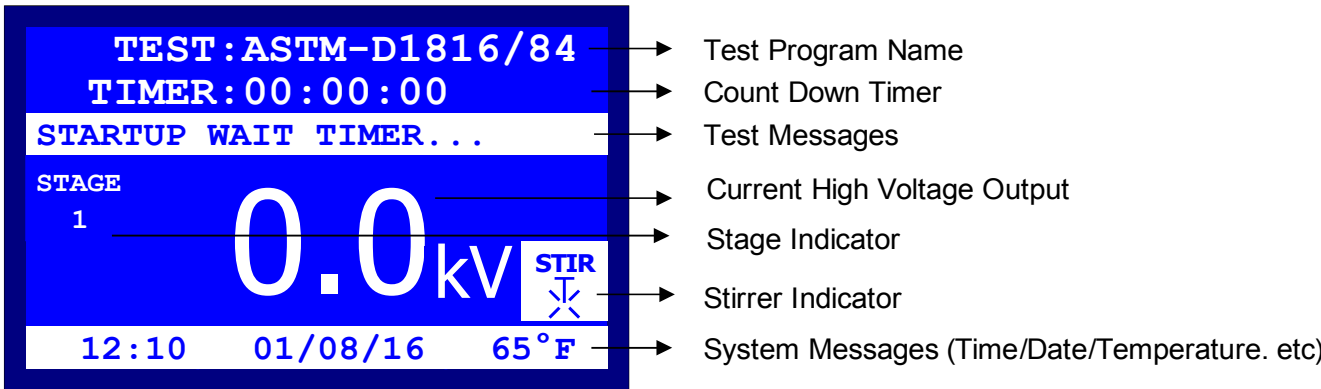
Figure 4-8 – Standard Test Main Screen

The Standard Test Main Screen for Test execution, Figure 4-8, includes all the information concerning the Test flow. More specifically, the 1st line indicates the selected Test Name. The 2nd line indicates the Test Timer, which is used as increasing timer (seconds resolution) during voltage rising, as well as a decreasing timer for wait periods. The 3rd line indicates the current Stage of execution, as well as the desired Voltage value and Duration. Obviously, the large digits indicate the current high voltage output (in kV) and the left icon indicates the Stirrer State (on/off). Finally, the last line is used for user interface messages, such as the time/date/temperature message.

During a Test Stage, the screen changes to show that high voltage is On, shows the start voltage and rate of rise, duration of the test so far, and the voltage, as shown in Figure 4-9.

TEST:ASTM-D1816/84 → Test Program Name
TIMER:00:00:30 → Count up Timer for current stage duration
1.0kV/s > BREAKDOWN → Rate of rise from 0kV to breakdown

STAGE
1
30.7kV
HV on → Current Stage/ High Voltage ON Indicator

12:10   01/08/16   65°F → System Messages
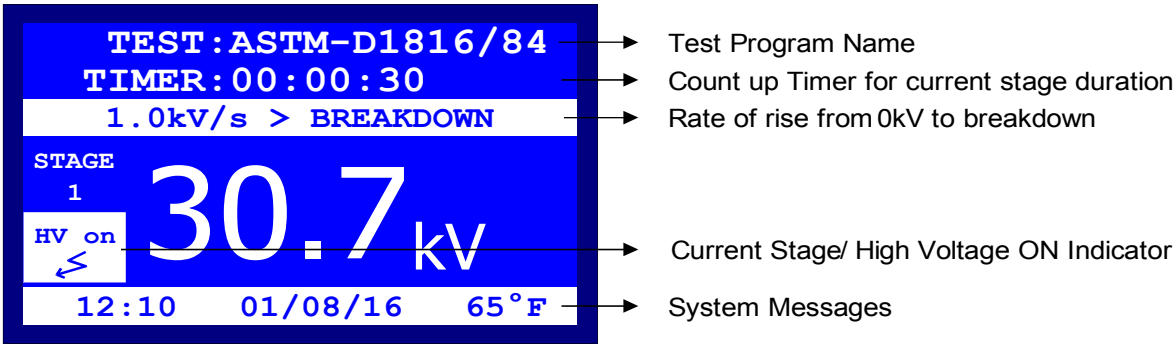
Figure 4-9 – Test Stage during voltage ramp

If the system detects a breakdown, it will display the event, Figure 4-10, and the test will proceed will proceed according to the chosen Standard.

TEST:ASTM-D1816/84 → Test Program Name
TIMER:00:01:00 → Count Down Timer for post breakdown wait
AFTER BD WAIT TIMER... → Stage Message - we are waiting to start next stage

STAGE
1
42.2kV → Blinking Breakdown Indicator

STIR → Current Stage Number

12:10   01/08/16   65°F → System Messages
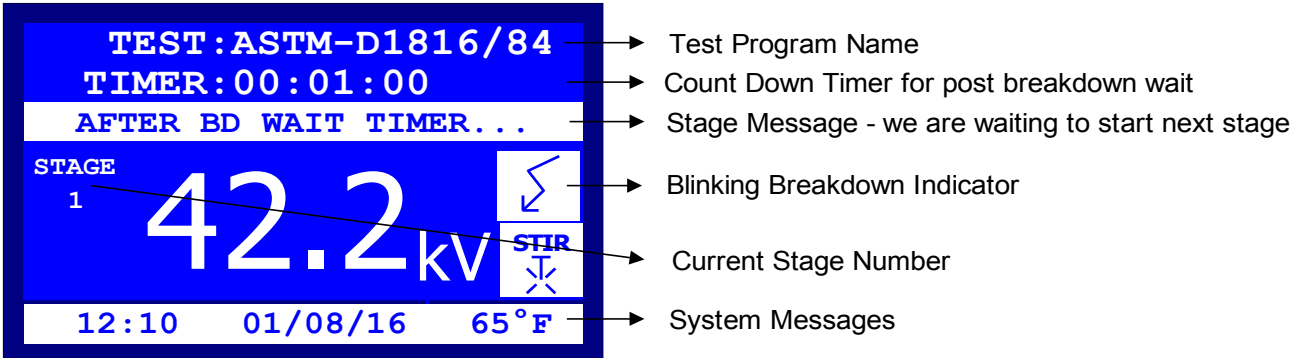
Figure 4-10 – After Breakdown Wait period

The LCD display will indicate when the Standard Test has completed and will prompt the operator with a Question Message that provides the option of printing the results. These test results are stored internally for later retrieval. Figure 4-11 shows the screen after the Standard Test has finished.
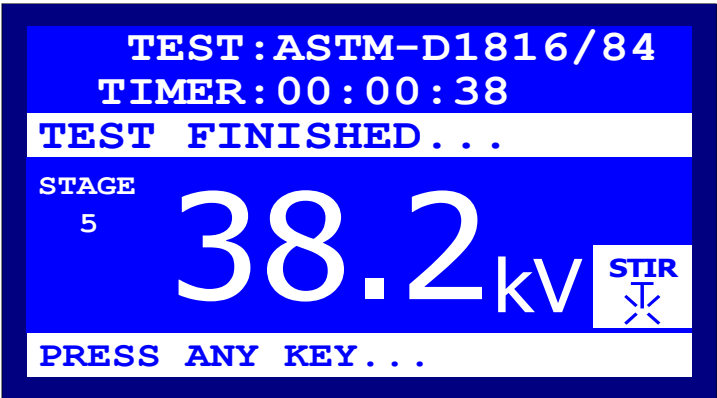
Figure 4-11 – Standard Test Completion

After a key is pressed, the user is shown the Test Results screen, as shown in Figure 4-12.
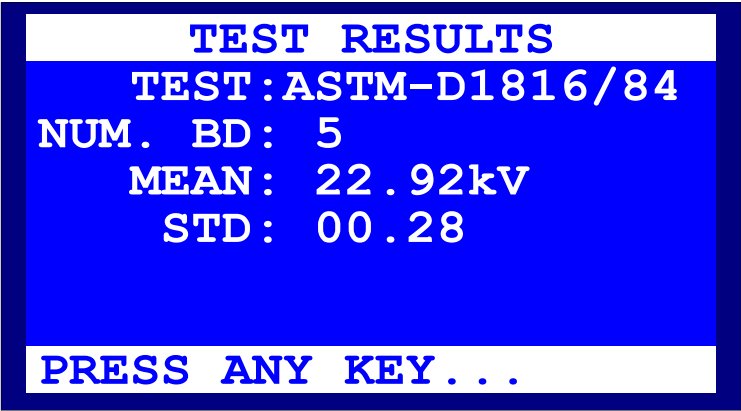
Figure 4-12 – Standard Test Results

After a key is pressed, the user is given the option to print the results with a Question Message screen, as shown in Figure 4-13.
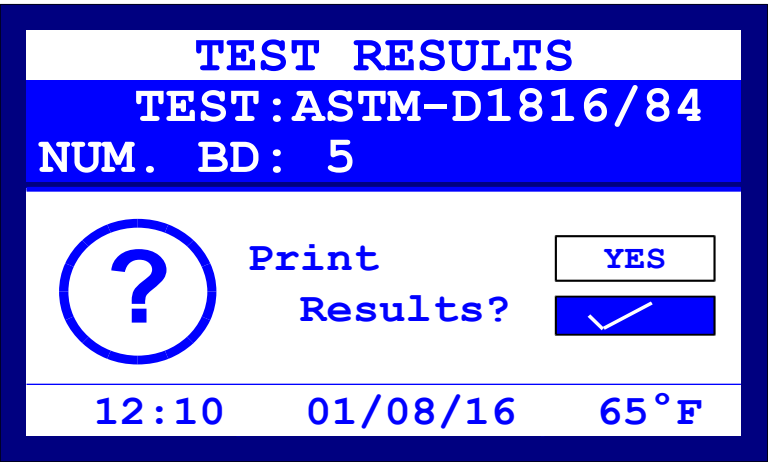
Figure 4-13 – Standard Test Print Option

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4.4 Standard Test Example

A detailed example of a Test Execution is illustrated in Figure 4-14.

Screen	Annotation
TEST:ASTM-D1816/84	Test Name
TIMER:00:00:00	Timer Information
TEST READY...	Test Ready to start.
⚠ **Electrodes:** ●— / **Spacing:0.04in**	Electrode Spacing Warning Message!
ENTER > PROCEED TEST	User Interface Help Message

Screen	Annotation
TEST:ASTM-D1816/84	Test Program Name
TIMER:00:00:17	Count Down Timer
STARTUP WAIT TIMER...	Test Messages
STAGE 1 **0.0**kV	Current High Voltage Output / Stage Indicator
STIR	Stirrer Indicator
12:10 01/08/16 65°F	System Messages (Time/Date/Temperature. etc)

Screen	Annotation
TEST:ASTM-D1816/84	Test Program Name
TIMER:00:00:30	Count up Timer for current stage duration
1.0kV/s > BREAKDOWN	Rate of rise from 0kV to breakdown
STAGE 1 **HV on** **30.7**kV	Current Stage/ High Voltage ON Indicator
12:10 01/08/16 65°F	System Messages

Screen	Annotation
TEST:ASTM-D1816/84	Test Program Name
TIMER:00:00:21	Count up Timer for current stage duration
AFTER BD WAIT TIMER...	Rate of rise from 0kV to breakdown
STAGE 1 **42.2**kV	Blinking Breakdown Indicator
STIR	Current Stage Indicator
12:10 01/08/16 65°F	System Messages

Screen	Annotation
TEST RESULTS	Test Results
TEST:ASTM-D1816/84	
NUM. BD: 5	
MEAN: 22.92kV	
STD: 00.28	
PRESS ANY KEY...	

Screen	Annotation
TEST RESULTS	Test Program Name
TEST:ASTM-D1816/84	
NUM. BD: 5	Test is finished!
? **Print Results?** **YES** ✓	Question Message
12:10 01/08/16 65°F	System Messages

Figure 4-14 – Test Program Execution Example

5
User Defined Tests

This section describes the operations of the User Defined Tests procedure.
These tests follow the same structure as Standard Tests, yet allow more flexibility
in creating test sequences.

5.1 Test Description

The DTS-60A & DTS-100A dielectric oil testers support the execution of user programmable testing scenarios. The main objective of the programmable test is the control of the high voltage on a time basis. Moreover, the test includes options for controlling the Stirrer and the Breakdown measurements. In this section, a detailed description of the test program structure, as well as the test operations are presented.

5.1.1 Test Structure

The Test consists of an **Information Session**, a **Startup Session**, and a **Main Session**.

The **Information Session** contains general details for the test. These are the following:
   a.   Program Name (up to 12 characters)
   b.   Electrodes Spacing (mm/in)
   c.   Number of Stages (see Main Session)
   d.   Creation Date/Time

The **Startup Session** refers to the start-up time. This is the period after the starting of the test (after pressing the ENTER key) until the system enables the output voltage to the oil-sample. The parameters included in the Startup Session define the Wait Time (SWT) after the start of the test and the part of this time (or all this time) the enable or disable of the stirrer. The Startup Session includes the following programmable parameters:
   a.   Startup Wait Timer (sec) - SWT
   b.   Startup Stirrer Timer (sec) - SST

The **Main Session** consists of a series of a maximum of 30 Stages. Every stage includes a set of programmable parameters:
   a.   Voltage Type (kV or kV/sec)
         Two are the possible voltage types. If a rated increase/ decrease is desired, the type refers to kV/s. If a stable voltage is desired, the type refers to kV.
   b.   Voltage Value (kV) or Voltage Rate (kV/s)
   c.   Stage Duration (sec)
   d.   Stirrer Timer (sec) - ST
         This timer starts counting from the beginning of the current stage and enables the stirrer for the programmed time.
   e.   After Breakdown Wait Timer (sec) -ABDWT
         After a breakdown occurs, the system will idle for this programmable duration.
   f.   After Breakdown Stirrer Timer (sec) -ABDST
         After a breakdown occurs, the system will enable the stirrer for this programmable duration.
   g.   After Breakdown Stage (0…29, next, end) - ABDSTG
         After the above timers the test will proceed to another stage. This programmable parameter indicates the next stage. The value can be any following stage (eg. If current stage is 10 then the value could be 11 to 29), next if it is desired to continue to the next stage, or end if it is desired to stop the test.
   h.   Store Breakdown Voltage (yes/no)
         If the user selects the yes option, the detected breakdown voltage will be calculated to the statistics. Otherwise, the detected breakdown voltage will NOT be calculated into the statistics.

5.1.2 Test Operations

Every Test operates according to the programmable parameters of the above sessions. This section will describe the operations of the system in respect with the programmable parameters.

During Startup the system initializes the **Startup Wait Timer - SWT** and the **Startup Stirrer Timer - SST**. The system introduces an idle operation time according the 1st timer, which is used as a 'Wait time after filling period'. During this time the system could turn on the stirrer according the 2nd Timer. If the 2nd Timer is zero the stirrer is disabled.

The Test continues the operation according to the parameters described in the 1st Stage. The **Voltage** Parameter and the **Duration** are inputs to the voltage controller, which will control the high voltage output. More specifically, if the voltage value indicates kV then the voltage controller will immediately adjust (according to the maximum system's rate) the output voltage to the programmed value therefore keeping the voltage stable for the specified Duration Parameter. If the voltage value indicates kV/sec then the voltage controller will adjust the output voltage according to the desired rate for the specified duration. It is noted that the Duration Parameter could take the value "Breakdown" which means no specified duration.

During both situations, if a breakdown is detected the output voltage is immediately disconnected (turned-off) and the Test Program proceeds with the **After Breakdown Wait Timer - ABDWT** and the **After Breakdown Stirrer Timer - ABDST**. During the 1st of these timers the system will be idle, concerning the output voltage. Moreover, the stirrer will be enabled for a duration according to the 2nd timer.

The Test Program will proceed to the stage indicated by the **After Breakdown Stage** – **ABDSTG** parameter (0-29). There are the following exceptions:
  i.   Indication of a stage prior to the current stage leads to program termination
  ii. Indication of a stage next (30) leads to next stage
  iii. Indication of a stage end (31) leads to program termination

It is noted that after every breakdown the output voltage will be initialized, thus the next stage's start voltage will be zero (0 kV). If a breakdown isn't detected, the program proceeds to the next stage bypassing the After Breakdown Wait Timer, the After Breakdown Stirrer Timer and the After Breakdown Stage.

The test termination will prompt the user to print a test results receipt and finally displays a Results screen.

The above operations are illustrated in Figure 5-1.
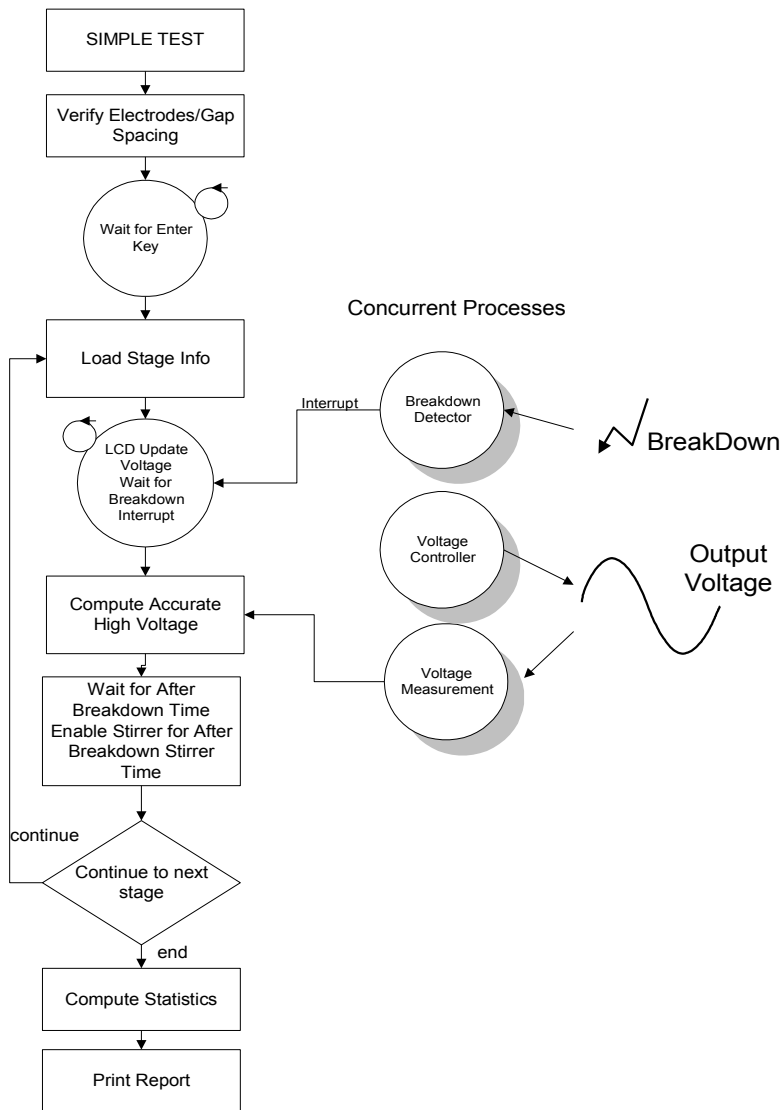
Figure 5-1 – Test Program Operation Flowchart

5.2 Select Test Menu

From the **'MAIN MENU'** the user can select the **'SELECT TEST'** item. The system displays the list of available test, starting with Simple Test, and followed by the Standard Tests. Any User Defined Tests will be listed after the Standard Tests.

The method for selecting a User Defined test is described in section 4.2

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5.3 Script Files for Tests

The method for creating User Defined Tests is implemented by using specific commands over the Remote Operation communications link. This link is either RS-232 or a USB Serial Port.

This method is based on **Script Test Program Files**, that can be written using a text editor on a Personal Computer (PC). The following sections explain the commands and arguments of the specific script files. Furthermore two examples are presented. The process of downloading Script Test Files to the equipment is described in chapter 8 (Remote Operation).

5.3.1 Script File Commands and Arguments

The Script Test Program Files are based on the following command structure:

```
new       - Start a new Script Test Program File
stage     - End of a new Script Test Program File
end       - Start Test Program Information Session
```
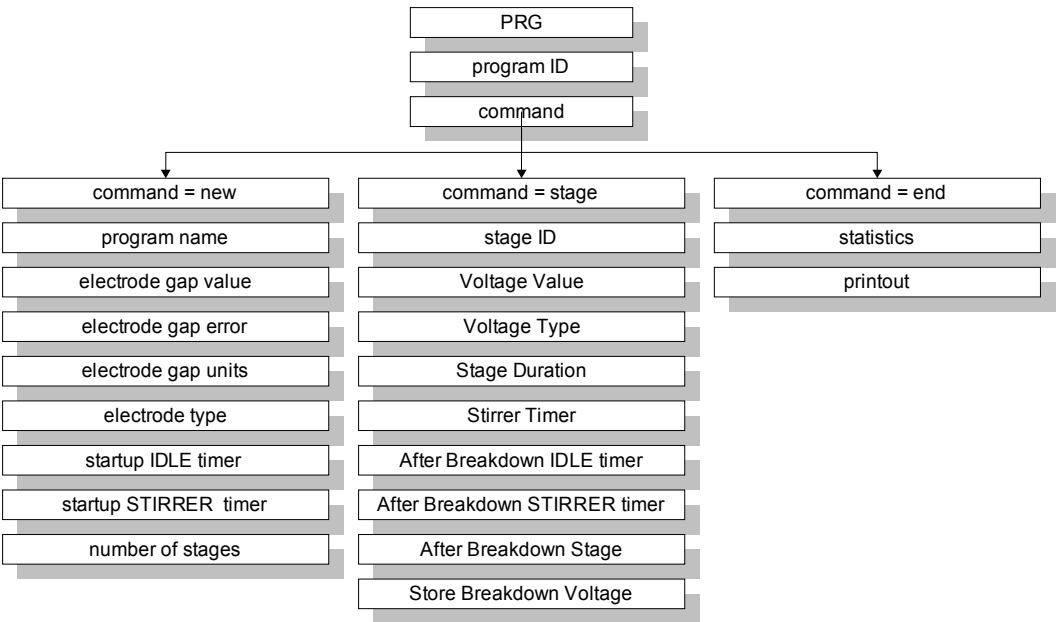

Figure 5-2 – Structure of the Script File

The above script file commands operate in respect with the parameters described in section 5.1.1 and 5.1.2.

The data items in figure 5-2 can get the following values:

Command = **new**

1. Program Name

Up to 12 characters. Do not use a space. Use '_' instead.

2. Electrode Gap Value

Floating-point value that indicates the Electrode Spacing

(eg. Electrode Spacing = **2.5** +/- 0.01 mm)

3. Electrode Gap Error

Floating-point value that indicates the Electrode Spacing possible error

(eg. Electrode Spacing = 2.5 +/- **0.01** mm)

4. Electrode Gap Units

Units defined for the above values.

Options: mm or in (eg. Electrode Spacing = 2.5 +/- 0.01 **mm**)

5. Electrode Type

Options: Type_I, Type_II, Type_I_II

6. Startup WAIT Timer -SWT

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

7. Startup STIRRER Timer - SST

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

8. Number of Stages

Integer value (0…29)

Command = **stage**

1. Stage ID

Indicates the stage that the following information refers.

Integer value (0…29)

2. Voltage Value

Floating-point value that indicates the desired Voltage

3. Voltage Type

Options: kV/s, kV

4. Voltage Duration

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

5. Stirrer Timer- ST

The time that the stirrer will be enabled (in respect with the above timer).

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

6. After Breakdown WAIT Timer- ABDWT

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

7. After Breakdown STIRRER Timer - ABDST

hh:mm:ss (hh = hours, mm = minutes, ss = seconds)

8. After Breakdown Stage _ABDSTG

Options: integer that indicates the stage that the test will proceed after a breakdown occurs during the current stage. The value can be 1…29 and must be greater than the current stage id. Other possible options are the 'next' that indicates next stage and the 'end' that indicates end of the test.

Options: 1…29, next, end

9. Store Breakdown Voltage

Indicates if the breakdown voltage (if occurred) of the current stage will be calculated in the final statistics.

Options: store or nothing

Command = **end**
        End of the Test Script File

Two examples follow, in order to clarify the development of script files.

5.3.2 Script File Test Examples

In order to make clear the above descriptions two examples will be mentioned. The first one concerns the IEC 156/63 International Standard and the other a more complicated scenario.

a. **IEC 156/63 International Standard**

The IEC_156/63 Standard is a 6 Stages program. Every stage is independent, which means that it is desired that every stage will have a breakdown. After filling the oil sample it is required to wait for 10 minutes. Every stage voltage will start from zero until breakdown, with a voltage increase rate of 2kV/s. After every breakdown, the test will store the output voltage (breakdown voltage) and then it is desired to wait for 5 minutes with the stirrer enabled for 1 minute. After every breakdown the test will proceed to the next stage. Finally, it is required for the system to print a results report.

The IEC 156/63 Standard should be described in a Script Test File as follows:

Script File 1 – IEC_156/63 Standard

```
prg 0 new IEC-156/95 2.5 0.05 mm type_I_II 00:05:00 00:05:00 06
prg 0 stage 00 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 01 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 02 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 03 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 04 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 05 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 end  store
prg 0 end
```

b. Complicated Example

Consider a more complicated example, depicted in Figure 22. The 1st 10min 0 kV duration is the Startup Wait time. After this the program consists of 7 stages:

- a. 1st stage : 1kV/s for 10 sec
- b. 2nd stage : 10kV for 10min
- c. 3rd stage : 2kV/s for 10 sec
- d. 4th stage : 30kV for 10 min
- e. 5th stage : 3kV/s for 10 sec
- f. 6th stage : 60kV/s for 10 min
- g. 7th stage : 4kV/s until breakdown

In case of breakdown (in anyone stage) the program is desired to terminate and no after breakdown wait and stirrer timer are needed. The script file for such a program is given in the next page.
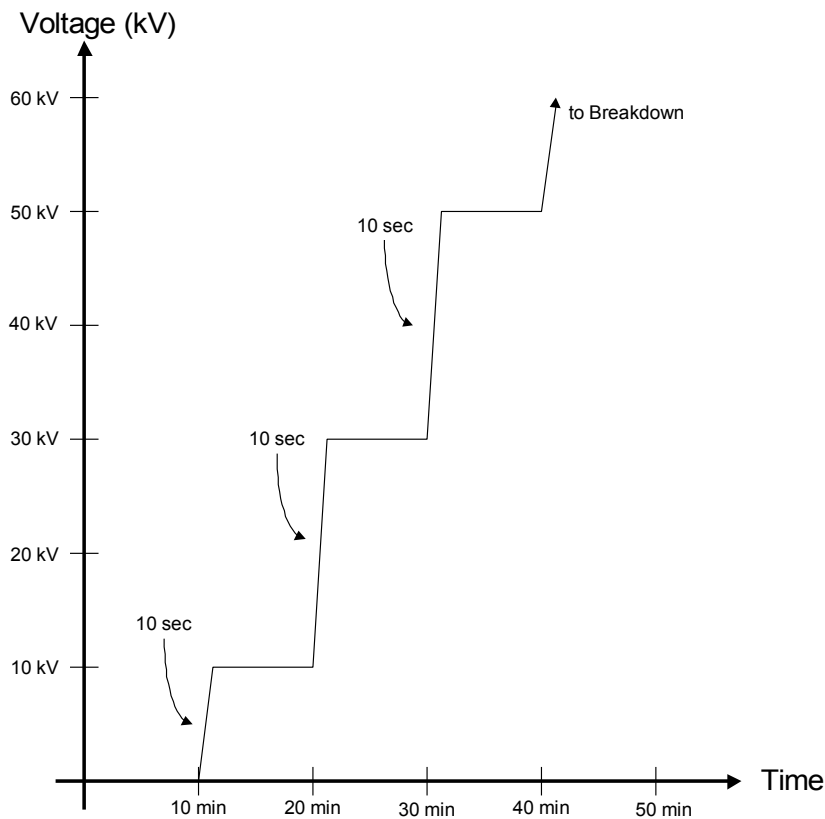
Figure 22 – Complicated Test Program

Script File 2 – Complicated Example

```
prg 0 new TEST_100 2.5 0.05 mm type_I_II 00:10:00 00:00:00 07
prg 0 stage 00 001.0 kV/s 00:00:10  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 01 010.0 kV   00:10:00  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 02 002.0 kV/s 00:00:10  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 03 030.0 kV   00:10:00  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 04 002.0 kV/s 00:00:10  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 05 050.0 kV   00:10:00  00:00:00 00:00:00 00:00:00 end store
prg 0 stage 06 003.0 kV/s breakdown 00:00:00 00:00:00 00:00:00 end store
prg 0
```

It is possible to replicate the whole test, in order to make a more complex scenario. For example, a 4 replicated test scenario could be a Test with 28 stages. In such a test the user should edit the After Breakdown Stage parameter, in order for the operation to proceed with the first stage of the next replica. It is noted that after a breakdown 10 min idle time will be programmed and all this time the stirrer will be enabled.

Script File 3 – Replicated Complicated Example

```
prg 0 new TEST_101 2.5 0.05 mm type_I_II 00:10:00 00:00:00 07
prg 0 stage 00 001.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 01 010.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 02 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 03 030.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 04 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 05 050.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 07   store
prg 0 stage 06 003.0 kV/s breakdown 00:00:00 00:10:00 00:10:00 next store
prg 0 stage 07 001.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 08 010.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 09 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 10 030.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 11 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 12 050.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 14   store
prg 0 stage 13 003.0 kV/s breakdown 00:00:00 00:10:00 00:10:00 next store
prg 0 stage 14 001.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 15 010.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 16 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 17 030.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 18 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 19 050.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 21   store
prg 0 stage 20 003.0 kV/s breakdown 00:00:00 00:10:00 00:10:00 next store
prg 0 stage 21 001.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 22 010.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 23 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 24 030.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 25 002.0 kV/s 00:00:10  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 26 050.0 kV    00:10:00  00:00:00 00:10:00 00:10:00 end  store
prg 0 stage 27 003.0 kV/s breakdown 00:00:00 00:10:00 00:10:00 end  store
prg 0 end
```

6
History and Results

This section describes the operations of the History and the Test Results.

6.1 History Results

The system is capable of storing the results of the last 50 tests.
This section describes the History Results application.

The History Results screen is shown in Figure 6-1. The display contains the following information:

1.	Result	Id of the test - Global ID
2.	Name	Name of the test
3.	Date	Date of the test
4.	Time	Time of the test
5.	Temperature	Environmental Temperature
6.	Breakdown	Number of Breakdowns and Mean Value
7.	Stage	Stage indicator
8.	Stage Info	Information about the selected stage

```
RESULT ID:  01 - 1016
      NAME:SIMPLE_TEST
      DATE:01/18/16
      TIME:12:10
      TEMP.:26°F
BREAKDOWN:12, 056.2kV
  STAGE ID:   01
000.0->058.4 kV,BD
```

MENU	Print Current Result
BACK	Return to the Main Menu
DOWN	Decrease ID for Result or Stage
UP	Increase ID for Result or Stage
ENTER	Toggle Betwen Result ID and Stage ID
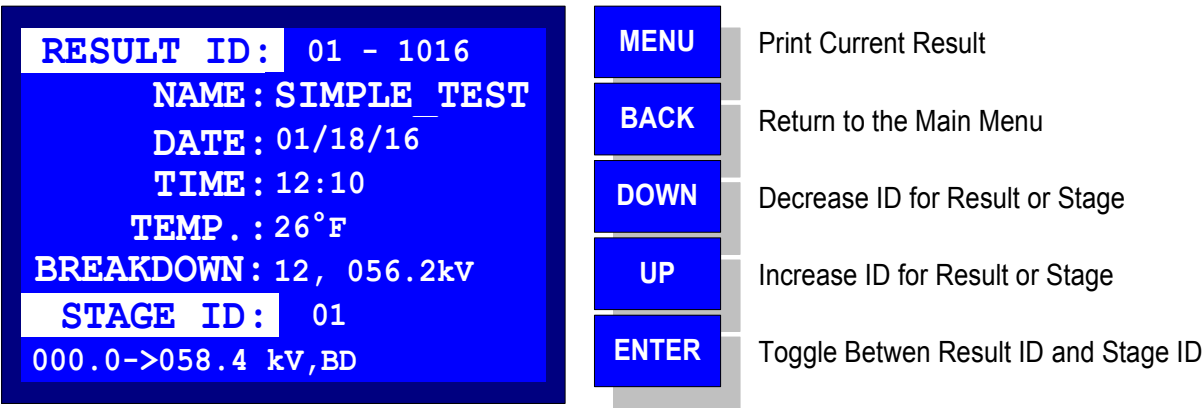
Figure 6-1 – History Application

When the History Result ID is blinking, the user can select history results by ID number.
Using the **'UP'** and **'DOWN'** keys, the user selects a test id, and results for that test ID will be presented.
When the desired test is selected the user may press the **'ENTER'** key and the Stage ID starts blinking. The user may use the **'UP'** and **'DOWN'** keys in order to examine the stage information.
The stage information consists of:

1. Starting Voltage
2. Ending Voltage
3. Occurrence of Breakdown

If the user presses again the **'ENTER'** key the blinking will revert to the History Results id again.
Using the **'BACK'** key the user exits the application.

6.2 Example Using History Results

An example of the History Results operation, is illustrated in Figure 6-2.

| STEP 1 | MENU
SELECT TEST
SETTINGS
TEST HISTORY
REMOTE OPERATION

12:10 01/08/16 65°F | ENTER | From the MAIN MENU select the TEST HISTORY item and press the ENTER key. |

| STEP 2 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/16
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:48,000.0->058.4 kV,BD | | The the Test Results History Browser is shown. The first line shows the history result ID and is blinking.
This indicates that the user may browse among the stored history ID's. |

| STEP 3 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/16
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:48,000.0->058.4 kV,BD | UP
DOWN | Use the UP and DOWN keys to select the desired test result report. On every key press the system updates all the information items below. |

| STEP 4 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/16
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:48,000.0->058.4 kV,BD | ENTER | If the desired report is found, the user may press the ENTER key. This enables the browsing among the stages in the selected test. Now the blinking item is the stage id. |

| STEP 5 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/04
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:50,000.0->059.4 kV,BD | UP
DOWN | Use the UP and DOWN keys to select the desired stage id. On every key press the system updates the information that corresponds to the selected stage. |

| STEP 6 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/04
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:50,000.0->059.4 kV,BD | ENTER | Press the MENU key. The system will prompt the user for printing the test report of the selected test. |

| STEP 7 | ? Print
Results? YES | | Press ENTER to Print the results of the selected test history results ID.
Press Back or activate the "NO" icon to return to the Test History Application |

| STEP 8 | RESULT ID: 01 - 1016
NAME: SIMPLE TEST
DATE: 01/18/04
TIME: 12:10
TEMP.: 80°F
BREAKDOWN: 12, 056.2kV
STAGE ID: 01
00:00:50,000.0->059.4 kV,BD | BACK | Press the BACK key to exit from the history browser and return to the Main Menu. |

Figure 6-2 – Example for History Results Application

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7
Printer & Printouts

This section describes the equipment's printer and the printout of the test's results.

7.1 Printer Description

The printer is an ultra-compact thermal line printer with the capability of printing forty characters per line.

Figure 7-1 is shows a front external view.

1. Paper Roll Compartment
2. Cover Opening Levers
3. Status LED
4. Panel Key
5. Feed Key
6. Paper Outfeed
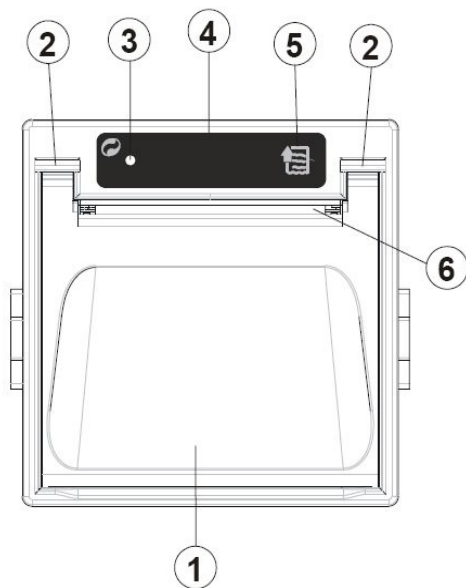
Figure 7-1 – External Front View of the Printer

The control of the printer uses one key (feed key) and a status LED.

1. Feed Key – When the feed key is pressed the printer advances the paper.
2. Status LED – The green status LED displays the printer operating status and this check is performed on-line. The operating status is as follows:
   - Always off – Printer Off
   - Always on – Printer On (no fault)
   - Slow Blinking – Paper Out Message
   - Fast Blinking – Recoverable Error (head over temperature, supply voltage error)

Figure 7-2 – Printer Control Panel
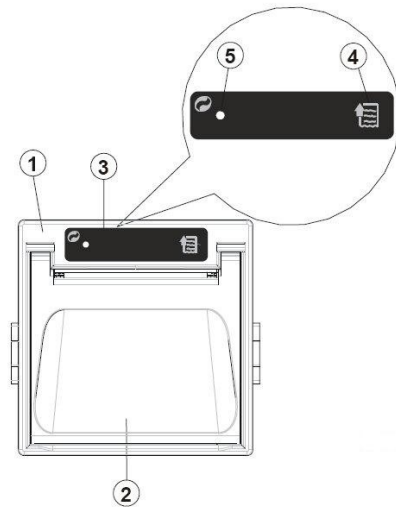
7.2 Changing the Paper Roll

To change the Paper Roll proceed as follows:

1. Open the printer cover, Fig. 7-3
2. Position the paper roll making sure it unrolls in the proper direction as shown in Fig. 7-4
3. Tear off the paper as shown in Fig. 7-5 and re-close the cover
4. The printer is ready, Fig. 7-6
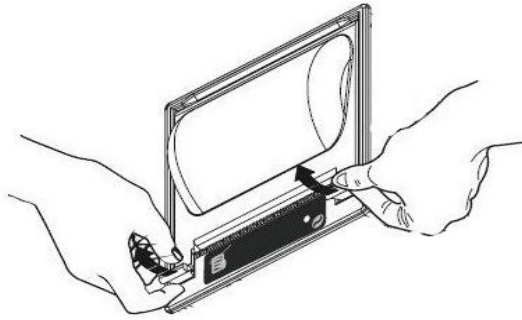
Figure 7-3 – Changing the paper roll - Step 1
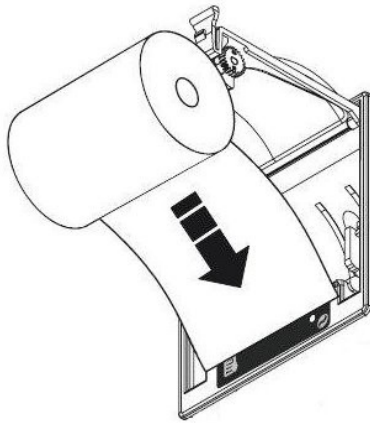
Figure 7-4 – Changing the paper roll - Step 2
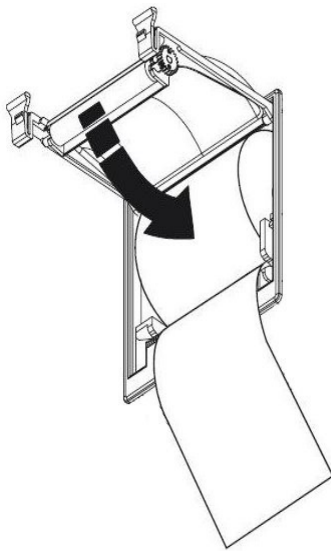
Figure 7-5 – Changing the paper roll - Step 3
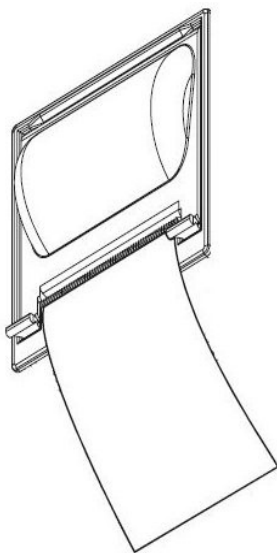
Figure 7-6 – Changing the paper roll - Step 4

7.3 Printout Description

Upon completion of a test, the user is prompted to print the results of the test. In Fig. 7-7 is depicted the printed information.

1. High-Voltage Logo
2. Operator information
3. Time and Date
4. Environmental temperature
5. Test Name
6. Electrodes
7. Number of Breakdowns
8. Mean Value of Breakdown Voltages
9. Standard Deviation of Breakdown Voltages
10. Stages/ Starting Voltage/ Ending Voltage/ Duration/ Breakdown

```
----------------------------------------
        HighVoltage, INC.
       DTS-60A Test Report
          Version 1.00
----------------------------------------
Operator
 Company : HighVoltage
 Name    : John Smith
 Contact : +30-210-9319505
 Info    : smith@hvinc.com
----------------------------------------
Report ID  : 01018
----------------------------------------
Time           : 14:41
Date           : 12/05/2016
Temperature    : 70°F
Test Name      : ASTM-D1816/84
Electrodes     : Mushroom electrodes
Num. Breakdown : 5
Mean Breakdown : 50.61
Std Breakdown  : 6.24
Stage 1: 0.5kV/s, 0.0> 48.1kV, Breakdown
Stage 2: 0.5kV/s, 0.0> 40.7kV, Breakdown
Stage 3: 0.5kV/s, 0.0> 54.9kV, Breakdown
Stage 4: 0.5kV/s, 0.0> 54.3kV, Breakdown
Stage 5: 0.5kV/s, 0.0> 55.1kV, Breakdown
----------------------------------------
```

Figure 7-7 – Printout Receipt

8

Remote Operation

This section describes the equipment's Remote Operation functionality

8.1 Remote Operation Description and Operation

The DTS-60A & DTS-100A provide a Remote Operation feature over a USB Serial Link or RS-232. This allows control of system parameters, download of test results, and programming of User Defined Tests.

The communications link is mutually exclusive with the test operation of the DTS-60A & DTS-100A. Tests cannot be conducted when the Remote Operation is active, and when running a test any communications cable (USB or RS-232) should be removed. A Bluetooth or other wireless link can be used.

The system uses a proprietary protocol and can be accessed with a serial communications program like the Open Source programs Qodem Terminal Emulator and Q Serial Terminal, or older programs like Hyperterminal, TeraTerm, and Procomm Plus.

If the user selects Remote Operation in the Main Menu, the system activates the communications link with the Personal Computer or other device.

The terminal emulator software must use the following serial port settings:

Baud Rate:	115200
Data:	8 bit
Parity:	none
Stop Bits:	1
Flow Control:	none
Transmit Delay:	10ms/character; 100ms/end of line

Figure 8-1 illustrates the menu items and keys active to enter and exit Remote Operation

BACK	Return to Test Main Screen
DOWN	Move selector down
UP	Move selector up
ENTER	Proceed to Selection Activate Remote Operation

BACK	Return to Main Menu, Terminate Remote Operation
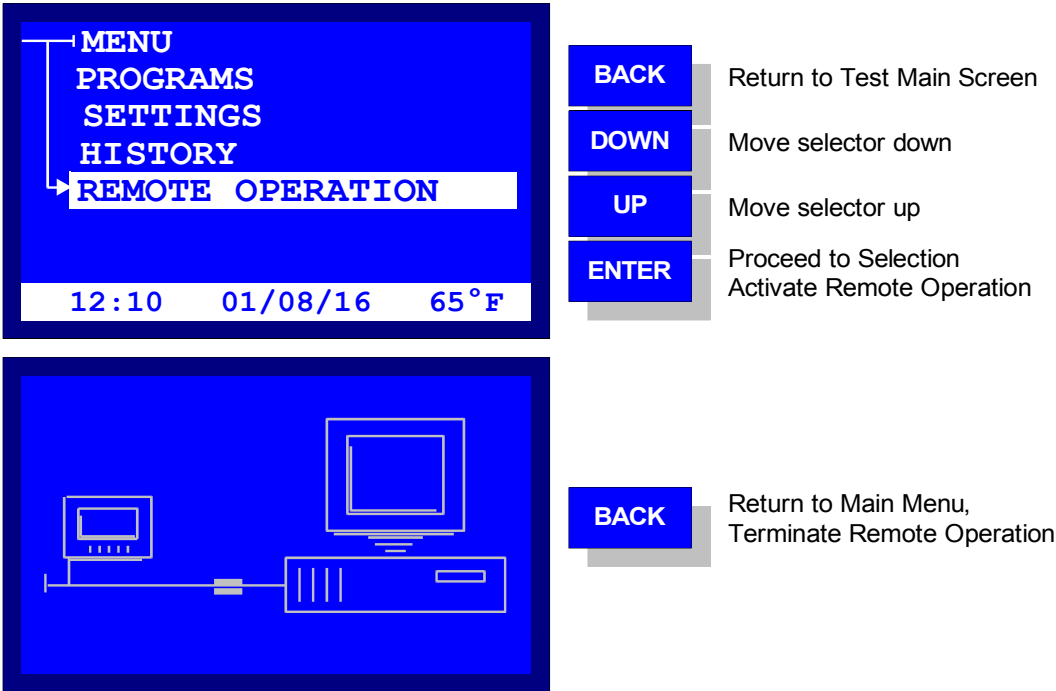
Figure 8-1 – Remote Operation Start-up

When the system enters Remote Operation mode, the terminal screen displays a start-up message and a user prompt showing the model of the unit, which indicates that the system is ready to accept commands, as follows:

```
----------------------------------------
High Voltage Inc.
DTS-60A AC Dielectric Oil Test Set
----------------------------------------
Remote Management System...
----------------------------------------

DTS60A >
```

A quick method to enter remote operations from a Test Main Screen is to press the sequence **'MENU' - 'UP' - 'ENTER'**

If no communications activity occurs after 60 seconds, Remote Operation mode ends, the communications link is deactivated, and the LCD display returns to the Main Menu.

8.2 System Commands and Parameters

8.2.1 ver Command

The **ver** command is used to echo the current version of the system's firmware.

```
DTS60A > ver
Firmware Version 1.03
Dec  1 2016, 20:32:47
DTS60A >
```

8.2.2 cls Command

The **cls** command is used for clearing the terminal screen.
```
DTS60A > cls
```

8.2.3 time Command

The **time** command is used for echoing or setting the system's time.
If no argument is given, the system returns the current time.

to set the time, use the following format
time set hh:mm:ss
Where:
hh = hours (00 to 23)
mm = minutes (00 to 59)
ss = seconds (00 to 59).

example:
```
DTS60A > time
       Current Time: 16:51:23
DTS60A > time set 16:52:00
       New Time: 16:52:00
DTS60A > time
       Current Time: 16:52:04
DTS60A >
```

8.2.4 date Command

The **date** command is used for echoing or setting the system's date.
If no argument is given, the system returns the current date.
Note that the **date** command uses European format dd/mm/yy

to set the date, use the following format:
date set dd/mm/yy
Where:
dd = days (0 to 31)
mm = months (00 to 12)
yy = years (00 to 99)

```
DTS60A > date
        Current Date: 05/12/16
DTS60A > date 04/12/16
        Current Date: 05/12/16
DTS60A > date set 04/12/16
        New Date: 04/12/16
DTS60A > date
        Current Date: 04/12/16
DTS60A >
```

8.2.5 operator Command

The **operator** command is assigning the labels used in the Test Results Printout Receipt.
If no argument is given, the system returns the current labels.

Note that all labels accept most Alphanumeric characters, but the label **cannot** contain any spaces.
Instead of a space, use '_'

These labels can also be assigned through the normal LCD/Keypad User Interface.

```
DTS60A > operator company High_Voltage_Inc

DTS60A > operator name Nick_Tesla

DTS60A > operator contact (518)-555-1212

DTS60A > operator other service@hvinc.com

DTS60A > operator
 -----------------------------------------
 User Information
 -----------------------------------------
 Company            : HIGH_VOLTAGE_INC
 User Name          : NICK_TESLA
 Contact Information : (518)-555-1212
 Other Information  : SERVICE@HVINC.COM
 -----------------------------------------

DTS60A >
```

8.2.6 contrast Command

The **contrast** command is used for asking or setting the LCD contrast, Figure 8-7. Possible values are 0 to 15.

If no argument is given, the system returns the current contrast setting value.

```
DTS60A > contrast
       Current Contrast Value: 07
DTS60A > contrast set 10
       New Contrast Value: 10
DTS60A >
```

8.3 Test Commands

The **test** command is used to list the Standard Tests and User Defined Tests contained in the system. This command also has the ability to list the individual stages of a given test. There is also the option of deleting a User Defined Test in case of error, as well as a command to clear all User Defined Tests. This is also the command which allow creation of new user defined tests.

8.3.1 test list

The **test list** command lists all tests present in the system, showing their test ID # which is needed for the read and delete functions.

For all tests, the number of stages is shown.
For User Defined Tests, the Time & Date when the test was created is shown.

```
DTS60A > test list
 Available Tests List...
 --------------------------------------------------
 ID : Name              Creation Time & Date   Stages
 --------------------------------------------------
 00 : IEC-156/95        -                      06
 01 : IEC-156/63        -                      06
 02 : ASTM-D1816/84     -                      05
 03 : ASTM-D877/87      -                      05
 04 : UTE-C27221        -                      06
 05 : CEI-10-1/73       -                      06
 06 : VDE-0370          -                      06
 07 : IRAM-2341/72      -                      06
 08 : RVHP-1985         -                      06
 09 : PN-77             -                      06
 10 : Evaluation    20:34:02 09/20/2016        30
 11 : Eval_400v     20:38:39 09/20/2016        30
 12 : Eval_100v     20:39:42 09/20/2016        30
 13 : Eval-mini     07:59:00 10/30/2016        03
 --------------------------------------------------
```

8.3.2 test read <test ID#>

The **test read <test ID#>** command displays information about the selected test id#.

The first block of information table includes: Test Name; Electrode Spacing and Type;
Number of Stages; Start Up Wait Timer; and Start Up Stirrer Timer (see section 4.1).

The second information block includes information about individual test stages, such as:
Stage ID#; Voltage Rate or Settings; Voltage Units; Duration; Stirrer Timer; After Breakdown Wait
Timer; Stirrer Timer; After Breakdown Stage GoTo; and finally the Breakdown Voltage Storage On/Off.

Example of a Standard Test:

```
DTS60A > test read 2

-----------------------------------------------------------------------------------------------
Test Name              : ASTM-D1816/84
Electrode Spacing      : 0.04 +/- 0.0010in
Electrode Type         : Type II
Number of Stages       : 05
Start-Up Wait Time     : 00:03:00
Stirrer During Start-UP : 00:03:00
-----------------------------------------------------------------------------------------------
| Stage | Voltage    | Duration | Stirrer   | WaitTimer | Stirrer   | GoTo Stage | BD Store |
-----------------------------------------------------------------------------------------------
| 00    | 000.5 kV/s | breakdown | 00:10:00 | 00:01:00 | 00:01:00 |   next     |   yes    |
| 01    | 000.5 kV/s | breakdown | 00:10:00 | 00:01:00 | 00:01:00 |   next     |   yes    |
| 02    | 000.5 kV/s | breakdown | 00:10:00 | 00:01:00 | 00:01:00 |   next     |   yes    |
| 03    | 000.5 kV/s | breakdown | 00:10:00 | 00:01:00 | 00:01:00 |   next     |   yes    |
| 04    | 000.5 kV/s | breakdown | 00:10:00 | 00:01:00 | 00:01:00 |   stop     |   yes    |
-----------------------------------------------------------------------------------------------

DTS60A >
```

Example of a User Defined Test:

```
DTS60A > test read 13

-----------------------------------------------------------------------------------------------
Test Name              : Eval-mini
Electrode Spacing      : 2.5 +/- 0.250mm
Electrode Type         : Type I
Number of Stages       : 03
Start-Up Wait Time     : 00:00:05
Stirrer During Start-UP : 00:00:05
-----------------------------------------------------------------------------------------------
| Stage | Voltage    | Duration | Stirrer   | WaitTimer | Stirrer   | GoTo Stage | BD Store |
-----------------------------------------------------------------------------------------------
| 00    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   next     |   yes    |
| 01    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   next     |   yes    |
| 02    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   stop     |   yes    |
-----------------------------------------------------------------------------------------------

DTS60A >
```

8.3.3 test delete <ID #>

The **test delete <ID #>** command deletes a User Defined Test.

Example:
```
DTS60A > test list
 Available Tests List...
 ----------------------------------------------------
 ID : Name             Creation Time & Date   Stages
 ----------------------------------------------------
 00 : IEC-156/95       -                      06
 01 : IEC-156/63       -                      06
 02 : ASTM-D1816/84    -                      05
 03 : ASTM-D877/87     -                      05
 04 : UTE-C27221       -                      06
 05 : CEI-10-1/73      -                      06
 06 : VDE-0370         -                      06
 07 : IRAM-2341/72     -                      06
 08 : RVHP-1985        -                      06
 09 : PN-77            -                      06
 10 : Evaluation       20:34:02 09/20/2016    30
 11 : Eval_400v        20:38:39 09/20/2016    30
 12 : Eval_100v        20:39:42 09/20/2016    30
 13 : Eval-mini        07:59:00 10/30/2016    03
 ----------------------------------------------------


DTS60A > test delete 13
 Are you sure you want to delete user test: Y/N? y
 User Test deleted!

DTS60A > test list
 Available Tests List...
 ----------------------------------------------------
 ID : Name             Creation Time & Date   Stages
 ----------------------------------------------------
 00 : IEC-156/95       -                      06
 01 : IEC-156/63       -                      06
 02 : ASTM-D1816/84    -                      05
 03 : ASTM-D877/87     -                      05
 04 : UTE-C27221       -                      06
 05 : CEI-10-1/73      -                      06
 06 : VDE-0370         -                      06
 07 : IRAM-2341/72     -                      06
 08 : RVHP-1985        -                      06
 09 : PN-77            -                      06
 10 : Evaluation       20:34:02 09/20/2016    30
 11 : Eval_400v        20:38:39 09/20/2016    30
 12 : Eval_100v        20:39:42 09/20/2016    30
 ----------------------------------------------------

DTS60A >
```

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8.3.4 test erase

The **test erase** command deletes all User Defined Tests.

Example:
```
DTS60A > test list
 Available Tests List...
 ---------------------------------------------------
 ID : Name            Creation Time & Date   Stages
 ---------------------------------------------------
 00 : IEC-156/95      -                      06
 01 : IEC-156/63      -                      06
 02 : ASTM-D1816/84   -                      05
 03 : ASTM-D877/87    -                      05
 04 : UTE-C27221      -                      06
 05 : CEI-10-1/73     -                      06
 06 : VDE-0370        -                      06
 07 : IRAM-2341/72    -                      06
 08 : RVHP-1985       -                      06
 09 : PN-77           -                      06
 10 : Evaluation      20:34:02 09/20/2016    30
 11 : Eval_400v       20:38:39 09/20/2016    30
 12 : Eval_100v       20:39:42 09/20/2016    30
 ---------------------------------------------------

DTS60A > test erase
 Are you sure you want to erase ALL user tests: Y/N? y
 Erasing Programs...Wait a moment...
 All Programs are ERASED!

DTS60A > test list
 Available Tests List...
 ---------------------------------------------------
 ID : Name            Creation Time & Date   Stages
 ---------------------------------------------------
 00 : IEC-156/95      -                      06
 01 : IEC-156/63      -                      06
 02 : ASTM-D1816/84   -                      05
 03 : ASTM-D877/87    -                      05
 04 : UTE-C27221      -                      06
 05 : CEI-10-1/73     -                      06
 06 : VDE-0370        -                      06
 07 : IRAM-2341/72    -                      06
 08 : RVHP-1985       -                      06
 09 : PN-77           -                      06
 ---------------------------------------------------

DTS60A > test list 9
```

8.3.5 test download

The **test download** command is used for creating a User Defined Test.

By entering the command, the system is ready to receive a Script Test File (see section 5.3), which describes a specific test scenario.

In order to simplify the program downloading, the user can create a text file that described the new User Defined Test sequence, and using their communications software of their choice, either copy and paste the new program or send it as a text file to the system.

It is noted that the terminal software should be paced to transmit with a delay of 50 ms between every outgoing character. The program can also, of course, be typed in by hand (check your work!).

After the new program is input, press the <enter> key on the PC's keyboard to make sure that the new program has been accepted and that the system prompt returns

Check your efforts by issuing a "test list" command, and observe your new test at the end of the list. Record the Test ID# and issue "test read <Test ID #>" to list the individual stages so that these can be verified.

Example:

```
DTS60A > test download
prg new Eval-mini 2.5 0.25 mm type_I 00:00:05 00:00:05 3
prg stage 00 003.0 kV/s breakdown 00:00:05 00:00:05 00:00:05 next store
prg stage 01 003.0 kV/s breakdown 00:00:05 00:00:05 00:00:05 next store
prg stage 02 003.0 kV/s breakdown 00:00:05 00:00:05 00:00:05 end store
prg end mean_yes print_yes

DTS60A > test list
 Available Tests List...
 -------------------------------------------------
 ID : Name             Creation Time & Date   Stages
 -------------------------------------------------
 00 : IEC-156/95       -                      06
 01 : IEC-156/63       -                      06
 02 : ASTM-D1816/84    -                      05
 03 : ASTM-D877/87     -                      05
 04 : UTE-C27221       -                      06
 05 : CEI-10-1/73      -                      06
 06 : VDE-0370         -                      06
 07 : IRAM-2341/72     -                      06
 08 : RVHP-1985        -                      06
 09 : PN-77            -                      06
 10 : Eval-mini        17:05:24 12/04/16      03
 -------------------------------------------------

DTS60A > test read 10
 ------------------------------------------------------------------------------------------------
 Test Name              : Eval-mini
 Electrode Spacing      : 2.5 +/- 0.250mm
 Electrode Type         : Type I
 Number of Stages       : 03
 Start-Up Wait Time     : 00:00:05
 Stirrer During Start-UP : 00:00:05
 ------------------------------------------------------------------------------------------------
 | Stage | Voltage    | Duration | Stirrer   | WaitTimer | Stirrer   | GoTo Stage | BD Store |
 ------------------------------------------------------------------------------------------------
 | 00    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   next     |   yes    |
 | 01    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   next     |   yes    |
 | 02    | 003.0 kV/s | breakdown | 00:00:05 | 00:00:05 | 00:00:05 |   stop     |   yes    |
 ------------------------------------------------------------------------------------------------

DTS60A >
```

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8.4 Test Result Download - history command

The **history** command is used to output the last 50 test results.

8.4.1 history list

The **history list** command shows all 50 test results, showing: Report ID #; Program Name; Date & Time; Number of Stages;

Example:
```
DTS60A > history list
-------------------------------------------------
ID Program Name  Date        Time      Stages
-------------------------------------------------
01 Eval_400v     10/24/2016  13:20       03
02 Evaluation    10/24/2016  13:22       30
03 Evaluation    10/24/2016  13:33       30
04 SIMPLE TEST   10/24/2016  13:54       01
05 Eval_400v     10/24/2016  15:48       03
06 Eval_400v     10/24/2016  19:45       03
07 Eval_400v     10/24/2016  19:52       03
08 Eval_400v     10/24/2016  19:53       03
09 Eval_400v     10/24/2016  19:56       03
10 Eval_400v     10/27/2016  08:34       03
11 Eval_400v     10/29/2016  10:39       03
12 Eval_400v     10/29/2016  22:15       03
13 Eval-mini     10/30/2016  08:03       03
14 Eval-mini     10/30/2016  08:12       03
15 Eval-mini     10/30/2016  08:15       03
16 Eval-mini     10/30/2016  08:33       03
17 SIMPLE TEST   10/30/2016  08:41       02
18 SIMPLE TEST   10/30/2016  10:34       02
19 Eval-mini     10/30/2016  10:43       03
20 SIMPLE TEST   10/30/2016  10:45       03
21 SIMPLE TEST   10/30/2016  18:39       01
22 Eval-mini     10/30/2016  18:40       03
23 Eval-mini     10/30/2016  18:45       03
24 Eval-mini     10/30/2016  18:52       03
25 Eval-mini     10/30/2016  19:17       03
26 SIMPLE TEST   12/01/2016  22:12       00
27 SIMPLE TEST   12/01/2016  22:30       00
28 SIMPLE TEST   12/01/2016  22:31       00
29 SIMPLE TEST   12/01/2016  22:38       00
30 SIMPLE TEST   12/01/2016  22:40       01
31 SIMPLE TEST   12/01/2016  22:40       00
32 SIMPLE TEST   12/02/2016  00:03       00
33 Evaluation    12/02/2016  02:07       30
34 SIMPLE TEST   12/02/16    11:52       00
35 SIMPLE TEST   12/04/16    20:10       01
36 SIMPLE TEST   12/04/16    20:37       01
37 SIMPLE TEST   12/04/16    20:43       10
38 SIMPLE TEST   12/04/16    22:20       01
39 SIMPLE TEST   12/04/16    23:11       10
40 SIMPLE TEST   12/04/16    23:46       02
41 ASTM-D1816/84 12/05/16    01:38       05
42 ASTM-D1816/84 12/05/16    09:47       05
43 ASTM-D1816/84 12/05/16    11:41       05
44 ASTM-D1816/84 12/05/16    11:56       05
45 ASTM-D1816/84 12/05/16    12:27       05
46 Evaluation    10/19/2016  20:46       30
47 Evaluation    10/20/2016  08:34       30
48 Eval_400v     10/20/2016  15:14       03
49 Evaluation    10/20/2016  15:22       30
50 Eval_400v     10/24/2016  13:11       03
```

8.4.2 history read <Report ID #>

The **history read <Report ID#>** command outputs Test Results for that Report ID# that contains information about the overall test and individual stages.

Example:
```
DTS60A > history read 45
 Result ID     : 44
 Time          : 12:27
 Date          : 12/05/16
 Temperature   : 75•F
 Test Name     : ASTM-D1816/84
 Num. Breakdown : 05
 Mean Breakdown : 0002.5
 Std  Breakdown : 0000.1
 Stages        : 05
 Stage  1:00.5kV/s,0000.0 >0002.7kV, BreakDown
 Stage  2:00.5kV/s,0000.0 >0002.6kV, BreakDown
 Stage  3:00.5kV/s,0000.0 >0002.6kV, BreakDown
 Stage  4:00.5kV/s,0000.0 >0002.3kV, BreakDown
 Stage  5:00.5kV/s,0000.0 >0002.6kV, BreakDown

DTS60A >
```

8.4.3 history erase

The **history erase** command clears out all Test Results from the DTS-60A & DTS-100A's memory.

Example:
```
DTS60A > history erase
 Are you sure you want to erase ALL history results: Y/N? y
 Erasing History Results...Wait a moment...
 All History Results are ERASED!

DTS60A > history list
 ------------------------------------------------
 ID Program Name  Date        Time        Stages
 ------------------------------------------------
01 -------------- --/--/---- --:--:--    00
02 -------------- --/--/---- --:--:--    00
03 -------------- --/--/---- --:--:--    00
...
49 -------------- --/--/---- --:--:--    00
50 -------------- --/--/---- --:--:--    00

DTS60A > history read 1
 Result ID     : 00
 Time          : --:--:--
 Date          : --/--/----
 Temperature   : ----
 Test Name     : -------------
 Num. Breakdown : 00
 Mean Breakdown : 0000.0
 Std  Breakdown : 0000.0
 Stages        : 00

DTS60A >
```

Appendix I - Care and Maintenance

1. Clean the test vessel
2. Calibrate System Periodically - contact High Voltage, Inc. at service@hvinc.com

Appendix II – Example Test Program Script Files

Standard	Electrodes			Procedures					
	Shape and Dimensions	Spacing	Tolerance	Rate of Rise	Start-up Wait Timer	Start-up Stirrer Timer	Stages / not evaluated	After BD Wait Timer	After BD Stirrer Timer
IEC 156/95	Type I/II	2.5 mm	± 0.05 mm	2 ± 0.2	5 min	5 min	6 / -	2 min	2 min
IEC 156/63	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
NBN C27-002	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
NEN 10 156	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
SEV 314/69	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
BS 5874/1980	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
VDE 370 - P5/92	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
UNE 21 309/70	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
AS 1767/75	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
SABS 555/76	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
UTE C27-221/74	Type I/II	2.5 mm	± 0.1 mm	2	10 min	-	6 / 1	5 min	1 min
CEI 10-1/73	Type II	2.5 mm	± 0.1 mm	2	10 min	-	6 / -	5 min	1 min
VDE 0370-P1/78	Type II	2.5 mm	± 0.05 mm	2	10 min	-	6 / -	2 min	1 min
IRAM 2341/72	Type I/II	2.5 mm	± 0.05 mm	2	10 min	-	6 / 1	2 min	1 min

```
prg 0 new IEC-156/95 2.5 0.05 mm type_I_II 00:05:00 00:05:00 06
prg 0 stage 00 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 01 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 02 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 03 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 04 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 next store
prg 0 stage 05 002.0 kV/s breakdown 00:10:00 00:02:00 00:02:00 end store
prg 0 end mean_yes print_yes

prg 1 new IEC-156/63 2.5 0.1 mm type_I_II 00:10:00 00:00:00 06
prg 1 stage 00 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 1 stage 01 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 1 stage 02 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 1 stage 03 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 1 stage 04 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 1 stage 05 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 end store
prg 1 end mean_yes print_yes

prg 2 new UTE_C27221/74 2.5 0.1 mm type_I_II 00:10:00 00:00:00 06
prg 2 stage 00 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next
prg 2 stage 01 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 2 stage 02 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 2 stage 03 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 2 stage 04 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 2 stage 05 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 end store
prg 2 end mean_yes print_yes

prg 3 new CEI_10-1/73 2.5 0.1 mm type_II 00:10:00 00:00:00 06
prg 3 stage 00 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 3 stage 01 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 3 stage 02 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 3 stage 03 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 3 stage 04 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 next store
prg 3 stage 05 002.0 kV/s breakdown 00:10:00 00:05:00 00:01:00 end store
prg 3 end mean_yes print_yes

prg 4 new VDE_0370-1/78 2.5 0.05 mm type_II 00:10:00 00:00:00 06
prg 4 stage 00 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 next store
prg 4 stage 01 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 next store
prg 4 stage 02 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 next store
prg 4 stage 03 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 next store
prg 4 stage 04 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 next store
prg 4 stage 05 002.0 kV/s breakdown 00:10:00 00:02:00 00:01:00 end store
prg 4 end mean_yes print_yes

prg 5 new IRAM_2341/72 2.5 0.05 mm type_I_II 00:10:00 00:00:00 06
prg 5 stage 00 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 next
prg 5 stage 01 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 next store
prg 5 stage 02 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 next store
prg 5 stage 03 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 next store
prg 5 stage 04 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 next store
prg 5 stage 05 002.0 kV/s breakdown 00:00:00 00:02:00 00:01:00 end store
prg 5 end mean_yes print_yes
```

```
prg 6 new RVHP_1985 2.5 0.05 mm type_II 00:10:00 00:00:00 06
prg 6 stage 00 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 6 stage 01 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 6 stage 02 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 6 stage 03 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 6 stage 04 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 6 stage 05 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 end store
prg 6 end mean_yes print_yes

prg 7 new PN-77/ED4408 2.5 0.05 mm type_II 00:10:00 00:00:00 06
prg 7 stage 00 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 7 stage 01 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 7 stage 02 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 7 stage 03 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 7 stage 04 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 7 stage 05 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 end store
prg 7 end mean_yes print_yes

prg 8 new JIS_C2101/78 2.5 0.05 mm type_I 00:03:00 00:00:00 02
prg 8 stage 00 003.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next
prg 8 stage 01 003.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 end store
prg 8 end mean_yes print_yes

prg 9 new OVE-W7TEL2/86 2.5 0.05 mm type_II 00:10:00 00:00:00 06
prg 9 stage 00 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 9 stage 01 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 9 stage 03 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 9 stage 04 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 next store
prg 9 stage 05 002.0 kV/s breakdown 00:00:00 00:05:00 00:01:00 end store
prg 9 end mean_yes print_yes

prg 10 new ASTM_D181684E 2.0 0.03 mm type_II 00:03:00 00:03:00 05
prg 10 stage 00 000.5 kV/s breakdown 00:00:00 00:01:00 00:01:00 next store
prg 10 stage 01 000.5 kV/s breakdown 00:00:00 00:01:00 00:01:00 next store
prg 10 stage 02 000.5 kV/s breakdown 00:00:00 00:01:00 00:01:00 next store
prg 10 stage 03 000.5 kV/s breakdown 00:00:00 00:01:00 00:01:00 next store
prg 10 stage 04 000.5 kV/s breakdown 00:00:00 00:01:00 00:01:00 next store
prg 10 end mean_yes print_yes

prg 11 new ASTM_D877/87 2.5 0.01 mm type_II 00:03:00 00:00:00 05
prg 11 stage 00 003.0 kV/s breakdown 00:00:00 00:01:00 00:00:00 next store
prg 11 stage 01 003.0 kV/s breakdown 00:00:00 00:01:00 00:00:00 next store
prg 11 stage 02 003.0 kV/s breakdown 00:00:00 00:01:00 00:00:00 next store
prg 11 stage 03 003.0 kV/s breakdown 00:00:00 00:01:00 00:00:00 next store
prg 11 stage 04 003.0 kV/s breakdown 00:00:00 00:01:00 00:00:00 next store
prg 11 end mean_yes print_yes
```

Appendix III – Firmware Upgrade Procedure

The **DTS-60A and DTS-100A** systems support in-system firmware upgrades.
Contact High Voltage, Inc. or your distributor to check for any firmware updates.

1. Obtain the **isp.exe** file and any supporting batch files
2. Obtain the latest hex file from High Voltage, Inc.
3. Establish the serial communications link between the system and a Personal Computer, using either USB cable or RS-232.
4. Power on the system, and from the Main Menu, access the Upgrade Firmware selection, press the **'ENTER'** key, and then press **'ENTER'** when prompted by the next screen (Section 2.3.6)
5. Execute the following command from a command prompt environment, as shown in Figure AIII-1:
     isp -pv hexfilename.hex COM1

     Note: The above command assumes that the system is interfaced to the COM1 serial port of the personal computer or the USB Serial link is assigned to COM1. This program also supports COM2, COM3, & COM4. If your COM port differs, contact High Voltage, Inc. directly for assistance.

6. The downloader will send the new firmware and verify for an error free transmission
7. Press any key in order to terminate the isp.exe operation
8. At this point the system has been upgraded with the new firmware and will reboot within 30 seconds.
9. Note that the Firmware Upgrade keeps all settings, calibration coefficients, User Defined Tests, and Test Results intact

Figure AIII-1 – Downloading new firmware

Appendix IV – DTS Remote Operation Program

The **DTS Remote Operation Program (DTSRO)** is a companion desktop application that allows off line retrieval of previous test results. **DTSRO** is compatable with both the DTS-60A and DTS-100A

1. Locate and run the install package located on the flash drive shipped with the system, or contact High Voltage Inc. for a copy.

   HVI HVINC_DTS_Remote_Operation_setup_v1_00.exe

   (a) Click Next
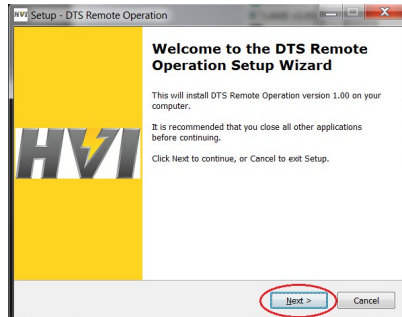
   (b) Click Next
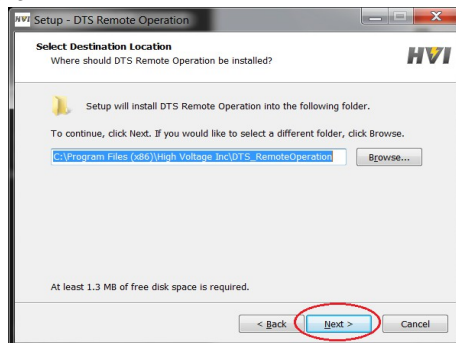
   (c) Click Next
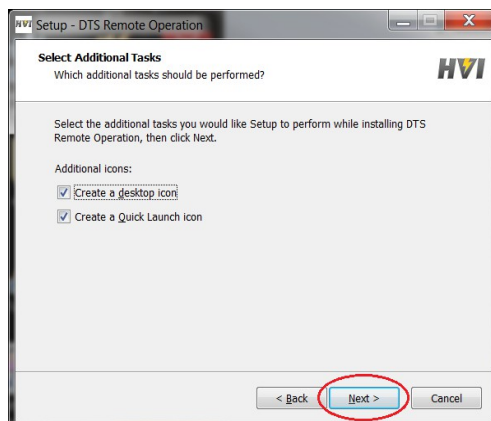
(d) Click Install
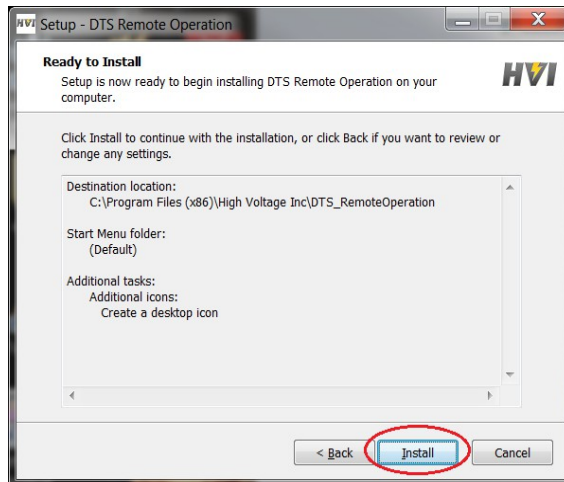
(e) Click Finish - The program will run if you leave the "Run ..." checkbox checked.
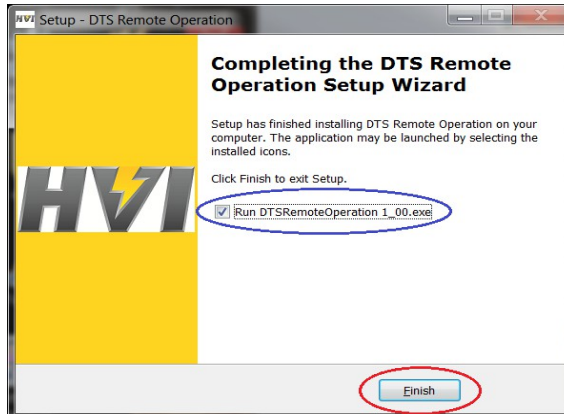
(f) The install package will also place a shortcut on the Desktop.
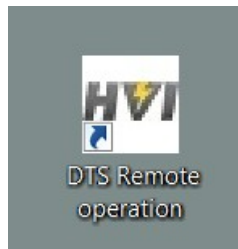
2. Operation of DTS Remote Operation (DTSRO)
   (a) DTSRO communicates over a serial communications link. The first step is to specify the connection to the DTS-60A or DTS-100A. Click Communications, then click Choose Serial Link
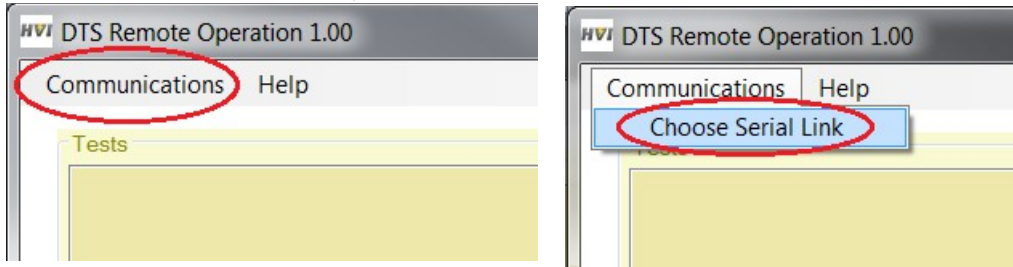
   (b) The Choose Serial Link Dialog will appear. It will list available Serial Links, choose the link that is attached to the system, then click the "Open Serial Link" button.
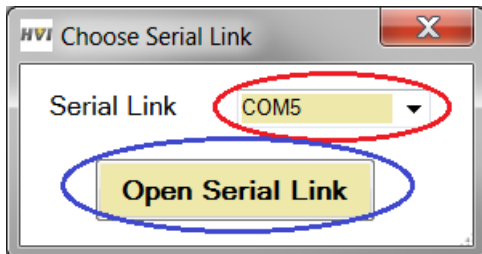
   (c) To download the list of test results from the system, click the "Download" button
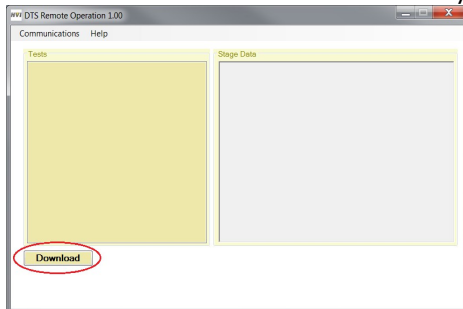
   (d) A message box will appear to remind the operator to activate Remote Operation mode of the system as described in section 8.1 of this manual, "Remote Operation Description and Operation". Click "OK" as soon as the system in is Remote Operation mode.
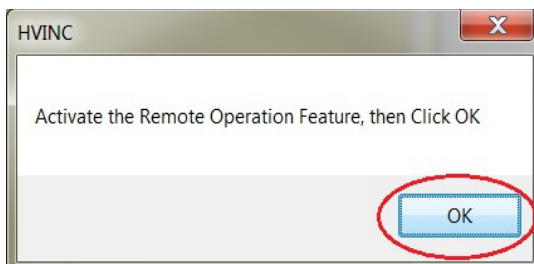
(e) The list of test results will be shown in the "Tests" list box. The system's firmware version and stored Operator settings will also be shown.
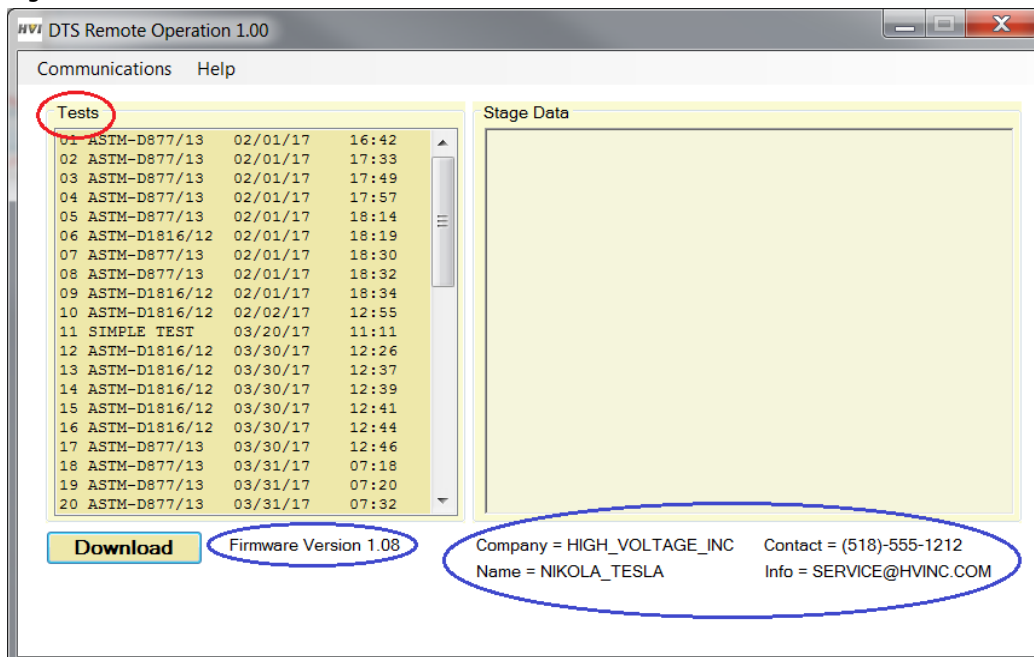
(f) Now we are ready to fetch Stage Data from an individual test. To do this, simply click on a result in the Test list box. Stage Data should appear for that test.
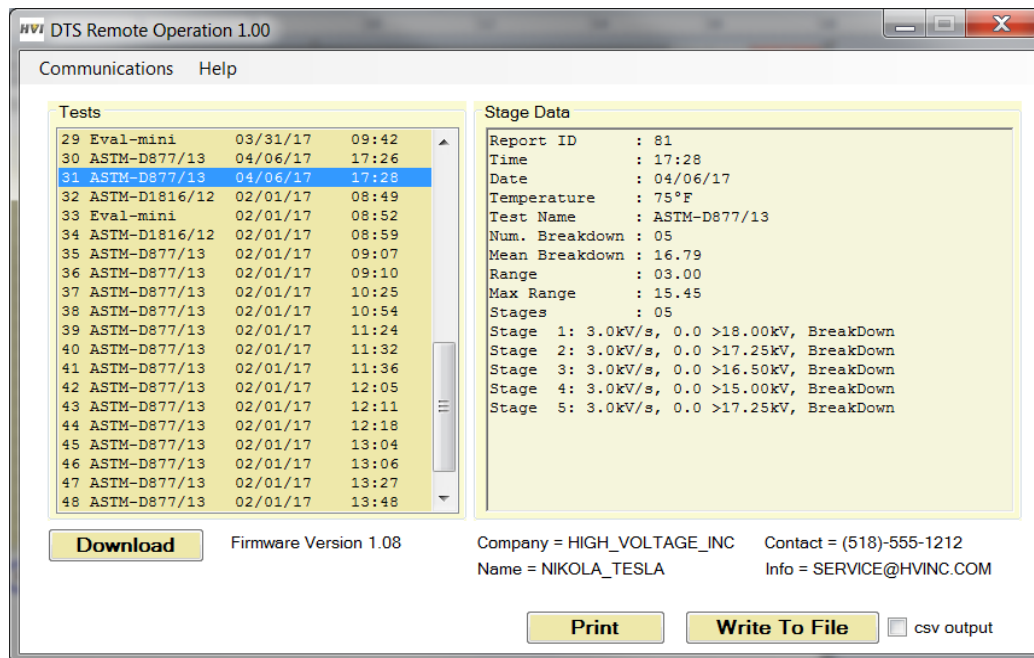
(g) The operator now has the choice of sending the data to a printer or writing to file as text or comma separated variable format (csv).

(h) **To print the data,** click the "Print" button
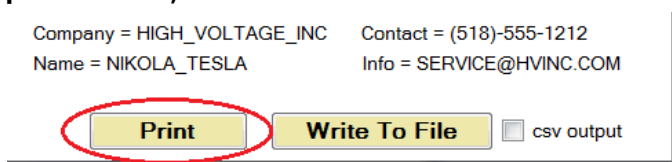
(i)   A print dialog will appear, select the desired printer and click the "OK" button
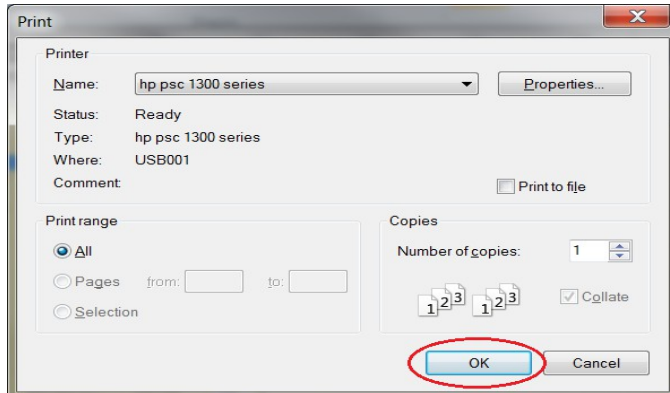
(j)   **To write the data as a text file,** click the "Write To File" button.
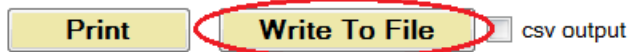
(k)   A Save File dialog will appear, allowing the operator to choose where they would like to store the file. It will always start off pointing at the \My Documents folder. Note that the filename has the format <product name><current date><current time>, which can be changed if required. Click the "Save" button to save the file.
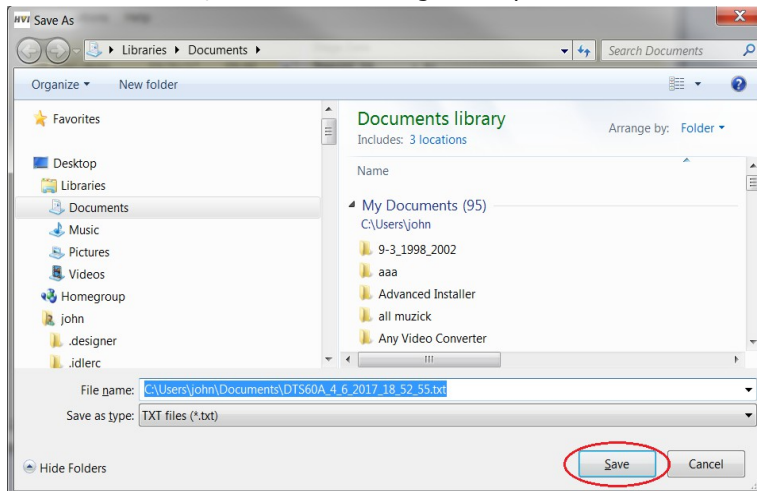
(l)   A confirmation dialog will appear indicating where that data was saved to and with what filename.
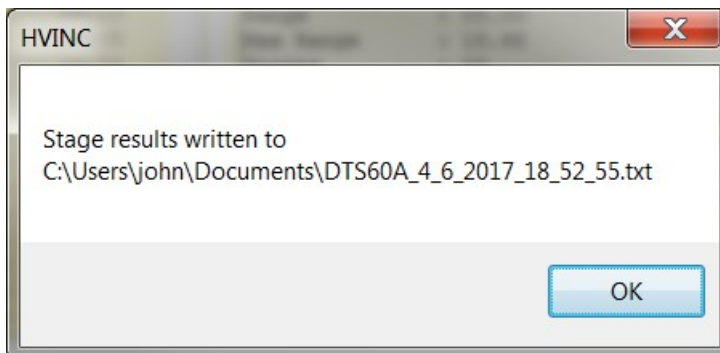
(m) The contents of the text file for the above result appear as follows:

```
High Voltage Inc.
DTS-60A Test Report
Firmware Version 1.08
Operator
Company = HIGH_VOLTAGE_INC
Report ID      : 81
Time           : 17:28
Date           : 04/06/17
Temperature    : 75°F
Test Name      : ASTM-D877/13
Num. Breakdown : 05
Mean Breakdown : 16.79
Range          : 03.00
Max Range      : 15.45
Stages         : 05
Stage  1: 3.0kV/s, 0.0 >18.00kV, BreakDown
Stage  2: 3.0kV/s, 0.0 >17.25kV, BreakDown
Stage  3: 3.0kV/s, 0.0 >16.50kV, BreakDown
Stage  4: 3.0kV/s, 0.0 >15.00kV, BreakDown
Stage  5: 3.0kV/s, 0.0 >17.25kV, BreakDown
```

(n) **To write the data as a .csv file,** click the "Write To File" button with the "csv output" check box checked

(o) A Save File dialog will appear as described above, and the contents of the .csv file for the above result will appear as follows:

```
DTS-60A_Test_Report
ReportID,81
Time,17:28
Date,04/06/17
Temperature,75°F
TestName,ASTM-D877/13
rate(kV/s),start(kV),stop(kV),result
3.0,0.0,18.00,BreakDown
3.0,0.0,17.25,BreakDown
3.0,0.0,16.50,BreakDown
3.0,0.0,15.00,BreakDown
3.0,0.0,17.25,BreakDown
```

3. Changing DTS type - DTS-60A or DTS-100A
    (a) DTSRO assumes that it is communicating with a DTS-60A unless otherwise indicated. If you are extracting data from a DTS-100A, you must click on Help->DTS-100A
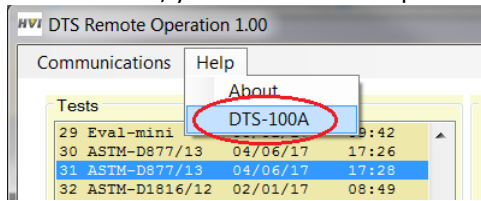
    (b) After this item has been clicked, a dialog will appear to confirm the choice, and a check mark will appear next to the DTS-100A label the next time you click on Help.
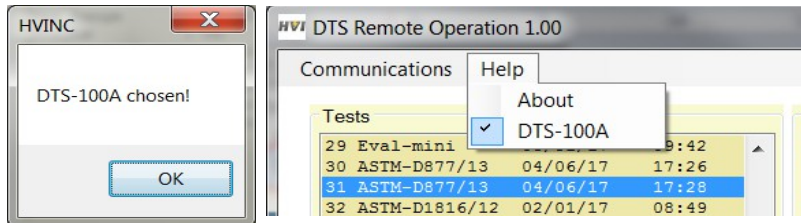
    (c) To restore DTSRO to DTS-60A mode, click on Help->DTS-100A a 2nd time or restart the program.

RETURNED MATERIAL

If for any reason it becomes necessary to return any equipment or materials to High Voltage, Inc., the Service Department of High Voltage, Inc. must be notified, and authorization received, prior to the shipment of the equipment. When notified, the following information must be provided:

MODEL:
SERIAL NO:
PART NO:
REASON FOR RETURN:
SUSPECTED DEFECT:
CAUSE OF DEFECT:

With the above information provided, High Voltage, Inc. will determine if the return of the equipment is appropriate. If deemed appropriate, a Return Authorization Number will be issued. At that time, the Purchaser will be instructed how to mark and return the equipment.

The above procedure must be adhered to in order to ensure prompt service. No equipment should be returned without the prior knowledge and authorization of High Voltage, Inc.

REPLACEMENT PARTS ORDERING

To order replacement parts, first refer to the Parts List for the product in question. Every part is issued a part number. It will be necessary for this part number and the product model and serial number to be provided. When calling High Voltage, Inc. request the Service Department.

THESE TERMS AND CONDITIONS OF SALE AND LIMITED WARRANTY OF HIGH VOLTAGE, INC. ("High Voltage") SHALL BE GOVERNED BY AND CONSTRUED ACCORDING TO THE INTERNAL LAWS OF THE STATE OF NEW YORK, USA, WITHOUT GIVING EFFECT TO ITS CONFLICT OF LAWS PROVISIONS. THE RIGHTS AND OBLIGATIONS OF ALL PARTIES AND ALL PERSONS OR ENTITIES CLAIMING HEREUNDER SHALL NOT BE GOVERNED BY THE PROVISIONS OF THE 1980 U.N. CONVENTION ON CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS.

1. **ACCEPTANCE.** All orders become effective only when accepted by High Voltage's written order acknowledgment at Copake, New York, USA. Unless modified in writing by an authorized representative of High Voltage, or modified in High Voltage's Quotation or order Acknowledgment, these Terms and Conditions and Limited Warranty shall solely control Purchaser's order. High Voltage expressly rejects any additional or different provisions, terms or conditions proposed by Purchaser at any time.

2. **SCHEDULING.** High Voltage's shipping date specified in High Voltage's quotation or purchase order acknowledgment is approximate and High Voltage shall use reasonable commercial efforts to effect timely shipment. Furthermore, High Voltage shall not be liable for any delay in the performance of orders or contracts or in the delivery or shipment of goods or for any damages suffered by Purchaser by reason of such delay when such delay is, directly or indirectly, caused by, or in any manner arising from Purchaser's fault, fires, floods, accidents, riots, acts of God, war, governmental interference or, embargoes, strikes, labor difficulties, shortage of labor, fuel, power, materials or supplies, transportation delays, or any other cause or causes (whether or not similar in nature to any of these hereinbefore specified) beyond the control of High Voltage.

3. **CANCELLATIONS.** Prior to shipment, Purchaser may request cancellation or delayed delivery of an order or part thereof, but such shall be conditioned upon written consent of High Voltage and upon payment to High Voltage of cancellation or delayed delivery charges to be determined by High Voltage.

4. **SALE AND DELIVERY.** Unless otherwise agreed in writing, sale and delivery of the goods hereunder shall be made   EXW or FCA (Incoterms® 2010) at High Voltage's option, High Voltage's dock at Copake, New York, USA, at which time all risk of loss or damage shall pass to Purchaser. All shipments and packaging shall be made in the manner determined by High Voltage, unless otherwise requested by Purchaser, in which case any resultant additional changes and expenses shall be paid by Purchaser.

5. **TAXES.** Any and all sales, use, excise and similar taxes, and duty and all other charges levied or imposed by governmental authority, foreign and domestic, upon any goods sold or contracted to be sold shall be paid by Purchaser and added to the purchase price unless appropriate tax exemption certificates are supplied to High Voltage in form satisfactory to High Voltage.

6. **PAYMENTS.**

a.   All payments shall be in US Dollars without discount unless otherwise specified in High Voltage's order acknowledgment. Credit card payments are accepted only if specified in High Voltage's order acknowledgment.

b.   Terms of payment are net thirty (30) days from date of invoice, unless otherwise agreed by High Voltage in its order acknowledgment. Delinquent payments are subject to a service charge on the unpaid balance from invoice date equal to the lower of 1-1/2% per month or the maximum rate permitted by law until all amounts are paid in full. If the financial responsibility of Purchaser becomes unsatisfactory to High Voltage for any reason, or if Purchaser has been in default to High Voltage under any order, High Voltage may require full payment in cash before shipment of goods.

c.   If Purchaser so requests and makes arrangements prior to shipment

which meet High Voltage's full satisfaction, High Voltage in its discretion may accept irrevocable letters of credit in its favor issued by a United States bank which is satisfactory to High Voltage.

7. **INFRINGEMENT, ETC.** On goods manufactured to Purchaser's specifications, Purchaser shall and does indemnify and hold High Voltage harmless against any claims, damages, liabilities, costs and expenses (including attorneys' fees) arising out of or resulting from actual or alleged infringement of patent, copyright, trademark or other proprietary rights, or claim of unfair trade or unfair competition arising from or occasioned by the use, possession, sale or delivery of any such goods sold by High Voltage.

8. **REPRODUCTION RIGHTS.** Drawings, specifications, reports, photographs and other data relating to all orders and all proprietary rights and interests therein and the subject matter thereof shall be and remain the property of High Voltage. Purchaser agrees that it shall not use High Voltage's drawings, specifications or other materials covered by this order, or any similar article from any other source, or reproduce the same or otherwise appropriate them, without the prior written authorization of High Voltage.

9.   **LIMITED WARRANTY.**

a.   High Voltage warrants to the original Purchaser of any new goods that the goods are free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of shipment by High Voltage. The obligation of High Voltage under this Limited Warranty is limited, in High Voltage's exclusive option, to repair, replace with new or reconditioned parts or issue credit for goods, parts or materials which prove to be defective. Costs incurred by Purchaser for labor or other expenses to repair or replace such goods, parts and/or materials shall be the sole responsibility of Purchaser. High Voltage shall not be responsible for any damage or lack of performance resulting from: (i) defects due to accident, negligence, alteration, modification, faulty installation, abuse or misuse, whether by Purchaser, Purchaser's agents or employees, or by others than High Voltage (ii) attempted or actual dismantling, disassembly, service or repair by any person, firm or corporation not specifically authorized in writing by High Voltage, or (iii) defects caused by or due to handling by carrier, or incurred during shipment, transshipment or other move.

b.   High Voltage expressly disclaims any warranty whatsoever of (i) consumables, and of (ii) parts, components, software (including but not limited to object code and source code and software user instructions), accessories, and materials not prepared, compiled or manufactured by High Voltage, and Purchaser must deal directly with such other supplier.   High Voltage may elect to assist Purchaser in settling such claim against such other supplier, but any such assistance shall not prejudice High Voltage's position as to its own liability.

c.   Compliance with the following Limited Warranty Claim Procedure is a condition precedent to the obligation of High Voltage under this Limited Warranty:

i.   Purchaser must notify High Voltage in writing as soon as is reasonably possible, but within the applicable warranty period, of any alleged defect in material, workmanship, or operation of any goods covered under this Limited Warranty. Such notice must describe in detail the defect, any and all defective parts, and the alleged cause of the defect. No goods may be returned to High Voltage without High Voltage's prior written permission, which permission may be withheld by High Voltage in its sole discretion.

ii.   At the exclusive option of High Voltage, Purchaser may be directed in writing to dismantle the goods at the Purchaser's cost and expense and ship the goods prepaid to High Voltage (refer to "Returns" Section 10 for provisions regarding the return of any goods to High Voltage). If High Voltage elects to inspect the goods at Purchaser's site, and to repair, replace,

or ship the defective goods to High Voltage's factory, Purchaser, at its own cost and expense, shall provide the facilities for such work as needed to inspect and evaluate and possibly repair/replace the goods. If inspection discloses that the defect is not one for which High Voltage is liable, then Purchaser shall promptly reimburse High Voltage for all expenses incurred.

iii. Upon receipt of the defective goods, or following access to the same, High Voltage shall inspect and evaluate the goods and determine the validity of Purchaser's claim.

iv. The validity of any warranty claim, Purchaser's compliance with the Limited Warranty and Limited Warranty Claim Procedure, and the obligation to replace, repair, or issue credit for any goods are solely and exclusively to be determined by High Voltage and any determination shall be final and binding.

d. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, STATUTORY OR EXPRESSED OR IMPLIED ON THE PART OF HIGH VOLTAGE, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT; FURTHERMORE, HIGH VOLTAGE MAKES NO WARRANTY REGARDING NON-INTERRUPTION OF USE OR SOFTWARE FREEDOM FROM BUGS. HIGH VOLTAGE NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON, FIRM, OR CORPORATION TO ASSUME ANY LIABILITY OR OBLIGATION IN CONNECTION WITH THIS SALE OR LIMITED WARRANTY ON HIGH VOLTAGE'S BEHALF AND PURCHASER ACKNOWLEDGES THAT NO REPRESENTATION EXCEPT THOSE MADE HEREIN HAS BEEN MADE TO PURCHASER.

10. **RETURNS.** No goods may be returned to High Voltage without High Voltage's prior written permission, which permission may be withheld by High Voltage in its sole discretion. Any request for return authorization must be in writing and include, as applicable, model number, serial number, part number, reason for return, alleged defect, and apparent cause of alleged defect. Except as specifically provided in Section 9 Limited Warranty, if High Voltage consents to return of goods: (a) all return shipments are to be via prepaid freight and with all other charges prepaid, (b) if goods are returned to High Voltage within sixty (60) days from the date of original shipment for reasons other than an error by High Voltage in filling the Purchaser's order, Purchaser shall only be entitled to receive a credit in an amount equal to the payment received by High Voltage for the goods minus (i) handling charges, and (ii) a restocking fee determined solely by High Voltage which shall not exceed twenty five percent (25%) of the invoiced amount, and (c) if goods are returned to High Voltage after sixty (60) days from the date of original shipment for reasons other than an error by High Voltage in filling the Purchaser's order, Purchaser shall only be entitled to receive a credit in the amount equal to the payment received by High Voltage for the goods minus (x) a handling fee, and (y) a restocking fee in excess of twenty five percent (25%) which shall be determined by High Voltage.

11. **SECURITY INTEREST.** In order to induce High Voltage to ship goods without full payment, Purchaser grants a security interest to High Voltage in any and all of Purchaser's right, title and interest in the goods, and Purchaser agrees to comply with any reasonable request of High Voltage to perfect such security interest. Purchaser hereby further authorizes High Voltage to perfect High Voltage's security interest in said goods and consents to filing one or more financing statements without the signature of Purchaser.

12. **ARBITRATION.** Any controversy arising out of or relating to this document, or any breach thereof, including, without limitation, any claim that this document is voidable or void, shall be submitted to final and binding arbitration before, and in accordance with, the Commercial Rules of the American Arbitration Association then in effect, and judgment upon the award may be entered in any court have jurisdiction thereof; provided, however, that this clause shall not be construed to limit any rights which

High Voltage may have to apply to any court of competent jurisdiction for equitable, injunctive or provisional relief. This arbitration provision shall be deemed self-executing, and in the event that either party fails to appear at any properly noticed arbitration proceeding, an award may be entered against such party notwithstanding said failure to appear. Such arbitration shall be conducted before a single arbitrator under the aegis of the American Arbitration Association in Columbia County, State of New York. The arbitrator shall have the authority to award expenses to the successful party.

13. **LIMITATION OF LIABILITY.** TO THE MAXIMUM EXTENT PERMITTED UNDER APPLICABLE LAW, AND NOTWITHSTANDING ANYTHING ELSE IN THIS DOCUMENT OR OTHERWISE, INCLUDING THAT HIGH VOLTAGE WAS WARNED THAT DAMAGES WOULD OCCUR OR WERE LIKELY TO OCCUR, HIGH VOLTAGE SHALL NOT BE LIABLE WITH RESPECT TO ANY SUBJECT MATTER OF THIS DOCUMENT UNDER ANY CONTRACT, NEGLIGENCE, STRICT LIABILITY OR OTHER LEGAL OR EQUITABLE THEORY FOR (i) ANY AMOUNTS IN EXCESS IN THE AMOUNT PAID TO HIGH VOLTAGE FOR THE PARTICULAR GOODS OR PART THEREOF WHICH GAVE RISE TO THE APPLICABLE CAUSE OF ACTION OR CLAIM, OR (ii) ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOST PROFITS OR LOST OR CORRUPTED DATA, OR (iii) COST OF PROCUREMENT OF SUBSTITUTE GOODS, SOFTWARE, TECHNOLOGY OR SERVICES. HIGH VOLTAGE SHALL HAVE NO LIABILITY FOR ANY FAILURE OR DELAY DUE TO MATTERS BEYOND ITS REASONABLE CONTROL.

14. **SEVERABILITY.** These Terms and Conditions and Limited Warranty are the entire understanding between Purchaser and High Voltage with respect to the subect matter hereof and supersede all prior agreements, dealings and negotiations. No modification, alteration or amendment shall be effective unless made in writing and signed by a duly authorized representative of High Voltage. No waiver of any breach hereof shall be held to be a waiver of any other or subsequent breach. Nothing contained in this document shall be construed as requiring the commission of any act contrary to law. Whenever there is any conflict between any provision of this document and any present or future statute, ordinance or regulation contrary to which the parties have no legal right to contract, the latter shall prevail, but in such event the provision of this document thus affected shall be curtailed and limited only to the extent necessary to bring it within the requirements of the law. In the event that any part, article, section, paragraph, sentence or clause of this document shall be held to be indefinite, invalid or otherwise unenforceable, the entire document shall not fail on account thereof, and the balance of the document shall continue in full force and effect. If any arbitration tribunal or court of competent jurisdiction deems any provision hereof (other than for the payment of money) unreasonable, said arbitration tribunal or court may declare a reasonable modification thereof, and this document shall be valid and enforceable, and the parties hereto agree to be bound by and perform the same as thus modified.

15. **BASIS OF BARGAIN.** Each party recognizes and agrees that the warranty disclaimers and liability and remedy limitations in this document are material, bargained for bases of their agreement and that they have been taken into account and reflected in determining the respective obligations of the parties.

[End]