1855
Capacitor Leakage Current/IR Meter
Instruction Manual

Form 150767/A7

September 2009

Sales 800-253-1230
Website www.quadtech.com

CAUTION

Voltage may be present on front and rear panel terminals. Follow all warnings in this manual when operating or servicing this instrument. Substantial levels of energy may be stored in capacitive devices tested by this unit.

 Product will be marked with this symbol (ISO#3864) when it is necessary for the user to refer to the instruction manual in order to prevent injury or equipment damage.

 Product marked with this symbol (IEC417) indicates presence of direct current.

 Product will be marked with this symbol (ISO#3864) when voltages in excess of 1000V are present.

Contents

Warranty **6**
Specifications **7**
Accessories **10**
Safety Precautions **11**
Condensed Operating Instructions **14**

Introduction - Section 1
1.1 Unpacking and Inspection 19
1.2 Product Overview 19
1.3 Controls and Indicators 20
1.3.1 Front Panel Controls and Indicators 20
1.3.2 Rear Panel Controls and Connectors 21
1.4 Installation 22
1.4.1 Dimensions 22
1.4.2 Instrument Positioning 22
1.4.3 Power Requirements 22
1.4.4 Safety Inspection 23

Operation - Section 2
2.1 Terms and Conventions 25
2.2 Start-Up 27
2.3 SYSTEM SETUP 27
2.3.1 Calibration 27
2.3.2 Memory Manage 27
2.3.3 System Configuration 28
2.3.3.1 Test Parameter 29
2.3.3.2 Beeper 29
2.3.3.3 Sound Mode 29
2.3.3.4 Alarm Mode 30
2.3.3.5 Trig Delay 30
2.3.3.6 Trig Edge 30
2.3.3.7 Handler Mode 31
2.3.3.8 Contrast 31
2.3.3.9 GPIB Address 31
2.3.3.10 RS232 Baud Rate 32
2.3.3.11 Key Lock 32
2.3.3.12 Line Frequency 33
2.3.3.13 Charge Time 33
2.3.3.14 Range Dwell 34
2.3.3.15 Average 34
2.3.3.16 EXT Vm Display 34
2.3.3.17 Discharge Voltage 35
2.3.3.18 Digits 35

Contents

Operation - Section 2 – Continued

2.4 MAIN INDEX 36
2.4.1 Sequence Test 36
2.4.2 Step Test 37
2.4.3 Null 37
2.4.4 W.V. Test 39
2.4.5 Compare 39
2.4.6 CC Power 42
2.4.7 Forward Voltage 42
2.4.8 Surge Test 42
2.5 MEAS DISPLAY 41
2.5.1 Test Voltage 44
2.5.2 Constant Current 45
2.5.3 Range 46
2.5.4 Charge Time 46
2.5.5 Dwell Time 47
2.5.6 Speed 47
2.5.7 Trigger 48
2.5.8 Rated Withstand Voltage (Vf) 49
2.5.9 Measurement Time (Tend) 49
2.5.10 Maximum Charge Time (CHG Tend) 50
2.5.11 Display 50
2.5.12 Compare 50
2.5.13 Charge Time (CHG T) 51
2.5.14 Discharge Time (DCHG T) 51
2.5.15 Loop 51
2.6 Connection to Device under Test 53
2.7 Measurement Procedure 54

Interface - Section 3

3.1 RS-232 Interface 51
3.1.1 RS232 Pin Configuration 51
3.1.2 RS232 Specifications 51
3.1.3 RS232 Commands 52
3.2 IEEE-488 Interface 53
3.2.1 Pin Configuration 53
3.2.2 IEEE-488 Interface Function Codes and Messages 55
3.2.3 IEEE-488 Interface Commands 57
3.2.4 IEEE-488 Command Format 59
3.2.5 IEEE-488 Commands - Detailed 60
3.2.6 Error Messages 71
3.3 Handler Interface 72
3.3.1 Trigger 73
3.3.2 Handler Pin Assignments for Compare Operation 74

Service & Calibration - Section 4

4.1 General 75
4.2 Instrument Return 75

Contents

4.3 Calibration 75
4.3.1 1855 Verification Procedure 76
4.3.2 1855 Verification Data Sheet 76

Warranty

QuadTech warrants that Products are free from defects in material and workmanship and, when properly used, will perform in accordance with QuadTech's applicable published specifications. If within one (1) year after original shipment it is found not to meet this standard, it will be repaired, or at the option of QuadTech, replaced at no charge when returned to a QuadTech service facility.

Changes in the Product not approved by QuadTech shall void this warranty.

QuadTech shall not be liable for any indirect, special or consequential damages, even if notice has been given of the possibility of such damages.

This warranty is in lieu of all other warranties, expressed or implied, including, but not limited to any implied warranty or merchantability of fitness for a particular purpose.

SERVICE POLICY

QuadTech's service policy is to maintain product repair capability for a period of at least five (5) years after original shipment and to make this capability available at the then prevailing schedule of charges.

Specifications

Leakage Current Test:

Leakage Current:	0.001uA – 20.0mA
Accuracy:	±(0.3% + 0.005uA)
Test Voltage:	1.0V – 650V DC, 0.1V/Step
Voltage Accuracy:	±(0.5% + 0.2V)
Test Current:	0.5mA – 500mA, 0.5mA/Step for DCV ≤ 100V 0.5mA – 150mA, 0.5mA/Step for DCV > 100V
Charge Current Accuracy:	±(3% + 0.05mA)

Insulation Resistance Test:

Insulation Resistance:	10Ω – 99.99GΩ
IR Accuracy:	$\pm\left(\left[0.6 + \frac{20V}{Vm} + \frac{0.5uA}{Im}\right] \times \left[1 + \frac{0.005uA}{Im}\right]\right)\%$

Where Vm and Im are measured voltage & current for a given load.

Test Voltage:	1.0V – 650V DC, 0.1V/Step
Voltage Accuracy:	±(0.5% + 0.2V)
Test Current:	0.5mA – 500mA, 0.5mA/Step for DCV ≤ 100V 0.5mA – 150mA, 0.5mA/Step for DCV > 100V
Charge Current Accuracy:	±(3% + 0.05mA)

Withstand Voltage Test:

Rise Time (Tr):	0.05s – 120s
Withstand Voltage (Vf):	1.0V – 650V DC, 0.1V/Step
Test Current:	0.5mA – 150mA, 0.5mA/Step
Charge Current Accuracy:	±(3% + 0.05mA)
Measure Time:	30s – 600s
MAX Charge Time:	5s – 600s

Specifications (Continued)

General Features

Test Types:	Automatic Sequence Test Manual Step Test C.C Power Forward Voltage Surge Test	
Null:	Correction for Lead Leakage	
Monitored Voltage (Vm):	1.0V – 650V DC (Voltage across DUT)	
Charge Time:	0 – 999seconds in 1s/10s increments <100s; 100s increments >100s	
Delay Time:	0.2 – 999seconds in 0.1s increments <100s; 10s increments>100s	
Discharge:	65 Watt Discharge Circuit	
Trigger:	Delay: Edge:	0 – 9.995 seconds in 0.1s increments Falling or Rising
Measurement Mode:	Continuous or Trigger (INT, EXT or Manual)	
Measurement Rate:	Fast: Medium: Slow:	18 measurements/second 14 measurements/second 7 measurements/second
Ranging:	Automatic or Hold	
Averaging:	1-8 measurements	
Compare:	Set Upper & Lower Limits for LC and IR Tests	
Display:	240 x 64 LCD Graphic display	
Indication:	Audible alarm programmable HI, LOW or OFF for Pass or Fail	
Standard Interface:	RS232	
Optional Interfaces:	IEEE-488 & Handler	

Specifications (Continued)

Connectors:	1 BNC terminal: Input 2 Banana terminals: HV (+), HV (-) 1 Banana Socket: Chassis Ground	
Front Panel Lockout:	Keypad Lock	
Mechanical:	Bench Mount Dimensions: (w x h x d): 12.50 x 4.00 x 13.50 inches 317.2 x 101.5 x 342.6 mm	
Weight:	18 lbs (8.2kg) net, 22 lbs (10kg) shipping	
Environmental:	Operating: Storage: Humidity: Pollution Degree 2 Installation Category I	10°C to 40°C -10°C to 50°C <90%
Power:	• 90-125VAC • 50 or 60Hz	• 190-250VAC • 400W max
Supplied:	• Instruction Manual • Calibration Certificate	• Power Cable • Lead Set

Ordering Information:

Description	Catalog No.
Capacitor Leakage Current/IR Meter	1855

Firmware Versions

Modes of C.C. Power, Forward Voltage and Surge Tests were added in firmware version 2.11. Any reference to these three modes in this manual are only applicable on an 1855 with firmware version 2.11 or higher.

Accessories

Accessories Included

Item	Quantity	QuadTech P/N
AC Power Cord	1	4200-0300
Power Line Fuse: 4A 250V SB for 115V operation	1	520149
Power Line Fuse: 2A 250V SB for 230V operation	1	520148
Test Leads: Banana to Alligator Clip & BNC to Alligator Clip	1	1855-01
Instruction Manual	1	150767
Calibration Certificate	1	N/A

Accessories/Options Available

Item	Quantity	QuadTech P/N
IEEE-488 & Handler Interface	1	700171
RS-232 Cable	1	630157

Safety Precautions

CAUTION

The 1855 Capacitor Leakage Current/IR Meter can provide an output voltage of 650V DC to the device under test (DUT). Although the 1855 unit is a low voltage instrument, some devices (especially capacitors) can store charge when tested. If not discharged properly, these devices may cause serious hazards. Follow these safety instructions.

1. Operate the 1855 unit with its chassis connected to earth ground. The instrument is shipped with a three-prong power cord to provide this connection to ground. This power cord should only be plugged in to a receptacle that provides earth ground. Serious injury can result if the 1855 unit is not connected to earth ground.
2. Tightly connect BNC cable to the silver INPUT terminal. If this is not done, the DUT's casing can be charged to the high voltage test level and injury or electrical shock hazards could result if the DUT is touched.
3. Never touch the test leads, test fixture or DUT in any manner (this includes insulation on all wires and clips) when [TRIGGER] has been pressed and the output is applied.
4. Before turning on the 1855 instrument, make sure there is no device (DUT) or fixture connected to the test leads.
5. Make sure any capacitive device has been **discharged fully** before touching the test lead wires or output terminals.
6. **In the case of an emergency**, turn OFF the POWER switch using a "hot stick" and disconnect the AC power cord from the wall. Do not touch the 1855 instrument.
7. Be wary when the 1855 instrument is used in remote control mode. The voltage/current output is being turned on and off with an external signal.]
8. Do not exceed the 1A Maximum Input Current.
   Position the equipment so it is easy to disconnect. Disconnect by means of the power plug or the power connector.

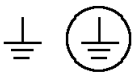
Safety Symbols

The product is marked with the following safety symbols.

 Product will be marked with this symbol (ISO#3864) when it is necessary for the user to refer to the instruction manual in order to prevent injury or equipment damage.

 Product marked with this symbol (IEC417) indicates presence of direct current.

 Product will be marked with this symbol (ISO#3864) when voltages in excess of 1000V are present.

 Indicates the grounding protect terminal, which is used to prevent electric shock from the leakage on chassis. The ground terminal must connect to earth before using the product.

Warning **P**rocedure can cause hazard to human if the warning is neglected.

Caution **A**void product misuse. It may cause damage to the product itself and the DUT if the caution is neglected.

Note Important information or tips for the procedures and applications.

Warning Signal During Testing

"DANGER – HIGH VOLTAGE TEST IN PROGRESS, UNAUTHORIZED PERSONS KEEP AWAY"

Material Contents Declaration

A regulatory requirement of The United States of America defined by specification SJ/T 11364-2006 mandates that manufacturers provide a material contents declaration of electronic products. QuadTech's materials are listed below.

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards.

1. QuadTech, Inc. is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
2. The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.

Disposal

Do not dispose of electrical appliances as unsorted municipal waste. Please use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliances for disposal free of charge.

Condensed Operating Instructions

General Information

The 1855 Capacitor Leakage Current/IR Meter is an instrument for measuring the parameters of leakage current (LC), insulation resistance (IR), withstand voltage (WV) and rise time (Tr). The 1855 instrument functions mainly as a leakage current and withstand voltage tester for aluminum foil electrolytic capacitors and high dielectric ceramic capacitors. The 1855 instrument is useful in testing any components for which leakage current is a major factor including Zener diodes, absorbers, etc. For production testing, the 1855 instrument has a Compare function and Pass/Fail indication. Connection to device under test is through BNC/Banana terminals on the front panel.

Start-Up

The 1855 Capacitor Leakage Current/IR Meter can be operated from a power source between 90-125V or 190-250V AC at a power line frequency of 50 or 60Hz. The standard 1855 unit is shipped from QuadTech with a 4A fuse in place for AC 90-125V operation. (A 2A fuse is included for AC 190-250V operation). The 1855 unit is shipped with the line voltage selector set for 115V. Refer to paragraph 1.4.3 for instructions on changing the fuse or line voltage selector.

Connect the 1855 Capacitor Leakage Current/IR Meter's AC power cord to the source of proper voltage. Operate the 1855 instrument with its chassis connected to earth ground. The 1855 instrument is shipped with a three-prong power cord to provide this connection to ground. This power cord should only be plugged into a receptacle that provides earth ground. Serious injury may result if the 1855 instrument is not connected to earth ground.

To turn the 1855 instrument ON, press the power button on the front panel. To switch the power OFF, press the button again or if measurements are to be made proceed with the Test Parameter Setup in Table COI-1. The 1855 instrument should warm up for 15 minutes prior to use.

Table COI-1: Test Parameter Setup

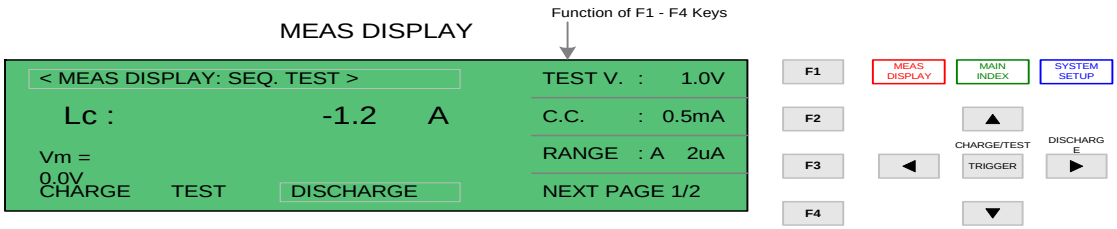
Test	LC/IR	WV/Tr	C.C Power	Forward Voltage	Surge
Parameter					
Test V	1.0V – 650V DC	N/A	1.0V – 650V DC	1.0V – 650V DC	1.0V – 650V DC
C.C.	0.5mA – 500mA	0.5mA – 150mA	0.5mA – 500mA	0.5mA – 500mA	0.5mA – 500mA
Range	2uA-20uA-200uA-2mA-20mA	N/A	N/A	N/A	N/A
CHG T	0s – 999s	N/A	N/A		0s – 999s
DWELL T	0.2s – 999s	N/A	N/A	0.2s – 999s	
Speed	Fast – Medium – Slow	N/A	N/A	Fast – Medium – Slow	Fast – Medium – Slow
Vf	N/A	1.0 – 650V DC	N/A	N/A	N/A
Tend	N/A	30s – 600s	N/A	N/A	N/A
CHG Tend	N/A	5s – 600s	N/A	N/A	N/A
Trigger	Manual, Ext	N/A	Manual, Ext	Manual, Ext	N/A
Display	N/A	N/A	Voltage		N/A
Comparison	See Compare	See Compare	N/A	On, Off	N/A
Discharge T	N/A	N/A	N/A	N/A	0s – 999s
Loop	N/A	N/A	N/A	N/A	1 - 9999

NOTE

Refer to paragraphs 2.3.3 through 2.4 for a full description of programming test parameters. Test parameters must be set before the 1855 instrument can be zeroed.

Condensed Operating Instructions (Continued)

There are three main menus within the 1855 instrument software. Familiarize yourself with these menus prior to programming a test. Figure COI-1 illustrates the MEAS DISPLAY screen and lists the functions that can be accessed by pressing the [MAIN INDEX] and [SYSTEM SETUP] keys.



MEAS DISPLAY

SEQ.
- Test Voltage
- Constant Current
- Range
- NEXT PAGE 1/2
- Charge Time
- Dwell Time
- Speed
- NEXT PAGE 2/2

STEP
- Test Voltage
- Constant Current
- Range
- NEXT PAGE 1/2
- Trigger
- Speed
- NEXT PAGE 2/2

C.C. Power (2.11 or Higher)
- Max. Voltage
- Constant Current
- Trigger
- Display

Forward Voltage (2.11 or Higher)
- Max. Voltage
- Constant Current
- Dwell
- NEXT PAGE 1/2
- Trigger
- Speed
- Comparison
- NEXT PAGE 2/2

Surge (2.11 or Higher)
- Test Voltage
- Constant Current
- Speed
- NEXT PAGE 1/2
- Charge Time
- Discharge Time
- Loop
- NEXT PAGE 2/2

MAIN INDEX

Sequence Test
- Test Voltage
- Constant Current
- Range
- Charge Time
- Dwell Time
- Speed

Step Test
- Test Voltage
- Constant Current
- Range
- Trigger
- Speed

Null

W.V. Test
- Foil Voltage
- Constant Current
- End Time
- Charge End Time

Compare

C.C. Power (2.11 or Higher)
- Max. Voltage
- Constant Current
- Trigger
- Display

Forward Voltage (2.11 or Higher)
- Max. Voltage
- Constant Current
- Dwell
- Trigger
- Speed
- Comparison

Surge (2.11 or Higher)
- Test Voltage
- Constant Current
- Speed
- Charge Time
- Discharge Time
- Loop

SYSTEM SETUP

CALIBRATION
- Need Password*

MEMORY MANAGE
- Need Paasword*

SYSTEM CONFIGURATION
- Test Parameter
- Beeper
- Sound Mode
- Alarm Mode
- Trigger Delay
- Trigger Edge
- Handler Mode
- Contrast
- GPIB Address
- RS232 Baud Rate
- Key Lock
- Line Frequency
- Charge Time
- Range Dwell
- Average
- EXT Vm Display
- Discharge Voltage (2.11 or Higher)
- Digits (2.11 or Higher)

* Qualified Service Personnel Only
Instrument Calibration & Verification

Figure COI-1: 1855 Instrument Menus

NOTE:

The function keys [F1 – F4] are used to select the parameter to change and in some menus to change the value of that selected parameter.

The function of UP/DOWN depends on the menu. In some menus, the LEFT/RIGHT keys are used to select a digit by moving the underscored cursor left or right.

1. Set Test Parameters

- Press [POWER] ON.
- Allow the instrument to warm up for 15 minutes.
- Press [MEAS DISPLAY]
- Set test parameters (voltage, current, range, etc.) using the function & arrow keys.

2. Null

After setting your test parameters, use the Null function of the 1855 instrument to zero the test leads. With no device connected, connect the appropriate cable to the front panel BNC/Banana connectors. Refer to paragraph 2.6 for cable connections.

With the instrument in MEAS DISPLAY status:

1. Press [MAIN INDEX]
2. Press [F3] = NULL
3. Press [TRIGGER] button.
4. Wait while instrument cycles through NULL test.
5. Press [MAIN INDEX] to return to MEAS DISPLAY status.
6. Choose Test: [SEQ Test], [STEP Test] or [Next Page] to select [WV Test]

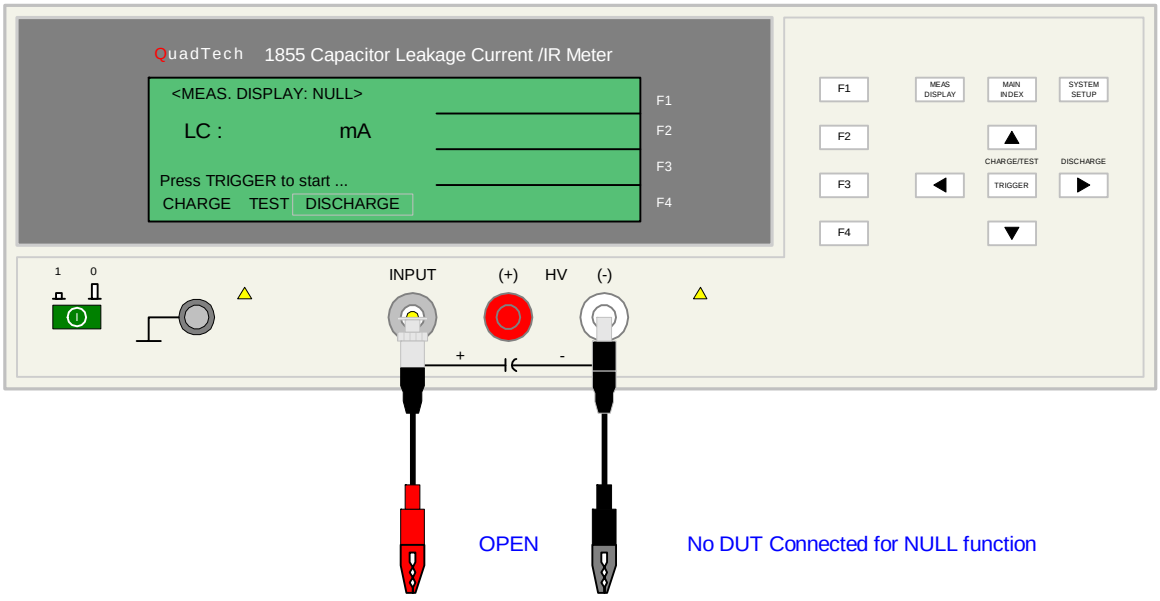
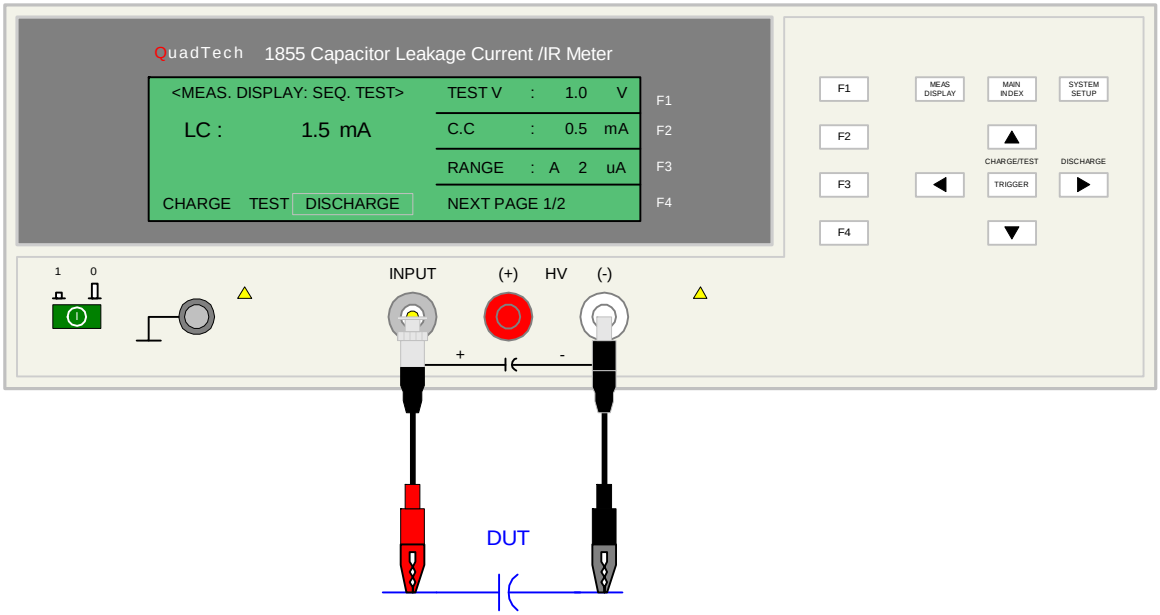


Figure COI-2: NULL OPEN Configuration

3. Connection to Device under Test (DUT)

Figure COI-3 illustrates the connection of the 1855 instrument to a DUT using the 1855-01 Lead Set. For Leakage Current, Insulation Resistance and Withstand Voltage Tests, the red alligator clip/BNC cable is connected between the silver INPUT terminal on the 1855 unit and the high side of the device under test. The black alligator clip/banana cable is connected between the white HV (-) terminal on the 1855 unit and the low side of the DUT.



COI-3: Connection to DUT for LC Test

4. Make a Measurement

1. Press [MEAS DISPLAY]
2. Connect device under test (DUT) to test leads.
3. Press [TRIGGER].
4. Record measurement.

NOTE

Please read this instruction manual in its entirety before operating this instrument. These condensed operating instructions are not a substitute for all the information provided in the remainder of this manual.

Section 1: Introduction

1.1 Unpacking and Inspection

Inspect the shipping carton before opening. If damaged, contact the carrier agent immediately. Inspect the 1855 Capacitor Leakage Current/IR Meter for any damage. If the instrument appears damaged or fails to meet specifications notify QuadTech (refer to instruction manual front cover) or its local representative. Retain the original shipping carton and packing material for future use such as returning the instrument for recalibration or service.

1.2 Product Overview

The 1855 Capacitor Leakage Current/IR Meter is a compact yet powerful LC Tester and IR meter for production or laboratory testing of aluminum electrolytic capacitors, resistors and other passive components. The 1855 instrument measures 4 parameters: Leakage Current (LC), Insulation Resistance (IR), Rise Time (Tr) and Withstand Voltage (Vf) and displays two simultaneously. Basic accuracy is ±0.3%. From 1-8 measurements can be made, averaged and the result displayed with the Averaging function. Ranging is automatic or user selectable. Measurement rate is also selectable (Slow, Medium or Fast) with rates up to 18 measurements per second. Measurements can be made continuously or triggered with a programmable delay time up to 10 seconds. The 1855 comes standard with an RS-232 interface. An optional IEEE-488 and Handler interface is also available. Voltage across the DUT can be monitored and displayed. Zero the effects of stray leakage in the test leads with the Null function. The Compare function on the 1855 instrument has programmable upper and lower limits and displays Pass/Fail in addition to the measurement value. Connection to the device under test is through 1 BNC INPUT terminal and 2 Banana HV terminals on the front panel.

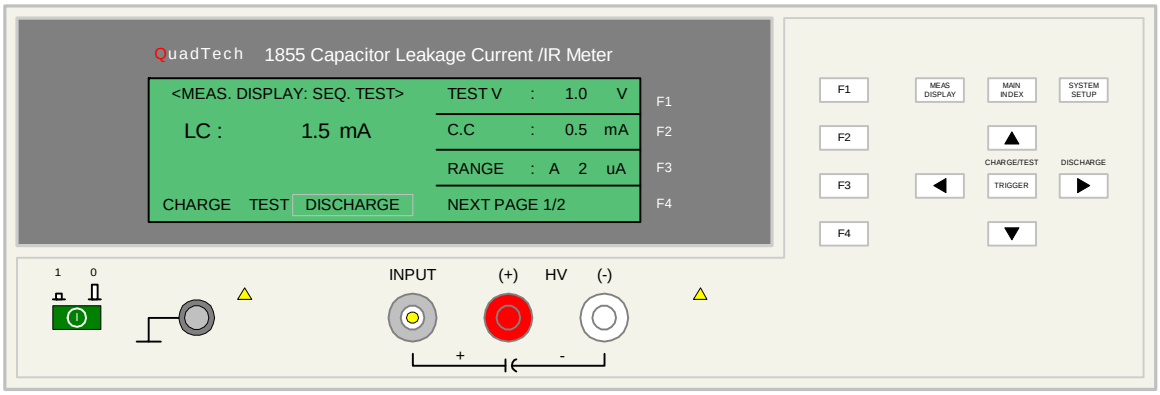


Figure 1-1: 1855 Capacitor Leakage Current/IR Meter

1.3 Controls and Indicators

1.3.1 Front Panel Controls and Indicators

Figure 1-2 illustrates the controls and indicators on the front panel of the 1855 Capacitor Leakage Current/IR Meter instrument. Table 1-1 identifies them with description and function.

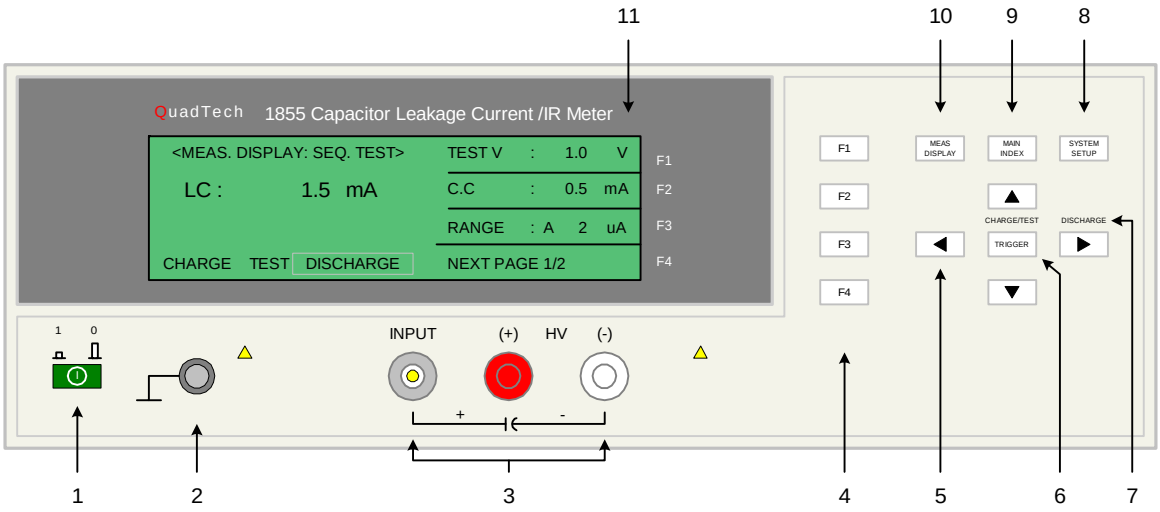


Figure 1-2: 1855 Front Panel Controls & Indicators

Table 1-1: 1855 Front Panel Controls & Indicators

Reference # Figure 1-2	Name	Type	Function
1		Green Push Button	Apply AC POWER: 1=ON, 0=OFF
2		Silver Banana Jack	Chassis ground connection
3a	INPUT	Silver BNC terminal	Current Drive Terminal, High (+)
3b	HV (+)	Red Banana Jack	Voltage Sense Terminal, High (+)
3c	HV (-)	White Banana Jack	Voltage Sense Terminal, Low (-)
4	F1, F2, F3 and F4	4 gray push buttons	Select Instrument Functions Keys perform different functions under different menus. Right side of display shows corresponding key function.
5	◄, ▼, ►, ▲	4 gray push buttons	Move backlit box around display to choose parameter Change parameter value (increase/decrease)
6	TRIGGER	Gray push button	Initiate measurement
7	DISCHARGE		STOP measurement in progress & initiate discharge time
8	SYSTEM SETUP	Gray push button	View, Select or Change System Parameters: Parameter, Beeper, Sound, Alarm, Trigger, Handler, Contrast, GPIB, RS-232, Key Lock, Line Frequency, Charge, Dwell, Average, EXT Vm Display, Discharge Voltage and Digits
9	MAIN INDEX	Gray push button	View, Select or Change Setup & Result Parameters: Sequence, Step, Null, WV Test, Compare, C.C. Power, Forward Voltage, and Surge.
10	MEAS DISPLAY	Gray push button	View, Select or Change Measurement Parameters: Voltage, Current, Range, Charge, Dwell, Speed & Trigger
11		240 x 64 LCD display	Show measurement results as value or pass/fail. Show programming instructions

1.3.2 Rear Panel Controls and Connectors

Figure 1-3 illustrates the controls and connectors on the rear panel of the 1855 Capacitor Leakage Current/IR Meter instrument. Table 1-2 identifies them with description and function.

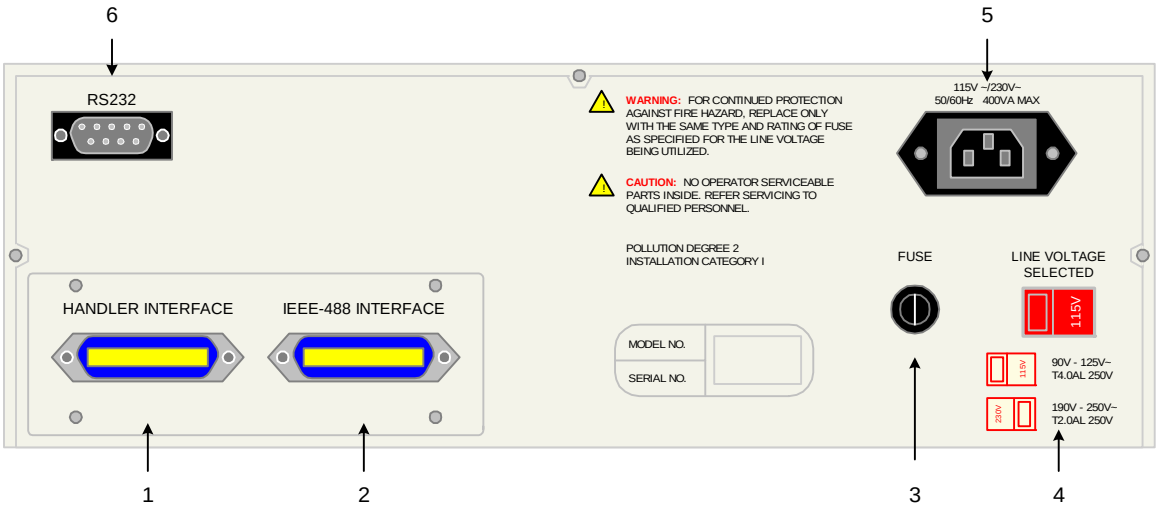


Figure 1-3: Rear Panel 1855 Instrument

Table 1-2: 1855 Rear Panel Controls & Connectors

Reference # Figure 1-3	Name	Type	Function
1	HANDLER INTERFACE	Blue 24-pin connector	Handler Interface connector for remote operation
2	IEEE-488 INTERFACE	Blue 24-pin connector	IEEE-488 Interface connector for data transfer
3	FUSE	Black screw cap fuse holder	Short circuit protection T 4A 250V fuse for 115V operation T 2A 250V fuse for 230V operation
4	LINE VOLTAGE SELECTED	2 Red 2-position Slide Switches	Select Voltage Level corresponding to AC Source 90V – 125V: T4.0A 250V fuse 190V – 250V: T 2A 250V fuse
5	AC Line Input	Black 3-wire inlet module	Connection to AC power source
6	RS-232 INTERFACE	Black 9-pin	RS-232 interface for serial communication

1.4 Installation

1.4.1 Dimensions

The 1855 Capacitor Leakage Current/IR Meter unit is supplied in a bench configuration, i.e., in a cabinet with resilient feet for placement on a table. Flip feet are attached under the front feet so that the 1855 instrument can be tilted up for convenient operator viewing.

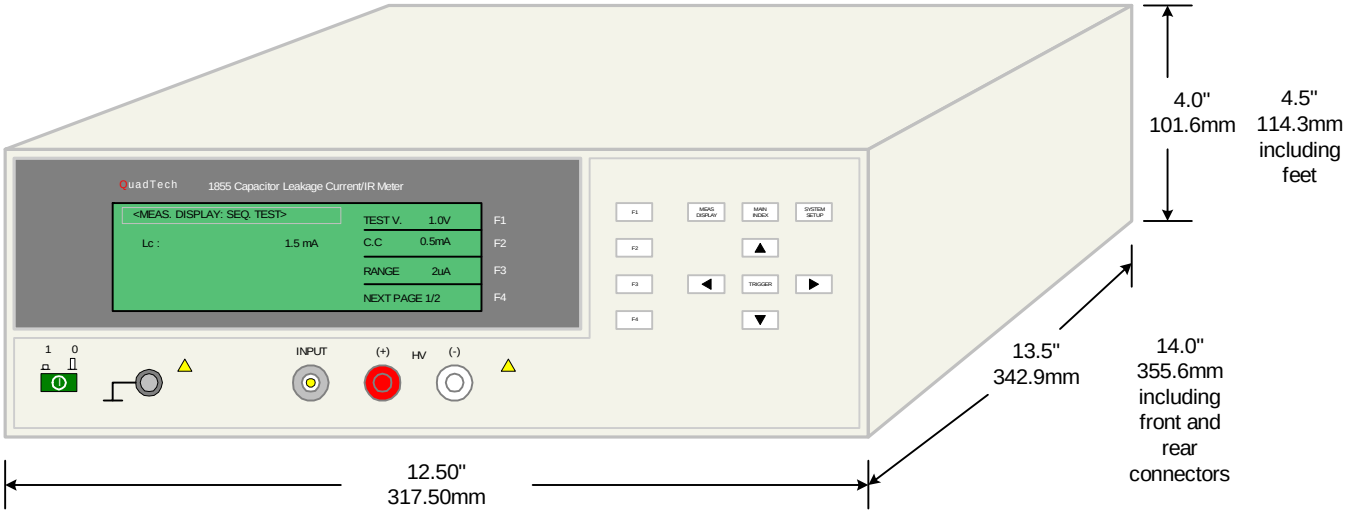


Figure 1-4: 1855 Instrument Dimensions

1.4.2 Instrument Positioning

The 1855 instrument contains one (1) graphic display for direct readout of measured parameters. The optimum angle for viewing is slightly down and about 10 degrees either side of center. For bench operation the front flip feet should always be used to angle the instrument up. In bench or rack mount applications the instrument should be positioned with consideration for ample air flow around the rear panel fan ventilation hole. An open space of at least 3 inches (75mm) is recommended behind the rear panel. Testing should be performed on a non-conductive surface. An ESD mat is not a recommended test platform.

1.4.3 Power Requirements

The 1855 can be operated from a power source of 90 to 125V AC or 190 to 250V AC. Power connection is via the rear panel through a standard receptacle. Before connecting the 3-wire power cord between the unit and AC power source, make sure the voltage selection switches on the rear panel (Figure 1-5) are in accordance with the power source being used. For a 90-125V source, use a 4A 250V fuse. For a 190-250V source, use a 2A 250V fuse. Always use an outlet that has a properly connected protection ground.

CAUTION

Make sure the unit has been disconnected from its AC power source for at least five minutes before proceeding.

Procedure for Changing an 1855 Instrument Fuse

Unscrew the fuse cap on the rear panel of the 1855 and pull fuse holder outward.

Once the fuse holder has been removed from the instrument snap the fuse from the holder and replace. Make sure the new fuse is of the proper rating.

Install the fuse back into the cap holder by pushing in until it locks securely in place.

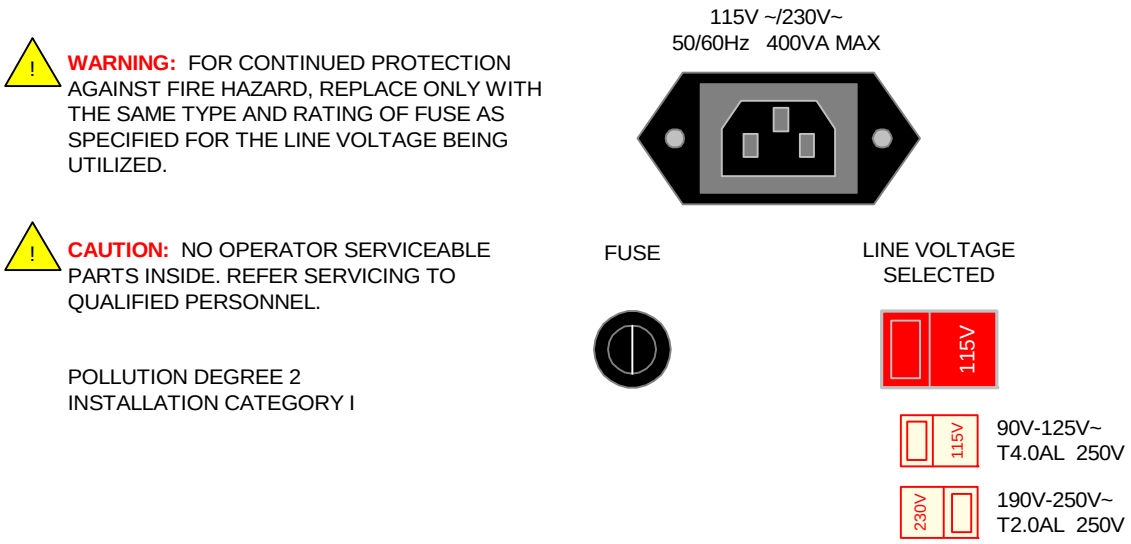


Figure 1-5: Close-Up of 1855 Rear Panel

1.4.4 Safety Inspection

Before operating the instrument inspect the fuse holder on the rear of the 1855 instrument to ensure that the properly rated fuse is in place, otherwise damage to the unit is possible. Make sure that the voltage selector switches are set in accordance with the power source in use. Refer to paragraph 1.4.3 and Figure 1-5.

The 1855 instrument is shipped with a standard U.S. power cord, QuadTech P/N 4200-0300 (with Belden SPH-386 socket or equivalent, and a 3-wire plug conforming to IEC 320). Make sure the instrument is only used with these cables (or other approved international cord set) to ensure that the instrument is provided with connection to protective earth ground.

The surrounding environment should be free from excessive dust to prevent contamination of electronic circuits. The surrounding environment should also be free from excessive vibration. Do not expose the 1855 instrument to direct sunlight, extreme temperature or humidity variations, or corrosive chemicals.

Section 2: Operation

2.1 Terms and Conventions

Table 2-1: Measurement Unit Prefixes

Multiple	Scientific	Engineering	Symbol
1000000000000000	10^{15}	Peta	P
1000000000000	10^{12}	Tera	T
1000000000	10^{9}	Giga	G
1000000	10^{6}	Mega	M
1000	10^{3}	Kilo	k
.001	10^{-3}	milli	m
.000001	10^{-6}	micro	μ
.000000001	10^{-9}	nano	n
.000000000001	10^{-12}	pico	p
.000000000000001	10^{-15}	femto	f

Capacitor: Abbreviated C. A capacitor is passive component comprised of two conductors separated by a dielectric. A capacitor stores charge blocks DC flow and allows AC flow based on frequency and capacitor design.

Capacitance: The measure of the ratio of charge on either plate of a capacitor to the potential difference (voltage) across the plates. Unit of measure is the Farad (F).

Compare: Procedure for sorting components by comparing the measured value against a known standard.

DC: Direct Current. Non-reversing polarity. The movement of charge is in one direction. Used to describe both current and voltage. Batteries supply direct current (DC).

Dielectric: A material which is an electrical insulator or in which an electric field can be sustained with a minimum dissipation of power.

Dielectric Absorption: The physical phenomenon of insulation appearing to absorb and retain an electrical charge slowly over time. Apply a voltage to a capacitor for an extended period of time and then quickly discharge it to zero voltage. Leave the capacitor open circuited for a period of time then connect a voltmeter and measure the residual voltage. The residual voltage is caused by the dielectric absorption of the capacitor.

Dielectric Constant: Abbreviated K, relative dielectric constant. The dielectric constant of a material is the ratio of the capacitance of a capacitor filled with a given dielectric to that same capacitor having only a vacuum as a dielectric.

Discharge: The act of draining off an electrical charge to ground. Devices that retain charge should be discharged after an IR test or DC hipot test.

DUT: Device Under Test. (i.e. the product being tested).

Ground: The base reference from which voltages are measured, nominally the same potential as the earth. Ground is also the side of a circuit that is at the same potential as the base reference.

Insulation Resistance: Measures the total resistance between any two points separated by electrical insulation. The IR test determines how effective the dielectric (insulation) is in resisting the flow of electrical current.

Interface:

- Handler: Device for remote control of test instrument in component handling operations.
- IEEE-488: General Purpose Interface Bus (GPIB). GPIB is an industry standard definition of a Parallel bus connection for the purpose of communicating data between devices.
- RS232: An industry standard definition for a Serial line communication link or port.

Range: The resistance ranges the instrument uses for reference in making the measurement.

Speed: The rate at which the instrument makes a measurement in measurements per second. Speed is inversely proportional to accuracy.

Trigger: The device for initiating the test (applying the voltage or current).

- External: The test is initiated via an external source such as a computer with an IEEE-488 or Handler interface. One measurement is made each time the external trigger is asserted on the handler.
- Internal: The instrument continuously makes measurements.
- Manual: The operator initiates the test by pressing the [START] button. One measurement is made each time the trigger is pressed.

Withstand Voltage: Voltage at which the product's insulation begins to break down. There are many definitions for Withstand Voltage. This manual uses the terminology from the EIAJ RC-2364A standard, "Test Methods of Electrode Foils for Aluminum Electrolytic Capacitors".

Term	Symbol	Definition
Formation Voltage	Vfe	The final applied voltage
Standard Dielectric Withstand Voltage	Vf	The withstand voltage of formed foil
Rise Time	Tr	The time between when the current is applied and the voltage reaches 90% of the rated withstand voltage, Vf.
Withstand Voltage	Vt	Tr + 3minutes ±10seconds (formed foils) Tr + 1minute ±10seconds (unformed foils)
Rated Voltage	WV	Rated working voltage of a capacitor

2.2 Startup

Check to make sure the red Line Voltage Selector switch on the rear panel agrees with the power source available. Depending on the power source the switch position should be in the up or down position as shown in Figure 1-5 (Close-Up of 1855 Rear Panel).

CAUTION
USE ALL PRECAUTIONS NECESSARY TO AVOID TOUCHING THE DEVICE UNDER TEST WHEN THE TRIGGER BUTTON HAS BEEN PRESSED.

Connect the instrument power cord to the source of proper voltage. **The instrument is to be used only with three-wire grounded outlets.**

Power is applied to the 1855 instrument by pressing the green power switch on the front panel to the ON (1 position). The 1855 unit should warm up for a period of at least 15 minutes prior to measurements being made.

2.3 SYSTEM SETUP

System Setup contains the 1855 instrument setup functions: Calibration, Memory Manage and System Configuration. Press [SYSTEM SETUP] to access these functions.

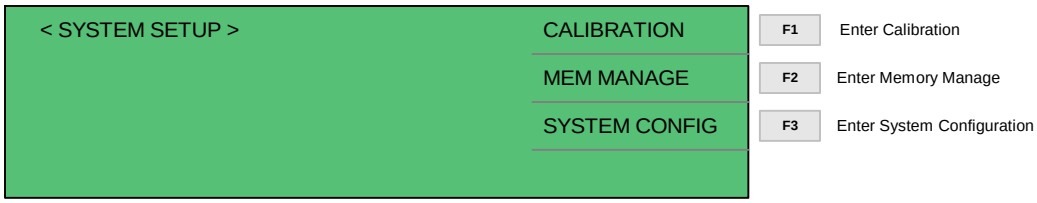


Figure: 2-1: System Setup

2.3.1 Calibration

The Calibration menu is to be accessed by Qualified Service Personnel Only. Altering the 1855 instrument calibration will void the instrument warranty. The Calibration function is used to verify the resistance measurement ranges. To access the calibration function, press [SYSTEM SETUP] then press [F1] = [CALIBRATION]. Enter the password. [▲] [▼] [◄] [►] [TRIGGER]. Select cal range 20V or 200V. Refer to paragraph 4.3 Calibration for procedure.

2.3.2 Memory Manage

The Memory Manage menu is to be accessed by Qualified Service Personnel Only. Altering the 1855 instrument memory will void the instrument warranty. The memory manage function is used to verify the setup of the 1855 unit with a Function Test and a Handler Test. To access the memory manage function, press [SYSTEM SETUP] then press [F2] = [MEM MANAGE]. Enter the password. [▲] [▼] [◄] [►] [TRIGGER].

2.3.3 System Configuration

Prior to programming a test or measuring a device, set up the system controls of the 1855 instrument. To access the system controls, press [SYSTEM SETUP] then press [F3] = [SYSTEM CONFIG]. Table 2-2 lists the contents of SYSTEM CONFIG.

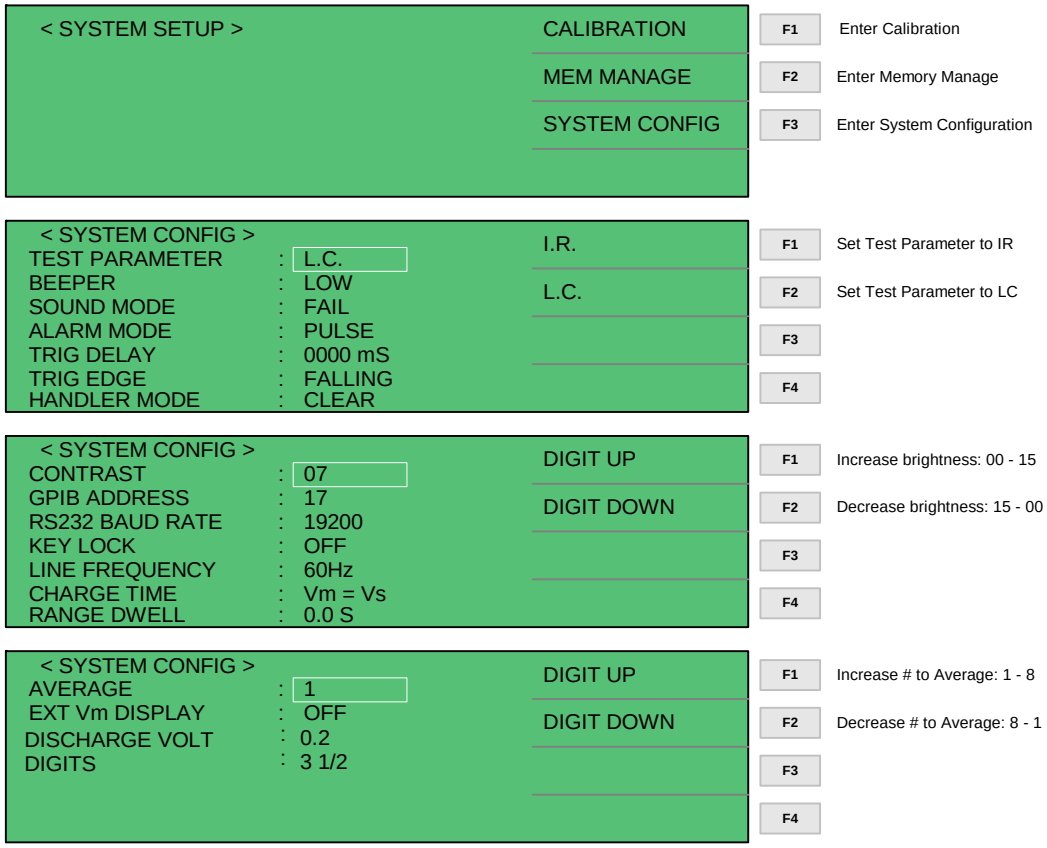


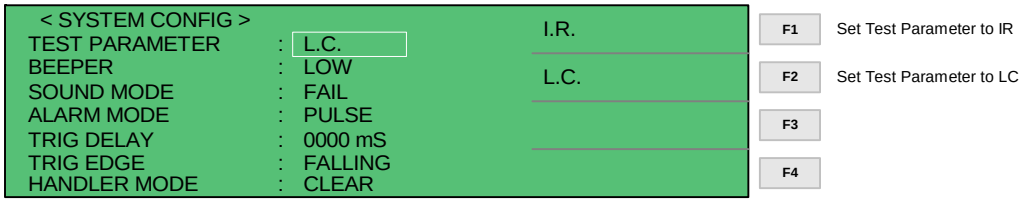
Figure 2-2: System Configuration

Table 2-2: SYSTEM CONFIG

Parameter	Function	Range
Test Parameter	Set the parameter to be tested	LC, IR
Beeper	Set beeper loudness	OFF, LOW or HIGH
Sound Mode	Set when the buzzer to sounds	PASS/FAIL
Alarm Mode	Set type of alarm signal	PULSE/CONTINUOUS
Trigger Delay	Set external trigger time	0000 – 9999 ms
Trigger Edge	Set trigger mode	FALLING/RISING
Handler Mode	Set handler interface mode	CLEAR/HOLD
Contrast	Set display contrast	00 – 15
GPIB Address Code	Set interface address	00 – 30
RS-232 Baud Rate	Set baud rate	600, 1200, 4800, 9600, 19200, 28800
Key Lock	Lock out front panel programming	OFF/ON
Line Frequency	Set line input frequency	50Hz/60Hz/NA50, NA60
Charge Time	Set time for unit to charge DUT	0 – 999seconds
Range Dwell	Set time for unit to stabilize at test level	0.2 – 9.9seconds
Average Time	Set measurement average	1 – 8
EXT VM Display	Display output voltage	OFF/ON
Discharge Voltage	Voltage for Discharge to complete	0.2 – 1.0 volts
Digits	Number of Digits for Measurement	3 ½ , 4 ½

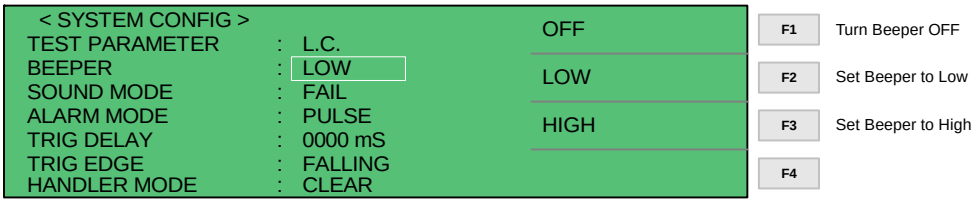
2.3.3.1 Test Parameter

The 1855 Capacitor Leakage Current/IR Meter can function as a Leakage Current tester or as an Insulation Resistance meter. The instrument default setting is L.C. To change the function of the 1855 Capacitor Leakage Current/IR Meter press [SYSTEM SETUP] then [SYSTEM CONFIG] The box next to TEST PARAMETER is highlighted. Press [F1] = I.R. to select an Insulation Resistance test or press [F2] = L.C. to select the Leakage Current test.



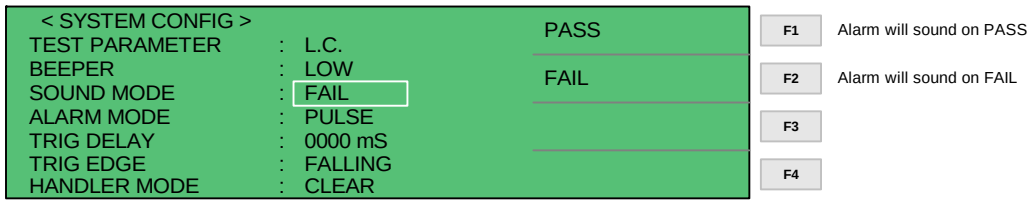
2.3.3.2 Beeper

The volume of the beeper or audible alarm can be set to OFF, LOW or HIGH. The instrument default setting is LOW. To change the beeper loudness press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to BEEPER is highlighted, then press [F1] = OFF, [F2] = LOW or [F3] = HIGH.



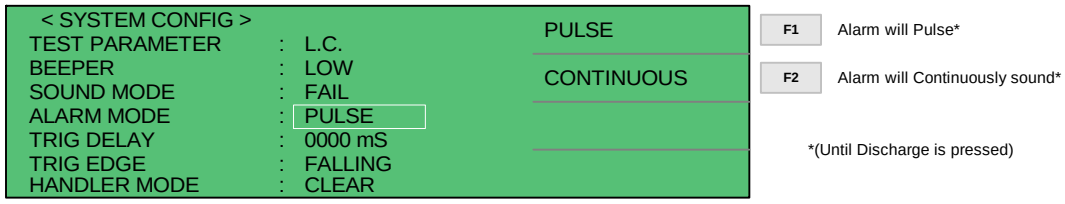
2.3.3.3 Sound Mode

The audible alarm can be set to sound on PASS or to sound on FAIL under high or low limit judgment in the measure display. The instrument default setting is FAIL. To change the sound mode press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to SOUND MODE is highlighted, then press [F1] = PASS for the alarm to sound on a pass result or [F2] = FAIL for the alarm to sound on a fail result.



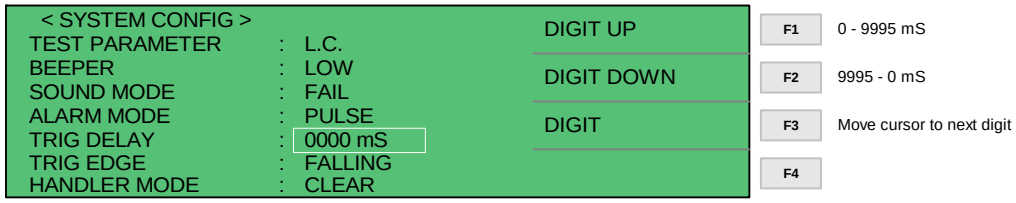
2.3.3.4 Alarm Mode

The type of audible alarm can be set to PULSE or CONTINUOUS during judgment in the measure display. The instrument default setting is PULSE. To change the alarm mode press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to ALARM MODE is highlighted, then press [F1] = PULSE for the alarm to sound in a pulse tone or [F2] = CONTINUOUS for the alarm to sound continuously.



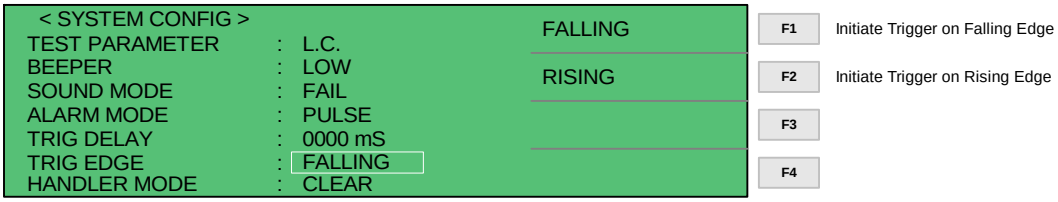
2.3.3.5 Trigger Delay

The trigger delay is the amount of time between the activation of a trigger (via IEEE, Handler or front panel) and the 1855 making the measurement. The delay time can be programmed from 0000 to 9995 seconds. The instrument default value is 0000 seconds. To change the TRIGGER DELAY press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to TRIGGER DELAY is highlighted, then press [F1] = DIGIT UP to increase the delay time, [F2] = DIGIT DOWN to decrease the delay time or [F3] = DIGIT to move over a decimal place.



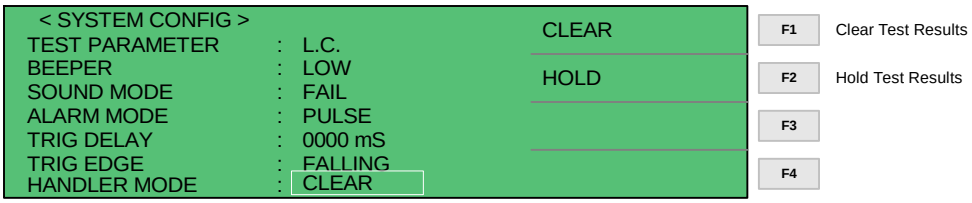
2.3.3.6 Trigger Edge

Select on which edge the measurement is triggered: FALLING or RISING. The instrument default setting is FALLING. To change the TRIGGER EDGE press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to TRIGGER EDGE is highlighted, then press [F1] = FALLING or [F2] = RISING.



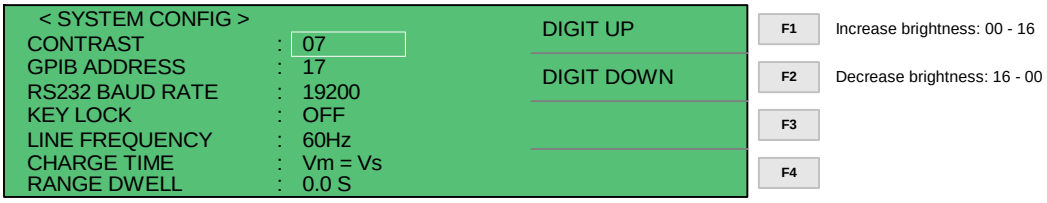
2.3.3.7 Handler Mode

The handler interface mode can be set to CLEAR or HOLD. The instrument default setting is CLEAR. When set to CLEAR, the handler interface will clear the last test result prior to each subsequent measurement. When set to HOLD, the handler interface will hold the last test result until the next measurement is made and displayed. To change the handler mode press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to HANDLER MODE is highlighted, then press [F1] = CLEAR or [F2] = HOLD.



2.3.3.8 Contrast

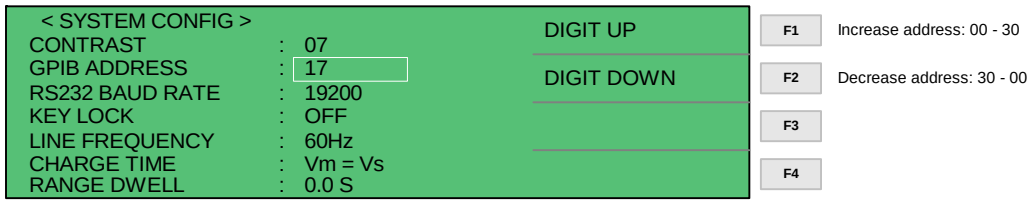
The display contrast can be set from 00 to 15. The instrument default setting is 07. The darkest contrast is 00 the brightest is 15. To change the display contrast press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to CONTRAST is highlighted, then press [F1] = DIGIT UP to brighten the contrast or [F2] = DIGIT DOWN to darken the contrast.



2.3.3.9 GPIB Address Code

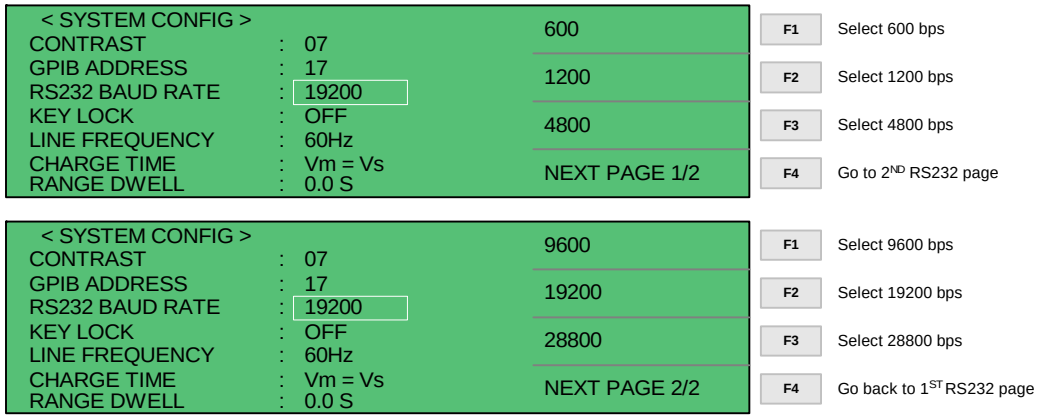
The IEEE-488 interface address can be programmed from 00 to 30. The instrument default setting is 17. To change the GPIB ADDRESS press [SYSTEM SETUP], [SYSTEM CONFIG]

and the down arrow [⇓] until the box next to GPIB ADDRESS is highlighted, then press [F1] = DIGIT UP to increase the address, or [F2] = DIGIT DOWN to decrease the address.



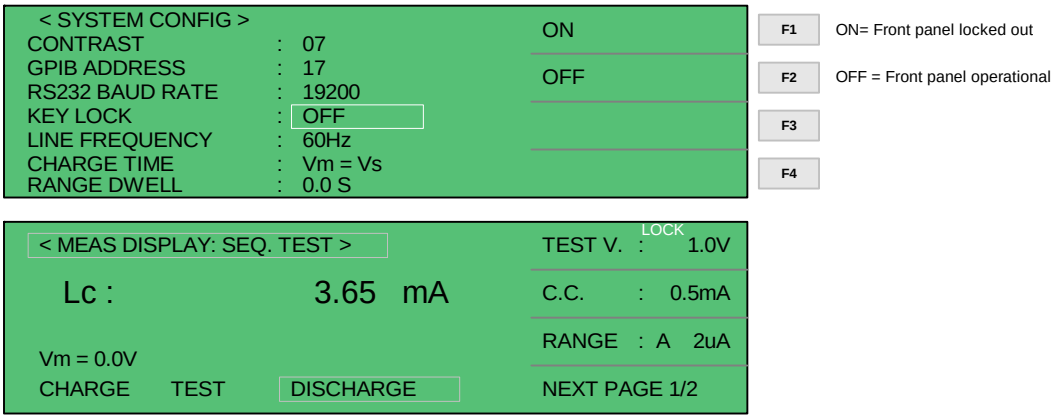
2.3.3.10 RS-232 Baud Rate

The baud rate of the RS-232 interface can be programmed from 600 to 28800 bps. The instrument default setting is 9600bps. To change the RS-232 BAUD RATE press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to RS-232 BAUD RATE is highlighted, then press [F1] = 600, [F2] = [1200], [F3] = 4800, [F4] = NEXT to go to the next page and select [F1] = 9600, [F2] = 19200, [F3] = 28800 or [F4] = NEXT to return to first RS232 baud rate selection page.



2.3.3.11 Key Lock

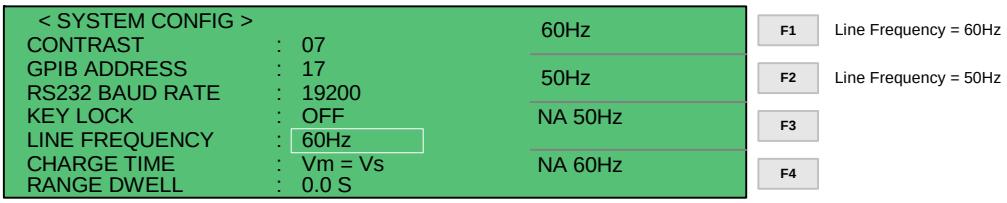
To lock out the front panel operations with the exception of the [TRIGGER] key, set the key lock function to ON. Press [SYSTEM SETUP], [SYSTEM CONFIG], [⇓] until OFF is highlighted next to KEY LOCK, then press [F1] = ON. The backlit LOCK block will appear in the top right hand corner of the measure display. To turn the key lock function OFF: press [F1], [F4] and then [SYSTEM SETUP]. Key lock can be set ON or OFF. The instrument default setting is OFF.



NOTE: Key Lock is disabled when the 1855 instrument is shut down.

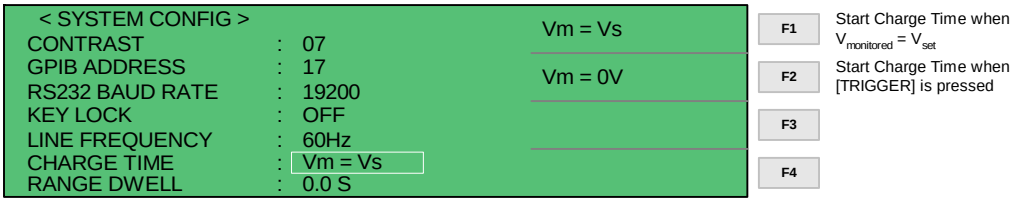
2.3.3.12 Line Frequency

In accordance with the AC power source, the frequency of the line voltage can be set to 50Hz, 60Hz, NA50 and NA60. The instrument default setting is 60Hz. NA has 3ms AD integration time. To change the line frequency press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to LINE FREQUENCY is highlighted, then press [F1] = 50Hz or [F2] = 60Hz.



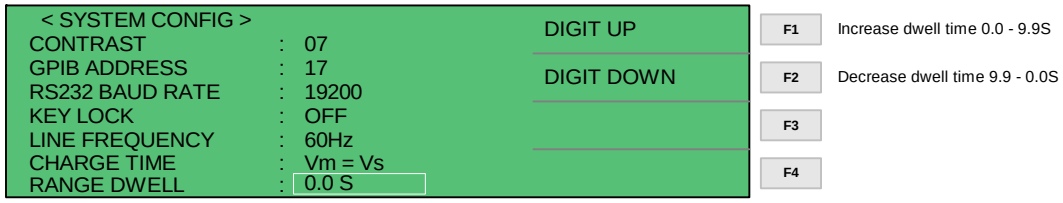
2.3.3.13 Charge Time

Charge Time is defined as when the 1855 instrument will start charging the device under test. Select Vm = Vs to have the 1855 instrument start charging when monitored voltage reaches the set (programmed) voltage. Select Vm = 0V to have the instrument start charging the device when the [TRIGGER] button is pressed. The instrument default value is Vm = Vs. To change the CHARGE TIME press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to CHARGE TIME is highlighted, then press [F1] = Vm=Vs or [F2] = Vm=0V.



2.3.3.14 Range Dwell

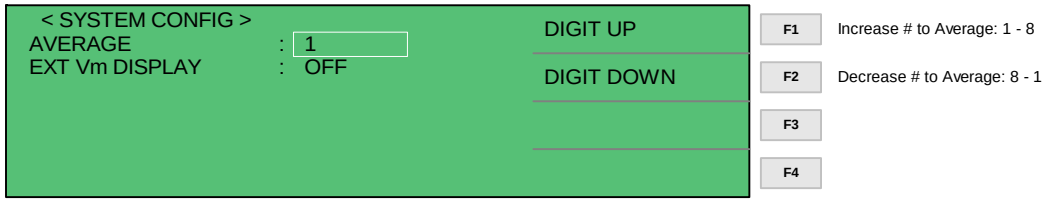
The range dwell is the amount of time the instrument holds at the programmed test voltage before the 1855 makes the measurement. The range dwell is in addition to, and occurs after, the charge time. The range dwell can be programmed from 0 to 9.9 seconds. The instrument default value is 0 seconds. To change the RANGE DWELL press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to RANGE DWELL is highlighted, then press [F1] = DIGIT UP to increase the delay time, [F2] = DIGIT DOWN to decrease the delay time or [F3] = DIGIT to move over a decimal place.



Note: Refer to paragraph 2.5.5 to program Dwell Time in a Sequence Test.

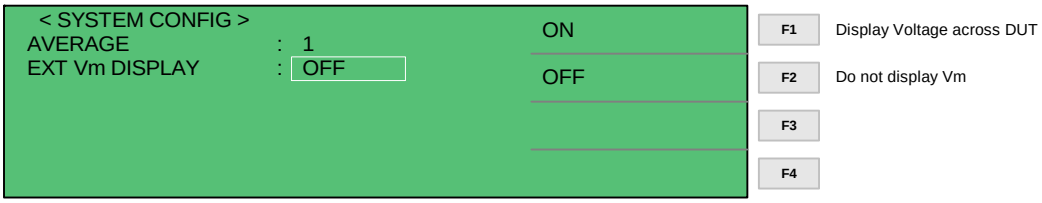
2.3.3.15 Average

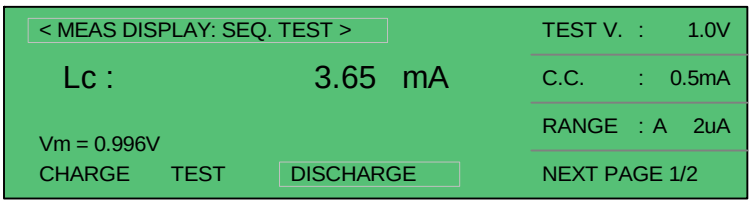
The 1855 instrument can make many measurements then display the average based on what average number was selected. The range is 1 – 8 and the instrument default setting is 1. To change the number to average press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to AVERAGE is highlighted, then press [F1] = DIGIT UP to increase then number of measurements to take before displaying the average or [F2] = DIGIT DOWN to decrease the number.



2.3.3.16 EXT VM Display

The voltage across the DUT can be displayed along with the measured value when EXT Vm DISPLAY is set to ON. EXT Vm DISPLAY can be selected OFF/ON. The instrument default setting is OFF. To change the EXT Vm Display press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to EXT Vm DISPLAY is highlighted, then press [F1] = ON to display the voltage across the DUT, or [F2] = OFF.



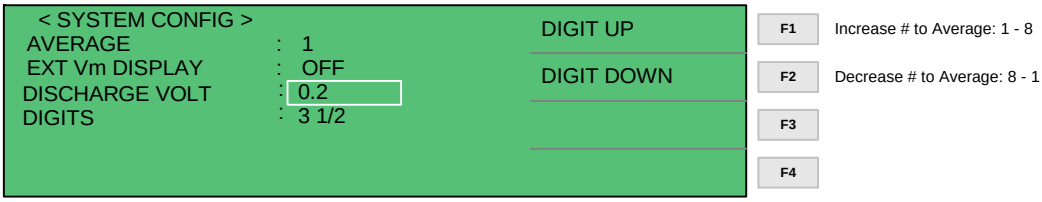


When selected ON, the measured voltage (Vm) will be displayed in the bottom left-hand corner of the display.

Note:
For Faster test speed during production testing, EXT Vm should be set to OFF.

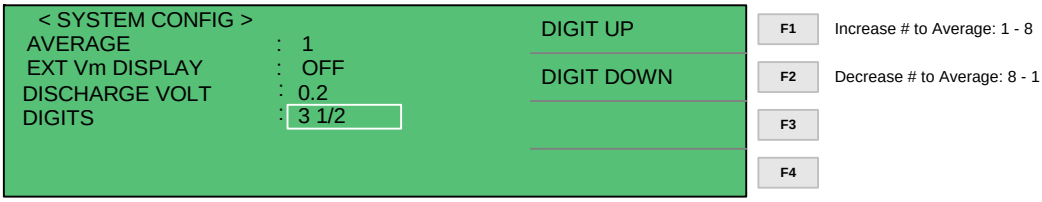
2.3.3.17 Discharge Voltage (Firmware 2.11 or Higher)

The 1855 instrument complete discharge when the set voltage is reached. This is used for Surge Test. The range is 0.2 – 1.0 and the instrument default setting is 0.2. To change the number to average press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to Discharge Volt is highlighted, then press [F1] = DIGIT UP to increase then voltage or [F2] = DIGIT DOWN to decrease the voltage.



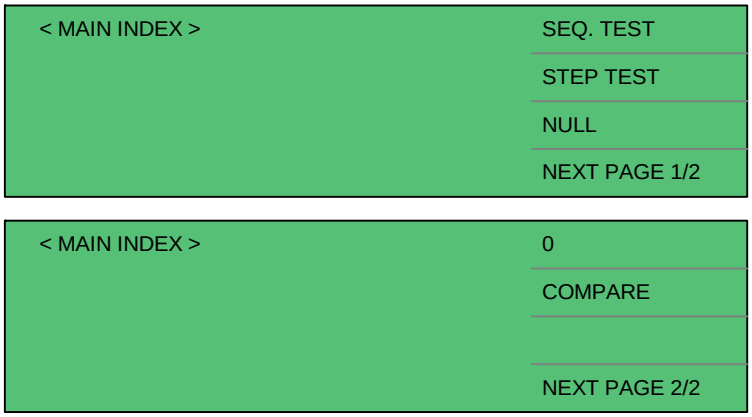
2.3.3.18 Digits (Firmware 2.11 or Higher)

The 1855 instrument can display the measured value with either 3 ½ or 4 ½ digits of resolution. The selections are 3 ½ or 4 ½ and the instrument default setting is 3 1/2 . To change the number of Digits press [SYSTEM SETUP], [SYSTEM CONFIG] and the down arrow [⇓] until the box next to Digits is highlighted, then press [F1] = 3 1/2 digits or [F2] = 4 ½ digits.

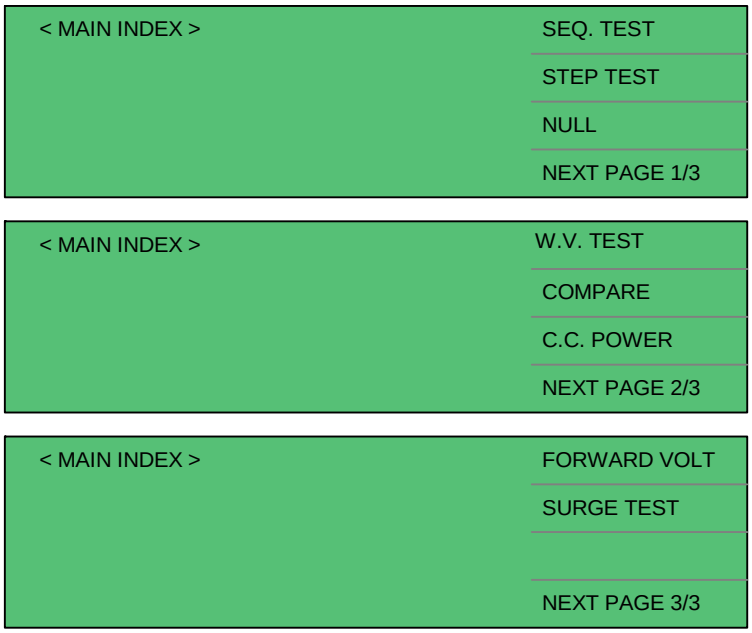


2.4 MAIN INDEX

Within the 1855 instrument's MAIN INDEX are the Sequence Test, Step Test, Null, Withstand Voltage Test and Compare functions. To access these functions, press [MAIN INDEX] and the display should look as shown in Figure 2-3.



Firmware < 2.11



Firmware 2.11 or higher

Figure 2-3: MAIN INDEX

2.4.1 Sequence Test

The Sequence Test automatically cycles through the test when [TRIGGER] is pressed. To access the Sequence Test, press [MAIN INDEX] and [F1] = SEQ. TEST. The MEAS DISPLAY menu will appear. Program the Test Voltage, Constant Current, Range, Charge Time, Dwell Time and Speed. Refer to paragraphs 2.5.1 through 2.5.6 for programming details.

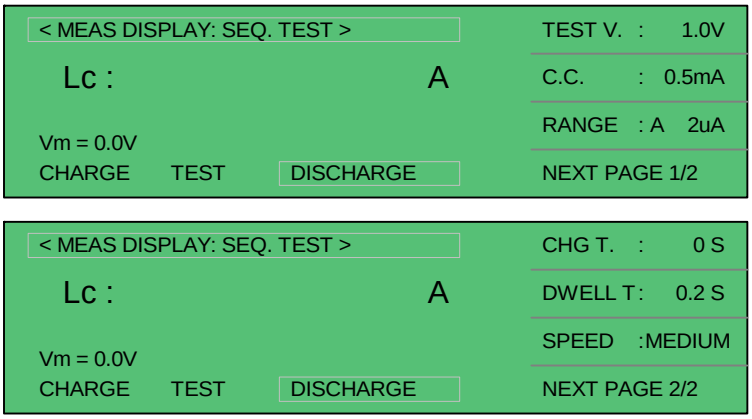


Figure 2-4: Sequence Test Parameters

2.4.2 Step Test

The Step Test manually cycles through the test when [TRIGGER] is pressed. To access the Step Test, press [MAIN INDEX] and [F2] = STEP TEST. The MEAS DISPLAY menu will appear. Program the Test Voltage, Constant Current, Range, Trigger and Speed. Refer to paragraphs 2.5.1 through 2.5.7 for programming details.

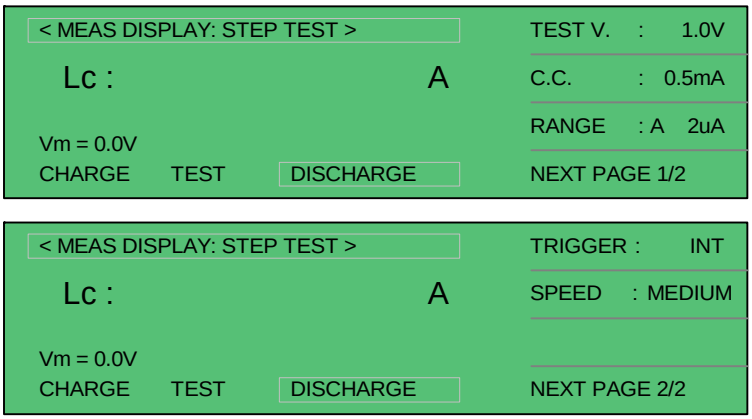


Figure 2-5: Step Test Parameters

2.4.3 Null

During the 1855 instrument Null process a correction is made (subtracted out) as the result of lead leakage current and stored in instrument memory to be applied to ongoing measurements. For maximum measurement accuracy it is recommended that the NULL function be performed on the 1855 instrument after power up, any time the test parameters are changed and any time the test leads or fixture is changed.

Using the output voltage set in the SEQ or STEP test, the Null function measures the leakage current of each range (20mA – 2mA – 200uA – 20uA – 2uA) under open circuit conditions. After setting test parameters in the SEQ or STEP tests, connect the test leads to the 1855 output

connectors. Do not connect the device under test. Press [MAIN INDEX] and [F3] = NULL TEST. There are no settings for NULL TEST. Press [TRIGGER] and the 1855 instrument will complete the null function.

Connection of test leads for Null function:

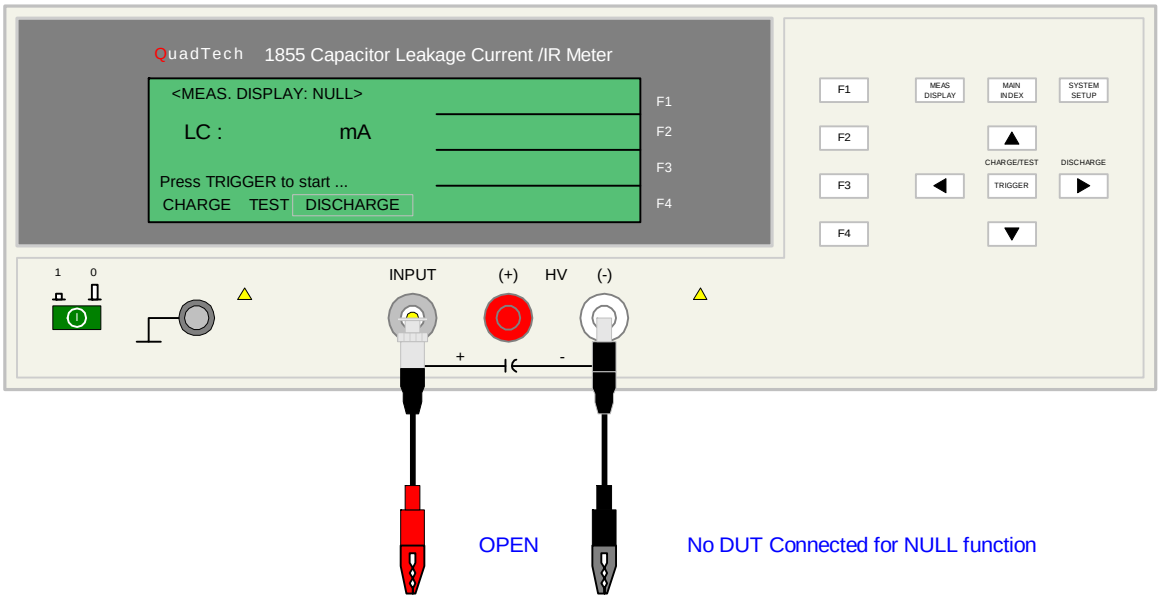
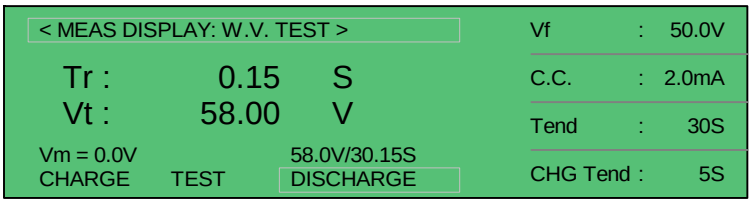


Figure 2-6: Null Connection

2.4.4 Withstand Voltage Test

To access the Withstand Voltage Test, press [MAIN INDEX] and [F4] = NEXT PAGE 1/2 and then press [F1] = W.V. TEST. The MEAS DISPLAY menu will appear. Program the Test Voltage, Constant Current, Measurement Time and maximum Charge Time. Refer to paragraphs 2.5.8 through 2.5.10 for programming details.



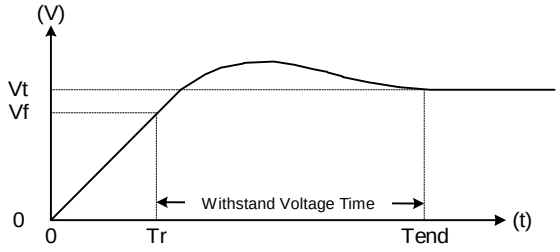


Figure 2-7: Withstand Voltage Parameters

Withstand Voltage is the voltage at which the product's insulation begins to break down. There are however many definitions for Withstand Voltage. The 1855 instrument and this manual use the WV terminology from the EIAJ RC-2364A standard, "Test Methods of Electrode Foils for Aluminum Electrolytic Capacitors".

Vf:	The standard dielectric withstand voltage
CC:	The constant charge current for the WV test
Tend:	The measurement time for the WV test. Tend = Tr+ the programmed test time.
CHG. Tend:	The maximum charge time for the WV test.
Tr:	The time between the start of the current application and the voltage reaching 90% of rated withstand voltage (Vf).
Vt:	The measured voltage at the end of the WV test.

Figure 2-7 illustrates a Withstand Voltage test. The following parameters were set: Vf=50V, CC=2mA, Tend=30seconds and CHG Tend=5seconds. After [TRIGGER] is pressed, the results shown in Figure 2-7 are Rise Time (Tr) = 0.15seconds and Measured Voltage (Vt) = 58.00V. In the bottom left-hand corner above the test status boxes (CHARGE – TEST – DISCHARGE) are two results: Vm=0.0V and 58.0V/30.15S. The Vm=0.0V box is the monitor of the output voltage during the test. The 58.0V/30.15S box is the last measured voltage and time when the test ended.

2.4.5 Compare

The Compare function provides the capability to set an upper and/or lower limit for a leakage current or insulation resistance test and to display Pass/Fail with the measured result. To access the Compare function, press [MAIN INDEX] and [F4] = NEXT PAGE 1/2 then press [F2] = COMPARE. Select the Mode first with LC/IR being used for Step, Sequence Test and Surge and VF used for forward voltage tests. Then program the Upper and Lower limits.

The Upper Limit is the high limit or upper value for a test to be considered a pass. If the measured value is higher than the upper limit the test is considered a fail. The Lower Limit is the lower value for a test to be considered a pass. If the measured value is lower than the low limit the test is considered a fail.

In an LC test, the range for Upper Limit is 0.000uA – 999.999mA and the Lower Limit range is 0.000uA to the Upper Limit. In an IR test, the range of the Upper Limit is 0.01kΩ – 99.99GΩ and the Lower Limit is 0.01kΩ – the Upper Limit.

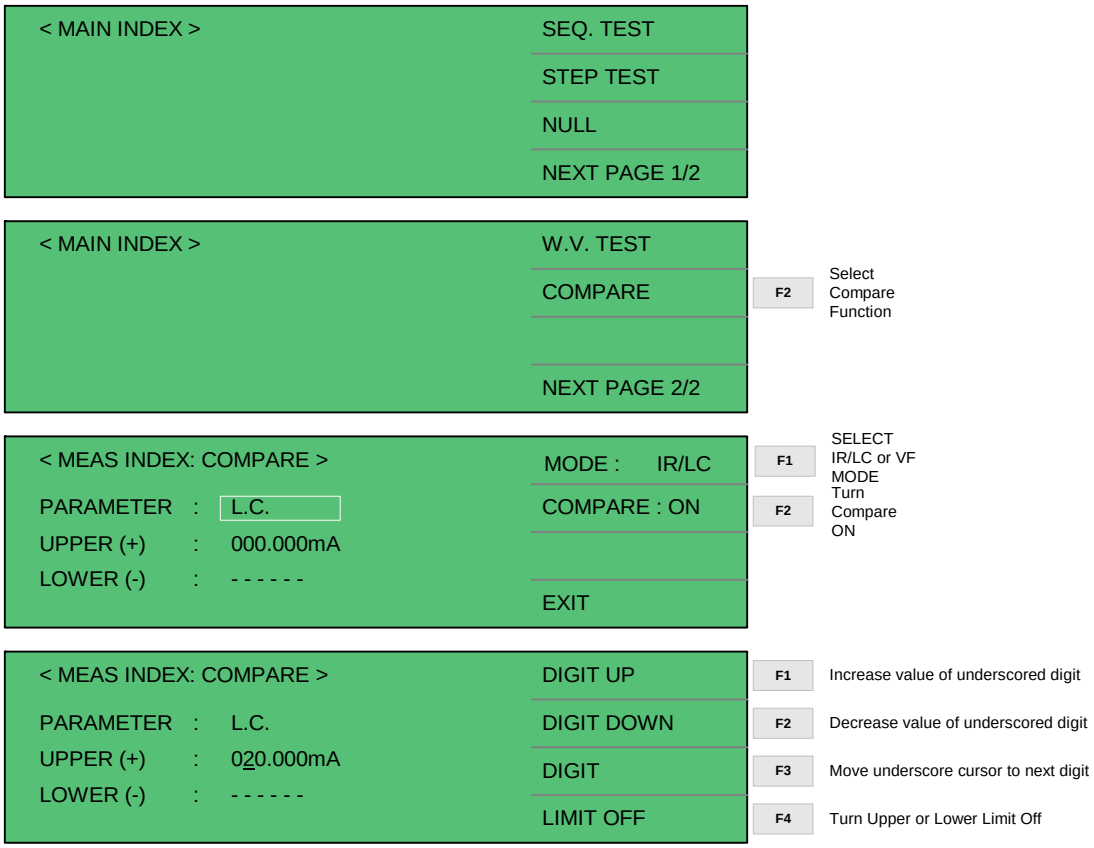


Figure 2-8: Compare Function

To set up and display PASS/FAIL on the MEAS DISPLAY screen, use the COMPARE function. Example: Parameter = Leakage Current. Upper Limit = 15mA, Lower Limit = 0.

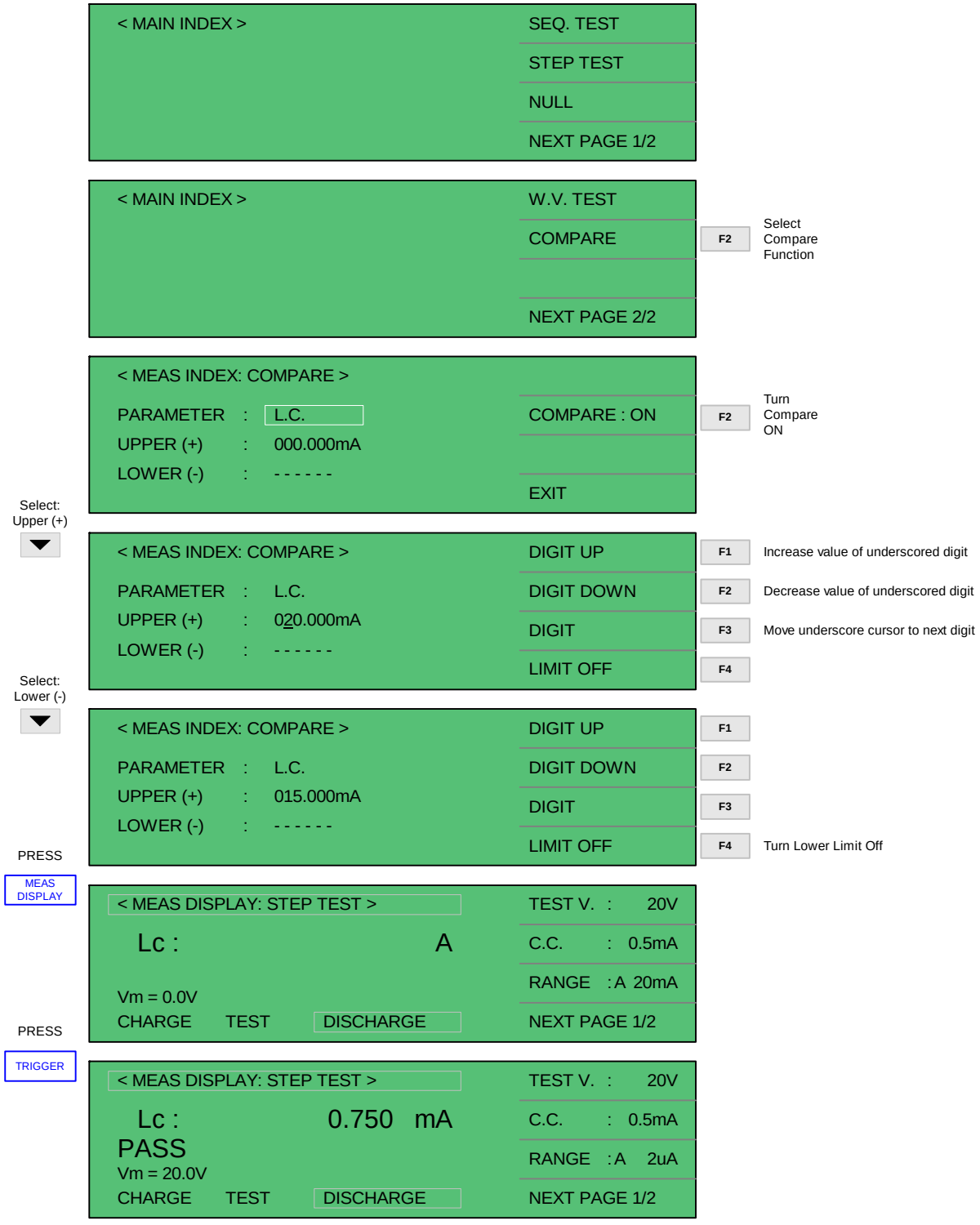


Figure 2-9: Compare Example

2.4.6 C.C. Power (Firmware 2.11 or Higher)

To access the C.C. Power Test, press [MAIN INDEX] and [F4] = NEXT PAGE 2/3 and then press [F3] = C.C. Power. The MEAS DISPLAY menu will appear. Program the Max. Voltage, Constant Current, Trigger and Display. Refer to paragraphs 2.5.8 through 2.5.10 for programming details.

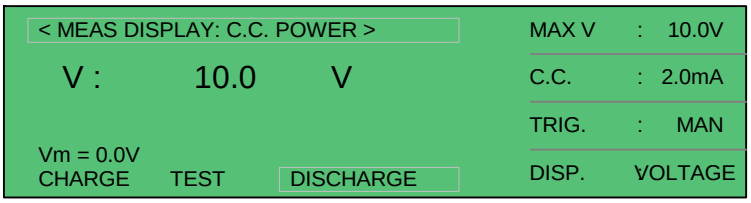


Figure 2-7: C.C. POWER Parameters

C.C. Power allows the 1855 to be used as a 65W Constant Current DC power supply. The display can show the measured voltage or current depending upon the DISP setting.

Max V: The maximum voltage applied during the test
CC: The constant charge current for the test
Trig: Manual Trigger via front panel or External via Handler.
Display: During Measurement this can be used to select if Voltage or Current is displayed.

2.4.7 Forward Voltage (Firmware 2.11 or Higher)

To access the Withstand Voltage Test, press [MAIN INDEX] and [F4] = NEXT PAGE 3/3 and then press [F1] = FORWARD VOLT. The MEAS DISPLAY menu will appear. Program the Max Voltage, Constant Current, Dwell Time, Trigger, Speed and Compare. Refer to paragraphs 2.5.8 through 2.5.10 for programming details.

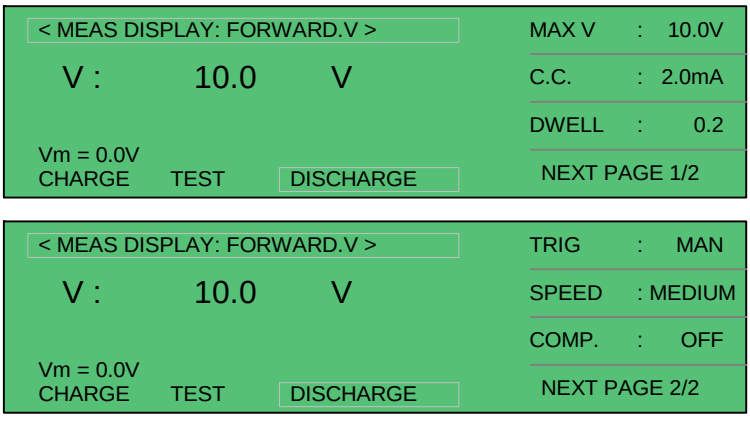


Figure 2-7: Forward Voltage Parameters

Forward Voltage is designed for testing devices such as diodes, MOVs, surge suppressors and similar devices where a constant current is applied and then the breakdown voltage is measured.

The breakdown voltage can be compared with high and low voltage limits for pass/fail indication.

Max V: The maximum voltage applied during the test
CC: The constant charge current for the test
Dwell Time: The dwell time for the test. Pass/Fail will be done at end of Dwell Time.
Trigger: Manual Trigger via front panel or External via Handler.
Speed: Measurement Speed, Slow, Medium or Fast
Compare: If a comparison is done for pass/fail indication.

2.4.8 Surge Test (Firmware 2.11 or Higher)

To access the Withstand Voltage Test, press [MAIN INDEX] and [F4] = NEXT PAGE 3/3 and then press [F2] = SURGE TEST. The MEAS DISPLAY menu will appear. Program the Test Voltage, Constant Current, Speed, Charge Time, Discharge Time and Loop. Refer to paragraphs 2.5.8 through 2.5.10 for programming details.

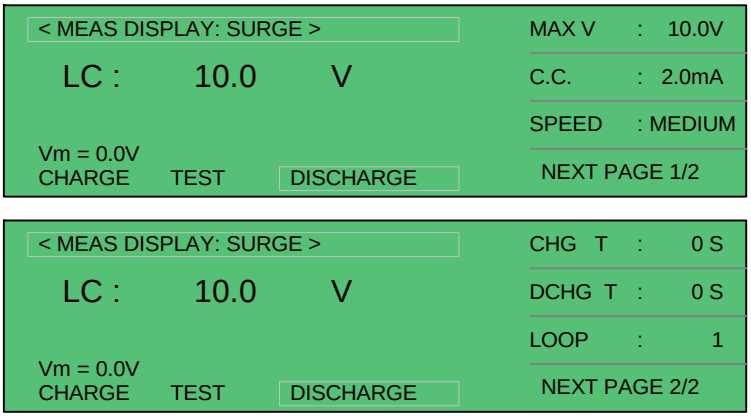


Figure 2-7: Surge Test Parameters

The Surge Test performs a capacitor surge test in accordance with (JIS C 5101-1, 5101-3 and 51101-4.

Note: Compare can be used in Surge Test. If compare is on and Discharge Time is set to 0s, Compare will be overwritten by “Discharge Warning !!”. Set Discharge Time to 1 s or greater to see comparison.
Note: If the voltage does not discharge below the setting of Discharge Voltage in System Setup:System Config then error “Poor Discharge” will be shown.

Max V: The maximum voltage applied during the test
CC: The constant charge current for the test
Speed: Measurement Speed, Slow, Medium or Fast
Charge Time: The Charge time for the test.
Discharge Time: The discharge time for the test.
Loop: Number of cycles the test will be repeated.

2.5 MEAS DISPLAY

The 1855 instrument's stand-by display is the MEAS DISPLAY. After power has been applied to the instrument and it cycles quickly through the information screen, the instrument reverts to the MAIN INDEX. To view the instrument information screen as illustrated in Figure 2.10, press [SYSTEM SETUP] then [⇐].

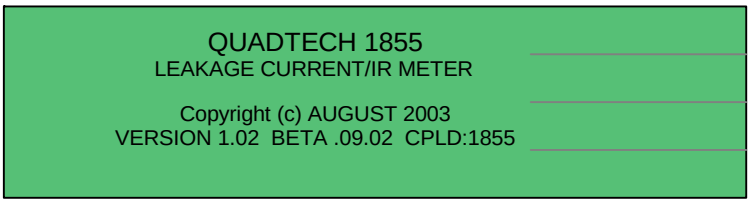


Figure 2.10: Instrument Information Screen

All programmable parameters are explained in Paragraphs 2.5.1 through 2.5.8.

2.5.1 Test Voltage

The test voltage and max voltage can be programmed from 1.0V to 650V. In MEAS DISPLAY press [F1] = TEST V or Max. V so that the 1.0 V box is highlighted. Use the up arrow or down arrow keys to in/decrease the voltage in multi-V increments. The left and right arrows will increase/decrease the voltage in 0.1V or 1 V increments. The instrument default setting is 1.0V.

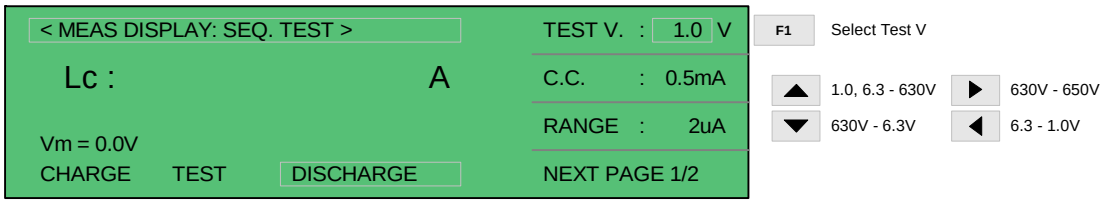
UP arrow [⇑] key: 6.3 → 10.0 → 16.0 → 25.0 → 35.0 → 50.0 → 63.0 → 100.0 → 160.0 → 200.0 → 250.0 → 350.0 → 400.0 → 450.0 → 500.0 → 550.0 → 600.0 → 630.0.

DOWN arrow [⇓] key: 630.0 → 600.0 → 550.0 → 500.0 → 450.0 → 400.0 → 350.0 → 250.0 → 200.0 → 160.0 → 100.0 → 63.0 → 50.0 → 35.0 → 25.0 → 16.0 → 10.0 → 6.3.

RIGHT arrow [⇒] key: increase voltage in 0.1V increments below 100V and 1V increments above 100V.

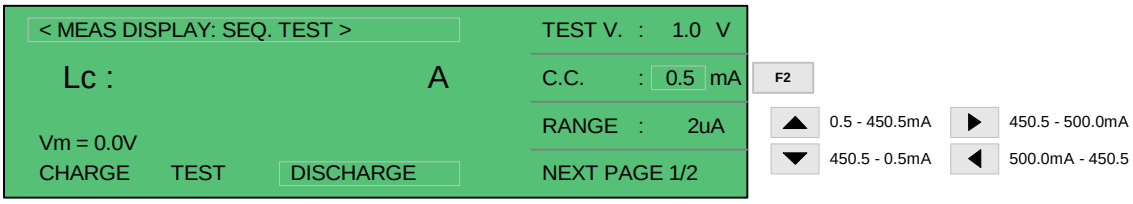
LEFT arrow [⇐] key: decrease voltage in 0.1V increments below 100V and 1V increments above 100V.

.



2.5.2 Constant Charge Current

The test current can be programmed from 0.5mA to 500mA. In MEAS DISPLAY press [F2] = C.C so that the 0.5 mA box is highlighted. Use the up arrow [⇑] key to increase the current or use the down arrow [⇓] key to decrease the current in 5/50mA increments. The left and right arrows will increase/decrease the current in 1mA increments. The instrument default setting is 0.5mA.



NOTE:
For the WV test, the range of C.C. is from 0.5mA to 150mA.

UP arrow [⇑] key: increase current by 5mA from 0.5mA to 100mA then by 50mA from 100mA to 500mA

DOWN arrow [⇓] key: decrease current by 50mA from 500mA to 100mA then by 5mA from 100mA to 0.5mA

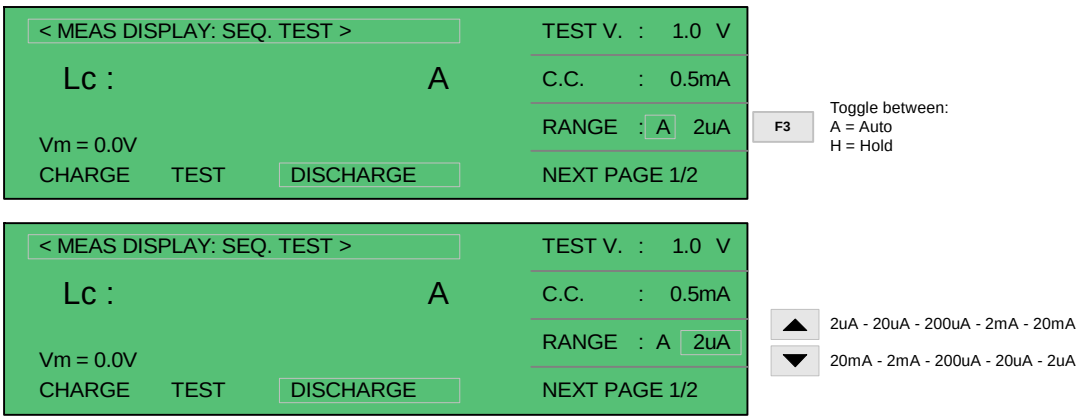
RIGHT arrow [⇒] key: increase current in 1mA increments.

LEFT arrow [⇐] key: decrease current in 1mA increments.

2.5.3 Range

The 1855 instrument's measurement range can be selected as AUTO or HOLD. The instrument current measurement ranges are 20mA, 2mA, 200uA, 20uA and 2uA. In MEAS DISPLAY, press [F3] = RANGE so that the A box is highlighted*. The instrument default setting is A (Auto Range).

* Use the up arrow [⇑] key to toggle between A (Auto) and H (Hold).



Press [F3] = RANGE a second time to select the value of the range.

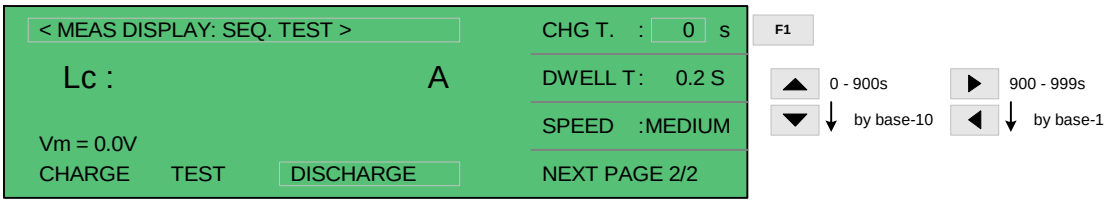
UP arrow [⇑] key: increase range: 2uA → 20uA → 200uA → 2mA → 20mA

DOWN arrow [⇓] key: decrease range: 20mA → 2mA → 200uA → 20uA → 2uA

2.5.4

2.5.5 Charge Time

The charge time can be programmed from 0 to 999seconds. In MEAS DISPLAY press [F4] = NEXT PAGE 1/2. Press [F1] = CHG T so that the 0 s box is highlighted. Use the up or down arrow keys to in/decrease the charge time by base-10 second increments. The left and right arrows will increase/decrease the time in 1second increments. The instrument default setting is 0s.



UP arrow [⇑] key: 0 → 10 → 20 → 30 → 40 → 50 → 60 → 70 → 80 → 90 → 100 → 200 → 300 → 400 → 500 → 600 → 700 → 800 → 900.

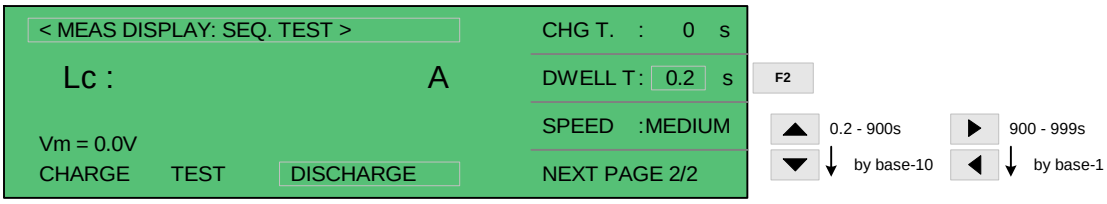
RIGHT arrow [⇒] key: increase charge time in 1 second increments. (example: 900 to 999)

DOWN arrow [⇓] key: 999 → 899 → 799 → 699 → 599 → 499 → 399 → 299 → 199 → 99 → 89 → 79 → 69 → 59 → 49 → 39 → 29 → 19 → 9.

LEFT arrow [⇐] key: decrease charge time in 1 second increments. (example: 9 to 0)

2.5.6 Dwell Time

The dwell time can be programmed from 0.2 to 999seconds. In MEAS DISPLAY press [F4] = NEXT PAGE 1/2. Press [F2] = DWELL T so that the 0.2 s box is highlighted. Use the up or down arrow keys to in/decrease the dwell time by base-10 second increments. The left and right arrows will increase/decrease the time in 1second increments. The instrument default setting is 0s.



UP arrow [⇑] key: 0.2 → 10 → 20 → 30 → 40 → 50 → 60 → 70 → 80 → 90 → 100 → 200 → 300 → 400 → 500 → 600 → 700 → 800 → 900.

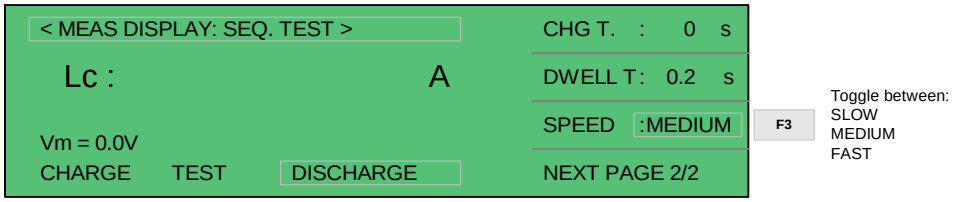
RIGHT arrow [⇒] key: increase dwell time in 1 second increments. (example: 900 to 999)

DOWN arrow [⇓] key: 999 → 899 → 799 → 699 → 599 → 499 → 399 → 299 → 199 → 99 → 89 → 79 → 69 → 59 → 49 → 39 → 29 → 19 → 9.

LEFT arrow [⇐] key: decrease dwell time in 1 second increments. (example: 9 to 0)

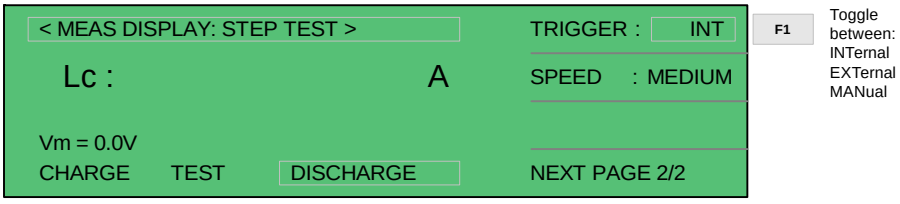
2.5.7 Speed

Program the measurement speed of the 1855 instrument to Slow (7measurements/second), Medium (14 measurements/second) or Fast (18 measurements/second). In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F3] = SPEED so that the MEDIUM box is highlighted. Press [F3] = SPEED to toggle through and select the measurement rate: SLOW, MEDIUM or FAST. The instrument default setting is MEDIUM (14 meas/second).



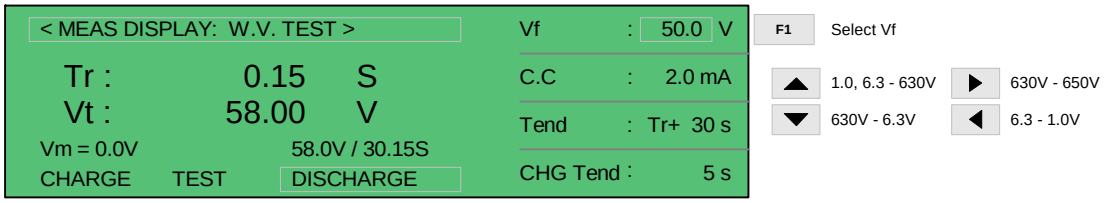
2.5.8 Trigger

In the **Step Test only**, the 1855 instrument can be triggered manually, internally or externally. In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F1] = TRIGGER so that the INT box is highlighted. Press [F1] = TRIGGER to change the trigger. The instrument default setting is INT (internal trigger). When MANUAL trigger is selected, one measurement will be made each time the trigger is pressed. When EXTERNAL trigger is selected, one measurement will be made each time the external trigger is asserted by the handler. When INTERNAL trigger is selected, measurements are performed continuously when in [MEAS DISPLAY].



2.5.9 Rated Withstand Voltage (Vf)

In the **W.V. Test only**, the rated withstand voltage (Vf) can be programmed from 1.00V to 650V. In MEAS DISPLAY press [F1] = Vf so that the 1.00 V box is highlighted. Use the up arrow or down arrow keys to in/decrease the voltage in multi-V increments. The left and right arrows will increase/decrease the voltage in 1V increments. The instrument default setting is 1.00V.



UP arrow [⇑] key: 6.3 → 10.0 → 16.0 → 25.0 → 35.0 → 50.0 → 63.0 → 100.0 → 160.0 → 200.0 → 250.0 → 350.0 → 400.0 → 450.0 → 500.0 → 550.0 → 600.0 → 630.0.

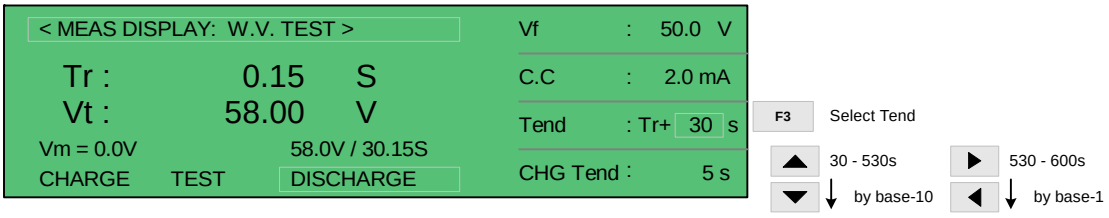
DOWN arrow [⇓] key: 630.0 → 600.0 → 550.0 → 500.0 → 450.0 → 400.0 → 350.0 → 250.0 → 200.0 → 160.0 → 100.0 → 63.0 → 50.0 → 35.0 → 25.0 → 16.0 → 10.0 → 6.3.

RIGHT arrow [⇒] key: increase voltage in 1V increments.

LEFT arrow [⇐] key: decrease voltage in 1V increments.

2.5.10 Measurement Time (Tend)

In the **W.V. Test only,** the measurement time can be programmed from 30 to 600seconds. In MEAS DISPLAY press [F3] = Tend so that the 30 s box is highlighted. Use the up or down arrow keys to in/decrease the measure time by 10 second increments. The left and right arrows will increase/decrease the time in 1second increments. The instrument default setting is 30s.



UP arrow [⇑] key: 30 → 40 → 50 → 60 → 70 → 80 → 90 → 100 → 200 → 300 → 400 → 500 → 600.

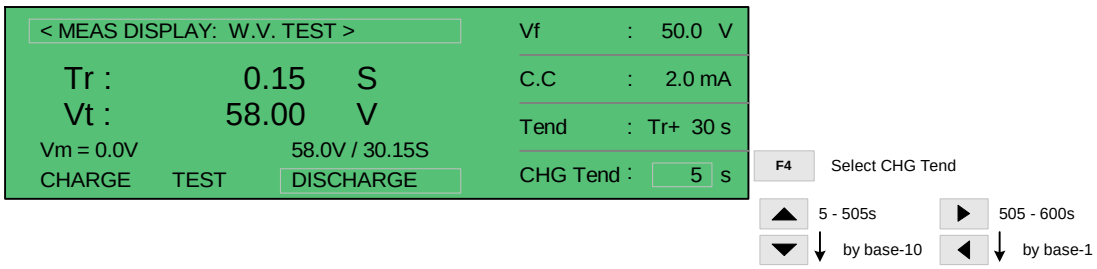
RIGHT arrow [⇒] key: increase measurement time in 1 second increments.

DOWN arrow [⇓] key: 600 → 500 → 400 → 300 → 200 → 100 → 90 → 80 → 70 → 60 → 50 → 40 → 30.

LEFT arrow [⇐] key: decrease measurement time in 1 second increments.

2.5.11 Maximum Charge Time (CHG Tend)

In the **W.V. Test only,** the charge time can be programmed from 5 to 600seconds. In MEAS DISPLAY press [F4] = CHG Tend so that the 5 s box is highlighted. Use the up or down arrow keys to in/decrease the charge time by 10 second increments. The left and right arrows will increase/decrease the time in 5 second increments. The instrument default setting is 5s.



UP arrow [⇑] key: 5 → 15 → 25 → 35 → 45 → 55 → 65 → 75 → 85 → 95 → 105 → 205 → 305 → 405 → 505.

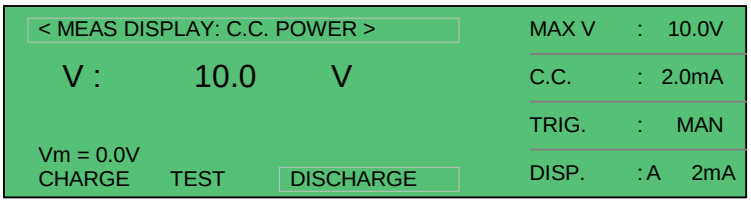
RIGHT arrow [⇒] key: increase charge time in 1 second increments. (example: 505 to 600)

DOWN arrow [⇓] key: 600 → 500 → 400 → 300 → 200 → 100 → 90 → 80 → 70 → 60 → 50 → 40 → 30 → 20 → 10.

LEFT arrow [⇐] key: decrease charge time in 1 second increments. (example: 10 to 5)

2.5.12 DISPlay (Firmware 2.11 or Higher)

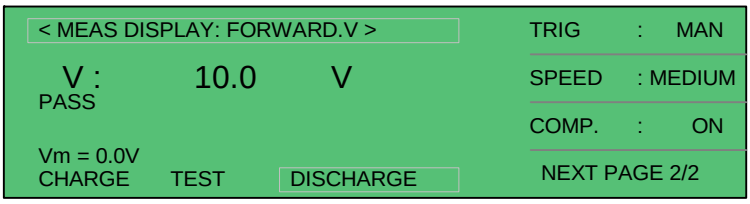
Display is for C.C. Power only. Program the display of the 1855 instrument to Voltage or "A" Current. In MEAS DISPLAY, Press [F4] = DISP to toggle the selection. The instrument default setting is Voltage. When "A" current is selected Press [F4] to highlight current range. Press UP arrow [⇑] or DOWN arrow [⇓] to hold a current range. Current ranges are: 2uA, 20uA, 200uA, 2mA, and 20mA.



2.5.13 COMPare (Firmware 2.11 or Higher)

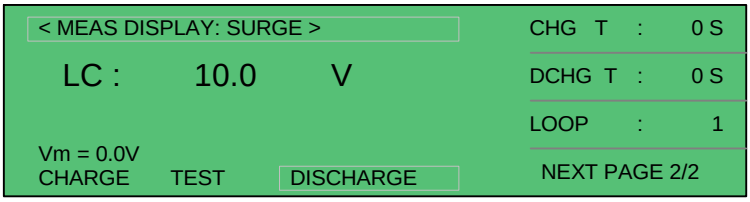
Compare is for Forward Voltage only. Turn compare of the 1855 instrument "ON" or "Off". In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F3] = COMP. so that the OFF

box is highlighted. Press [F4] to change to "ON". The instrument default setting is OFF. When ON is selected Compare values are set in Main Index:Compare. Change the compare Parameter to VF to allow setting of high and low limits for voltage. Display will show High, Low or Pass.



2.5.14 Charge Time (CHG T) (Firmware 2.11 or Higher)

In the **Surge Time only,** the charge time can be programmed from 0 to 999 seconds. In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F1] = CHG T so that the 0 s box is highlighted. Use the up or down arrow keys to increase/decrease the charge time by 10 second increments. The left and right arrows will increase/decrease the time in 1 second increments. The instrument default setting is 0s.



UP arrow [⇑] key: 10 → 20 → 30 → 40 → 50 → 60 → 70 → 80 → 90 → 100

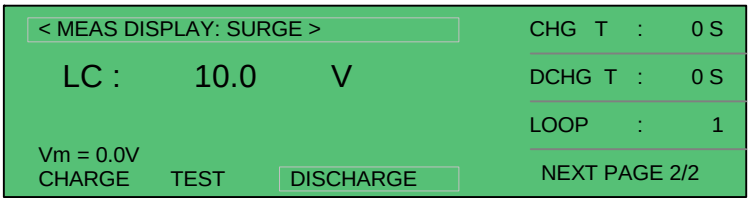
RIGHT arrow [⇒] key: increase charge time in 1 second increments. (example: 0 to 1)

DOWN arrow [⇓] key: 600 → 500 → 400 → 300 → 200 → 100 → 90 → 80 → 70 → 60 → 50 → 40 → 30 → 20 → 10.

LEFT arrow [⇐] key: decrease charge time in 1 second increments. (example: 10 to 9)

2.5.15 Discharge Time (DCHG T) (Firmware 2.11 or Higher)

In the **Surge Time only,** the discharge time can be programmed from 0 to 999 seconds. In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F2] = DCHG T so that the 0 s box is highlighted. Use the up or down arrow keys to increase/decrease the discharge time by 10 second increments. The left and right arrows will increase/decrease the discharge time in 1 second increments. The instrument default setting is 0s.



UP arrow [⇑] key: 10 → 20 → 30 → 40 → 50 → 60 → 70 → 80 → 90 → 100

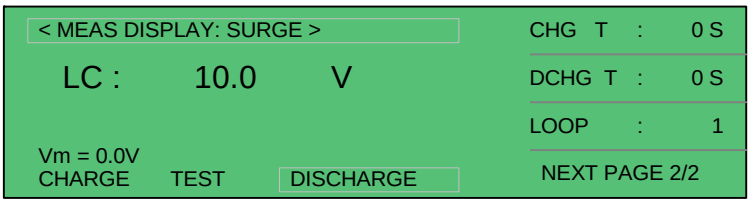
RIGHT arrow [⇒] key: increase charge time in 1 second increments. (example: 0 to 1)

DOWN arrow [⇓] key: 600 → 500 → 400 → 300 → 200 → 100 → 90 → 80 → 70 → 60 → 50 → 40 → 30 → 20 → 10.

LEFT arrow [⇐] key: decrease charge time in 1 second increments. (example: 10 to 9)

2.5.16 Loop (LOOP) (Firmware 2.11 or Higher)

In the **Surge Time only,** the number of loops can be programmed from 1 to 9999 loops. The test will be performed once per loop setting. i.e. If set to 2 loops the test will be performed twice when the test is initiated. In MEAS DISPLAY, press [F4] = NEXT PAGE 1/2 and then press [F3] = LOOP so that the [1] box is highlighted. Use the up or down arrow keys to increase/decrease the number of loops by 100 increments. The left and right arrows will increase/decrease the time in 1 increments. The instrument default setting is 1.



UP arrow [⇑] key: 101 → 201 → 301 → 401 → 501 → 601 → 701 → 801 → 901 → 1001

RIGHT arrow [⇒] key: increase charge time in 1 loop increments. (example: 0 to 1)

DOWN arrow [⇓] key: 600 → 500 → 400 → 300 → 200 → 100 → 1

LEFT arrow [⇐] key: decrease charge time in 1 loop increments. (example: 10 to 9)

2.6 Connection to Device under Test

Figure 2-13 illustrates the connection of the 1855 instrument to a DUT using the 1855-01 Lead Set. For Leakage Current, Insulation Resistance and Withstand Voltage Tests, the red alligator clip/BNC cable is connected between the silver INPUT terminal on the 1855 unit and the high side of the device under test. The black alligator clip/banana cable is connected between the white HV (-) terminal on the 1855 unit and the low side of the DUT.

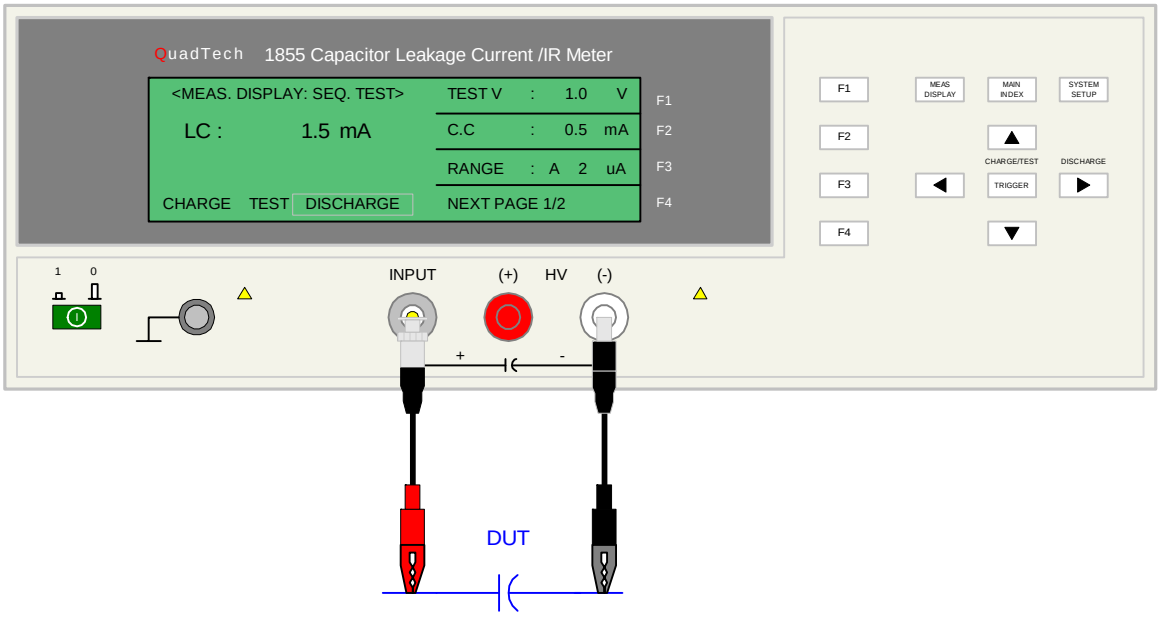


Figure 2-13: Connection for Leakage Current Test

2.7 Measurement Procedure

Before a measurement is made verify the following:

1. 1855 instrument [POWER] ON.
2. 15-minute warm-up.
3. Test parameters programmed and shown on MEAS DISPLAY.
4. Test cables or fixture connected.
5. NULL function initiated.
6. Device under test connected.

To initiate a test:

- Press [TRIGGER].
- The test voltage is shut **off** when all test steps are completed,
- **OR** when a test result is judged a FAIL per programmed test limits.
- The test result is displayed on MEAS DISPLAY

NOTE:
If for any reason the output must be terminated during a test, press the right arrow marked "DISCHARGE".

The 1855 instrument judges the measurement value based on the COMPARE function set up previously. Refer to paragraph 2.4.5 for instructions on setting the COMPARE Pass/Fail judgment parameter. Upon completion of the test the output voltage is terminated and the display shows the test result.

CAUTION:
Before touching the DUT or the 1855 instrument, make sure all capacitive devices have been fully discharged.

Section 3: Interface

3.1 RS-232 Interface

3.1.1 RS-232 Pin Configuration

The 1855 instrument comes standard with an RS232 Interface for remote operation. Connection is through the black/silver 9-pin connector labeled 'RS232' on the rear panel of the 1855 instrument. Figure 3-1 illustrates the designation of the pins on the RS232 connector. The connection cable must be a 'straight through' cable for the 1855 unit to communicate.

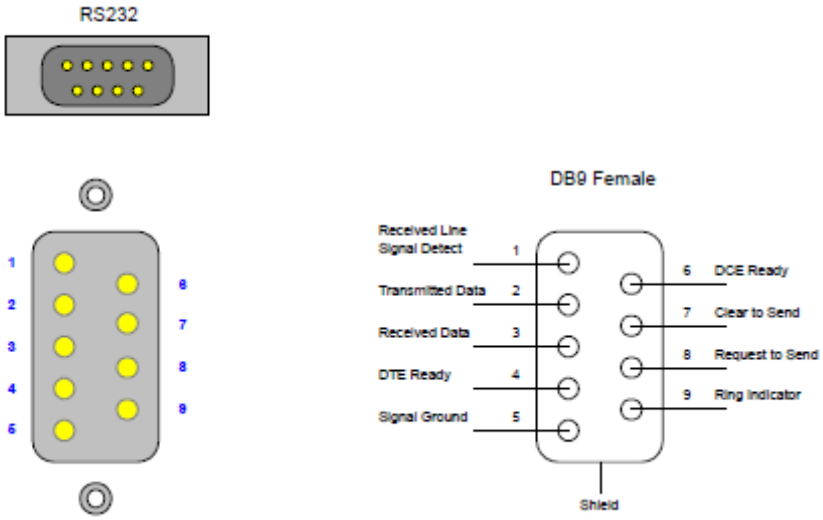


Figure 3-1: RS-232 Interface Pin Configuration

3.1.2 RS232 Specifications

Data Bits:	8
Stop Bits:	1
Parity:	None
Baud Rate:	600, 1200, 4800, 9600, 19200 or 28800bps, Software selectable
EOS:	CR + LF
Echo:	Off

Refer to paragraph 2.3.3.10. Setting the Baud Rate is done in the SYSTEM CONFIGURATION function under SYSTEM SETUP settings:

- From the MEAS DISPLAY, press [SYSTEM SETUP]
- Press [F3] = SYSTEM CONFIG.
- Press [⇓] = until the box next to BAUD RATE is highlighted.
- Press [F1] = INCREASE or [F2] = DECREASE to select baud rate.
- Press [F4] to EXIT

3.1.3 RS232 Commands

The command set for the RS232 interface is the same as the IEEE-488 interface command set listed in paragraphs 3.2.3 through 3.2.5 of this instruction manual.

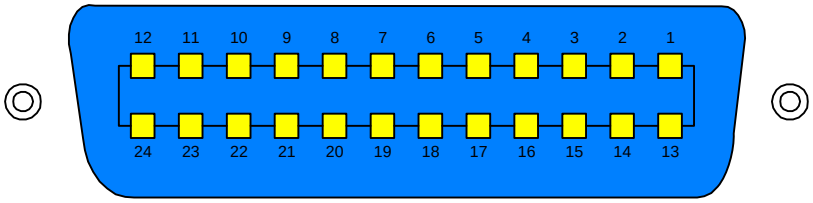
NOTE
CR + LF is the necessary end code for the RS232 commands.

3.2 IEEE-488 Interface

3.2.1 Pin Configuration

The 1855 instrument has an optional IEEE-488 interface as illustrated in Figure 3-2. Connection is through the blue 24-pin connector labeled 'IEEE-488 INTERFACE' on the rear panel of the 1855 instrument. This interface can be used to connect a system containing a number of instruments and a controller in which each meets IEEE Standard 488.2 (Standard Digital Interface for Programmable Instrumentation).

1855 IEEE-488 Interface PIN Configuration: Rear Panel View



1855 IEEE-488 Interface PIN Designation

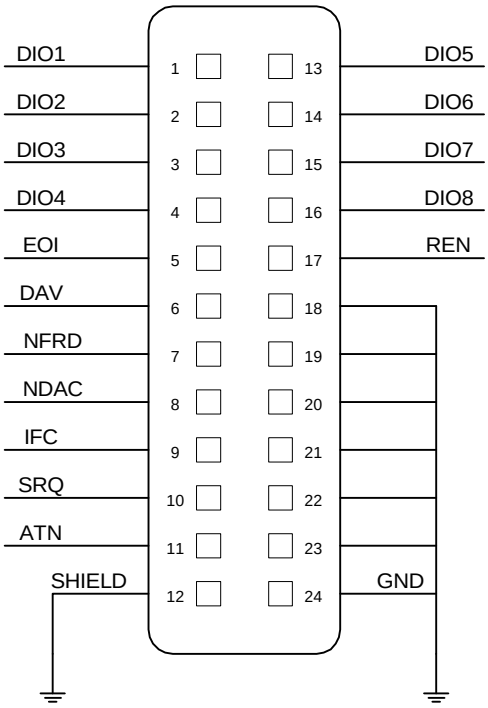


Figure 3-2: IEEE-488 Interface Pin Configuration

Table 3-1 lists the IEEE-488 Interface pin designations by pin number, signal name and pin function. Bus and driver information is also listed.

Table 3-1: IEEE-488 Interface Pin Designations

Bus	Driver	Signal Name	Pin Number	Function
Handshake	3 States	DAV	6	Low State: "Data is Available" and valid on DI01 through DI08
	Open Collector	NRFD	7	Low State: At least one Listener on the bus is "Not Ready For Data"
	Open Collector	NDAC	8	Low State: At least one Listener on the bus is "Not Accepting Data"
Control	3 States	ATN	11	"Attention" specifies 1 of 2 uses for the DI01 through DI08 lines: Low State: Controller command messages High State: Data bytes from the Talker device
	3 States	IFC	9	"Interface Clear" Low State: Returns portion of interface system to a known quiescent state
	Open Collector	SRQ	10	"Service Request" Low State: A Talker or Listener signals (to the controller) need for attention in the midst of the current sequence of events.
	3 States	REN	17	"Remote Enable" Low State: Enables each device to enter remote mode when addressed to listen. High State: All devices revert to Local control.
	3 States	EOI	5	"End of Identify" If ATN is in HIGH state, then EOI LOW state indicates the end of a multiple-byte data transfer sequence. If ATN is in LOW state, then EOI LOW state indicates a parallel poll.
Data	Open Collector	DI01	1	The 8-Line Data Bus. If ATN is in LOW state, then the bus conveys interface messages. If ATN is in HIGH state, then the bus conveys device-dependent messages. (Example: carries remote control commands from the controller or from a talker device)
		DI02	2	
		DI03	3	
		DI04	4	
		DI05	13	
		DI06	14	
		DI07	15	
		DI08	16	

3.2.2 IEEE-488 Interface Function Codes and Messages

The IEEE-488 (GPIB) address is defined under the SYSTEM SETUP in the SYSTEM CONFIG menu. Press [SYSTEM SETUP], then the numerical key [F3] to enter the SYSTEM CONFIG menu. Press down arrow [⇓] to enter the GPIB ADDRESS code. To select a new IEEE-488 address, use the function keys. Refer to paragraph 2.3.2 for more information. The default setting for the IEEE address is 17.

Table 3-2 defines the IEEE-488 interface codes and their function. Table 3-3 defines the IEEE-488 interface messages the 1855 instrument responds to and their function.

Table 3-2: IEEE-488 Interface Functions

Code	Function
SH1	Source Handshake (Talker)
AH1	Acceptor Handshake (Listener)
T6	Basic Talker Function
	Serial Poll Function
	Listener-specified Talker Release Function
	No TALK-ONLY Function
L4	Basic Listener Function
	Talker-specified Listener Release Function
SR1	Service Request Function
RL1	All Remote/Local Functions
PP0	No Parallel Poll Function
DC1	Device Clear Function
DT1	Device Trigger Function
C0	No Controller Functions

Table 3-3: IEEE-488 Interface Messages

Interface Message	Function	Description
GTL	Go To Local	Only addressed devices that receive this command are set to local mode. Cancels the remote control mode, making the front panel switches operative.

Table 3-4 lists the IEEE-488 interface commands the 1855 instrument accepts to set or query a parameter value. Paragraphs 3.2.3 through 3.2.5 detail the function, format, return value and description of the IEEE-488 commands.

Table 3-4: IEEE-488 Commands

Command	Name	Function	Output Format
*CLS	Clear Status	Clear standard event status register. Clear status bit group register except for bit 4 (MAV)	
*ESE	Event Status Enable	Enable standard event status register value.	0 – 255
*ESE?	Event Status Enable	Query standard event status of device enable register	0 – 255
*ESR?	Event Status Register	Query standard event register value of device. After this command, the standard register is cleared to 0.	0 – 255
*IDN?	Identification	Query/Read basic device data. (A comma separates the identification fields.)	4 ID: Manufacturer, Device Model, Serial Number, Firmware Version
*OPC	Operation Complete	Operation is complete.	0
*OPC?	Operation Complete	Query operation complete.	1
*RST	Reset	Reset Device.	
*SRE	Service Request Enable	Enable service request register value.	0 – 255
*SRE?	Service Request Enable	Query/Read service request register value.	0 – 255
*TRG	Trigger Bus	Trigger the 1730 instrument	
*TST?	Self Test	Perform self test & report error	0 = no error 1 = RAM 2 = EEPROM 4 = CPLD 8 = Calibration Data
*LRN?	Null	Perform Null	Returns NULL
*SAV	Save	Save current status to memory.	1 – 50
*RCL	Recall	Recall saved status from memory.	1 – 50

3.2.3 IEEE-488 Commands

Figure 3-3 illustrates the programming commands accepted by the IEEE-488 interface of the 1855 instrument. The commands are written in tabular format as a single reference to view all the commands. The command format and examples are detailed in paragraphs 3.2.4 – 3.2.5.

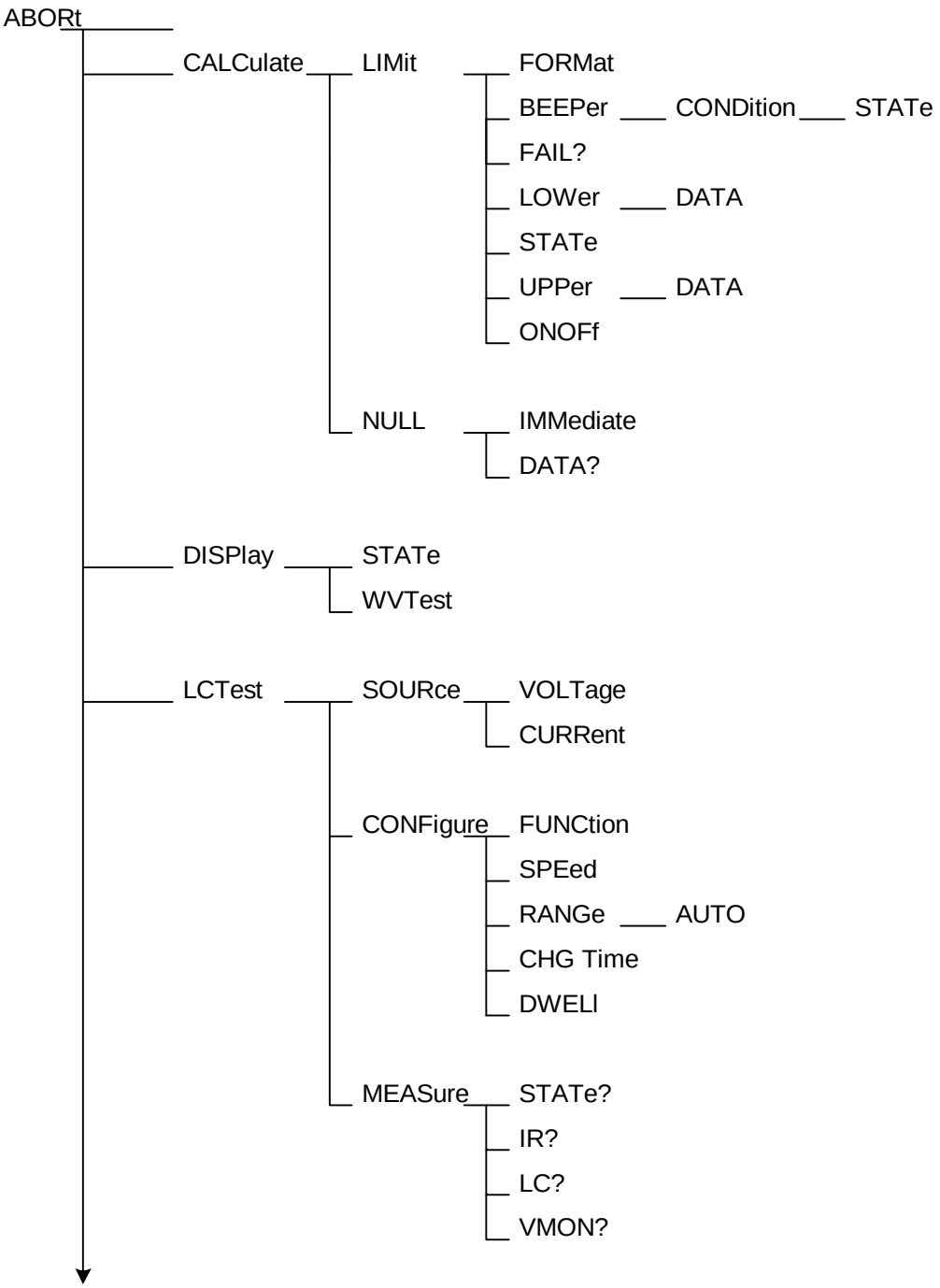


Figure 3-3a: IEEE-488 Commands

Tabular Format IEEE-488 Commands – continued

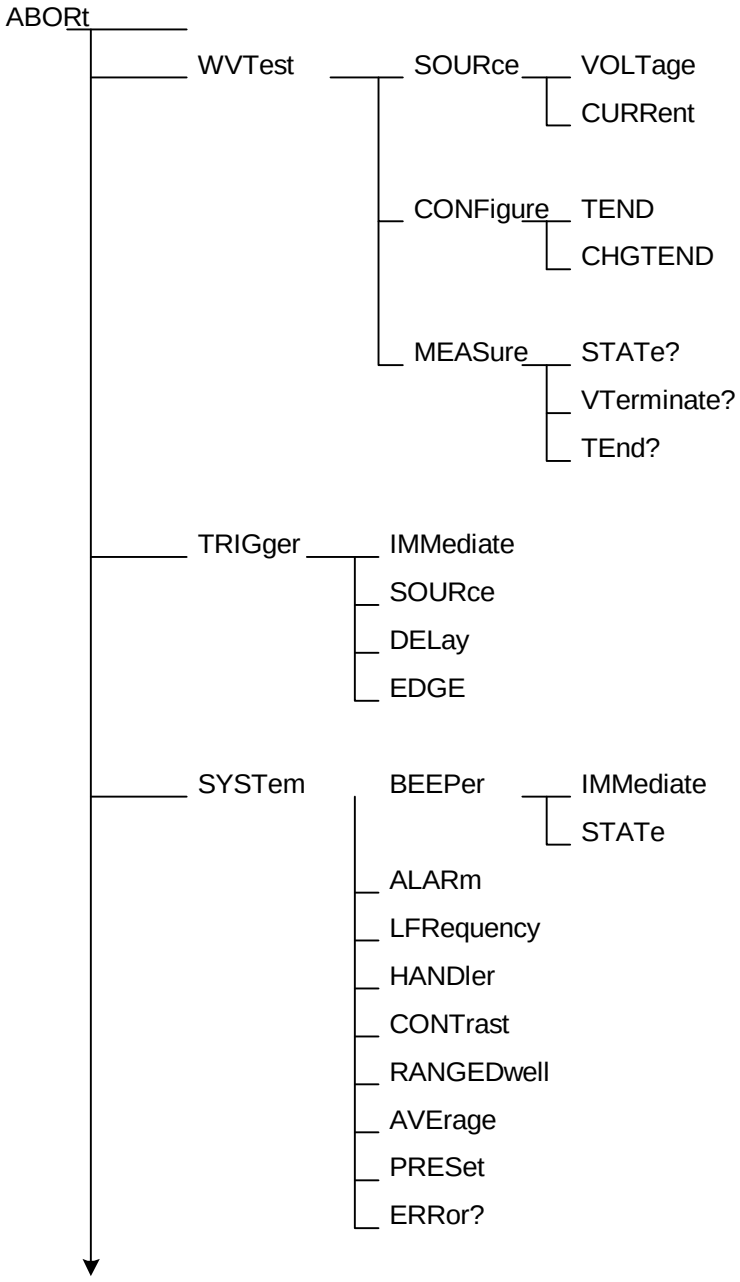


Figure 3-3b: IEEE-488 Commands

3.2.4 IEEE-488 Command Format

The IEEE-488 commands are configured in Root format. There are six levels of the instruction from top to bottom. Follow the specific path (as illustrated in Figure 3.3) to configure a specific command. The colon at the beginning of each line denotes that all line signals are root. Use a colon (:) to separate levels. Use the semicolon (;) to separate two commands on the same line.

For example, to format the command for the LC function, use this path:

:CALCulate:LIMit:FORMat:LC

If the command is a setting, then put the parameter after the instruction. If the command is an inquiry, then put a question mark (?) after the instruction.

For example, to set the beeper to sound on Fail:

:CALCulate:LIMit:BEEPer:CONDition:FAIL

To inquire what the beeper is set to:

:CALCulate:LIMit:BEEPer:CONDition?

The Ending Code can be any type in Table 3-5.

Table 3-5: IEEE-488 Interface Ending Codes

Ending Code
[CR] (0Dh)
[LF] (0Ah)
[CR] (0Dh) + [LF] (0Ah)

3.2.5 IEEE-488 Commands - Detailed

The IEEE commands listed in Figure 3-3 are detailed in paragraphs 3.2.5.1 – 3.2.5.39 including command, parameter, return value, function, and description. Note: Numerical data is transferred via one of three methods: integer format, fixed decimal format or floating point decimal format. Refer to Figure 3-4.

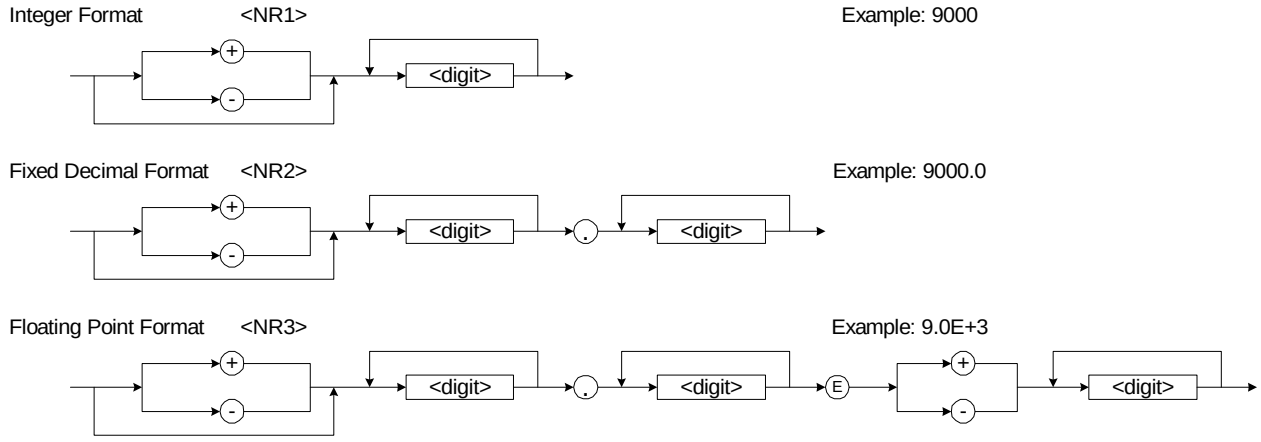


Figure 3-4: Numerical Data Transfer

3.2.5.1 ABOR

Instruction: ABOR
Parameter: None
Return Value: None
Function: Terminate Trigger in process and initiates Discharge.

3.2.5.2 CALC:LIM:FORM

Instruction: CALC:LIM:FORM
Parameter: {IR | LC | VF}
Return Value: {IR | LC | VF}
Function: Set or Query the measurement parameter for the Compare function.
Description:

IR	Insulation Resistance
LC	Leakage Current
VF	Voltage

3.2.5.3 CALC:LIM:BEEP:COND

Instruction: CALC:LIM:BEEP:COND
Parameter: {FAIL | PASS}
Return Value: {FAIL | PASS}
Function: Set or Query the condition on which the beeper sounds.
Description:

FAIL	Beeper sounds on FAIL result

PASS Beeper sounds on PASS result

3.2.5.4 CALC:LIM:BEEP:STAT

Instruction: CALC:LIM:BEEP:STAT
Parameter: {OFF | ON | 0 | 1}
Return Value: {0 | 1}
Function: Set or query the status of the beeper.
Description: OFF (0) Beeper sound is set to OFF
ON (1) Beeper sound is set to ON

3.2.5.5 CALC:LIM:CLEar

Instruction: CALC:LIM:CLEar
Parameter: None
Return Value: None
Function: Clears the report data of :CALC:LIMIT:FAIL? command.

3.2.5.5 CALC:LIM:FAIL?

Instruction: CALC:LIM:FAIL?
Parameter: {0 (FAIL) | 1 (PASS)}
Return Value: {0 | 1}
Function: Query the result of the Compare function.
Description: 0 FAIL result
1 PASSL result

3.2.5.6 CALC:LIM:LOW[:DATA]

Instruction: CALC:LIM:LOW[:DATA]
Parameter: {The lower limit value | MAX | MIN}
Return Value: The lower limit value, the format is <NR3> (Floating point)
Function: Set or query the lower limit value.
Description: IR: kOhm,MOohm,GOhm / LC: uA,mA / VF: V

3.2.5.7 CALC:LIM:STAT

Instruction: CALC:LIM:STAT
Parameter: {OFF | ON | 0 | 1}
Return Value: {0 | 1}
Function: Set or query the state of the Compare Function.
Description: 0 Compare Function is OFF
1 Compare Function is ON

3.2.5.8 CALC:LIM:UPP[:DATA]

Instruction: CALC:LIM:UPP[:DATA]
Parameter: {The upper limit value | MAX | MIN}
Return Value: The upper limit value, the format is <NR3> (Floating point)
Function: Set or query the upper limit value.
Description: IR: kOhm,MOohm,GOhm / LC: uA,mA / VF: V

3.2.5.9 CALC:LIM:ONOF

Instruction: CALC:LIM:ONOF
Parameter: {0 | 1 | 2 | 3 | 4 | 5}
Return Value: {0 | 1 | 2 | 3 | 4 | 5}
Function: Set or query the status of the Compare function.
Description:

0	Compare function is OFF
1	Compare Upper Limit is ON
2	Compare Lower Limit is ON
3	Compare Upper and Lower Limits are ON
4	Compare Lower Limit for VF function is ON
5	Compare Upper Limit for VF function is ON

3.2.5.10 CALC:NULL:[IMMediate]

Instruction: CALC:NULL:[IMMediate]
Parameter: None
Return Value: None
Function: Initiate NULL.
Description: No data. Instrument performs Null function

3.2.5.11 CALC:NULL:DATA?

Instruction: CALC:NULL:DATA?
Parameter: None
Return Value: The Null value in <NR3> format (-20.0E6 to 20.0E6)
Function: Query the Null leakage current reading for each current range.
Description:

____	Null value of 20mA range
____	Null value of 2mA range
____	Null value of 200uA range
____	Null value of 20uA range
____	Null value of 2uA range

3.2.5.12 DISP:STATe?

Instruction: DISP:STATe?
Parameter: {ON (1) | OFF (0)}
Return Value: {LCTEST | WVTEST | NULL | MAIN | SYSTEM}
Function: Query the status of the LCD display.
Description: LCTEST Display is in LCTEST mode

WVTEST	Display is in WVTEST mode
NULL	Display is in NULL mode
MAIN	Display is in MAIN mode
SYSTEM	Display is in SYSTEM mode

3.2.5.13 DISP:│WVT, LCT, CCP, VF, Surge null, main, system│

Instruction: DISP: WVT
DISP: LCT
DISP: CCP
DISP: VF
DISP: SURGE
DISP: NULL
DISP: MAIN
DISP: SYSTem
Parameter: None
Return Value: None
Function: Set the Display to WV Mode, LCT mode, C.C. Power Mode, Forward Voltage Mode, Surge Test Mode, null, main or system mode.
Description: Set the Display to WV Mode

LC Test and Surge Test Subsection

3.2.5.14 LCT:SOUR:VOLTage

Instruction: LCT:SOUR:VOLTage
Parameter: {Test Voltage│MIN│MAX}
Unit: Volts
Return Value: {Test Voltage} in {NR3} format
Function: Set or query the test voltage for the LC Test.

{Voltage}	1.0 -650V
MIN	1.0V
MAX	650V

3.2.5.15 LCT:SOUR:CURR

Instruction: LCT:SOUR:CURR
Parameter: {Test Current│MIN│MAX}
Unit: Milliamps
Return Value: {Test Current} in {NR3} format
Function: Set or query the test current for the LC Test.

{current}	0.5mA – 500mA	
MIN	0.5mA	
MAX	500mA	(150mA for V>100V)

3.2.5.16 LCT:CONF:FUNC

Instruction: LCT:CONF:FUNC
Parameter: {SEQ | STEP}
Return Value: {SEQ | STEP}
Function: Set or query the configuration of the LC Test.
Description:

SEQ	LC Test is a Sequence Test
STEP	LC Test is a Single Manual Test

3.2.5.17 LCT:CONF:SPEed

Instruction: LCT:CONF:SPEed
Parameter: {FAST | MEDIUM | SLOW}
Return Value: {FAST | MEDIUM | SLOW}
Function: Set or query the Measurement Speed.
Description:

FAST	18 measurements/second
MEDIUM	14 measurements/second
SLOW	7 measurements/second

3.2.5.18 LCT:CONF:RANGe

Instruction: LCT:CONF:RANGe
Parameter: {<range> | MIN | MAX}
Return Value: {<range>}
Function: Set or query the measurement range for the LC Test.
Description:

4	20mA
3	2mA
2	200uA
1	20uA
0	2uA
MIN	2uA
MAX	20mA

3.2.5.19 LCT:CONF:RANG:AUTO

Instruction: LCT:CONF:RANG:AUTO
Parameter: {OFF | ON | 0 | 1}
Return Value: {0 | 1}
Function: Set or query if the Auto Range function is OFF or ON.
Description:

0	Auto Range is OFF
1	Auto Range is ON

3.2.5.20 LCT:CONF:CHGTime

Instruction: LCT:CONF:CHGTime
Parameter: {<numeric value> | MIN | MAX}
Return Value: {<numeric value>}

Function: Set or query the charge time for the LC Test.
Description: <numeric value> 0 – 999seconds
MIN 0seconds
MAX 999seconds

3.2.5.20 LCT:CONF:DCHGTime

Instruction: LCT:CONF:DCHGTime
Parameter: {<numeric value>|MIN|MAX}
Return Value: {<numeric value>}
Function: Set or query the discharge time for the LC Test.
Description: <numeric value> 0 – 999seconds
MIN 0seconds
MAX 999seconds

3.2.5.20 LCT:CONF:CYCLP

Instruction: LCT:CONF:CYCLP
Parameter: {<numeric value>|MIN|MAX}
Return Value: {<numeric value>}
Function: Set or query the number of times for loop for the Surge Test.
Description: <numeric value> 1 – 9999
MIN 1
MAX 9999

3.2.5.21 LCT:CONF:DWELl

Instruction: LCT:CONF:DWELl
Parameter: {<numeric value>|MIN|MAX}
Return Value: {<numeric value>}
Function: Set or query the dwell time for the LC Test.
Description: <numeric value> 0.2 – 999seconds
MIN 0.2seconds
MAX 999seconds

3.2.5.22 LCT:MEAS:STATe?

Instruction: LCT:MEAS:STATe?
Parameter: None
Return Value: {CHG|TEST|DCHG}
Function: Query the test status of the Test (Charge, Test or Discharge).
Description: CHG Instrument is in Charge mode
TEST Instrument is in Test mode
DCHG Instrument is in Discharge mode

3.2.5.23 LCT:MEAS:FETC?

Instruction: LCT:MEAS:FETC?
Parameter: None
Return Value: {0 | 1}, {ON | PASS | HIGH | LOW}
Function: Query the test result of the LC Test.
Description:

0	Okay
1	Error
ON	Instrument in Test mode
PASS	Test Passed
HIGH	Test Failed – result above High Limit
LOW	Test Failed – result below Low Limit

3.2.5.24 LCT:MEAS:IR?

Instruction: LCT:MEAS:IR?
Parameter: None
Return Value: {Measured value} in <NR3> format
Function: Query the IR measurement value.
Description: IR measurement value

3.2.5.25 LCT:MEAS:LC?

Instruction: LCT:MEAS:LC?
Parameter: None
Return Value: {Measured value} in <NR3> format
Function: Query the LC measurement value.
Description: LC measurement value

3.2.5.26 LCT:MEAS:SURge:IR?

Instruction: LCT:MEAS:SURge:IR?
Parameter: None
Return Value: {Measured value} in <NR3> format
Function: Query the value of IR in Surge Test.
Description: IR value

3.2.5.26 LCT:MEAS:SURge:LC?

Instruction: LCT:MEAS:SURge:LC?
Parameter: None
Return Value: {Measured value} in <NR3> format
Function: Query the value of LC in Surge Test.
Description: IR value

3.2.5.26 LCT:MEAS:VMON?

Instruction: LCT:MEAS:VMON?
Parameter: None
Return Value: {Measured value} in <NR3> format
Function: Query the value of the monitored voltage (voltage across DUT).
Description: VMON value

WVTest Subsection

3.2.5.27 WVT:SOUR:VOLT

Instruction: WVT:SOUR:VOLT
Parameter: {<numeric value>|MIN|MAX}
Unit: Volts
Return Value: {Test Voltage} in <NR3> format
Function: Set or query the test voltage for the Withstand Voltage Test.
Description: <numeric value> 1.0 – 650volts
MIN 1.0volt
MAX 650volts

3.2.5.28 WVT:SOUR:CURR

Instruction: WVT:SOUR:CURR
Parameter: {<numeric value>|MIN|MAX}
Unit: Milliamps
Return Value: {Test Current} in <NR3> format
Function: Set or query the test current for the Withstand Voltage Test.
Description: <numeric value> 0.5 – 150mA
MIN 0.5mA
MAX 150mA

3.2.5.29 WVT:CONF:TEND

Instruction: WVT:CONF:TEND
Parameter: {<numeric value>|MIN|MAX}
Unit: seconds
Return Value: {Measurement Time} in <NR3> format
Function: Set or query the measurement time for the WV Test.
Description: <numeric value> 30 – 600seconds
MIN 30seconds
MAX 600seconds

3.2.5.30 WVT:CONF:CHGTEND

Instruction: WVT:CONF:CHGTEND
Parameter: {<numeric value>|MIN|MAX}
Unit: seconds

Return Value: {Maximum Charge Time} in <NR3> format
Function: Set or query the maximum charge time for the WV Test.
Description: <numeric value> 5 – 600seconds
MIN 5seconds
MAX 600seconds

3.2.5.31 WVT:MEAS:STAT?

Instruction: WVT:MEAS:STAT?
Parameter: None
Return Value: {CHG | TEST | DCHG}
Function: Query the test status of the WV Test.
Description: CHG Instrument is in Charge mode
TEST Instrument is in Test mode
DCHG Instrument is in Discharge mode

3.2.5.32 WVT:MEAS:TRise?

Instruction: WVT:MEAS:VT?
Parameter: None
Return Value: {Rise Time} in <NR3> format
Function: Query the Rise Time when the test voltage reaches 0.9*Vf .
Description: <numeric value> Seconds

3.2.5.32 WVT:MEAS:VT?

Instruction: WVT:MEAS:VT?
Parameter: None
Return Value: {Test Voltage} in <NR3> format
Function: Query the Test Voltage at the Termination of the WV Test.
Description: <numeric value> 1.0 – 650volts

3.2.5.33 WVT:MEAS:TE?

Instruction: WVT:MEAS:TE?
Parameter: None
Return Value: {Measurement Time} in <NR3> format
Function: Query the total Measurement Time of the WV Test (Tr + Test Time).
Description: <numeric value> 30 – 600seconds

3.2.5.33 WVT:MEAS:VE?

Instruction: WVT:MEAS:VE?
Parameter: None
Return Value: {Voltage} in <NR3> format
Function: Query the voltage at the end of the WV Test.

Description: <numeric value> 1.0 – 650Volts

3.2.5.33 WVT:MEAS:DATA?

Instruction: WVT:MEAS:DATA?
Parameter: None
Return Value: <Set1>, <Set2>,….<SetN> (N is determined by POINTS command)
Function: Returns data in the buffer with number of data sets being determined by Points command
Description: <set n> <point>, <time>, <voltage>

3.2.5.33 WVT:MEAS:POINts <Start>, <End>

Instruction: WVT:MEAS:POINts <Start>, <End>
Parameter: {<numeric value>|MIN|MAX}
Return Value: Query returns number of data entries saved in <NR1> format. If 0 is returned there is no data.
Function: Returns data in the buffer with number of data sets being determined by Points command
Description: <numeric value> 1 - 220
MIN 1
MAX 220

C.C. Power Test Subsection

3.2.5.27 CCP:SOUR:VOLTage

Instruction: CCP:SOUR:VOLT
Parameter: {<numeric value>|MIN|MAX}
Unit: Volts
Return Value: {Test Voltage} in <NR3> format
Function: Set or query the test voltage for the Withstand Voltage Test.
Description: <numeric value> 1.0 – 650volts
MIN 1.0volt
MAX 650volts

3.2.5.28 CCP:SOUR:CURR

Instruction: CCP:SOUR:CURR
Parameter: {<numeric value>|MIN|MAX}
Unit: Milliamps
Return Value: {Test Current} in <NR3> format
Function: Set or query the test current for the Withstand Voltage Test.
Description: <numeric value> 0.5 – 150mA
MIN 0.5mA
MAX 150mA

3.2.5.32 CCP:MEASure:VOLTage?

Instruction: CCP:MEAS:VOLTage?
Parameter: None
Return Value: {Test Voltage} in <NR3> format
Function: Query the Test Voltage
Description: <numeric value> 1.0 – 650volts

3.2.5.32 CCP:MEASure:STATe?

Instruction: CCP:MEAS:STATe?
Parameter: None
Return Value: {CHG | DCHG , ON | OFF}
Function: Query the test status of the CCP Test.
Description:

DCHG,CC mode ON	Instrument is in discharge mode, CC Mode ON
DCHG, CC Mode OFF	Instrument is in discharge mode, CC Mode Off
CHG,CC mode ON	Instrument is in charge mode, CC Mode ON
CHG, CC Mode OFF	Instrument is in charge mode, CC Mode Off

Forward Voltage Test Subsection

3.2.5.27 VF:SOUR:VOLTage

Instruction: VF:SOUR:VOLT
Parameter: {<numeric value> | MIN | MAX}
Unit: Volts
Return Value: {Test Voltage} in <NR3> format
Function: Set or query the test voltage for the Withstand Voltage Test.
Description: <numeric value> 1.0 – 650volts

MIN	1.0volt
MAX	650volts

3.2.5.28 VF:SOUR:CURR

Instruction: VF:SOUR:CURR
Parameter: {<numeric value> | MIN | MAX}
Unit: Milliamps
Return Value: {Test Current} in <NR3> format
Function: Set or query the test current for the Withstand Voltage Test.
Description: <numeric value> 0.5 – 150mA

MIN	0.5mA
MAX	150mA

3.2.5.17 VF:CONF:SPEed

Instruction: VF:CONF:SPEed

Parameter: {FAST | MEDIUM | SLOW}
Return Value: {FAST | MEDIUM | SLOW}
Function: Set or query the Measurement Speed.
Description: FAST 18 measurements/second
MEDIUM 14 measurements/second
SLOW 7 measurements/second

3.2.5.21 VF:CONF:DWELl

Instruction: VF:CONF:DWELl
Parameter: {<numeric value> | MIN | MAX}
Return Value: {<numeric value>}
Function: Set or query the dwell time for the LC Test.
Description: <numeric value> 0.2 – 999seconds
MIN 0.2seconds
MAX 999seconds

3.2.5.23 VF:MEAS:FETC?

Instruction: VF:MEAS:FETC?
Parameter: None
Return Value: {0 | 1}, {ON | PASS | HIGH | LOW}
Function: Query the test result of the LC Test.
Description: 0 Okay
1 Error
ON Instrument in Test mode
PASS Test Passed
HIGH Test Failed – result above High Limit
LOW Test Failed – result below Low Limit

3.2.5.32 VF:MEASure:VOLTage?

Instruction: VF:MEAS:VOLTage?
Parameter: None
Return Value: {Test Voltage} in <NR3> format
Function: Query the Test Voltage
Description: <numeric value> 1.0 – 650volts

3.2.5.32 VF:MEASure:STATe?

Instruction: VF:MEAS:STATe?
Parameter: None
Return Value: {CHG | DCHG , ON | OFF}
Function: Query the test status of the CCP Test.
Description: DCHG,CC mode ON Instrument is in discharge mode, CC Mode ON
DCHG, CC Mode OFF Instrument is in discharge mode, CC Mode Off

CHG,CC mode ON	Instrument is in charge mode, CC Mode ON
CHG, CC Mode OFF	Instrument is in charge mode, CC Mode Off

3.2.5.34 TRIG[:IMMediate]

Instruction: TRIG[:IMMediate]
Parameter: None
Return Value: None
Function: Initiate the Trigger function.

3.2.5.35 TRIG:SOURce

Instruction: TRIG:SOURce
Parameter: {BUS | EXT}
Return Value: {BUS | EXT | INT | MAN}
Function: Set or query the trigger mode.
Description:

BUS	Bus trigger
EXTernal	External trigger
INTernal	Internal trigger
MANual	Manual trigger

3.2.5.36 TRIG:DELay

Instruction: TRIG:DELay
Parameter: {<numeric value> | MIN | MAX}
Unit: milliseconds
Return Value: {Trigger Delay Time} in <NR3> format
Function: Set or query the trigger delay time.
Description:

<numeric value>	0 – 9999milliseconds
MIN	0milliseconds
MAX	9999milliseconds

3.2.5.37 TRIG:EDGE

Instruction: TRIG:EDGE
Parameter: {FALL | RISI}
Return Value: {FALL | RISI}
Function: Set or query the edge on which to initiate the trigger.
Description:

FALL	Measurement is triggered on falling edge
RISI	Measurement is triggered on rising edge

3.2.5.38 SYST:BEEP[:IMM]

Instruction: SYST:BEEP[:IMM]
Parameter: None
Return Value: None
Function: Set the beeper to sound immediately.

3.2.5.39 SYST:BEEP:STATe

Instruction: SYST:BEEP:STAT
Parameter: {OFF | LOW | HIGH }
Return Value: {OFF, LOW, HIGH}
Function: Set the loudness of the beeper.
Description:

Off	Turn Beeper OFF
Low	Set Beeper sound to LOW
High	Set Beeper sound to HIGH

3.2.5.40 SYST:ALARm

Instruction: SYST:ALARm
Parameter: {PULS | CONT}
Return Value: {PULS | CONT}
Function: Set the mode the alarm will sound in.
Description:

PULS	The alarm sound will pulse
CONT	The alarm will continuously sound

3.2.5.41 SYST:LFRequency

Instruction: SYST:LFRequency
Parameter: {50 | 60 | NA50 | NA60}
Unit: Hz
Return Value: {50 | 60 | NA50 | NA60}
Function: Set or query the Line Frequency.
Description: 50Hz AC Power Line Source is 50Hz, AD integration same as int. trigger
60Hz AC Power Line Source is 60Hz, AD integration same as int. trigger
NA50 AC Power Line Source is 50Hz, AD integration 3 ms
NA60 AC Power Line Source is 60Hz, AD integration 3ms

3.2.5.42 SYST:HANDler

Instruction: SYST:HANDler
Parameter: {CLEA | HOLD}
Return Value: {CLEA | HOLD}
Function: Set the Handler to clear result or hold result for each test
Description:

CLEA	Handler will clear result after each test
HOLD	Handler will hold result after each test

3.2.5.43 SYST:CONTrast

Instruction: SYST:CONTrast
Parameter: {<numeric value>}
Return Value: {Contrast} in <NR1> format
Function: Set or query the contrast of the display.
Description: <numeric value> 1-15

3.2.5.44 SYST:RANGEDwell

Instruction: SYST:RANGEDwell
Parameter: {<numeric value>|MIN|MAX}
Return Value: {Dwell Time} in <NR3> format
Function: Set or query the range dwell time.
Description: <numeric value> 0.0 – 9.9seconds
MIN 0.0seconds
MAX 9.9seconds

3.2.5.45 SYST:AVERage

Instruction: SYST:AVERage
Parameter: {<numeric value>|MIN|MAX}
Return Value: {Average} in <NR1> format
Function: Set or query the number of measurements made & averaged before result shown.
Description: <numeric value> 1-8
MIN 1
MAX 8

3.2.5.46 SYST:PRESet

Instruction: SYST:PRESet
Parameter: None
Return Value: None
Function: Set the instrument to initial default values.

3.2.5.47 SYST:ERRor?

Instruction: SYST:ERRor?
Parameter: None
Return Value: Error message
Function: Query if there are any system errors.
Description: <numeric value>, <string>

3.2.5.43 STATUs:OPERation OESR?

Instruction: STATUs:OPERation OESR?

Parameter: None
Return Value: {Operation Complete} in <NR1> format
Function: Query the event register contents of operation status group.
Description: <numeric value>

3.2.5.43 STATUs:OPERation OEER

Instruction: STATUs:OPERation OEER
Parameter: {<numeric value>}Decimal value of register contents
Return Value: {Enable register of Operation Complete} in <NR1> format
Function: Sets or Queries the enable register contents of operation status group.
Description: <numeric value>

3.2.5.43 STATUs:OPERation OSR?

Instruction: STATUs:OPERation OSR?
Parameter: None
Return Value: {Operation Complete} in <NR1> format
Function: Query the operation register contents of operation status group.
Description: <numeric value>

3.2.5.46 STATUs:PRESet

Instruction: STATUs:PRESet
Parameter: None
Return Value: None
Function: Clears the event and enable register contents of operation status group.

3.2.6 Error Messages

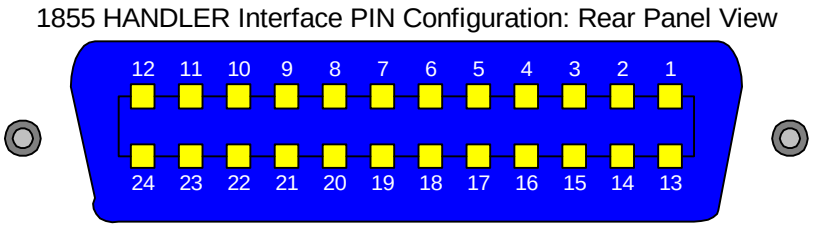
Table 3-6 lists the Error Messages for the IEEE-488 interface of the 1855 instrument. In response to the command "SYSTem:ERRor?", the 1855 unit responds with the error message number and an error message string of up to 80 characters in length.

Table 3-6: Error Messages

Code	Type	Message
0	No error	There is no error in the error queue
-102	Syntax error	Invalid character exists in the command string.
-104	Data Type error	Parameter is not defined in the command string.
-106	Illegal parameter	Parameter is not a valid command.
-202	Conflicting Settings	Command conflicts with instrument settings. Example: Send 'Trigger' when mode is external.
-203	Data range	Data exceeds the valid range.
-211	Data stale	No resent measurement result. Example: Send 'Read?' when in Standby status.
-224	Self-Test failed	Self-test via remote interface (*TST) failed.
-225	Excess errors	The error queue is full (more than 20 errors). Queue cleared after power down or *CLS command.
-226	Query interrupted	Device status changed after query sent. Output buffer will be cleared

3.3 Handler Interface

There is an available Handler interface for the 1855 instrument as illustrated in Figure 3-4. [The IEEE-488 and HANDLER interfaces come together as an optional accessory]. Connection to the Handler interface is through the blue 24-pin connector labeled HANDLER on the rear panel of the 1855 instrument.



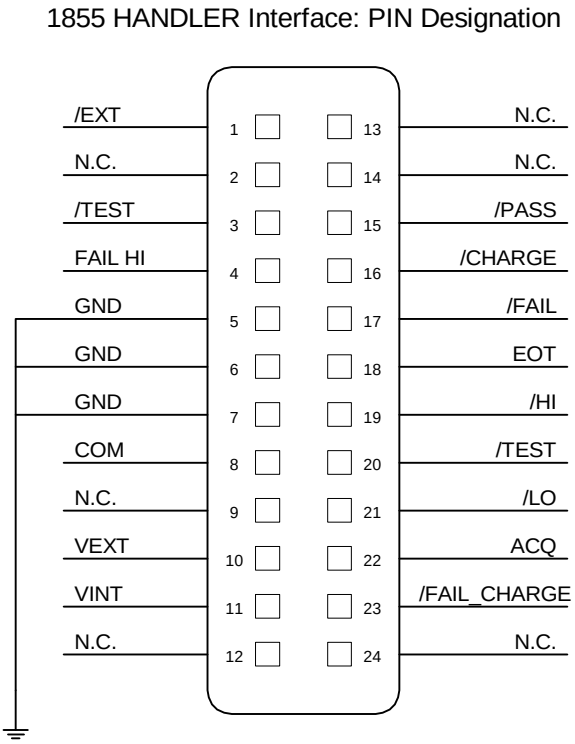


Figure 3-4: Handler Interface Pin Configuration

3.3.1 Trigger

Paragraph 2.3.16 contains the instructions for changing the Handler mode. Paragraphs 2.3.3 and 2.3.4 contain instructions for setting the Trigger Delay time and selecting the Trigger Edge. Figure 3-5 illustrates the Trigger function.

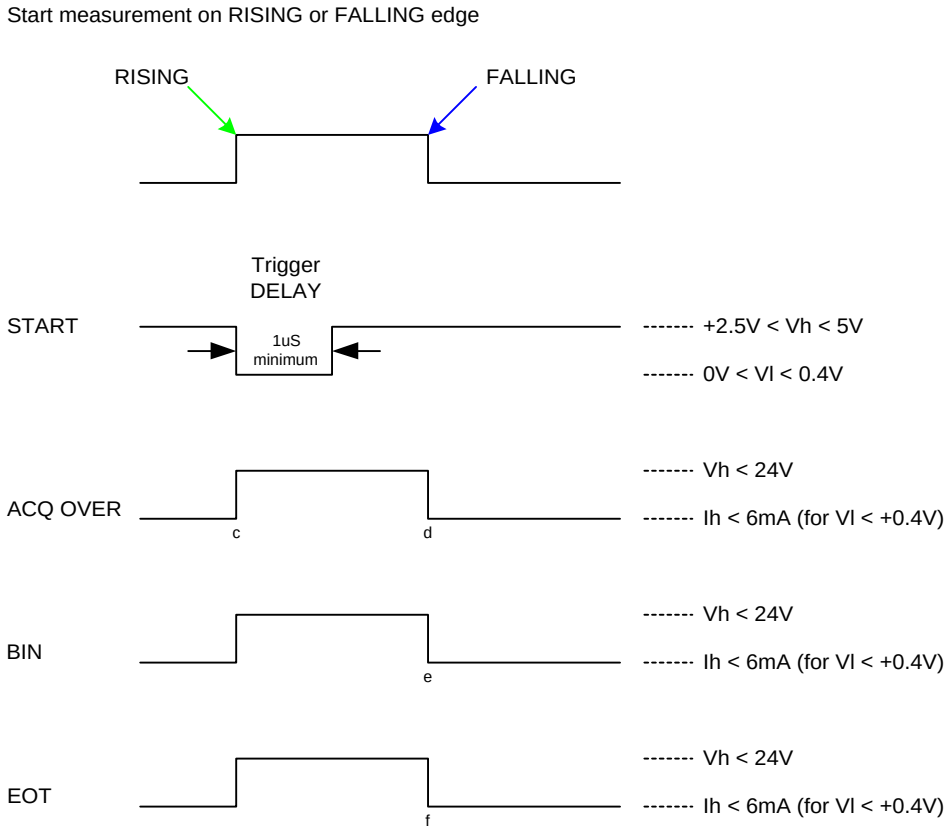


Figure 3-5: Trigger

Output Signals

The output lines of the 1855 Handler interface are open collector drivers that pull each signal line to a low voltage, signal ground when the signal is active (true). Each external line should be pulled up (with a resistor) to a positive voltage between 5V and 24V. The pull-up resistor must limit the current to < 6mA for a signal of a comparison function and to < 5mA for a control signal (EOT).

Input Signal

The input signal to the 1855 Handler interface is active low and requires a positive external voltage to pull the signal down below 0.4V, ground.

3.3.2 Handler Pin Assignments for Compare Operation

Table 3-7 lists the pin assignments when the handler interface on the 1855 instrument is performing a Compare operation. The device under test is being compared against a standard of known value. High and low limits can be defined as absolute value or percent value.

Table 3-7: Handler Pin Assignments for Compare

Pin	Name	Description
1	/EXT	External trigger
2	X	No connection
3, 20	/TEST	Instrument is in Test mode
4, 24	X	No connection
5 - 7	GND	Ground external DC
8	COM	Common Ground
9, 13	X	No connection
10	VEXT	External DC voltage: 5V ~ 24V
11	VINT	Internal DC voltage: +5V
12	X	No connection
14	X	No connection
15	/PASS	Measured Result is within the upper/lower limit(s) (PASS)
16	/CHARGE	Instrument is in Charge mode
17	/FAIL	Measured Result is outside the upper/lower limit(s) (FAIL)
18	/EOT	End of Test
19	/HI	For LC: Measured Result is > Upper Limit For IR: Measured Result is < Lower Limit
21	/LO	For LC: Measured Result is < Lower Limit For IR: Measured Result is > Upper Limit
22	ACQ	Received data, ready to accept next
23	/FAIL_CHARGE	Instrument is in Discharge mode

NOTE:
When using External DC Voltage (VEXT), Pins 5, 6 & 7 (GND) must be connected to Pin 8 (COM).

Section 4: Service & Calibration

4.1 General

Our warranty (at the front of this manual) attests to the quality of materials and workmanship in our products. If malfunction should be suspected or other information be desired, applications engineers are available for technical assistance. Application assistance is available in the U.S. by calling 800-253-1230 and asking for Applications Support. For support outside of the United States, please contact your local QuadTech Distributor.

4.2 Instrument Return

Before returning an instrument to QuadTech for Service please obtain an online Return Materials Authorization Number (RMA#). This number, when placed on the outside of the shipping package, will speed processing at our Service Lab and will serve as a reference number for the time your unit is at QuadTech. Please contact our **Customer Care Center (CCC)** at **800-253-1230** for additional support. The CCC phone line is staffed from 8:00am to 5:00pm (EST).

It will be necessary to include a Purchase Order Number and credit card information to insure expedient processing, although units found to be in warranty will be repaired at no-charge. For any questions on repair costs or shipment instructions please contact our CCC Department at the above number. To safeguard an instrument during storage and shipping please use packaging that is adequate to protect it from damage, i.e., equivalent to the original packaging and mark the box "Delicate Electronic Instrument". Please follow online instructions for shipping materials back to QuadTech.

4.2 Calibration

Calibration of the 1855 Capacitor Leakage Current/IR Meter is completed at the factory and includes a NIST calibration certificate. Verification of the instrument is recommended on an annual basis. Accurate operation of the 1855 instrument is confirmed using the 1855-TP Test Procedure.

4.3.1 1855 Verification Procedure

This section outlines the relevant information to verify performance of the 1855 Meter. It is recommended that performance be performed at least once a year using this outline procedure. Instrument should be warmed up for a minimum of 15 minutes prior to verification. Verification should be performed under the following conditions: Temperature equal to 23°C ±1.2°C and Relative Humidity (RH) between 35% and 55%.

Recommended standards are listed below. All standards should be traceable to a National Laboratory (such as NIST) and have calibrated values for primary and secondary parameters at the required test frequencies. QuadTech's verification conforms to ANSI Z540 and QuadTech recommends that the calibrated values for the primary and secondary standards have an uncertainty 4 times better than the primary and secondary accuracy specified in the Verification Data Sheet. If the calibrated values for the standards used do not have an uncertainty of 4 times better than the specified accuracy of the 1855 the uncertainty of the standard should be added to the specified accuracy of the 1855.

4.3.2 1855 Verification Data Sheet

Out Voltage: @ 10mA

(Verify Display & Measured Values are within high and low limits)
(Note: MEASURE between RED (+) and WHITE (-) mounting jacks)

Voltage Setting (V)	Measured Voltage (Fluke)	Displayed Voltage (1855)	Low Limit Voltage	High Limit Voltage
1			795mV	1.205V
50			49.55V	50.45V
200			198.8V	201.2V
400			397.8V	402.2V
600			596.8V	603.2V

IR Measurement: @ .5mA

(Note: MEASURE between BNC jack and WHITE (-) mounting jacks)

Voltage Setting (V)	Nominal Resistance (Ω)	Actual Resistance (Ω)	Before	After	Test Specifications
			Displayed Value (Ω)	Displayed Value (Ω)	
100V	10M				0.805%
100V	100M				0.854%
200V	1G				0.973%
500V	1G				0.747%