OPERATOR MANUAL

MODEL 1656 & 1657

BATTERY ELEMENT TESTER

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1656 & 1657 Operator Manual

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The customer must prepay transportation costs for the return of instrument for warranty service. The return method will be at the discretion of STS Instruments.

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CALIBRATION

STS Instruments certifies that this instrument was calibrated using standards that are traceable to the National Institute of Standards and Technology (NIST). We recommend that your instrument be calibrated on a twelve-month cycle.

Contents

Table of Figures

CAUTION

READ

Section 3, Installation and Safety

Section 4, Operation

of this manual before installing or operating this equipment.

WARNING

IF THIS EQUIPMENT IS NOT INSTALLED AND/OR USED IN A MANNER SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED

1 Introduction

1.1 Manuals

This manual covers only operator use of the STS Instrument model 1656 or 1657 Battery Element Tester. For complete information on setup, programming, use, specifications, principle of operation, maintenance and calibration, refer to the STS 1656 & 1657 Owner's Manual P/N 201353 instead. Both manuals are supplied with the unit.

1.2 Background

For over 30 years, the STS Instruments Battery Element Testers have been the de-facto benchmark for Battery Cell quality testing. The new 1656 and 1657 models build on this legacy of reliable, high volume testing using a state-of-the-art digital design made possible by advanced microcontrollers (MCUs) and high resolution, fast Analog to Digital conversion (ADC) of voltage and current test signals. This advanced and modern digital design is complemented by a convenient operator interface using a large LED backlight, color graphic LCD screen that displays settings that results in large, easy to read operator information.

The Model 1656/1657 Digital Battery Element Tester is designed to test the dielectric strength of separators in lead-acid battery cells. The high level of digital processing used in the 1656 and 1657 designs provides enhanced resolution of defective separators with reduced false rejects due to moisture in damp process plates.

Test voltage is adjustable to 3000 volts peak and is measured and indicated on the large color LCD. The Model 1656 and 1657 testers produce high voltage, high-current pulses of very short time duration. These pulses repeat at a programmable rate. Duration of each pulse is approximately 120 microseconds. Although the instantaneous energy in each pulse is high, the short duration of the pulses results in a low average energy level. Therefore, the high voltage stress required to obtain a good test is produced without the problem of producing excessive heat within the test object as is the case for other test methods.

The high speed digitizing metering circuits of the 1656 and 1657 monitor the loading of the tester by the unit under test. This measurement is indicated in quantitative units, on a scale of 0 to 1000.

The Model 1656 and 1657 Battery Element Testers (BET) are equipped with a Modular Line Cord Assembly and a universal AC input supply that allows the tester to operate on a nominal 90Vac through 264Vac input at 50 or 60 Hz.

Optional USB or RS232 control interfaces and a Programmable Logic Controller interface option are available on the rear panel to facility factory integration and data collection for quality control purposes.

2 Technical Specifications

This section includes performance specifications for the 1656 and 1657 Battery Element Testers. All specifications are valid over the stated temperature. Calibration is performed at 23°C ± 5°.

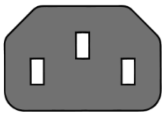
2.1 Output

Parameter	Specification	Notes
Channels	1	
Test Voltage		
Range	300 – 3000 V peak	
Resolution	10 V	
Accuracy	±2.0% F.S.	
Shape	Pulse	
Duration	120 µsec (typical)	
Test Interval	Programmable from 30 to 5000 msec	
High Voltage Connections		
Front Panel Sockets	Amphenol / Alden	
Rear Panel Sockets	Amphenol / Alden	-RPC Option

2.2 Measurements

Parameter	Specification	Notes
Channels	1	
Voltage Measurement		
Range	0 – 3000 Vpk	
Resolution	1 V	
Accuracy	± 2.0% F.S.	
Quality Measurement		
Range	10 - 3750	
Resolution	1	
Accuracy	± 2.0% F.S.	

2.3 AC Input

Parameter	Specification	Notes
AC Input Voltage		
Type	Universal Input	
Range	100Vac – 240Vac ±10%	RMS
Frequency	47 – 63 Hz	
AC Input Current		
Max.	500 mA	
Input Power Factor		
Typical	0.98	
Input Fuse		
Type	250V, 0.5A, Slow Blow	
Dimension	5 x 20 mm / 0.20” x 0.80”	
On/Off Switch		
Type	Rocker Type, Front Panel. Press O to turn Off	
Line Cord		
Type	IEC 60329, C13, Detachable	
AC Input Connector		
Type	IEC 60320, C14	

3 Installation and Safety

This chapter describes required installation provisions and precautions necessary to deploy this equipment effectively and above all safely. Please ensure anyone that will be assigned to operate this equipment is fully qualified and trained to operate this equipment in a safe manner.

3.1 Important Safety Precautions

After the equipment has been installed, a careful study should be made of the test station to determine what, if any, safeguards are needed. It is suggested that any electrical test station involving voltages in excess of 42.4 volts peak (approximately 30 volts RMS) should be equipped with safeguards. These should operate both for the protection of the operating personnel and for the protection of casual bystanders. At the minimum, safeguards should prevent the operating personnel or casual bystanders from coming into contact with the test circuit. In the event electrical interlocks of any sort are required, either to insure that guards are in place, or to insure that the operator's hands are in a safe location, we will be happy to provide suggestions and schematics for safety interlocking our test equipment.

The test procedure should be well thought out to ensure that it adequately tests the product to the desired criteria but that the procedure does not require the operator to perform tasks that are unsafe. The product should never be touched during a test.

Good safety practice dictates labeling of hazards properly. Since high voltage testing can be hazardous, the work station should be labeled. Naturally, the location of the label should be carefully selected so that it can be placed in a location that will do the most good.

In some cases, this may be on the test instrument itself, and in others, it may be in a location directly in front of the operator, somewhat removed from the instrument.

3.2 Initial Setup Procedure

Setup adjustments should be made with no load connected to the test leads. Proceed as follows:

1. Insert the AC line cord into a suitable AC outlet. The 1656/1657 has a universal input and will operate from any voltage between 100Vac RMS L-N and 240Vac RMS L-N.
2. Install the supplied test leads on the front panel sockets. The test leads are color coded to match the positive and negative terminals on the 1656/1657 front panel.
3. Turn the unit ON using the front panel toggle switch.
4. Adjust voltage setting to desired Peak Volts reading using one of the VOLTn buttons.
5. The Quality readout with no battery cell connected to the test leads varies with the set test voltage. Typical open circuit Q readings for the BET are:
    - Test Voltage @1000V, Q = 210
    - Test Voltage @2000V, Q = 440
    - Test Voltage @3000V, Q = 650
6. To check the unit, set the lower trip level to 10 and the upper trip level to 1000.
7. Battery impedance is complex in nature and composed mainly of capacitive leakage combined with resistive and inductive leakage. Because the open circuit reading on the Quality Meter is 'balanced' to zero (0) against an internal load that is primarily inductive and resistive, we do not assign a scalar value to the Quality meter reading. It is used to indicate a change from this balance condition and to allow you to determine your product's relative impedance.

    To determine your product's relative impedance:

    a. Adjust the test voltage to the desired level, e.g. 1500V.

    b. Adjust the Lower Trip level to 10 and the upper trip level to 1000.

    c. Test 10 to 12 known good battery cells.

    d. Note down the Quality Meter reading of each.

    For example:

    You test 10 known good batteries and record readings of 650, 653, 680, 675, 701, 645, 665, 663, 688, and 660. Since your 'average' reading calculated to 668, you would set your Trip Level limits for production test use to 668 ± 10% or larger 601 for low limit and 735 for high limit. (601 / 735).

    Actual settings can be as "tight" as you like but, you should allow for normal product variation and the effect of humidity on the moisture content of the plates. If you perform your setup under low humidity conditions you would expect the readings to slightly higher during high humidity conditions.

8. Apply the test probes to battery to be tested. The reject visual and audible signals operate if quality meter is outside the trip level setting range. The reject signals cancel automatically when the probes are lifted from the battery.
9. Even on good parts, a slight spark will be noticed when the tester probe is touched to the part under test. This is normal, since charging current flows as a result of the inherent capacity of the part under test.

4 Operation

Figure 4-1: 1656 Rack Mount Model Front Panel View

Figure 4-2: 1657 Bench Model Front Panel View

This chapter describes the various front panel controls, menu's, settings and readouts that are used to interface with the operator. It is strongly recommended that the user familiarizes him / her with the contents of this chapter before attempting to operate this equipment.

Note: The front panel operation of the 1657 is the same as that of the 1656 as both models use the same controls, screens and menus. The samples shown in this section are taken from the 1656.

4.1 Controls, Indicators and Connectors

Functions of the various controls and indicators found on the front panel of the 1656 and 1657 Battery Element Tester are explained in the table below. Figure 4-3 shows call-outs to the various controls and indicators to help familiarize the operator with the front panel layout.

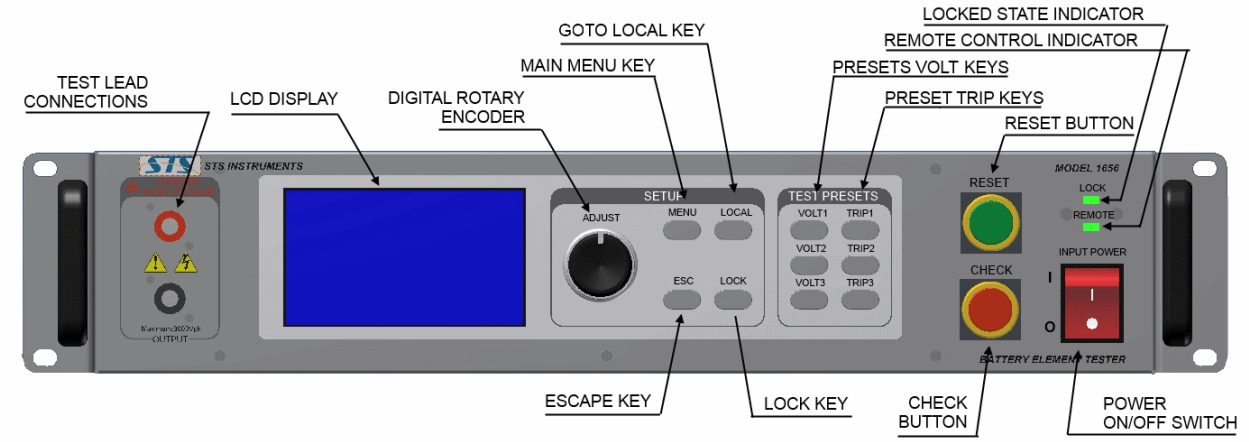


Figure 4-3: Control and Indicator Locations

Controls	Description
POWER ON/OFF SWITCH	The Power On/Off rocker switch is used to turn the instrument on or off. Press the switch bottom (O symbol) to turn the unit OFF. Press the switch top half (I symbol) to turn the unit ON.
ADJUST	The rotary knob in the center of the front panel is used to adjust settings and values as displayed on the LCD screen whenever the selected field is in EDIT mode. EDIT mode is indicated by a blinking field. To Enter/Exit EDIT mode, push in the knob till a click is felt and heard. To adjust a value, turn the knob to the right (increment) or the left (decrement.) When not in EDIT mode, the same knob is used to scroll from field to field in any menu screen. A selected field is indicated by a reversal of the text and background color of the field.
SETUP KEYS	
MENU	The MENU key brings up the MAIN MENU screen. From this screens, all settings can be accessed and changes as needed using the ADJUST knob to scroll through fields. Some fields will bring up nested MENU's below the MAIN MENU.
LOCAL	The LOCAL key may be used to change the state of the instrument from LOCK (no front panel control) to LOCAL. NOTE that this key may be disabled through the remote control interface.
ESC	The ESC (Escape) key exits any menu field and backs up to the previous state of the selected field.
LOCK	The LOCK key may be used to put the instrument in a LOCKed state. In this state, no changes to any settings can be made. To unlock the instruments, a password must be entered.

Controls	Description
TEST PRESET KEYS	
VOLT1, VOLT2, VOLT3	These 3 keys allow for quick setting of the voltage test level for 1000V (VOLT1), 2000V (VOLT2) or 3000V (VOLT3)
TRIP1, TRIP2, TRIP3	These 3 keys allow quick setting of the following trip levels: TRIP1 = 200/250 TRIP2 = 400/500 TRIP3 = 600/750
BUTTON / INDICATORS	
CHECK BUTTON	The red CHECK Button is START a test. The test will be run for the number to counts set or indefinitely is set to “CONT.” If this, case the RESET button must be used to terminate a test. During a test, the CHECK button will blink ON at the programmed test interval rate. The green RESET light will be OFF during a test.
RESET BUTTON	The green RESET Button may be used to stop a test in progress. When the green light is ON, the red CHECK light will be off. When a battery cell fails the test, the red CHECK light will blink at a lower rate and the alarm will be ON. Once the probes are removed from the defective cell, the alarm will turn off.

Indicators	Description
LCD DISPLAY	This is the main display area of the instruments. All settings and readings are displayed on the main LCD screen uses a variety of menus and measurement/test screens.
REJECT INDICATOR	The 1656/1657 has two Reject Indications; an Audible Tone and a 15- pin HD D-sub PLC interface connector on the rear panel which provides a Dry Contact Closure when a reject occurs.
CHECK BUTTON	See Controls Table
LOCK LED	Indicates instrument is in LOCKED state (Controls are Locked out)
REMOTE LED	Indicate instruments in being controlled remotely over one of its digital control interfaces.

Connectors	Description
HIGH VOLTAGE CONNECTORS	Two (2) High Voltage connectors are provided on the front panel. Polarity should be observed when connecting the leads. The black socket is referenced to ground.
OUTPUT HIGH	Test Lead High Voltage Mating Connector, RED
OUTPUT LOW	Test Lead High Voltage Mating Connector, BLACK
-RPC Option	The –RPC option adds rear panel High Voltage connectors to the 1656/1657 unit.

4.2 Rear Panel Connectors

The available connectors located on the rear panel of the 1656 Battery Element Tester are shown in the Figure below.

Figure 4-4: 1656 Rear Panel Connector Locations (shown with PLC and optional RS232)

The available connectors located on the rear panel of the 1657 Battery Element Tester are shown in the Figure below.

Figure 4-5: 1657 Rear Panel Connector Locations (shown with optional RS232, PLC Interface and –RPC)

4.3 Test Result Data Display

This is the default screen that comes up after power on once the initialization of the tester has been completed. The STS Instruments logo will disappear and the normal test data display window will be shown.

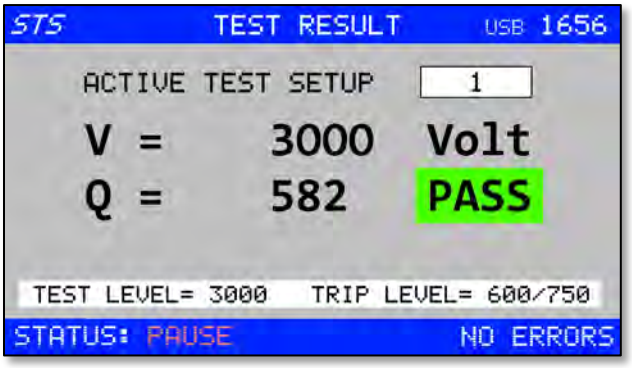


Figure 4-6: Test Results Screen

Note that there are 9 possible setups (1 through 9) that are stored in non-volatile memory. The first three of these setups (1 through 3) are directly available using the VOLT n and TRIP n front panel keys.

Figure 4-7: TEST PRESET keys for Test Setups 1 through 3

This screen also allows selection of the ACTIVE SETUP. The number of the Test Setup to use is shown in the parameter field in the top right corner. In this example, Test Setup number 4 is selected. The Shuttle can be used to scroll through available setup numbers 1 through 9. Push the Shuttle (ENTER) to make your selection.

Index

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