

# 1868 A-D Megohmmeter Instruction Manual

Form 150753/A1

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The material in this manual is for informational purposes only and is subject to change, without notice. QuadTech assumes no responsibility for any error or for consequential damages that may result from the misinterpretation of any procedures in this publication.

## WARNING

Potentially dangerous voltages may be present on front and rear panel terminals. Follow all warnings in this manual when operating or servicing this instrument. Dangerous levels of energy may be stored in capacitive devices tested by this unit. Always make sure the high voltage indicator is **not** on when connecting or disconnecting the device under test.



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.



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# Contents

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<b>Warranty</b>	5
<b>Specifications</b>	7
<b>Accessories</b>	9
<b>Safety Precautions</b>	11
<b>Condensed Operating Instructions</b>	13
<b>Introduction - Section 1</b>	
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	23
1.4.4 Safety Inspection	23
<b>Operation - Section 2</b>	
2.1 Terms and Conventions	25
2.2 Start-Up	27
2.3 Menus	29
2.3.1 Measure Setup	30
2.3.1.1 HV Control	31
2.3.1.2 Range	33
2.3.1.3 Result	33
2.3.1.4 Measure Timing	34
2.3.1.5 Measurement Mode	36
2.3.1.6 Average Count	36
2.3.1.7 Contact Check	36
2.3.2 Sequence Setup	37
2.3.3 Limit Setup	40
2.3.3.1 Edit Limit	41
2.3.3.2 Limit Set Setup	43
2.3.4 Measure Graphics	44
2.3.4.1 Normal Text	44
2.3.4.2 X-Y Graph	44
2.3.4.3 Bar Graph	46

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## Contents (Continued)

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### Operation - Section 2 – continued

2.3	Menus – continued .....	47
2.3.5	Zero Adjust Menu .....	47
2.3.6	Setup Status .....	48
2.3.7	Setups .....	48
2.4	Programming a Manual Test .....	49
2.5	Programming a Sequence Test .....	51
2.6	Instrument Zero/Offset Function.....	53
2.7	Connection To Device Under Test.....	55
2.8	Measurement Procedure.....	58
2.8.1	Binning Example .....	59
2.9	[alt] Menu .....	60
2.9.1	Instrument Reset .....	61
2.9.2	Test Program .....	61
2.9.3	Display Setup .....	61
2.9.4	Bus I/O Setup .....	62
2.9.5	PC Memory Card .....	64

### Interface - Section 3

3.1	Remote I/O Interface .....	65
3.2	RS232 Interface.....	68
3.2.1	PIN Configuration.....	68
3.2.2	RS232 Specifications.....	68
3.2.3	RS232 Commands .....	69
3.2.4	Sample QuickBASIC Program .....	70
3.3	IEEE-488 Interface.....	72
3.3.1	PIN Configuration.....	72
3.3.2	IEEE-488 Interface Functions.....	73
3.3.3	IEEE-488 Interface Commands .....	74

### Service & Calibration - Section 4

4.1	General.....	85
4.2	Instrument Return .....	85
4.3	Calibration.....	85
4.3.1	Verification Equipment .....	86
4.3.2	Verification Procedure .....	86
4.3.3	Calibration Equipment .....	91
4.3.4	Calibration Procedure .....	91

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## Warranty

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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 or fitness for a particular purpose.**

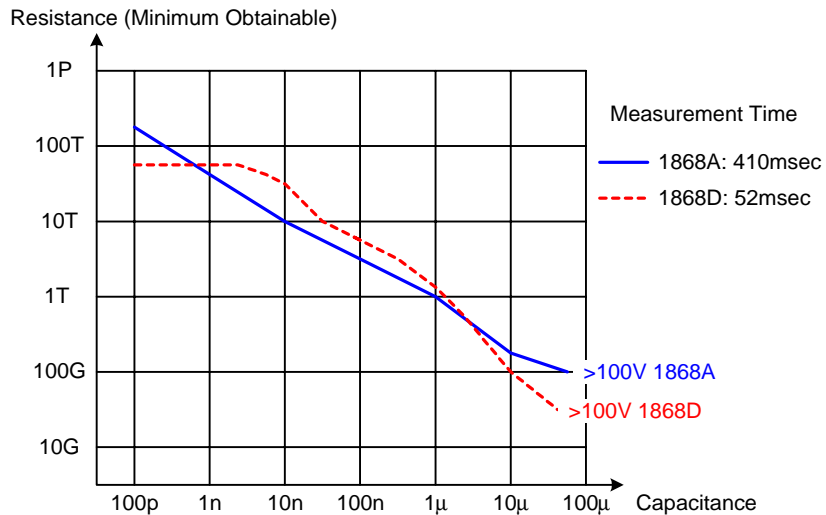
### SERVICE POLICY

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

**Resistance Range:** 10kΩ – 1PΩ (dependent on test voltage, 4 Ranges or Auto Range)  
 Range 1: 1pA to 10nA  
 Range 2: 2nA to 100nA  
 Range 3: 20nA to 10μA  
 Range 4: 2μA to 1mA



**Resistance Accuracy:** For  $R_x < 20G\Omega(V_x)$ :  $\pm(2\%$  of reading + 5cnts)  
 For  $R_x > 20G\Omega(V_x)$ :  $\pm(V_x/1pA)$  in ohms. Max reading:  $V_x/0.1pA$   
 $R_x$  = Measured resistance in ohms  
 $V_x$  = Programmed voltage in volts

**Voltage Range:** 10 to 1000V DC in 1V steps, 1868A  
 50 to 5000V DC in 1V steps, 1868D

**Voltage Accuracy:** 2% of setting  
 $\pm 1V$  in uncalibrated mode

**Source Resistance:** 100Ω, 1kV (1868A); 3.3kΩ, 5kV (1868D)

**Charge Current:** 2/25/80mA (1868A); 2/10/18mA (1868D)

**Discharge Resistance:** 100kΩ

**Current Measure:** 1pA to 1mA

**Current Accuracy:**  $\pm[2\%$  of reading + 5cnts + 1pA]

**Input Impedance:** For  $I_x > 10nA$ : 10kΩ; For  $I_x < 10nA$ : 1MΩ  
 $I_x$  = Programmed current in amperes

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## Specifications (Continued)

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<b>Test Speed:</b>	Trigger Mode: 40msec Continuous Mode: 90-4000msec depending on #to Average						
<b>Test Time:</b>	Charge time: 0 – 9999msec (Charge Resistance 200Ω) Measure time: 0 – 9999msec Discharge time: 0.1(Cx) as Vx decreases to 1% test level Cx = Measured capacitance in microfarads (μF) Vx = Programmed voltage in volts						
<b>Delay Time:</b>	0 – 9999msec						
<b>Display:</b>	LCD graphic display Current: 3.5 digit resolution Bar Graph: 8 ranges/2 decades per graph, fixed or auto-scale Line Graph: X-Y: Current or Resistance versus Time Indicators: High Voltage, Pass/Fail, Remote						
<b>Input Terminals:</b>	Two BNC Connectors, One sheathed banana plug terminal						
<b>Standard Interfaces:</b>	• RS232      • IEEE-488      • Remote I/O						
<b>Dimensions:</b>	Bench Mount with 19” Rack Mount Brackets (h x w x d): 5.75 x 17.375 x 15.25in (143.75 x 34.375 x 381.25mm)						
<b>Weight:</b>	12.7 kg (28lbs) – Net; 18.6 kg (41lbs) – Ship						
<b>Environmental:</b>	Operating: 10°C to 40°C, RH 80%						
<b>Power:</b>	• 110 - 240V    • 50 - 60Hz • 400W Max (1.8A at 220VAC, 3.2A at 125VAC)						
<b>General:</b>	• Fully programmable via menu • Zeroing • Stored test conditions and results						
<b>Accessories Supplied:</b>	• Instruction Manual      • AC Power Cable • Calibration Certificate    • Lead Set: 1.5m coax cable HV/BNC						
<b>Ordering Information:</b>	<table><thead><tr><th style="text-align: left;"><u>Description</u></th><th style="text-align: left;"><u>Catalog No.</u></th></tr></thead><tbody><tr><td>Megohmmeter: 2/25/100mA, 1kV</td><td>1868A</td></tr><tr><td>Megohmmeter: 2/10/18mA, 5kV</td><td>1868D</td></tr></tbody></table>	<u>Description</u>	<u>Catalog No.</u>	Megohmmeter: 2/25/100mA, 1kV	1868A	Megohmmeter: 2/10/18mA, 5kV	1868D
<u>Description</u>	<u>Catalog No.</u>						
Megohmmeter: 2/25/100mA, 1kV	1868A						
Megohmmeter: 2/10/18mA, 5kV	1868D						



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## Accessories

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### Accessories Included

<b>Item</b>	<b>Quantity</b>	<b>QuadTech P/N</b>
AC Power Cord	1	700070
1868A Alligator Clip Lead Set	1	1868-01
Rack Mount Brackets (19")	2	1868-02
1868D Alligator Clip Lead Set	1	1868-03
Interlock Plug (3-pin male)	1	1868-04
Instruction Manual	1	150753
Calibration Certificate	1	N/A

### Accessories/Options Available

<b>Item</b>	<b>Quantity</b>	<b>QuadTech P/N</b>
PCMCIA Memory Card (2Meg SRAM) (For memory expansion of setups & downloading of instrument firmware)	1	2100-04



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## Safety Precautions

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### WARNING

The 1868 Megohmmeter can provide an output voltage as high as 1000V DC (1868A) and 5000V DC (1868D) to the external device under test (DUT). Although the 1868 instrument is designed with full attention to operator safety, serious hazards could occur if the instrument is used improperly and these safety instructions are not followed.

1. Operate the 1868 Megohmmeter 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 1868 Megohmmeter is not connected to earth ground.
2. Never touch the metal of the High Voltage probe directly. Touch only the insulated parts of the lead(s).
3. Never touch the test leads, test fixture or DUT in any manner (this includes insulation on all wires and clips) when the high voltage is applied and the red **HV BREAK** light is ON.
4. Before turning on the 1868 unit, make sure there is no device (DUT) or fixture connected to the test leads.
5. After each test, press the [HV BREAK] button for safety. This terminates the high voltage being applied to the output terminals.
6. When the red **HV BREAK** LED is lit, NEVER touch the device under test, the lead wires or the output terminals.
7. 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 1868 instrument.
8. If the **HV BREAK** LED does not go off when the [HV BREAK] button is pressed, immediately stop using the tester. It is possible that the output voltage is still being delivered regardless of the TEST ON/OFF control signal.
9. When the 1868 instrument is used in remote control mode, be extremely careful. The High Voltage Output is being turned On/Off with an external signal.



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# Condensed Operating Instructions

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## WARNING

High Voltage is applied to the H.V. Output Terminal anytime the red **HV BREAK** LED is ON. Always make sure the **HV BREAK** LED is OFF when connecting or disconnecting the device under test (DUT).

## General Information

The 1868 Megohmmeter is a computer controlled measuring instrument for direct readout of resistance and current. The voltage applied to the device under test is programmable from 10V to 1kVDC for the 1868A and from 50V to 5kVDC for the 1868D. Resistance from 10k $\Omega$  to 1P $\Omega$  is measureable with charge current of up to 80mA (1868A) and 18mA (1868D).

## Start-Up

The 1868 Megohmmeter can be operated from a power source between 110 and 240VAC at a power line frequency of 50 or 60Hz. The 1868 Megohmmeter contains an auto-sensing power supply. There are no external voltage selector switches or power line fuses.

Connect the 1868 Megohmmeter AC power cord to the source of proper voltage. The 1868 instrument is designed to be operated with its chassis connected to earth ground and 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 which provides earth ground. Serious injury can result if the 1868 Megohmmeter is not connected to earth ground.

To apply power, press the [POWER ON] switch on the rear panel to 1. To switch the power off press the [POWER ON] toggle switch again or if measurements are to be made proceed with Test Parameter Set-Up below. **Note:** To obtain the stated accuracy, the 1868 Megohmmeter should warm-up for 30 minutes prior to use.

## NOTE

The Interlock pin must be connected to the middle 3-pin connector of Slot 3 on the rear panel of the 1868 unit. No measurements will be made if the Interlock is disconnected.

## 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.

# Condensed Operating Instructions

## NOTE

Refer to paragraphs 2.3 - 2.4 for a full description of programming test parameters and instruction on how to store the test setup. Test parameters must be set before the 1868 unit can be zeroed.

## NOTE:

The 1868 can be zeroed with or without cables. If cables have sufficiently high resistance, use the Zero Function. If the leakage needs to be offset due to cables or test fixture, use the Zero/Offset Function.

There are 2 separate functions in the Zero Adjust Menu. 1: Zero the current detector. 2: Perform an Offset with the cables connected and the HV activated.

## Zeroing

After setting your test parameters, zero the 1868 unit with no device or cables connected. The 'zero' adjusts the current input amplifier before any measurements are made.

Press the green [MENU] key once. Press [F8] = ZERO ADJUST. Press [F8] = ZERO ALL RANGES. Display reads "ZERO ADJ. RUNNING". The STATUS LED is red as long as there is no Zero Adjustment stored in memory. When the 1868 instrument has completed the ZERO measurement, the display reads "ZERO ADJ. END". The display shows YES for the 4 ranges and the STATUS LED changes from red to green.

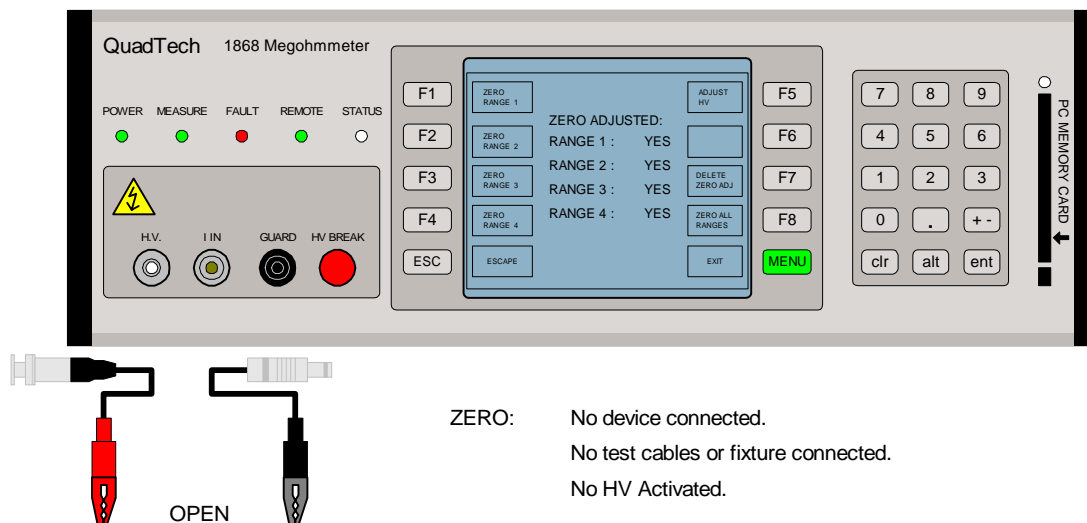


Figure COI-1: Zero Adjustment

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# Condensed Operating Instructions

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## Zero/Offset Function

The 'offset' compensates for the leakage in the cables or test fixture when the HV is activated. To perform an Offset, connect the test cables (or fixture) to the 1868 output terminals as they would be connected for the pre-programmed test. Do not connect the device under test.

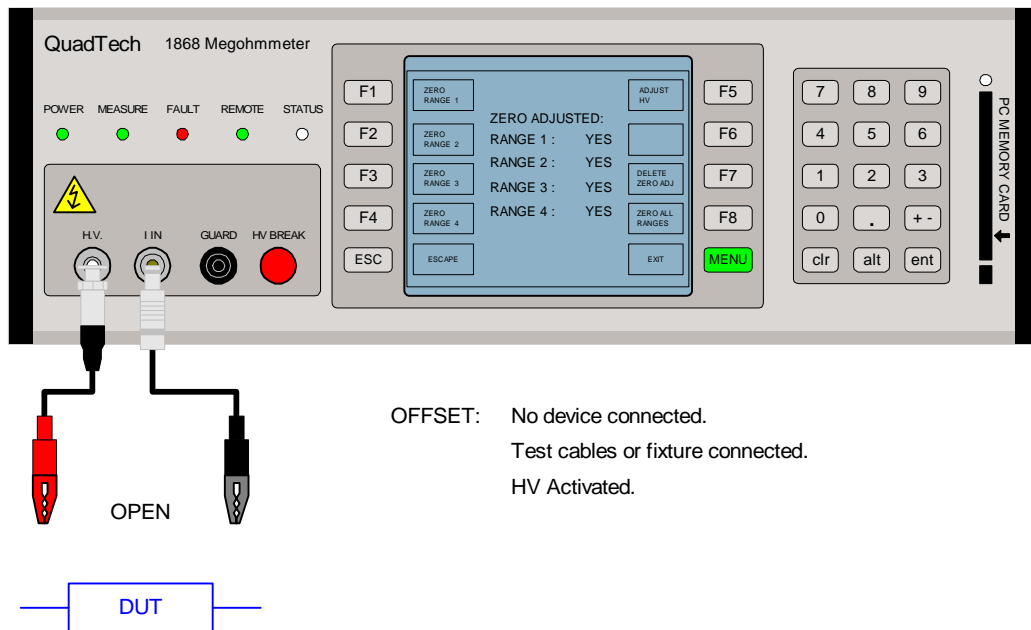
Press [F5] = ACTIVATE HV

Press the green [MENU] key once.

Press [F8] = ZERO ADJUST.

Press [F8] = ZERO ALL RANGES.

Display reads "ZERO ADJ. RUNNING".



**Figure COI-2: Zero/Offset Adjustment**

**NOTE:**

[F5] = ADJUST HV is used only when Dual HV Supplies are installed in the 1868 Megohmmeter. When HV1 and HV2 are set to the same voltage, "HV ADJUST" is used to remove any minor differences in the actual voltage output. HV needs to be activated to initiate HV adjust.

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# Condensed Operating Instructions

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## Measurement Mode

The 1868 Megohmmeter is capable of measuring resistance and current. Refer to paragraphs 2.3.1, 2.3.2 and 2.4 for instruction on programming a manual or sequence test. As an example of a manual test, program a resistance test with a 100V test voltage and 25mA charging current.

### Manual Measurement Example:

Turn Power ON.

Connect Black cable to 1868 **I IN** terminal.

Connect Red high voltage cable to 1868 **H.V.** terminal.

Press the green softkey [MENU] = EXIT

Press [MENU] again.

Press [F1] = MEASURE SETUP.

Press [F1] = HV CONTROL.

Press [F1] = HV VOLTAGE.

Press gray softkeys [1] [0] [0] [ent] = 100V

Press [F8] = MAXIMUM CURRENT

Press [F2] = HV CUR <25MA

Press [1][2][3][4][ent]

Press [MENU] = EXIT

Press [MENU] = EXIT

Press [MENU] = EXIT

Zero the 1868 unit.

Connect Device Under Test (DUT).

Press gray [F1] to start measurements, press [F5] = ACTIVATE HV button.

Record Readings.

When finished, Press gray [F1] to stop measurements, press [F5] = CANCEL HV button.

At any time, press red [HV BREAK] button to stop test.

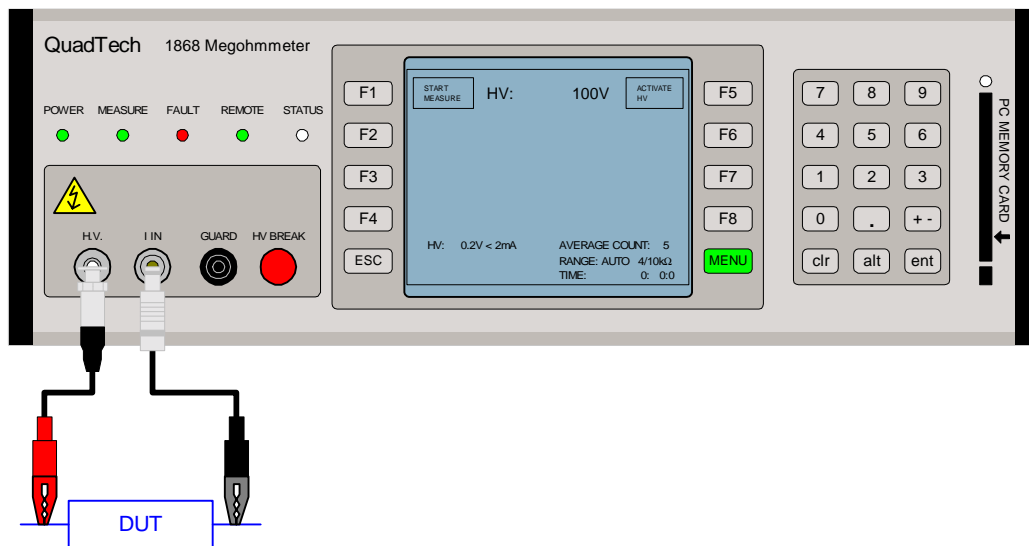


Figure COI-3: 1868-01 Cable Connection To Device Under Test



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# Condensed Operating Instructions

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## Sequence Measurement Mode Example

As an example, program a resistance sequence with 1000V, 3sec charge time, 3sec meas delay, 3sec discharge, auto range and an average count of 15 measurements. To program this automatic multi-step test follow these steps:

Power ON 1868 instrument.

Press the green softkey [MENU] = EXIT

Press [MENU] again.

Press [F2] = SEQUENCE SETUP.

Press [F6] = NEXT SEQUENCE to move highlighted box to **Empty Sequence 1**.

Press [F2] = EDIT SEQUENCE.

Press [F1] = EDIT STEP.

Press [F1] = SELECT COMMAND to select highlighted parameter **CHARGE**.

Press gray softkeys [1] [0] [0] [0] [ent] = 1000V

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

Press [F6] = NEXT STEP to move highlighted box to step **2**.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **M. DELAY**.

Press gray softkeys [1] [0] [0] [0] [ent] = 1000V

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

Press [F6] = NEXT STEP to move highlighted box to step **3**.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **MEASURE**.

Press gray softkeys [0] [ent] = Range 0 = AUTO RANGE

Press gray softkeys [0] [ent] = Zi: 0 = 1M $\Omega$  input impedance.

Press gray softkeys [1] [5] [ent] = 15 measurements for Average Count

Press gray softkeys [0] [ent] = L: 0 = No Limits Set.

Press [F6] = NEXT STEP to move highlighted box to step **4**.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **DISCHARGE**.

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

Press [MENU] to EXIT step setup and return to Sequence Setup menu.

**Note:** Sequence is automatically saved

Press [F1] = ACTIVATE SEQUENCE

Press [ESC] = ESCAPE

Press [F1] = START SEQUENCE

**Note:** MEASURE LED flashes while measurements are being made.



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## Section 1 : Introduction

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### 1.1 Unpacking and Inspection

Inspect the shipping carton before opening. If damaged contact the carrier agent immediately. Inspect the 1868 instrument 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 shipping carton and packing material for future use such as returning for recalibration or service.

### 1.2 Product Overview

The 1868 Megohmmeter measures insulation resistance and charge current. Insulation resistance measurements are possible from 10k $\Omega$  to 1P $\Omega$  at programmable DC test voltages between 50 and 1000V. The charge current test is programmable from 2mA to 80mA (1868A) and to 18mA (1868D). The instrument has internal storage of 4 user programmable test sequences (up to 20 steps each) plus 4 pre-programmed test sequences. The PCMCIA interface increases test data storage with the capability of uploading/downloading test setups to a memory card. The 1868 Megohmmeter comes standard with Remote I/O, RS232 and IEEE-488.2 interfaces for remote control operation and communication with other instrumentation.

**WARNING**

The 1868 Megohmmeter is capable of generating HIGH VOLTAGE up to 1000V DC (1868A) and 5000V DC (1868D).

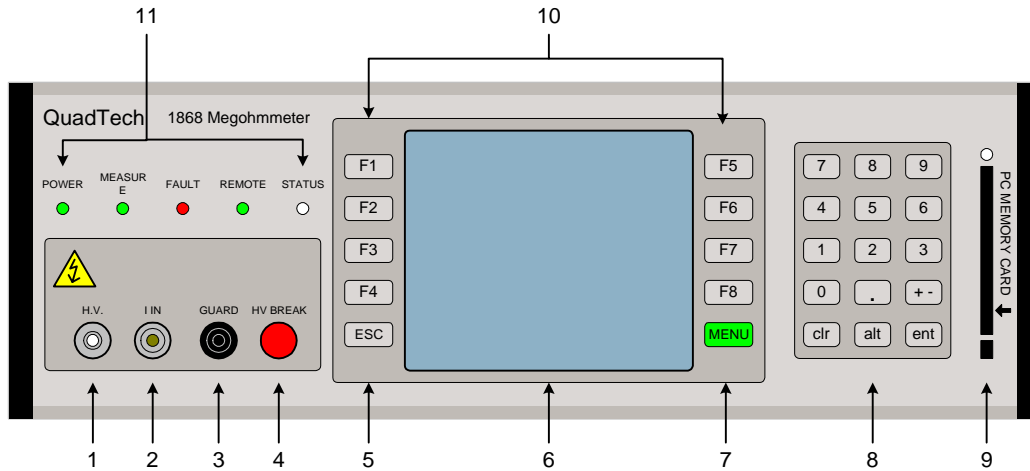
Do NOT touch the Test Terminals when the red **HV BREAK** LED is ON.

Always make sure the **HV BREAK** LED is OFF when connecting or disconnecting the device under test (DUT).

## 1.3 Controls and Indicators

### 1.3.1 Front Panel Controls and Indicators

Figure 1-1 illustrates the controls and indicators on the front panel of the 1868 Megohmmeter. Table 1-1 identifies the controls and indicators with descriptions and functions.



**Figure 1-1: 1868 Front Panel Controls & Indicators**

**Table 1-1 : 1868 Front Panel Controls and Indicators**

Reference Number Figure 1-1	Name	Type	Function
1	HV	Silver BNC	High Voltage Output Terminal
2	I IN	Silver Triaxial Receptacle	Low Voltage Terminal (Current Sense)
3	GUARD	Black Banana Receptacle	Guard for 3-terminal measurement
4	HV BREAK	Red Push Button	Terminate High Voltage at output terminals
5	ESC	Gray soft key	To exit current menu & return to measurement screen
6	Display	Graphic LCD	Indicates step, mode, limits, test setup, test result, graphs
7	MENU	Green soft key	Enter programming mode, select menu
8	Keypad	Numerical soft keys	Enter/Clear numerical values, decimal place; Alt Menu
9	PCMCIA	Memory Card Receptacle	Save test setups to PCMCIA memory card
10	F1-F8	Gray soft keys	Function keys: select test parameters & activate tests
11	Status LEDs		
11a	Power	Green LED	When lit, indicates instrument is ON.
11b	Measure	Green LED	When lit, indicates the instrument is measuring.
11c	Fault	Red LED	When lit, indicates failure or fault.*
11d	Remote	Green LED	When lit indicates Remote test being performed.
11e	Status	Red/Green LED	When red, indicates ZERO has not been performed. When green, indicates ZERO has been performed.

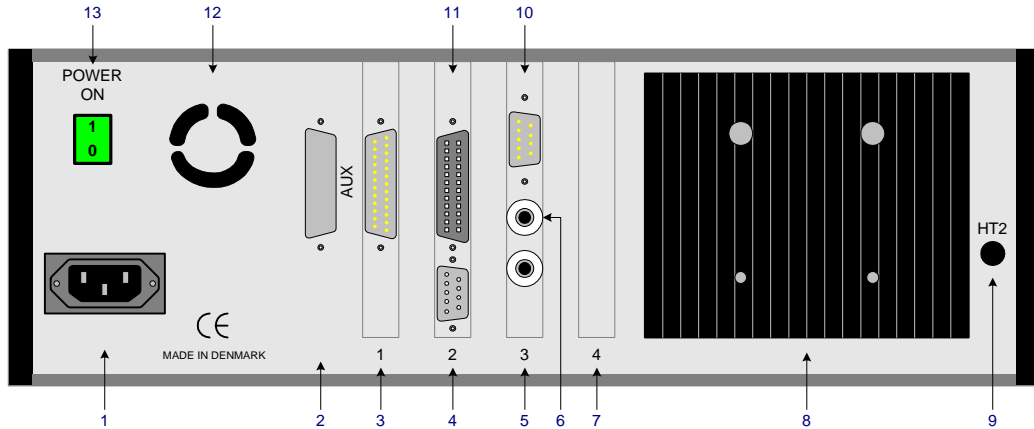
\*When flashing during startup, indicates failure of CPU, requiring service.

When lit during measurement, indicates:

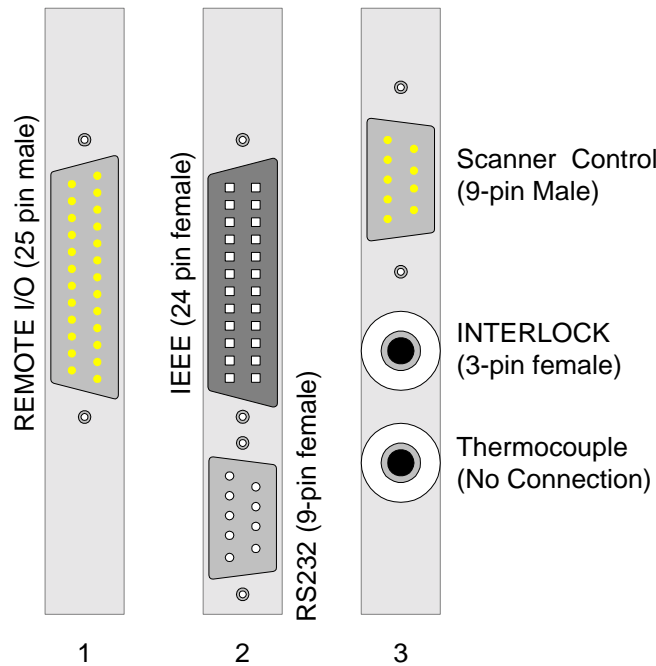
- Output voltage is lower than programmed voltage due to short, DUT capacitance or fault.
- A/D overflow due to incorrect programmed setting or insufficient charge time due to DUT capacitance.
- No contact if Contact Check is ON.

### 1.3.2 Rear Panel Controls and Indicators

Figure 1-3 illustrates the controls and indicators on the rear panel of the 1868 Megohmmeter. Figure 1-4 is a detailed illustration of the remote connectors on the rear panel of the 1868 instrument. Table 1-2 identifies them with description and function.



**Figure 1-3: 1868 Rear Panel Controls and Connectors**



**Figure 1-4: Detail 1868 Interface Connectors**

**NOTE**

The Interlock pin must be connected to the middle 3-pin connector of Slot 3 on the rear panel of the 1868 unit. No measurements will be made if the Interlock is disconnected.

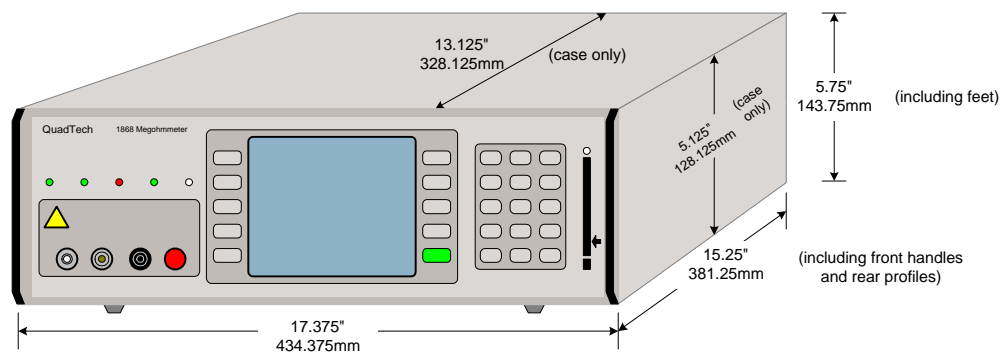
**Table 1-2: 1868 Rear Panel Connectors and Controls**

Reference Number Figure1-3	Name	Type	Function
1	AC Inlet Module	Black 3-prong receptacle	3-wire connection for AC power Source.
2	AUX	Interface cut-out	No Connection – Future expansion
3	Remote I/O	Black 25 pin D-Type male	Input/Output connections for Remote I/O Interface
4	RS232	Black 9 pin D-Type female	Input/Output connections for RS232 Interface
5	N/A	Black 3-pin female	No Connection - Thermocouple
6	INTERLOCK	Black 3-pin male	Insert Interlock Plug or unit will not function
7	N/A	Blank Expansion Slot	No Connection – Future expansion
8	N/A	Black Heat Fins	Do not block.
9	HV2	Silver BNC connector	Rear Panel Output High Voltage Output
10	N/A	Silver 9 pin D-Type male	Input/Output connections for Scanner Interface
11	IEEE	Black 24 pin female	Input/Output connections for IEEE-488 (GPIB)
12	N/A	Temp Control Fan Outlet	Do not block. Cool unit : ON $\geq 50^{\circ}\text{C}$ , OFF $< 50^{\circ}\text{C}$
13	POWER ON	Green Toggle Switch	Apply AC Power: 1=On, 0=OFF

## 1.4 Installation

### 1.4.1 Dimensions

The 1868 instrument is supplied in bench configuration ( a cabinet with resilient feet for placement on a table). Flip feet are provided under the front feet so that the unit can be tilted back for convenient operator viewing. Rack mount brackets for installation in a 19” rack are included with the 1868 instrument.



**Figure 1-5: 1868 Instrument Dimensions**

### 1.4.2 Instrument Positioning

The 1868 Megohmmeter contains a liquid crystal display for direct readout of the measured parameters. The optimum viewing angle is slightly down and about  $10^{\circ}$  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.

### 1.4.3 Power Requirements



The 1868 Megohmmeter can be operated from a power source of 110 to 240 VAC. Power connection is via the rear panel through a standard AC inlet module. The 1868 Megohmmeter contains an auto-sensing power supply. There are no external voltage selector switches or power line fuses. Always use an outlet which has a properly connected protection ground.

### 1.4.4 Safety Inspection

The 1868 Megohmmeter is shipped from QuadTech with a standard U.S. power cord, QuadTech P/N 700070 (with Belden SPH-386 socket or equivalent and 3-wire plug conforming to IEC 320). Make sure that the instrument is used only with these cables (or 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 1868 instrument to direct sunlight, extreme temperature or humidity variations, or corrosive chemicals.





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## Section 2 : Operation

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### 2.1 Terms and Conventions

Table 2-1 : Measurement Unit Prefixes

<u>Multiple</u>	<u>Scientific</u>	<u>Engineering</u>	<u>Symbol</u>
1000000000000000	10 <sup>15</sup>	Peta	P
1000000000000	10 <sup>12</sup>	Tera	T
1000000000	10 <sup>9</sup>	Giga	G
1000000	10 <sup>6</sup>	Mega	M
1000	10 <sup>3</sup>	Kilo	k
.001	10 <sup>-3</sup>	milli	m
.000001	10 <sup>-6</sup>	micro	u
.000000001	10 <sup>-9</sup>	nano	n
.0000000000001	10 <sup>-12</sup>	pico	p
.000000000000001	10 <sup>-15</sup>	femto	f

**Charging Current:** An insulated product exhibits the basic characteristics of a capacitor. Application of a voltage across the insulation causes a current to flow as the capacitor charges. This current instantaneously rises to a high value as voltage is applied then exponentially decays to zero as the DUT becomes fully charged. Charging current decays to zero much faster than dielectric absorption.

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

**Discharge:** The act of draining off an electrical charge to ground. Devices that retain charge should be discharged after an IR or DC HiPot test. The 1868 instrument uses a 100k $\Omega$  resistor for Discharge. For safety, it is always recommended that the Discharge function be turned ON.

**Guard:** A Guard terminal provides a means of reducing errors in measurements from an external leakage source. Only leakage current flowing into the Guard terminal will be subtracted from the measurement.

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.
Frequency:	The rate at which current or voltage reverses polarity and then back again completing a full cycle, measured in Hertz (Hz) or cycles/second. AC Line Freq = 50/60 Hz. The 1868 instrument features HUM REJECTION to reject line frequency noise. Make sure "HUM REJECT" is set to the line frequency used in the local area.
Ground:	The base reference from which voltages are measured, nominally the same potential as the earth. The side of a circuit that is at the same potential as the base reference.
Leakage Current:	The steady state current that flows through the insulation. Leakage current is equal to the applied voltage divided by the insulation resistance.
Test Time:	
Charge Time:	The period of time for the voltage to climb to the programmed level.
Measurement Delay:	The period of time for the voltage to settle at the programmed level. (a.k.a.: delay)
Measure (Test):	The period of time that the voltage is applied to the DUT.
Discharge (Fall):	The period of time for the voltage to decrease back to 0.

## 2.2 Startup

Prior to programming, refer to paragraph 2.7, Connection to Device Under Test, to verify proper connection of DUT. The 2-Terminal or 3-Terminal grounded or guarded connections determine how a test will be programmed.

**WARNING**

NEVER TOUCH THE TEST LEADS IN ANY MANNER (this includes insulation on all wires and clips) when the HIGH VOLTAGE IS APPLIED and red HV BREAK LED is ON.

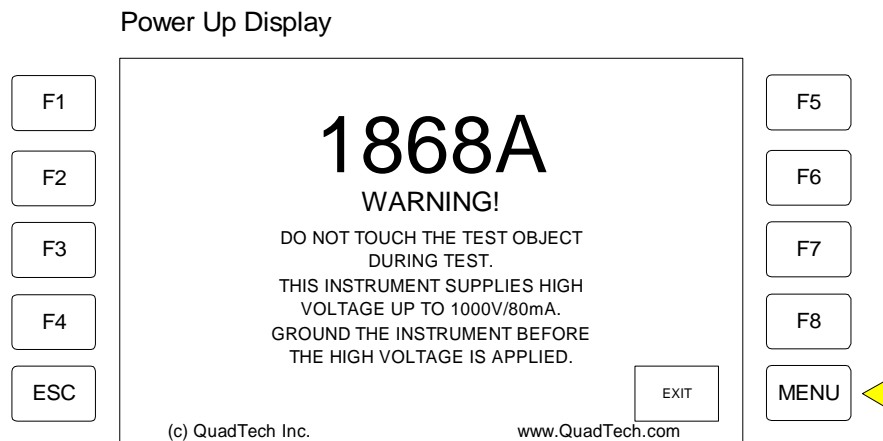
USE ALL PRECAUTIONS NECESSARY TO AVOID TOUCHING THE DEVICE UNDER TEST WHEN THE RED HV BREAK LED IS ON.

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 1868 Megohmmeter by pressing the green [POWER ON] toggle switch on the rear panel to ON (1 position). The green POWER LED on the front panel is lit when the instrument power is ON. The 1868 unit should have a warm-up time of at least 30 minutes prior to use.

**WARNING**

DO NOT TURN INSTRUMENT POWER ON OR OFF WITH TEST DEVICES CONNECTED.



**Figure 2-1: Initial Power Up Display**

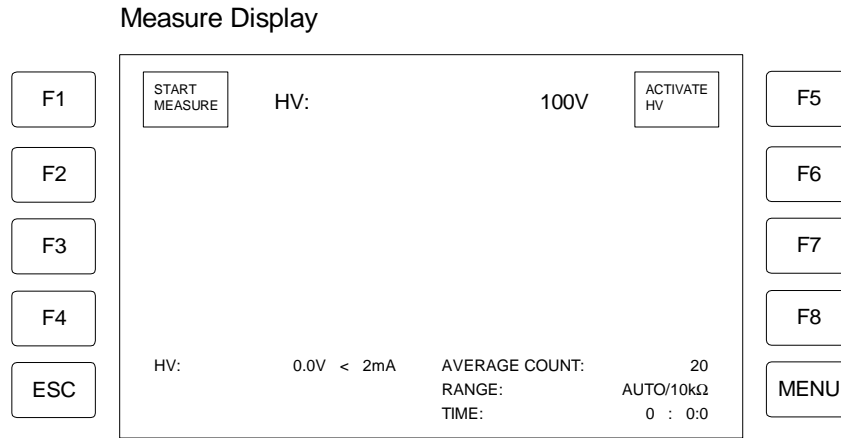
Press [MENU] = EXIT to access the Measure Display. Prior to programming a test, review the menus embedded in the 1868 software.

**NOTE:**

In this manual or the 1868 software you may encounter the abbreviation HT. HT denotes High Tension. **High Tension is High Voltage (HV).**

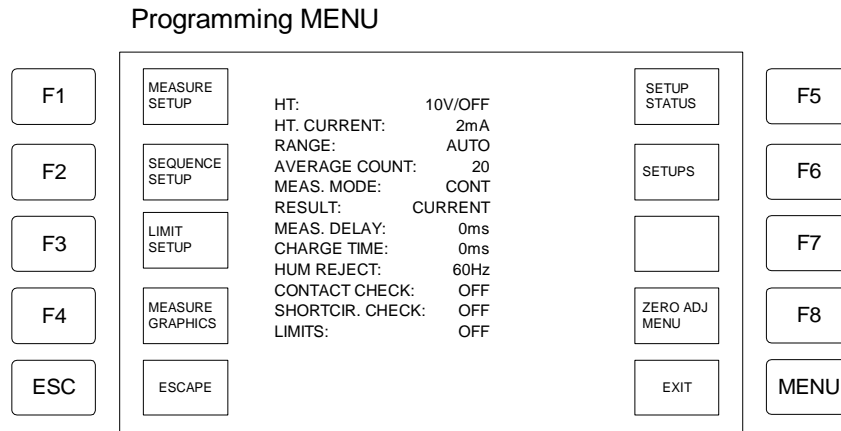
## Measure Display

Figure 2-2 illustrates the Measure Display of the 1868 Megohmmeter. There are 3 modes in which to view the measured result: text, x-y line graph or a bar graph. Text is the instrument default mode.



**Figure 2-2: Measure Display**

There is no initial voltage programmed into the 1868 Megohmmeter. Press [MENU] to enter the Program Display as illustrated in Figure 2-3. There are two modes for programming a test: manual (Measure Setup) and sequence (Sequence Setup).



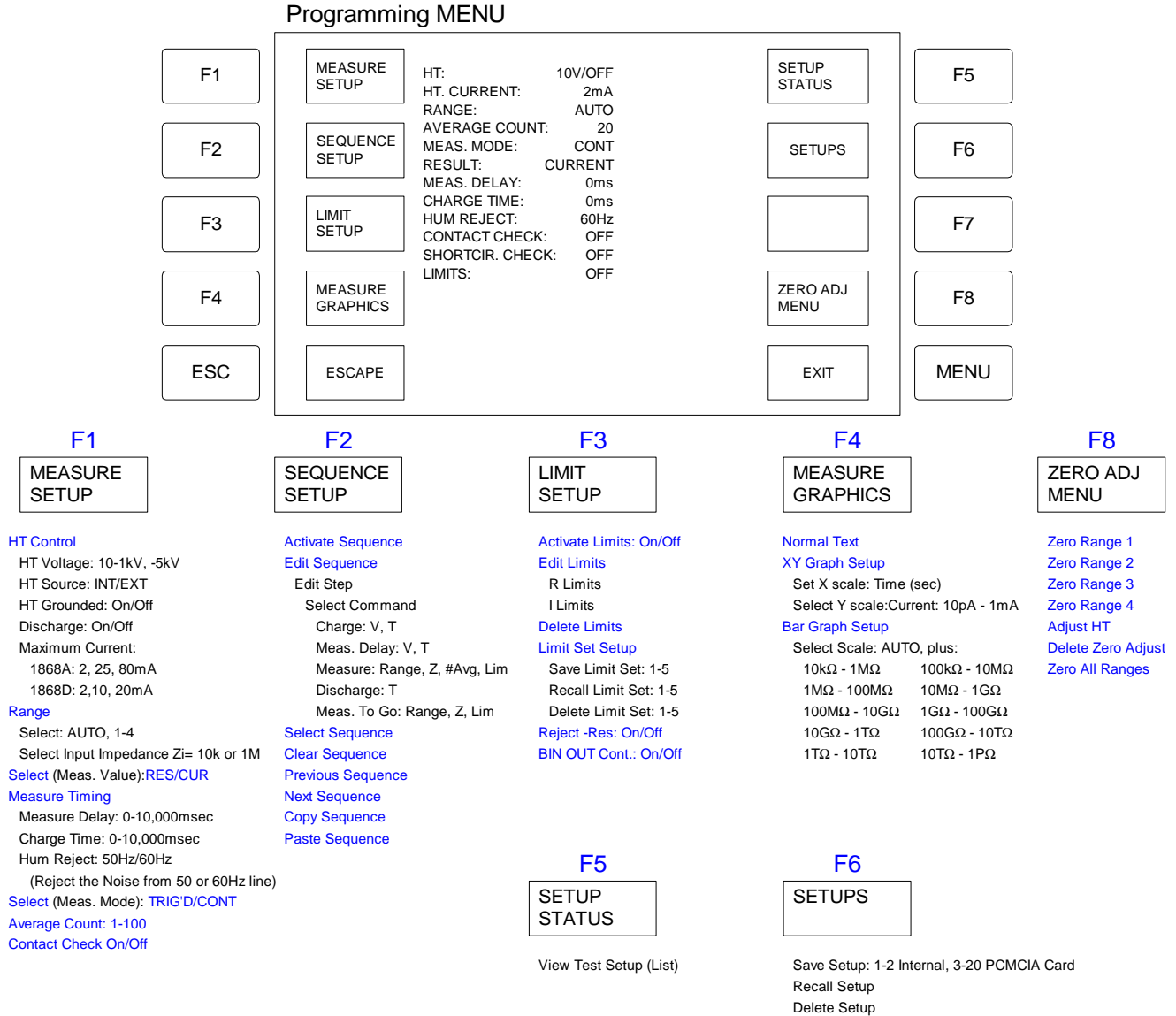
**Figure 2-3: Program Display**

Press [F1] = MEASURE SETUP to program a manual test.

## 2.3 Menus

**NOTE:**  
**Do not press the display.**  
 Press the gray softkeys adjacent to the display or the gray numerical keypad to program the instrument.

Figure 2-4 illustrates the initial menu display when [F8] = MENU is pressed twice following the power-up display.

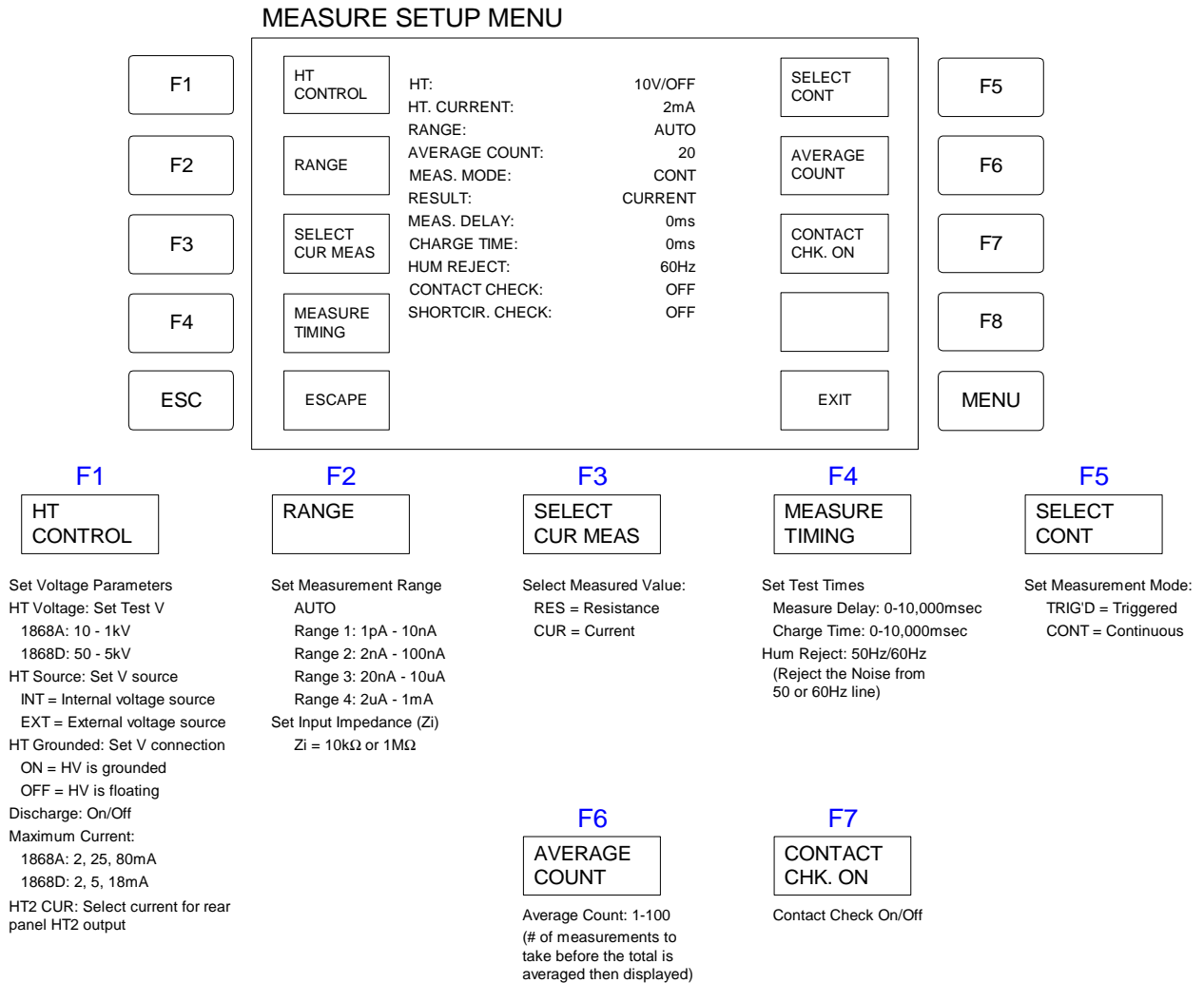


**Figure 2-4: Initial Menu Display**

Prior to programming a manual or sequence test, review the main menus of the 1868 Megohmmeter. Each of these menus contains sub-menus.

### 2.3.1 MEASURE SETUP

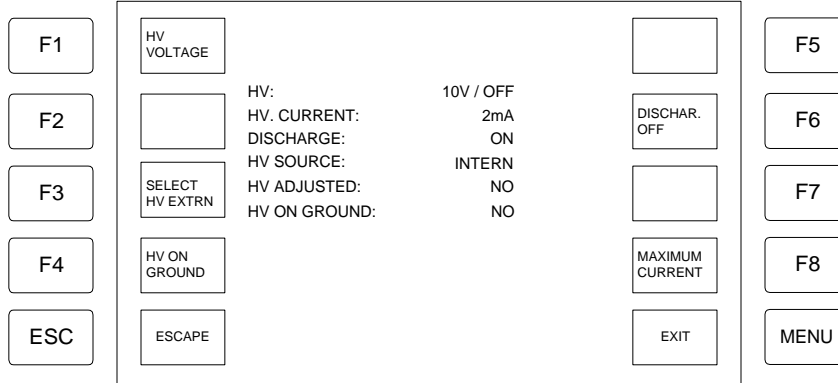
Use Measure Setup to program a manual test. From the initial menu, press [F1] = MEASURE SETUP. Within Measure Setup, 8 parameters can be selected and programmed: test voltage, range, measured value, test times, line frequency, measurement mode, average count and continuity check. Figure 2-5 illustrates the Measure Setup menu.



**Figure 2-5: Measure Setup Menu**

### 2.3.1.1 HV CONTROL

In the Measure Setup menu, press [F1] = HV CONTROL to program the test voltage level, source and connection to ground. Set the discharge function and select the maximum current. If the optional HV2 rear panel output is installed and to be used, select the HV2 CUR output current.



**Figure 2-6: HV Control Menu**

**Table 2-2: HV Control Parameters**

[pb]	Name	Parameter	1868A	1868D
F1	HV VOLTAGE	Level	Off, 10V–1000V	Off, 50V–5000V
F2	HV2 VOLTAGE	Dual Supply Only	Off, 10V–1000V	Off, 50V–5000V
F3	SELECT HV EXT	Source	INTernal, EXTernal	INTernal, EXTernal
F4	HV ON GROUND	Connection	On, Off	N/A
F6	DISCHAR. OFF	Discharge	On, Off	Always On
F8	MAXIMUM CURRENT	Charge Current	2, 25, 80mA	2, 10, 20mA

**NOTE:**

[F2] is blank if the optional dual HV supply (HV2) is not installed on the rear panel of the 1868 instrument.

Press [F1] = HV Voltage to set the test voltage. Use the numerical keys to enter the voltage level then press [ent] to accept the value.

Press [F2] = HV2 Voltage to set the test voltage of the rear panel dual voltage supply. Use the numerical keys to enter the voltage level then press [ent] to accept the value.

Press [F3] = SELECT HV EXTERNAL to set the source of the test voltage supply. [F3] toggles between EXTERNAL and INTERNAL. The instrument default value is INTERNAL. External is for use with an external power supply to apply voltage to DUT.

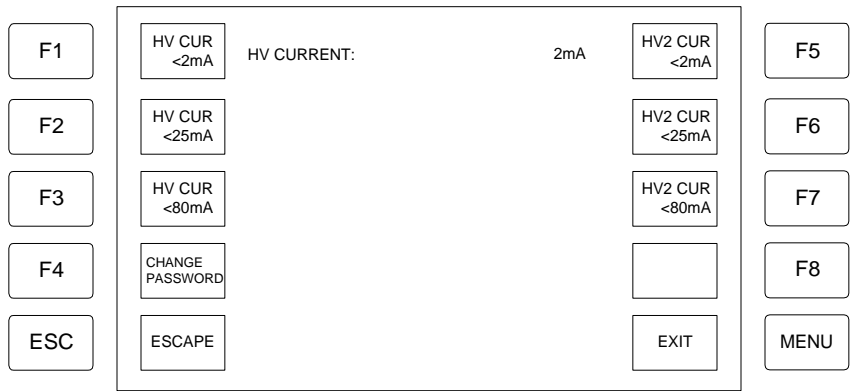
Press [F4] = HV ON GROUND to connect the HV output to ground (1868A only). The I IN and GUARD terminals are now **negative** with respect to ground when HV is activated. For most 2-terminal measurements, it is recommended that HV ON GROUND is ON to reduce noise. Turn HV ON GROUND OFF if one side of the DUT is connected to earth ground. Such as measurements in a water bath.

HV ON GROUND is useful when testing insulation resistance in cables. Connect the HV output to the cable shield and the current input to the inner cores. The ground connection of the shield provides noise reduction and makes the testing of long cables safer.

**WARNING:**  
When HV ON GROUND is active, the Guard terminal follows the input terminal potential with respect to ground.

Press [F6] = DISCHAR. OFF to set the instrument discharge function ON/OFF. When Discharge is ON, the 1868 automatically discharges the device under test through a 100kΩ resistor via a solid state switch. The instrument default value is ON.

Press [F8] = MAXIMUM CURRENT to set the charge current. Table 2-3 lists the charge currents for the 1868A and 1868D instruments. For operator safety, a password is required for charge current >2mA. Use numerical keys then press [ent] to accept charge current value.



**Figure 2-7: Maximum Current Menu**

**NOTE:**  
[F5], [F6], and [F7] are blank if the optional dual HV supply (HV2) is not installed on the rear panel of the 1868 instrument.

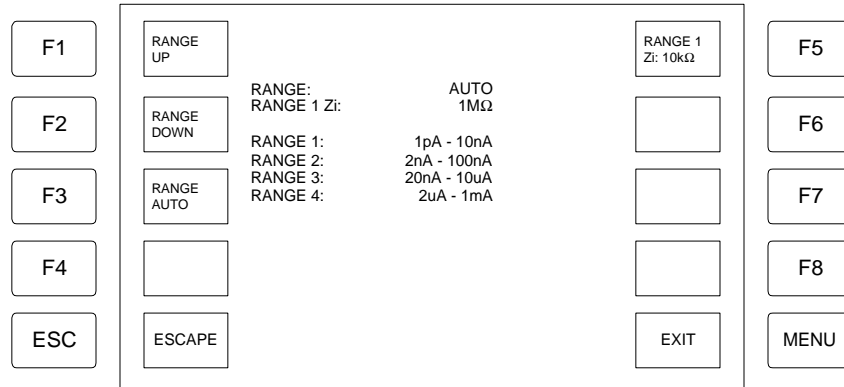
**Table 2-3: Maximum Current Parameters**

[pb]	1868A D Current	1868D Current	Password Req'd
F1	HV CUR <2mA	HV CUR <2mA	N/A
F2	HV CUR <25mA	HV CUR <10mA	[1][2][3][4][ent]
F3	HV CUR <80mA	HV CUR <18mA	[4][3][2][1][ent]
F5	HV2 CUR <2mA	HV2 CUR <2mA	N/A
F6	HV2 CUR <25mA	HV2 CUR <10mA	[1][2][3][4][ent]
F7	HV2 CUR <80mA	HV2 CUR <18mA	[4][3][2][1][ent]



### 2.3.1.2 RANGE

In the Measure Setup menu, press [F2] = RANGE to select the measurement range. Choose AUTO or Ranges 1-4. The instrument default value is AUTO. The input impedance (Zi) is selectable for Range 1 only. Choose Zi = 10kΩ or 1MΩ. The instrument default value is 10kΩ.



**Figure 2-8: Range Menu**

**Table 2-4: Range Parameters**

Range	Input Impedance	1868A	1868D
AUTO = 0	N/A		
RANGE 1	Zi = 10kΩ/1MΩ	1pA – 10nA	1pA – 10nA
RANGE 2	N/A	2nA – 100nA	2nA – 100nA
RANGE 3	N/A	20nA – 10uA	20nA – 10uA
RANGE 4	N/A	2uA – 1mA	2uA – 1mA

**NOTE:**

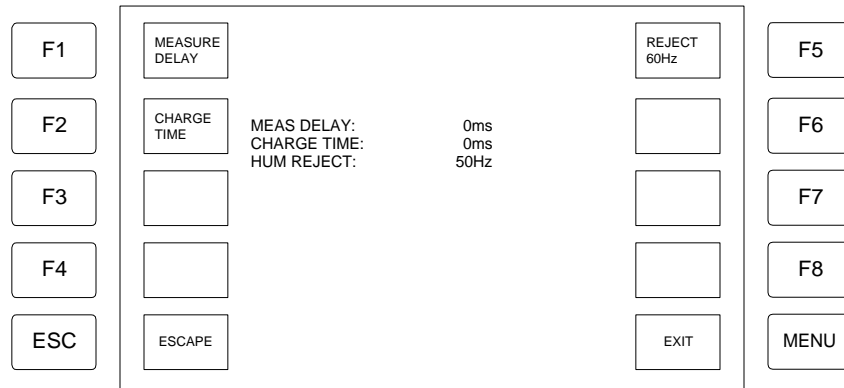
When measuring a capacitor, the AC noise from the HV supply may cause noise in the measurement. In Range 1, select the input impedance (Zi) = 1MΩ to decrease the noise gain by a factor of 100.

### 2.3.1.3 RESULT

In the Measure Setup menu, press [F3] = SELECT RES MEAS to select the value to be measured. [F3] toggles between SELECT RES MEAS (measured value = resistance) or SELECT CUR MEAS (measured value = current). The instrument default value is RES.

### 2.3.1.4 MEASURE TIMING

In the Measure Setup menu, press [F4] = MEASURE TIMING to program a measure delay and/or charge time and to select the line frequency (HUM REJECT).



**Figure 2-9: Measure Timing Menu**

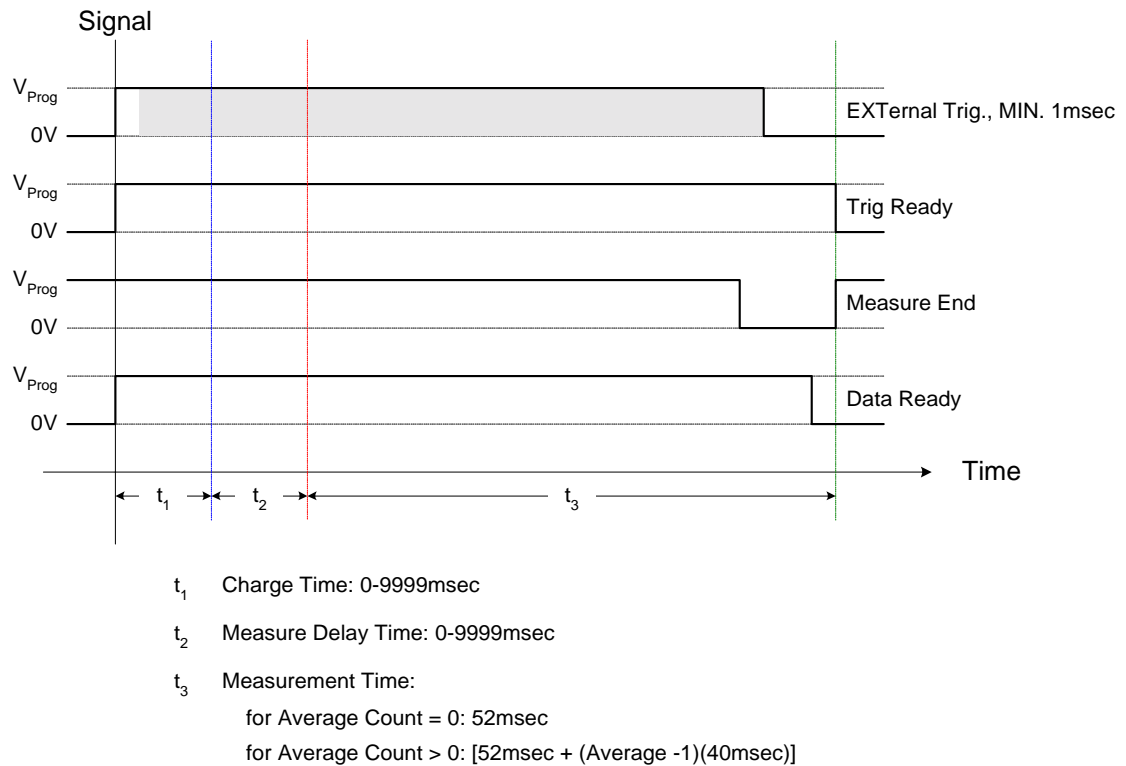
Press [F1] = Measure Delay, to program a delay time from TRIG to measurement start. The range of Measure Delay is 0 to 9999milliseconds and the instrument default value is 0msec. Use numerical keys then press [ent] to accept value.

Press [F2] = Charge Time to program a charge time from 0 to 9999milliseconds. The instrument default value is 0msec. Use numerical keys then press [ent] to accept value. During Charge Time, the input amplifier is shorted with a 100Ω resistor for the programmed charge time.

**NOTE:**

During Charging, the input impedance ( $Z_i$ ) is 10kΩ or 1MΩ depending upon the selection of the input impedance in the Range Menu (paragrapg 2.3.1.2).

When both Measure Delay and Charge Time are programmed, the Charge Time precedes the Measure Delay: [TRIG] initiated, Charge Time elapses, Measure Delay elapses and then the 1868 makes the measurement.



**Figure 2-10: Measurement Time**

At a line frequency of 60Hz, the 1868 instrument takes 48.7msec to make a measurement: 20msec to stabilize the input amplifier and measure the HV voltage, 16.7msec integration time to measure the current and 12msec for internal housekeeping. At 50Hz, the 1868 instrument makes a measurement in 52msec: 20msec voltage, 20msec integration and 12msec internal.

Line Frequency is selected within the Measure Timing menu. Press [F5] = REJECT 50Hz to set the 1868 instrument to reject the noise (HUM) from the 50Hz line, therefore the line frequency is set to 60Hz. [F5] toggles between REJECT 50Hz and REJECT 60Hz and the instrument default value is REJECT 50Hz. To suppress the influence of noise, each measurement is integrated over one period of the mains supply frequency.

### 2.3.1.5 MEASUREMENT MODE

In the Measure Setup menu, press [F5] = SELECT TRIG'D to select the measurement mode. [F5] toggles between SELECT TRIG'D (measure mode = triggered) or SELECT CONT (measure mode = continuous). In SELECT TRIG'D mode, the 1868 will make one measurement when triggered by an external signal (IEEE, RS232) or when the [F1] TRIG button is pressed manually. In SELECT CONT mode, when the [F1] START MEASURE button is pressed, the 1868 will make continuous measurements until the stop measurement button is pressed.

### 2.3.1.6 AVERAGE COUNT

In the Measure Setup menu, press [F6] = AVERAGE COUNT to select the number of measurements to be taken before the average is calculated and displayed. Use the numerical keys to enter a whole number from 1-100 then press [ent] to accept value. The instrument default value is 20.

### 2.3.1.7 CONTACT CHECK

In the Measure Setup menu, press [F7] = CONTACT CHK. ON to select the contact check function. [F7] toggles between CONTACT CHK. ON (1868 will check if there is contact to DUT) or CONTACT CHK. OFF (1868 will not check for connection). The instrument default value is OFF. Contact Check operates by sending a 1kHz signal out the HV terminal and checking for the signal at the I IN terminal.

Contact Check can only be used on capacitive devices. When measuring a 1.5m long cable, a capacitance >25pF can be detected in the 1200pF range (Ranges 2, 3 & 4).

If Contact Check is ON and no contact is detected, the 1868 display will read "NO CONTACT" and the Fault LED will be lit. If limits are active, the rear panel PLC will reject (BIN 5).

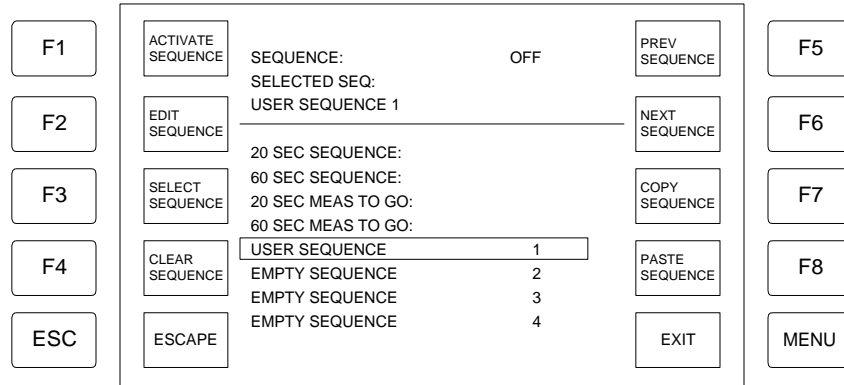
Paragraph 2.4 illustrates a complete Measure Setup programming example for a manual test.

### 2.3.2 SEQUENCE SETUP

Use Sequence Setup to program a multi-step test. From the initial menu, press [F2] = SEQUENCE SETUP. Figure 2-11 illustrates the Sequence Setup menu.

**NOTE:**

If a user sequence has not been programmed, the Sequence Setup display will not contain: [F4] = Clear Sequence, [F7] = Copy Sequence and [F8] = Paste Sequence.  
 [F1] toggles between “Activate Sequence” and “Cancel Sequence” and [F2] toggles between “Edit Sequence” and “View Sequence” depending upon the sequence selected.



**Figure 2-11: Sequence Setup Menu**

**Table 2-5: Sequence Setup Parameters**

[pb]	Name	Operation
F1	ACTIVATE/CANCEL SEQUENCE	Turn ON/OFF current sequence
F2	VIEW/EDIT SEQUENCE	View/Edit the programmed steps of sequence
F3	SELECT SEQUENCE	Select highlighted sequence
F4	CLEAR SEQUENCE	Clear the programmed steps of sequence
F5	PREV SEQUENCE	Toggle UP list of sequences
F6	NEXT SEQUENCE	Toggle DOWN list of sequences
F7	COPY SEQUENCE	Copy highlighted sequence
F8	PASTE SEQUENCE	Paste sequence to selected location

#### Pre-Programmed Sequences:

Within Sequence Setup, there are 4 pre-programmed sequences: 20 SEC, 60 SEC, 20 SEC MEAS TO GO and 60 SEC MEAS TO GO.

When the 20 SEC sequence is chosen, continuous measurements are performed as defined in the measurement setup until 20 seconds have elapsed. The measurements are stopped and the DUT is automatically discharged.

When the 60 SEC sequence is chosen, continuous measurements are performed as defined in the measurement setup until 60 seconds have elapsed. The measurements are stopped and the DUT is automatically discharged.

When the 20 SEC MEAS TO GO sequence is chosen, as soon as the lowest active limit is reached, the measurements are stopped and the DUT is automatically discharged. If the lowest active limit is not reached when 20 seconds have elapsed, the measurements are stopped and the DUT is automatically discharged.

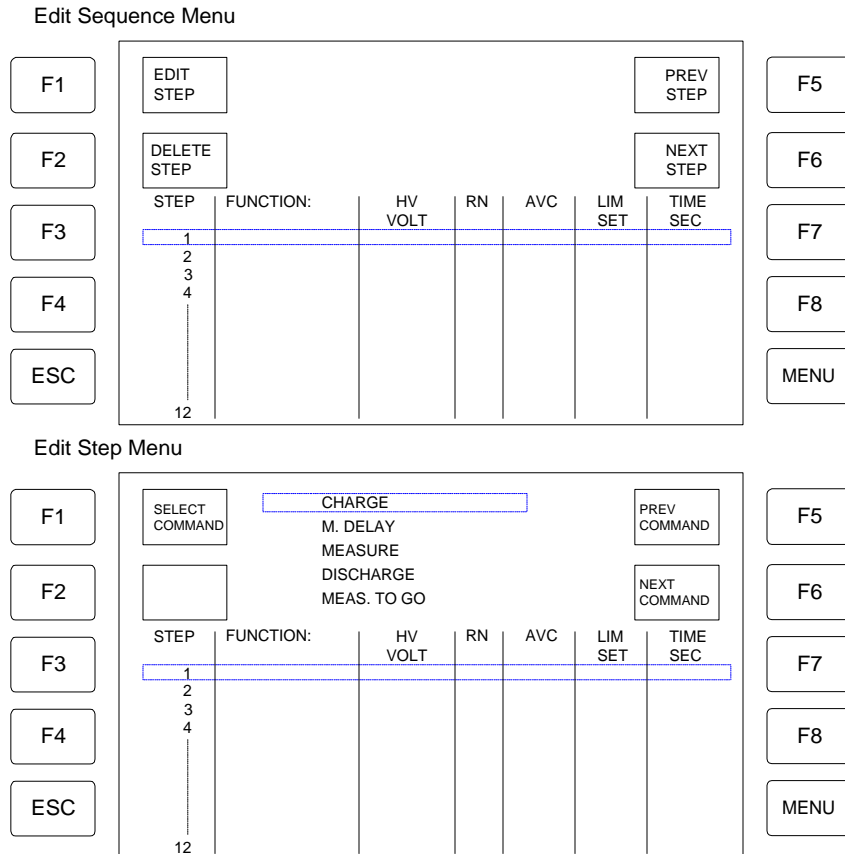
When the 60 SEC MEAS TO GO sequence is chosen, as soon as the lowest active limit is reached, the measurements are stopped and the DUT is automatically discharged. If the lowest active limit is not reached when 60 seconds have elapsed, the measurements are stopped and the DUT is automatically discharged.

**User- Programmed Sequences:**

There are 4 “Empty Sequences” that the user can program with up to 20 steps each and save to internal instrument memory or to the PCmCIA memory card. Sequences are also saved when setups are stored, refer to paragraph 2.3.7.

In the Sequence Setup menu, press [F2] = EDIT SEQUENCE to program a user sequence. Press [F1] = EDIT STEP to choose a step number to edit. Each step may consist of one of the following options:

1. Charge: input amplifier shorted with 100Ω resistor.
2. Charge Normal: charge through the input impedance (10kΩ or 1MΩ).
3. Measure: make a measurement.
4. Discharge: discharge DUT through 100kΩ resistor.



**Figure 2-12: Edit Sequence & Edit Step Menus**

**NOTE:**

If Measure is chosen and no limit testing desired, choose LIM SET 0. If a limit is to be used, the limit must be stored as a Limit Set.  
Time cannot be specified for Measure. The duration is calculated from the average count.

**NOTE:**

A Measurement Delay is required in sequence mode to eliminate erroneous results.  
Display will show 1.000kΩ if Measurement Delay is too short.

**Table 2-6: Programmable Sequence Parameters**

FUNCTION	PARAMETER						
	Voltage 1868A	Voltage 1868D	Time	Range	Zi	Average Count	Limit Set
CHARGE	10-1000V	50-5000V	0-9999ms	--	--	--	--
M. DELAY	10-1000V	50-5000V	0-9999ms	--	--	--	--
MEASURE	--	--	--	0, 1-4	0, 1	1-100	0-4
DISCHARGE	--	--	0-9999ms	--	--	--	--
MEAS. TO GO	--	--	--	0, 1-4	0, 1	1-100	0-4

**NOTE:**

In Table 2-6, In Range, 0 = Auto Range. Refer to paragraph 2.3.1.2 for Range setup. For the input impedance (Zi): 0 = 1MΩ and 1 = 10kΩ.

The 1868 instrument automatic editor contains repeat functions. If a step is blank and the previous step has been programmed, pressing the [ent] key will copy each parameter from the previous step to the blank step. If a step is already programmed, it can be left unchanged by pressing the [ent] key.

To exit sequence editing, press [MENU].

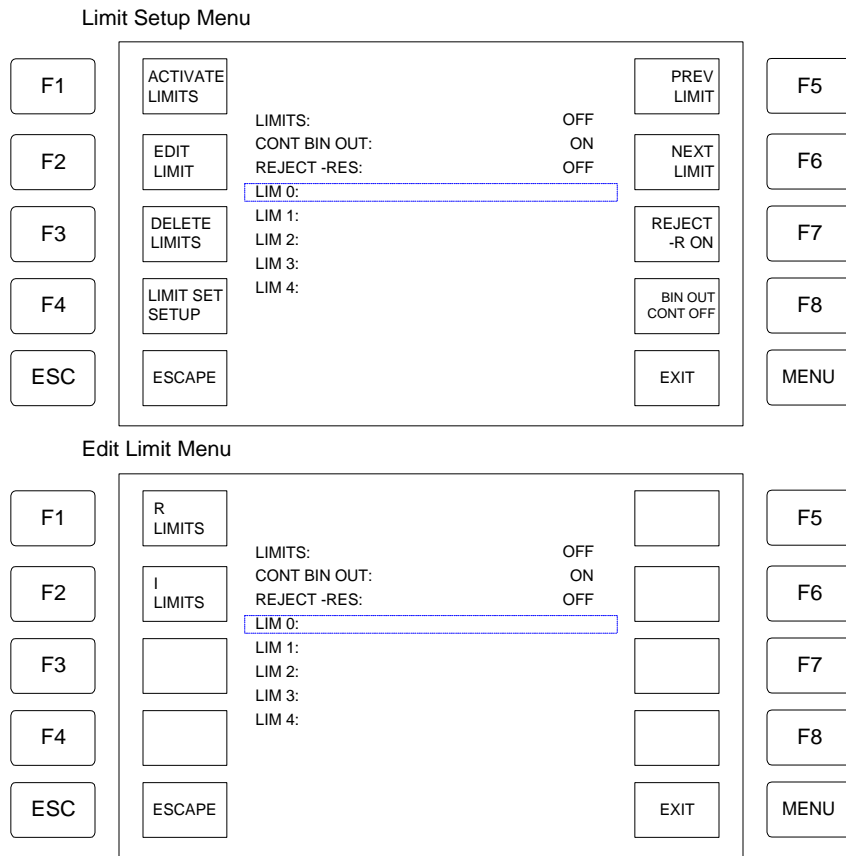
**NOTE:**

The X-Y graph display cannot be used in sequence measurements.

Paragraph 2.5 illustrates a complete Sequence Setup programming example for a multi-step test.

### 2.3.3 LIMIT SETUP

Select Limit Setup to program and store test limits. From the initial menu, press [F3] = LIMIT SETUP. Figure 2-13 illustrates the Limit Setup and Edit Limit menus.



**Figure 2-13: Limit Setup and Edit Limit Menus**

In the Limit Setup, up to 5 limits at a time can be defined for sorting purposes. The BIN number into which the component shall be dropped is displayed in the measurement display together with the measurement result.

Press [F7] = REJECT -R ON to have the 1868 reject a component based on a negative resistance measurement.

Press [F8] = BIN OUT CONT ON to set the 1868 Bin Out function to continuous mode.

A total of 5 limit sets can be stored ( via [SAVE LIMSET]) and recalled (via [RECALL LIMSET]) from the 1868 internal memory.



### 2.3.3.1 EDIT LIMIT

As shown in Figure 2-13, from the Limit Set menu, press [F2] = EDIT LIMIT to set or change the test limits.

**NOTE:**

When [EDIT LIMIT] is pressed, choose [R] to set resistance limits or [C] to set current limits. When the result is [RES] only [R] limits can be set. When the result is [CUR] only [C] limits can be set. Current [C] limits can be set as positive or negative.

#### **Example Resistance Limits Setup:**

To program a set of resistance limits so that the components sorted to Lim 0 = 1000k $\Omega$ , Lim 1 = 100M $\Omega$ , Lim 2 = 100G $\Omega$ , Lim 3 = 100T $\Omega$  and Lim 4 = 500T $\Omega$ , follow these steps:

In the Limit Setup Menu, with **LIM 0** highlighted:

Press [F2] = EDIT LIMITS

Press [F1] = R LIMITS

Press [F1] = k $\Omega$

Press [1] [0] [0] [0] [ent] = 1000k $\Omega$  (= 1.000M $\Omega$ )

Press [F6] = NEXT LIMIT until **LIM 1** is highlighted

Press [F2] = EDIT LIMITS

Press [F1] = R LIMITS

Press [F1] = M $\Omega$

Press [1] [0] [0] [ent] = 100M $\Omega$

Press [F6] = NEXT LIMIT until **LIM 2** is highlighted

Press [F2] = EDIT LIMITS

Press [F1] = R LIMITS

Press [F1] = G $\Omega$

Press [1] [0] [0] [ent] = 100G $\Omega$

Press [F6] = NEXT LIMIT until **LIM 3** is highlighted

Press [F2] = EDIT LIMITS

Press [F1] = R LIMITS

Press [F1] = T $\Omega$

Press [1] [0] [0] [ent] = 100T $\Omega$

Press [F6] = NEXT LIMIT until **LIM 4** is highlighted

Press [F2] = EDIT LIMITS

Press [F1] = R LIMITS

Press [F1] = T $\Omega$

Press [5] [0] [0] [ent] = 500T $\Omega$

Figure 2-14 illustrates the initial Edit Limit and final Edit Limit displays for the previous example.

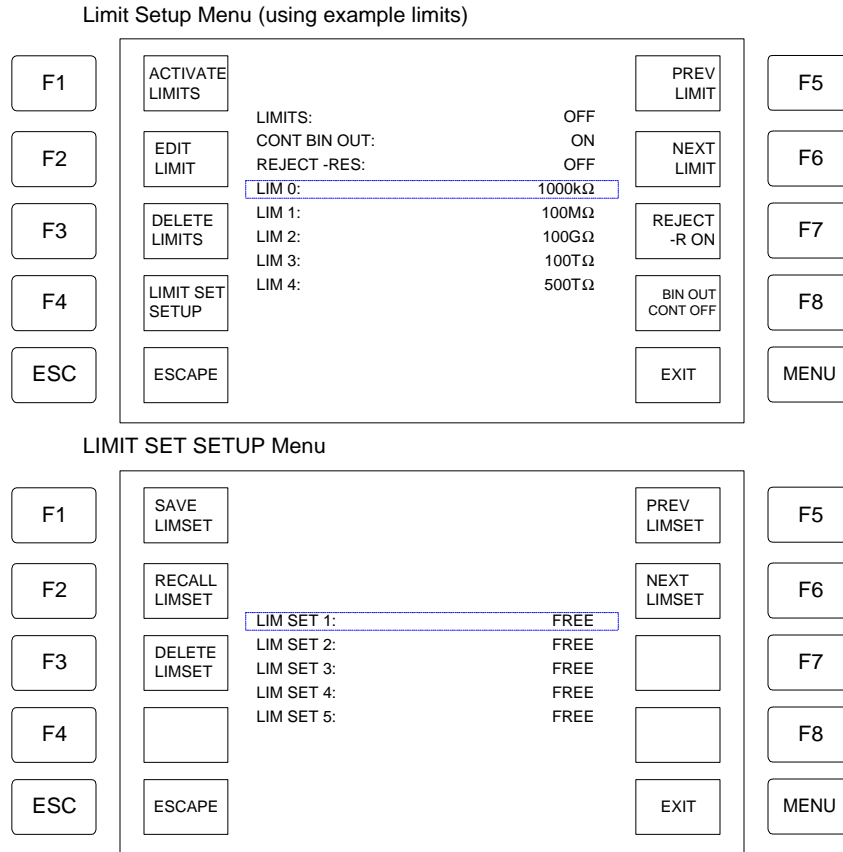
<p>F1</p> <p>F2</p> <p>F3</p> <p>F4</p> <p>ESC</p>	<table border="0" style="width: 100%;"> <tr> <td style="width: 15%; text-align: center;">kΩ</td> <td style="width: 60%;"></td> <td style="width: 15%; text-align: right;">kΩ</td> <td style="width: 10%;"></td> </tr> <tr> <td></td> <td>LIMITS:</td> <td style="text-align: right;">OFF</td> <td></td> </tr> <tr> <td></td> <td>CONT BIN OUT:</td> <td style="text-align: right;">ON</td> <td></td> </tr> <tr> <td></td> <td>REJECT-RES:</td> <td style="text-align: right;">OFF</td> <td></td> </tr> <tr> <td></td> <td>LIM 0:</td> <td></td> <td></td> </tr> <tr> <td></td> <td>LIM 1:</td> <td></td> <td></td> </tr> <tr> <td></td> <td>LIM 2:</td> <td></td> <td></td> </tr> <tr> <td></td> <td>LIM 3:</td> <td></td> <td></td> </tr> <tr> <td></td> <td>LIM 4:</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">ESCAPE</td> <td></td> <td></td> <td style="text-align: center;">EXIT</td> </tr> </table>	kΩ		kΩ			LIMITS:	OFF			CONT BIN OUT:	ON			REJECT-RES:	OFF			LIM 0:				LIM 1:				LIM 2:				LIM 3:				LIM 4:			ESCAPE			EXIT	<p>F5</p> <p>F6</p> <p>F7</p> <p>F8</p> <p>MENU</p>	<p><b>R Limits Menu</b></p> <p>[F1] [1][0][0][0][ent] = 1000kΩ</p> <p>[F6], Select Lim 1 then [F2] Edit Limit</p> <p>[F2] [1][0][0][ent] = 100MΩ</p> <p>[F6], Select Lim 2 then [F2] Edit Limit</p> <p>[F3] [1][0][0][ent] = 100GΩ</p> <p>[F6], Select Lim 3 then [F2] Edit Limit</p> <p>[F4] [1][0][0][ent] = 100TΩ</p>
kΩ		kΩ																																									
	LIMITS:	OFF																																									
	CONT BIN OUT:	ON																																									
	REJECT-RES:	OFF																																									
	LIM 0:																																										
	LIM 1:																																										
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	LIM 4:																																										
ESCAPE			EXIT																																								
<p>F1</p> <p>F2</p> <p>F3</p> <p>F4</p> <p>ESC</p>	<table border="0" style="width: 100%;"> <tr> <td style="width: 15%; text-align: center;">ACTIVATE LIMITS</td> <td style="width: 60%;"></td> <td style="width: 15%; text-align: right;">OFF</td> <td style="width: 10%; text-align: center;">PREV LIMIT</td> </tr> <tr> <td></td> <td>LIMITS:</td> <td style="text-align: right;">ON</td> <td></td> </tr> <tr> <td></td> <td>CONT BIN OUT:</td> <td style="text-align: right;">OFF</td> <td></td> </tr> <tr> <td></td> <td>REJECT-RES:</td> <td style="text-align: right;">OFF</td> <td></td> </tr> <tr> <td></td> <td>LIM 0:</td> <td style="text-align: right;">1000kΩ</td> <td style="text-align: center;">NEXT LIMIT</td> </tr> <tr> <td></td> <td>LIM 1:</td> <td style="text-align: right;">100MΩ</td> <td></td> </tr> <tr> <td></td> <td>LIM 2:</td> <td style="text-align: right;">100GΩ</td> <td style="text-align: center;">REJECT -R ON</td> </tr> <tr> <td></td> <td>LIM 3:</td> <td style="text-align: right;">100TΩ</td> <td></td> </tr> <tr> <td></td> <td>LIM 4:</td> <td style="text-align: right;">500TΩ</td> <td style="text-align: center;">BIN OUT CONT OFF</td> </tr> <tr> <td style="text-align: center;">ESCAPE</td> <td></td> <td></td> <td style="text-align: center;">EXIT</td> </tr> </table>	ACTIVATE LIMITS		OFF	PREV LIMIT		LIMITS:	ON			CONT BIN OUT:	OFF			REJECT-RES:	OFF			LIM 0:	1000kΩ	NEXT LIMIT		LIM 1:	100MΩ			LIM 2:	100GΩ	REJECT -R ON		LIM 3:	100TΩ			LIM 4:	500TΩ	BIN OUT CONT OFF	ESCAPE			EXIT	<p>F5</p> <p>F6</p> <p>F7</p> <p>F8</p> <p>MENU</p>	<p>[F6], Select Lim 4 then [F2] Edit Limit</p> <p>[F4] [5][0][0][ent] = 500TΩ</p> <p><b>Complete Lim Set Display</b></p> <p>[F4] = LIMIT SET SETUP to <u>save</u> limits</p>
ACTIVATE LIMITS		OFF	PREV LIMIT																																								
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	CONT BIN OUT:	OFF																																									
	REJECT-RES:	OFF																																									
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	LIM 1:	100MΩ																																									
	LIM 2:	100GΩ	REJECT -R ON																																								
	LIM 3:	100TΩ																																									
	LIM 4:	500TΩ	BIN OUT CONT OFF																																								
ESCAPE			EXIT																																								

**Figure 2-14: Programming R Limit Set**

Press [F4] = LIMIT SET SETUP to save this set of limits.

### 2.3.3.2 LIMIT SET SETUP

Use Limit Set Setup to store and recall limit sets. From the Limit Setup menu, press [F4] = LIMIT SET SETUP. Figure 2-15 illustrates the Limit Setup menu using the example limits from paragraph 2.3.3.1 and the LIMIT SET SETUP menu.



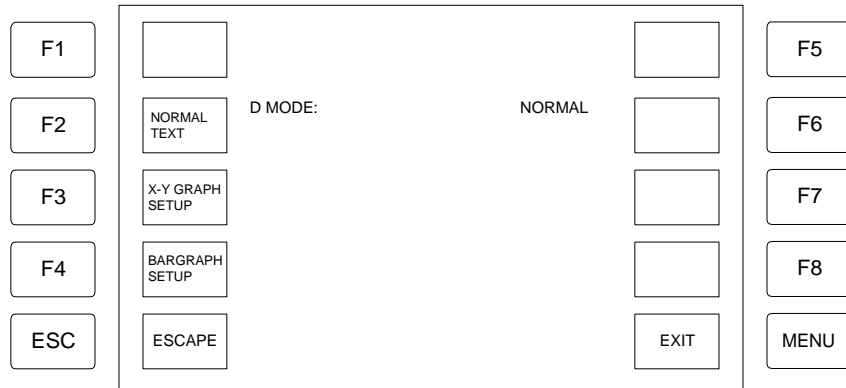
**Figure 2-15: Limit Set Setup**

After a set of limits has been programmed, it may be saved to 1 of 5 “LIMSET” internal memory locations. This can save time by simply recalling a stored set of limits. To use the LIM SET SETUP function:

1. Choose a Memory Location to store the set of limits to:
  - Press [F6] = NEXT LIMSET to move the highlighted box down the list of Lim Sets.
  - Press [F5] = PREV LIMSET to move the highlighted box up the list of Lim Sets.
2. Save Pre-Programmed Limits the selected Lim Set:
  - Press [F1] = SAVE LIMSET to save to the highlighted LIM SET.
3. Recall the selected LIM SET:
  - Press [F2] = RECALL LIMSET to recall the highlighted LIM SET.
4. Delete limits stored in selected LIM SET:
  - Press [F3] = DELETE LIMSET to delete contents of the highlighted LIM SET.
5. Press [MENU] = EXIT when finished with Limit Set Setup.

### 2.3.4 Measure Graphics

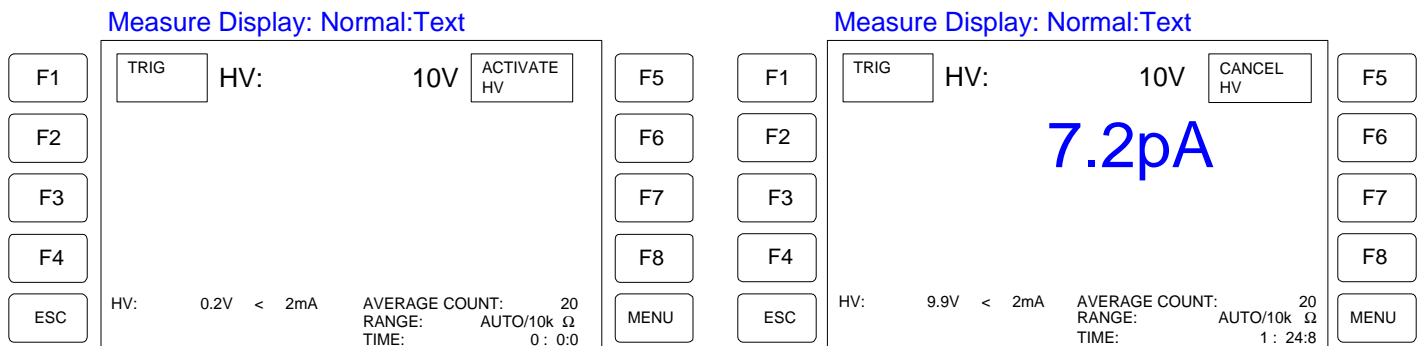
Select Measure Graphics to change the display mode from text to an X-Y graph or a bar graph. From the initial menu, press [F4] = MEASURE GRAPHICS to access the display mode. Figure 2-16 illustrates the Measure Graphics menu.



**Figure 2-16: Measure Graphics Display**

#### 2.3.4.1 NORMAL TEXT

In the Measure Graphics menu, press [F2] = NORMAL TEXT to display the results as text. Text is the instrument default display.



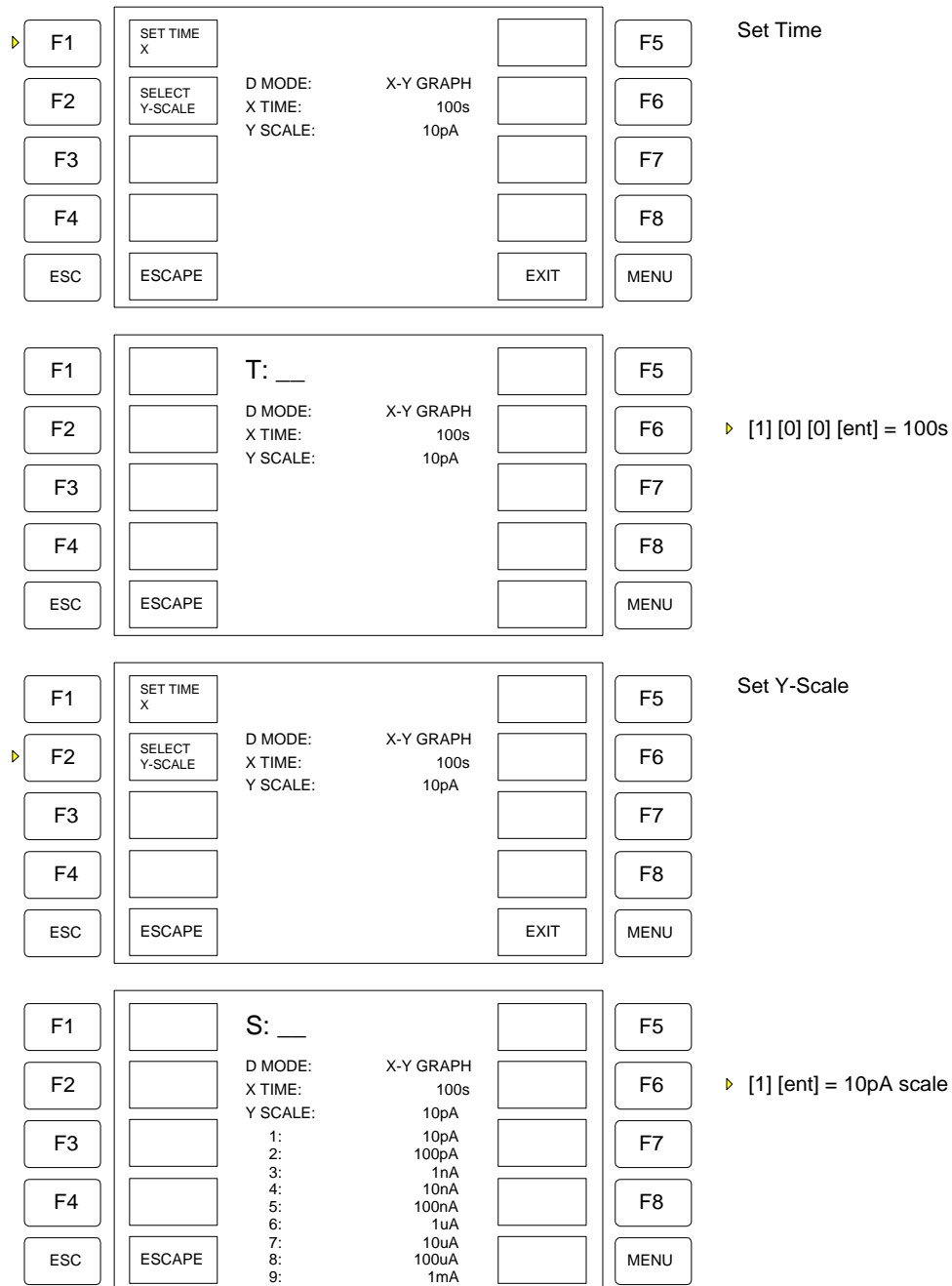
**Figure 2-17: Text Display**

#### 2.3.4.2 X-Y GRAPH

In the Measure Graphics menu, press [F3] = X-Y GRAPH SETUP to display results as a line graph. The X-Y graph displays the leakage current or insulation resistance as a function of time.

The X-scale, i.e. the time period for which the measurements shall be shown, can be programmed by pressing [SET TIME] and inputting the time from 1sec to 9999sec. The Y-scale is fixed and logarithmic from  $1M\Omega$  to  $1P\Omega$  for resistance results. For current results, the Y-scale can be set to one of nine linear scales from  $10pA$  to  $1mA$ .

Press [F1] = SET TIME to select the duration of the x- scale. Use the numerical keys to enter the time up to 9999sec and then press [ent] to accept this time. Press [F2] = SELECT Y-SCALE. Use the numerical keys (1-9) to select y-scale then press [ent] to accept scale.

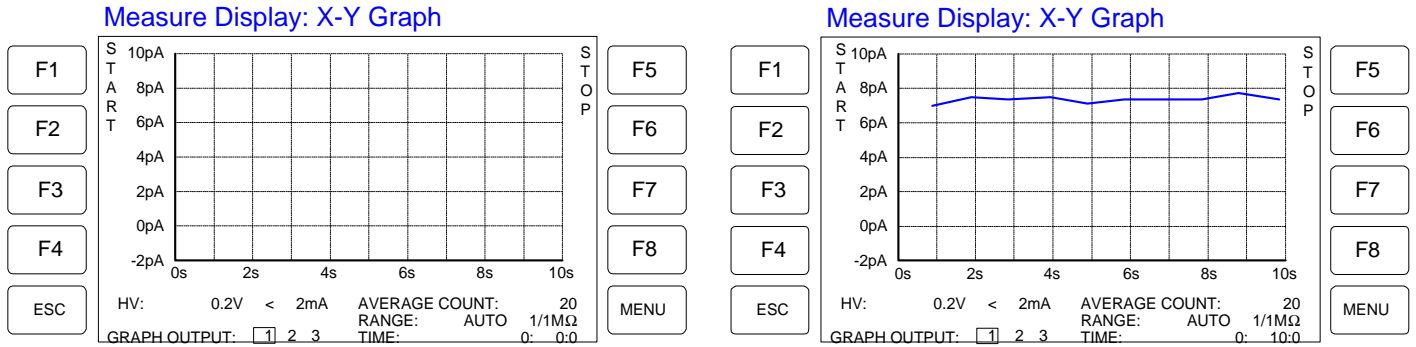


**Figure: 2-18: X-Y Graph Setup Menus**

**Note:** The X-Y Graph display cannot be used when instrument is in Sequence Mode.

**Note:** A spike in the X-Y graph might be seen when the input impedance is changed. This is caused by the change in the voltage division between the insulation resistance and the input resistance, and is therefore a physical phenomenon that cannot be avoided.

When the measurements are started, the label of the softkey [F1] = [START GRAPH] is no longer shown.



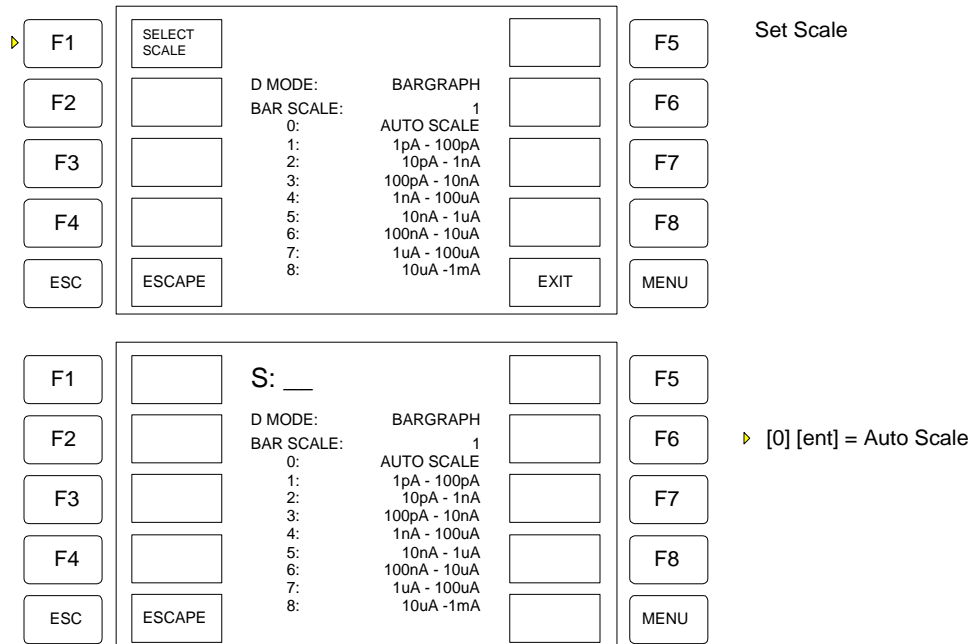
**Figure 2-19: X-Y Graph Display**

**NOTE:**  
Graph output can be held in volatile RAM in 3 locations. Press number 1,2,3 to switch between graph outputs. This provides a quick way to compare results from different tests.

### 2.3.4.3 BAR GRAPH

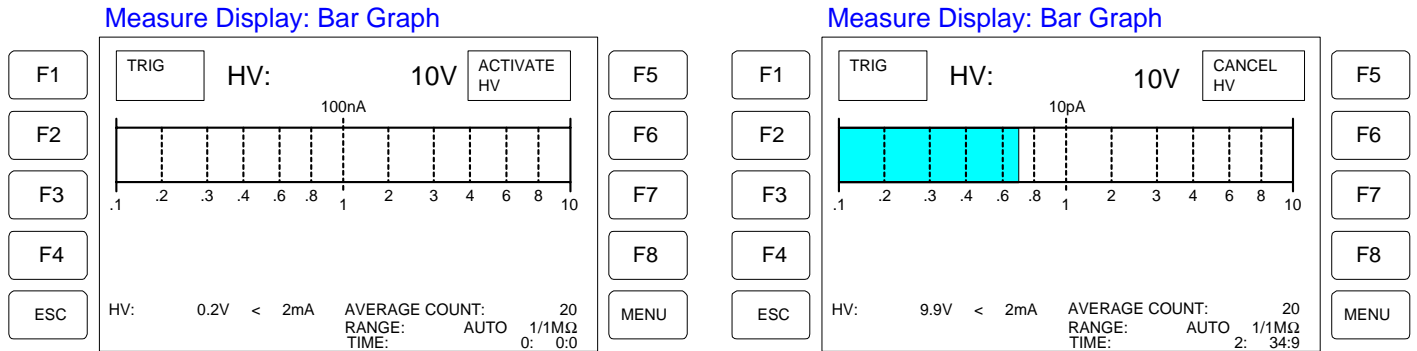
Press [F4] = BARGRAPH SETUP to display results as a bar graph. The bar graph simulating an analog meter. The bar graph can be set to autoscaling or 8 fixed scales with two decades each.

To set up the bargraph, press [F1] = SELECT SCALE in the Bar Graph Menu. Use numerical keys (0-8) to select the bar scale then press [ent] to accept the scale.



**Figure 2:20: Bar Graph Setup Menus**

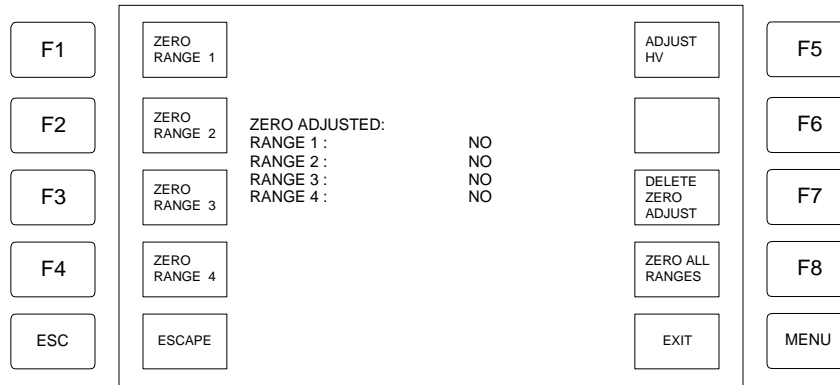
Figure 2-21 illustrates a bargraph display setup and result.



**Figure 2-21: Bargraph Display**

### 2.3.5 Zero Adjust Menu

Prior to making any measurements with the 1868 instrument, it is necessary to zero adjust the current input amplifier in the instrument. Select the Zero Adjust Menu to perform instrument offset after the test parameters have been programmed. From the initial menu, press [F8] = ZERO ADJ MENU to access the zero function. Figure 2-22 illustrates the Zero Adjust menu.



**Figure 22: Zero Adjust Menu**

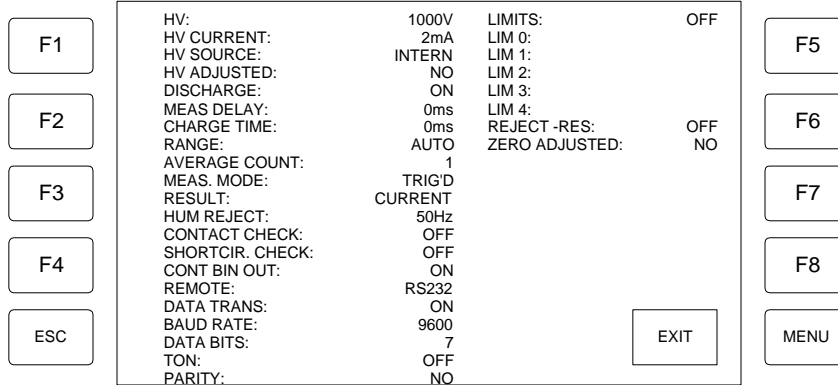
To singularly zero Ranges 1-4 use the softkeys [F1] – [F4]. To zero all the ranges, press [F8] = ZERO ALL RANGES. Press [F7] to delete the zero adjust value.

When the STATUS LED on the front panel is red, press [MENU] then [F8] = ZERO ALL RANGES and zero adjust all ranges. When zero is complete, the STATUS LED should change from red to green.

The zero adjust may also be used to zero the leakage in a test jig when the HV is on. If the Dual Supply is installed and HV1 and HV2 are set to the same voltage level, use [F5] = ADJUST HV to remove any minor differences in the actual voltage output. HV needs to be activated before adjusting the HV voltage.

### 2.3.6 Setup Status

Select Setup Status to view a list of the programmed test parameters. From the initial menu, press [F5] = SETUP STATUS to view the current setup. Figure 2-23 illustrates the Setup Status menu. No parameters are changeable in Setup Status. Press [MENU] = EXIT to return to initial Measure Menu.

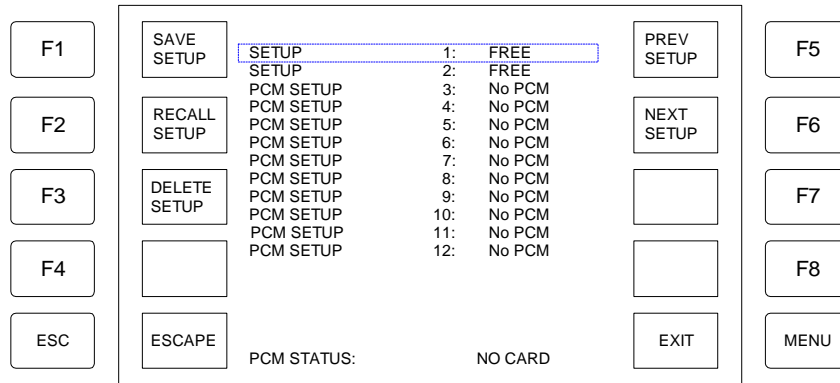


**Figure 2-23: Setup Status Menu**

### 2.3.7 Setups

**NOTE:**  
Sequence Setups are stored with Setups.  
Software Reset does not clear user-programmed sequences. Use DELETE SETUP in the Setups menu to clear a user programmed sequence.

Select Setups to store or recall a test setup from internal memory or a PCMCIA card. The two global SETUPS at the top of Figure 2-24, store all user-programmed sequences and the existing instrument setup status. From the initial menu, press [F6] = SETUPS to store/recall setups form memory. Figure 2-24 illustrates the Setups menu.



**Figure 2-24: Setups Menu**



## To Save, Recall or Delete a Setup:

1. Choose a Memory Location to store the setup to:  
Press [F6] = NEXT SETUP to move the highlighted box down the list of Setups.  
Press [F5] = PREV SETUP to move the highlighted box up the list of Setups.
2. Save Pre-Programmed Setup to the selected location:  
Press [F1] = SAVE SETUP to save to the highlighted **SETUP**.
3. Recall the selected location:  
Press [F2] = RECALL LIMSET to recall the highlighted **SETUP**.
4. Delete setup stored in selected location:  
Press [F3] = DELETE SETUP to delete contents of the highlighted **SETUP**.
5. Press [MENU] = EXIT when finished with Setups.

## 2.4 Programming a Manual Test

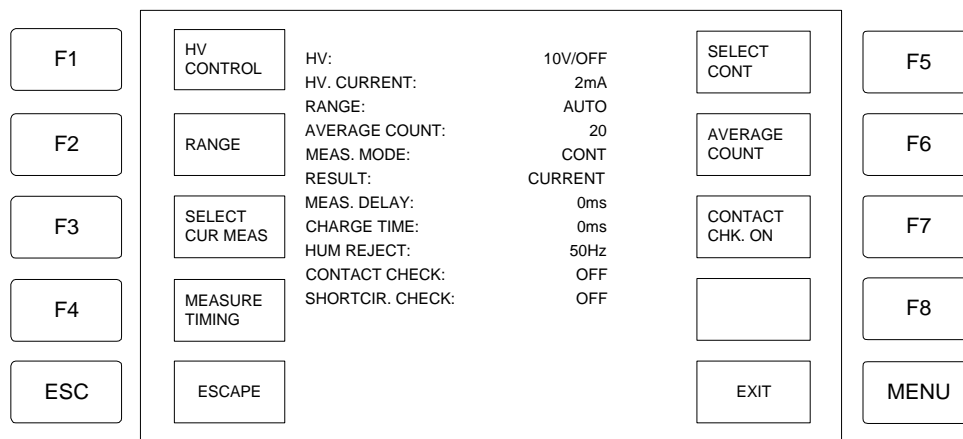
**NOTE:**

Do **not** press the display.

Press the gray softkeys adjacent to the display or the gray numerical keypad to program the instrument.

### Measure Setup

From the program menu in Figure 2-4, press [F1] = Measure Setup to access the Measure Setup display as illustrated in Figure 2-25. This menu is for programming the test voltage, maximum charge current, measurement range, mode and time, plus other test parameters for a manually controlled 1-step test. Refer to p 2.3.1 for explanation of the parameters in the Measure Setup Menu.



**Figure 2-25: Measure Setup**

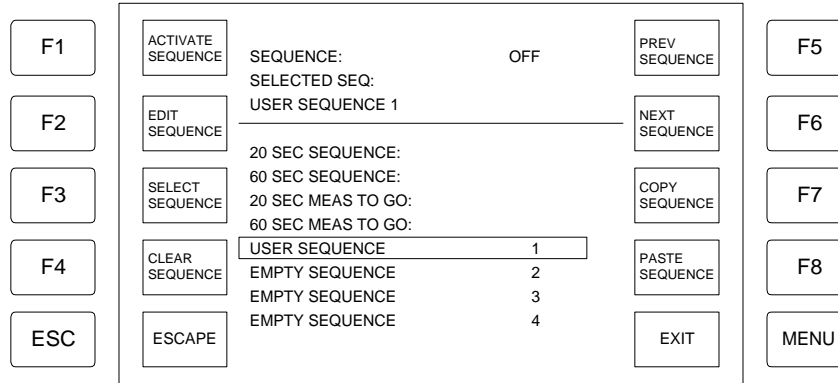
### **Manual Programming Example:**

As an example, program a resistance test with a 100V test voltage and 25mA charging current. For a single, manually controlled test with Meas Mode set to Triggered, follow these steps:

- Power ON 1868 instrument.
- Press the green softkey [MENU] = EXIT
- Press [MENU] again.
- Press [F1] = MEASURE SETUP.
- Press [F1] = HV CONTROL.
- Press [F1] = HV VOLTAGE.
- Press gray softkeys [1] [0] [0] [ent] = 100V
- Press [F8] = MAXIMUM CURRENT
- Press [F2] = HV CUR <25MA
- Press [1][2][3][4][ent]
- Press [MENU] = EXIT
- Press [MENU] = EXIT
- Press [MENU] = EXIT
- Press [F5] = ACTIVATE HV
- Press [F1] = TRIG to make measurement.

## 2.5 Programming a Sequence Test Test

From the program menu in Figure 2-4, press [F2] = Sequence Setup to access the Sequence Setup display as illustrated in Figure 2-26. This menu is for programming a multi-step test. Refer to p 2.3.2 for explanation of the parameters in the Measure Setup Menu.



**Figure 2-26: Sequence Setup**

### Sequence Programming Example:

As an example, program a resistance sequence with 1000V, 3sec charge time, 3sec meas delay, 3sec discharge, auto range and an average count of 15 measurements. To program this automatic multi-step test follow these steps:

Power ON 1868 instrument.

Press the green softkey [MENU] = EXIT

Press [MENU] again.

Press [F2] = SEQUENCE SETUP.

Press [F6] = NEXT SEQUENCE to move highlighted box to **Empty Sequence 1**.

Press [F2] = VIEW SEQUENCE.

Press [F2] = EDIT SEQUENCE.

Press [F1] = EDIT STEP.

Press [F1] = SELECT COMMAND to select highlighted parameter **CHARGE**.

Press gray softkeys [1] [0] [0] [0] [ent] = 1000V

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

Press [F6] = NEXT STEP to move highlighted box to step **2**.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **M. DELAY**.

Press gray softkeys [1] [0] [0] [0] [ent] = 1000V

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

Press [F6] = NEXT STEP to move highlighted box to step **3**.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **MEASURE**.

Press gray softkeys [0] [ent] = Range 0 = AUTO RANGE

Press gray softkeys [0] [ent] = Zi: 0 = 1M $\Omega$  input impedance.

Sequence Programming example – continued:

Press gray softkeys [1] [5] [ent] = 15 measurements for Average Count

Press gray softkeys [0] [ent] = L: 0 = No Limits Set.

Press [F6] = NEXT STEP to move highlighted box to step 4.

Press [F1] = EDIT STEP.

Press [F6] = NEXT COMMAND to move highlighted box to **DISCHARGE**.

Press gray softkeys [3] [0] [0] [0] [ent] = 3.0sec

The screenshot shows a menu with function keys F1-F8 and MENU. The central display area contains the following information:

EDIT STEP      CHARGE      PREV STEP  
M. DELAY  
MEASURE  
DISCHARGE  
MEAS. TO GO      NEXT STEP

STEP	FUNCTION:	HV VOLT	RN	AVC	LIM SET	TIME SEC
1	CHARGE	1000				3.0s
2	M. DELAY	1000				3.0s
3	MEASURE		AH	15	0	600ms
4	DISCHARGE					3.0s

Below the table, there is a vertical list of numbers: 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1.

Press [MENU] to EXIT step setup and return to Sequence Setup menu.

Press [F1] = ACTIVATE SEQUENCE

Press [MENU] = EXIT

Press [MENU] = EXIT

Press [F1] = START SEQUENCE

The screenshot shows a menu with function keys F1-F8 and MENU. The central display area contains the following information:

START SEQUENCE      HV:      1000V      STOP SEQUENCE

HV:      9.9V < 2mA      AVERAGE COUNT:      15

RANGE:      AUTO      1 / 1MΩ

TIME:      0 : 20 : 6

CHARGE 999V, M. DELAY 999V, MEASURE 0.2V

**Figure 2-27: Result of Example Sequence Setup**

## 2.6 Instrument Zero/Offset Function

### NOTE:

The 1868 can be zeroed with or without cables. If cables have sufficiently high resistance, use the Zero Function. If the leakage needs to be offset due to cables or test fixture, use the Zero/Offset Function.

The 1868 instrument provides two automatic zeroing functions: 1. Zero to zero out any offset in the measurement detectors and 2. Offset to compensate for leakage in the test cable or fixture. For maximum measurement accuracy it is recommended that the unit be zeroed after power-up. The zero is saved under setup storage and is also saved on a power down and power back up. **The instrument should warm-up for at least 30 minutes before zeroing.**

### Zero Function

After setting your test parameters, zero the 1868 unit with no device or cables connected. The 'zero' adjusts the current input amplifier before any measurements are made.

Press the green [MENU] key once. Press [F8] = ZERO ADJUST. Press [F8] = ZERO ALL RANGES. Display reads "ZERO ADJ. RUNNING". The STATUS LED is red as long as there is no Zero Adjustment stored in memory. When the 1868 instrument has completed the ZERO measurement, the display reads "ZERO ADJ. END". The display shows YES for the 4 ranges and the STATUS LED changes from red to green.

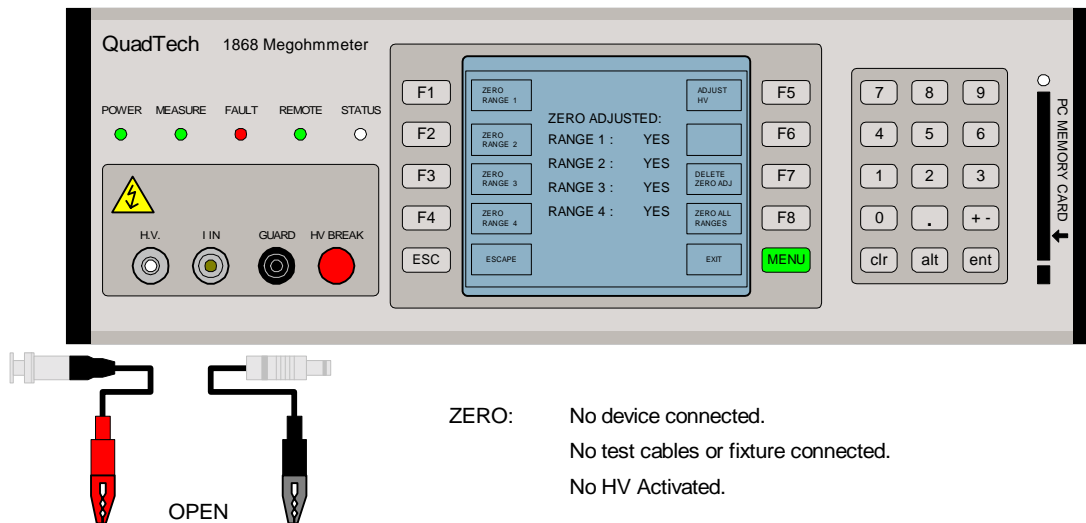


Figure 2-28a: ZERO Adjustment

## Zero/Offset Function

The ‘offset’ compensates for the leakage in the cables or test fixture when the HV is activated. To perform an Offset, connect the test cables (or fixture) to the 1868 output terminals as they would be connected for the pre-programmed test. Do not connect the device under test.

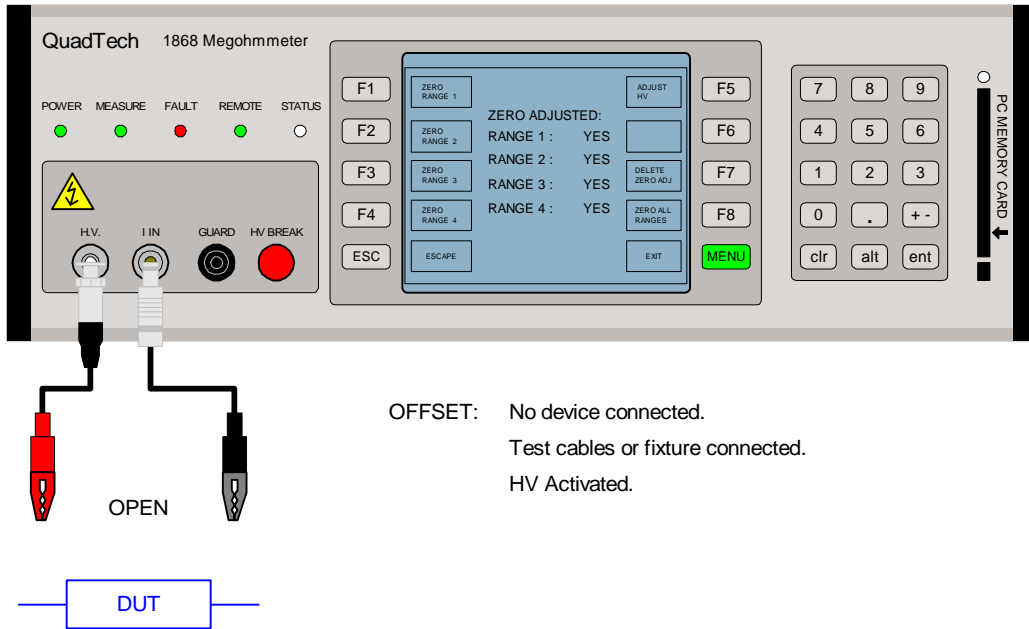
Press [F5] = ACTIVATE HV

Press the green [MENU] key once.

Press [F8] = ZERO ADJUST.

Press [F8] = ZERO ALL RANGES.

Display reads “ZERO ADJ. RUNNING”.



**Figure 28b: Zero/Offset Adjustment**

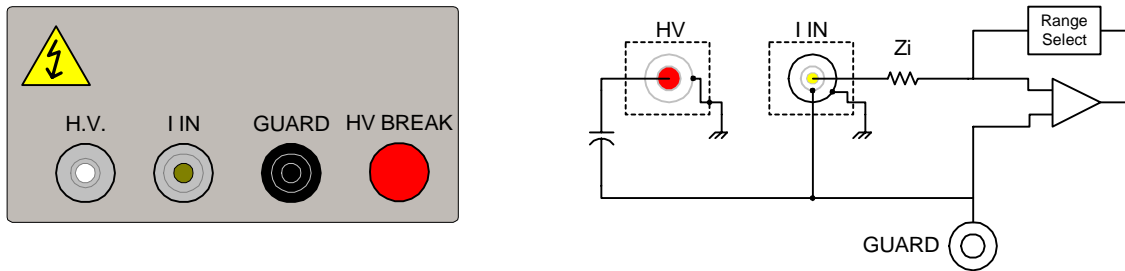
### NOTE:

[F5] = ADJUST HV is used only when Dual HV Supplies are installed in the 1868 Megohmmeter. When HV1 and HV2 are set to the same voltage, “HV ADJUST” is used to remove any minor differences in the actual voltage output. HV needs to be activated to initiate HV adjust.

## 2.7 Connection to Device Under Test

Before connecting the device for test, press the red **[HV BREAK]** key and make sure the red **HV BREAK** light is **OFF**. Refer to the Figures 2-29 through 2-35 to determine the correct configuration.

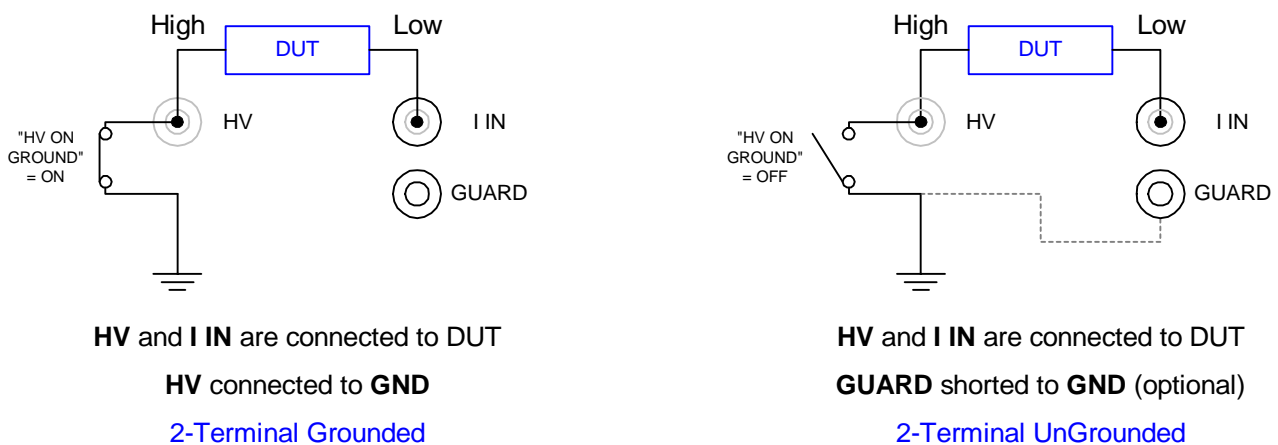
How to connect the DUT to the 1868 output terminals depends if the device being measured is grounded, ungrounded or guarded. The HV terminal is High Voltage Output Terminal. The I IN terminal is the Current Measurement Input. The GUARD terminal is the shield. The HV and I IN circuits have a floating (isolated) ground.



**Figure 2-29: Output Terminals and Block Diagram**

### The 2-Terminal Connection

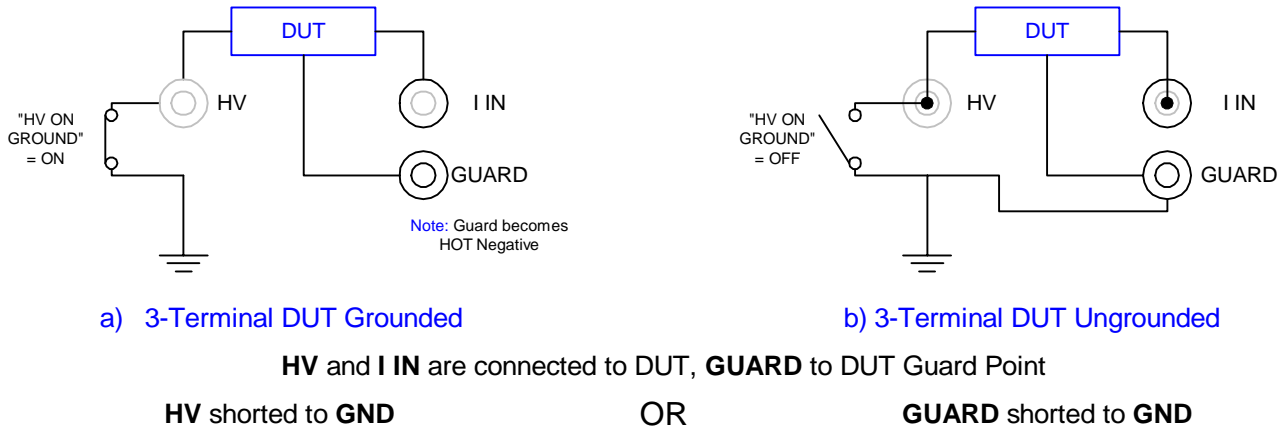
A 2-Terminal Floating Ground (“HV ON GROUND” = OFF) measurement will produce more noise in the measurement than a 2-Terminal Grounded (“HV ON GROUND” = ON) measurement. The two-wire grounded connection is the recommended connection of ungrounded components. The two-wire ungrounded measurement is the recommended connection for grounded components. A grounded component is one in which one of its connections goes to an earth ground, whereas on an ungrounded component neither connection goes to earth ground.



**Figure 2-30: 2-Terminal Measurement**

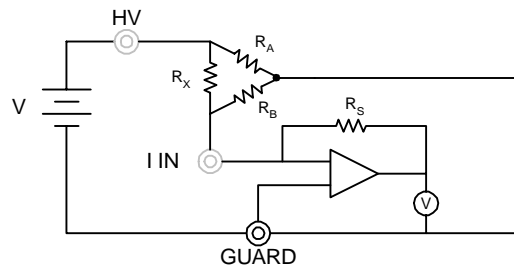
## The 3-Terminal Connection

A 3-Terminal Guarded measurement is used to measure resistance between two points in the presence of resistance from each of these points to the third point. The guarded measurement may require different grounding techniques depending on the expected impedance of the DUT.



**Figure 2-31: 3-Terminal Measurement**

This third point can often be guarded to avoid error caused by the extraneous resistance as shown in Figure 2-32. Here  $R_X$  is the quantity to be measured in the presence of  $R_A$  and  $R_B$ . If the junction of  $R_A$  and  $R_B$  is tied to guard,  $R_A$  is placed across the voltage source and has no effect if it is greater than  $1.25M\Omega$ . As long as  $R_B$  is greater than  $R_S$  (standard range resistor) the error caused by  $R_B$  is minimized, thus if there is a choice it's better to have the higher of the two stray resistances connected to  $R_B$ .

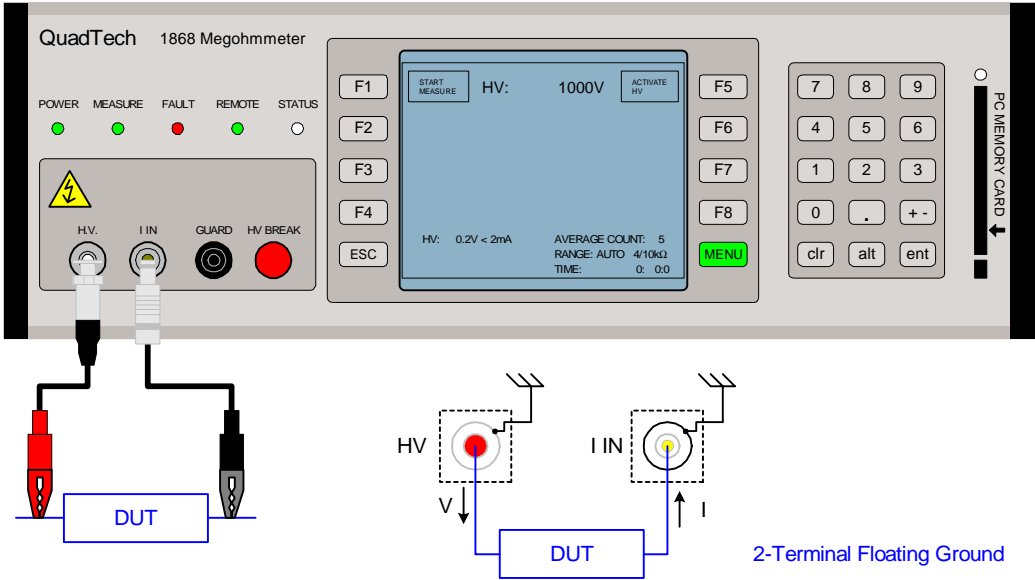


**Figure 2-32: Guard Point**

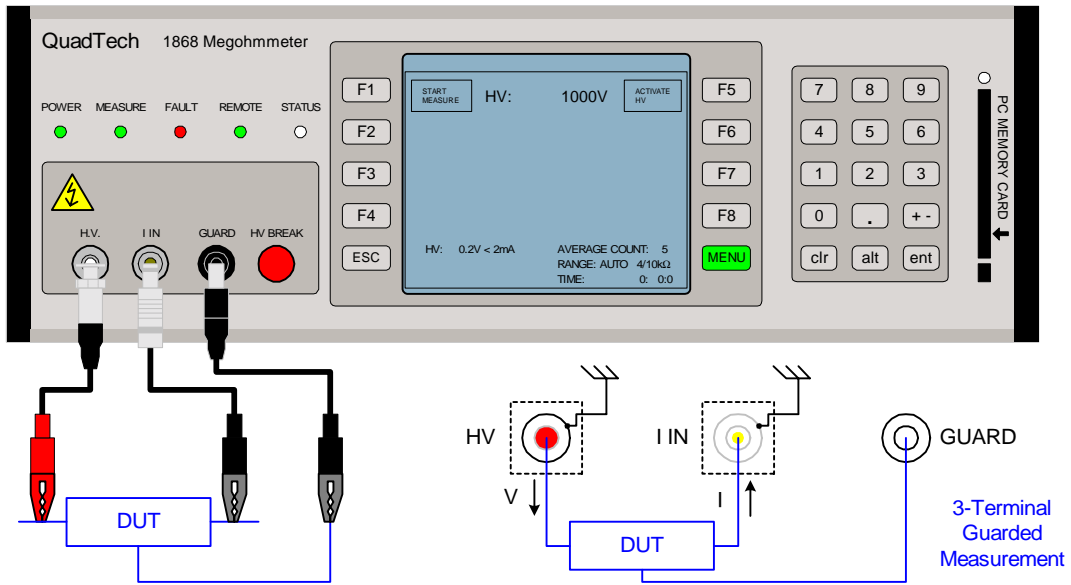
The guard terminal can be used whether GUARD or the HV terminal is grounded, but it's important to note that if the HV terminal is grounded the GUARD terminal will be at a high negative voltage level. When the GUARD terminal is connected to a true ground of a device, such as chassis, it is the one that must be grounded, not the HV so "HV ON GROUND" = OFF.



**WARNING**  
 NEVER TOUCH THE TEST LEADS OR THE DEVICE UNDER TEST WHEN THEY ARE CONNECTED TO THE INSTRUMENT AND THE RED DANGER LIGHT IS ON.

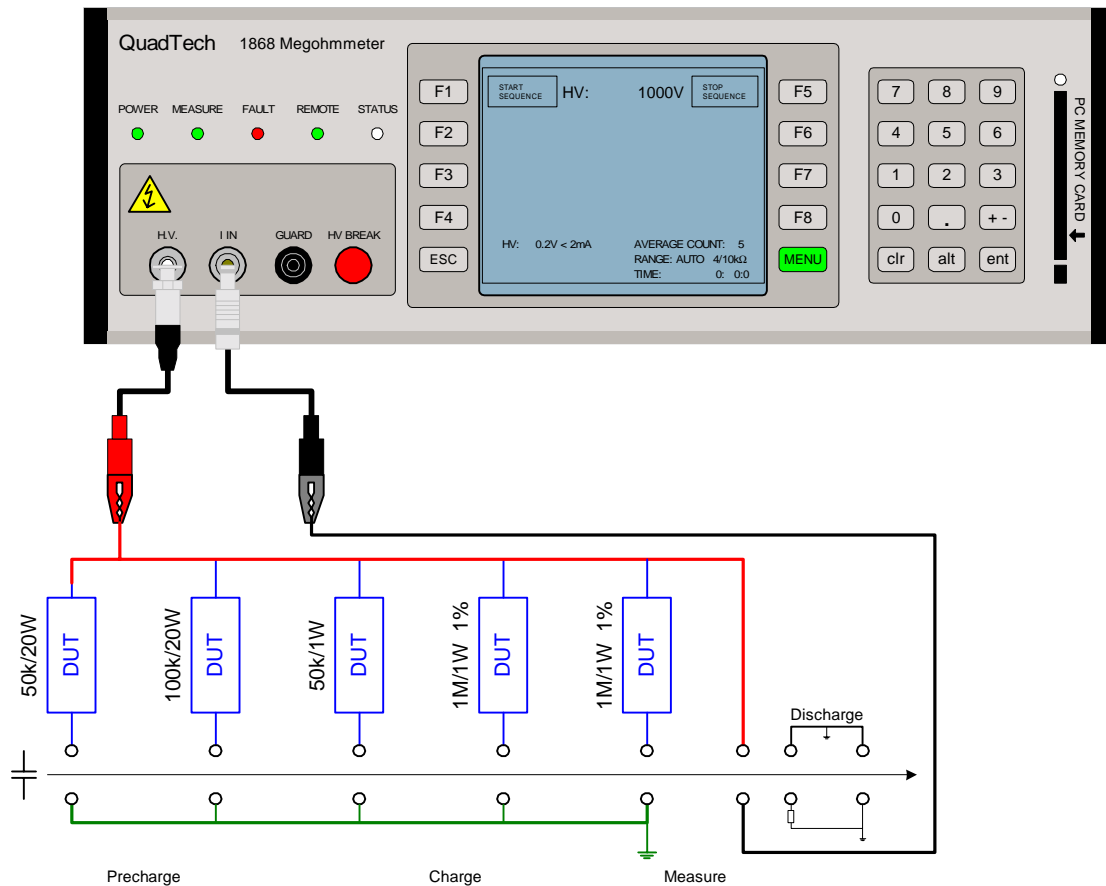


**Figure 2-33: 2-Terminal Connection using 1868-01 Cable Lead Set**



**Figure 2-34: 3-Terminal Guarded Connection**

Figure 2-35 illustrates a rack of multiple devices for an automated (sequence) test setup.



**Figure 2-35: Multiple Device Connection**

## 2.8 Measurement Procedure

Before a measurement is made, verify the following:

- 1 1868 unit power is ON
- 2 Test parameters programmed
- 3 Test Setup stored
- 4 Zero function selected
- 5 Device Under Test (DUT) connected

The operator has a choice of performing a test at power-up conditions (test conditions at which the instrument was last powered down), or recalling one of 8 possible stored setups. Refer to paragraphs 2.3 - 2.5 for instructions to change the test setup conditions.

## 2.8.1 Binning Example

Included herein is a simple Binning Example to sort components by resistance value into three bins.

- 1.) Go to Limit Setup
- 2.) Press [Edit Limit]
- 3.) Select R Limits or I Limits
- 4.) Enter Value for Limit 0: and press [ent]
- 5.) Press [Next Limit]
- 6.) Press [Edit Limit]
- 7.) Enter Value for Limit 1: and press [ent]
- 8.) Repeat steps 5 to 7 for Limits 2, 3 and 4
- 9.) Activate Limits

Bin Information will be shown at the bottom of the screen

For R Binning

If Lim 0: = 1M

Lim 1: = 2M

Lim 3: = 3M

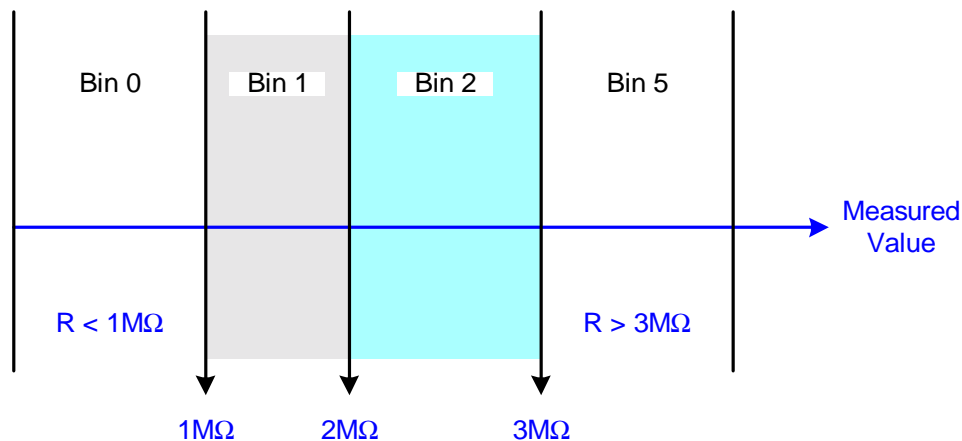
Bins will be shown as follows:

$R < 1M$  Bin 0 is displayed

$R \geq 1M < 2M$  Bin 1 is displayed

$R \geq 2M < 3M$  Bin 2 is displayed

$R \geq 3M$  Bin 5 is displayed



**Note:** for Pass/Fail operation:

If all that is wanted is a Pass/Fail indication for resistance for example anything equal to or over 10M is a pass then set Lim 0: = 10M

Unit will indicate Bin 0 for Fail and Bin 5 for Pass.

## 2.9 [alt] Menu

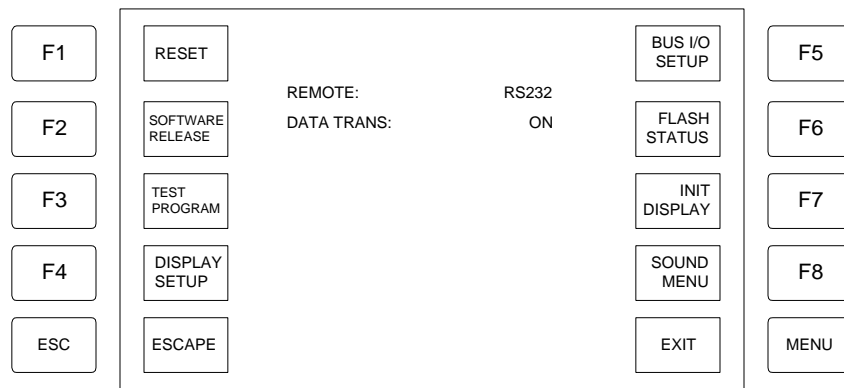
The 1868 Megohmmeter has some parameter settings that seldom require change. These parameters are listed in the Table 2-7. To view or change an initial parameter press [alt].

**CAUTION:**  
 Qualified Personnel Only.  
 The [alt] Menu contains some hardware test routines.  
 Altering these Test Programs affects the instrument calibration and will void the 1868 instrument warranty.

**Table 2-7: [alt] Menu**

[pb]	[alt] Menu	[pb]	Sub-Menu	Description
[F1]	Reset	[F1]	Hardware	Hardware Reset
		[F2]	Software	Software Reset
[F2]	Software Release	--	--	View Software Version
[F3]	Test Program	--	--	Qualified Personnel Only.
[F4]	Display Setup	[F2]	Cancel Display	No display
		[F6]	Display BK on WH	Toggle: Black text on white screen
		[F7]	Display Contrast	(blue) -16 to +16 (white)
[F5]	Bus I/O Setup	[F1]	IEEE Setup	Ton, EOI, Address
		[F2]	RS232 Setup	Baud, Data Bits, Ton, Parity
		[F3]	Cancel Data Out	Data transfer: On/Off
		[F4]	Select IEEE	Remote: IEEE or RS232
[F6]	Flash Status	--	--	View Flash Memory Statistics
[F7]	Init Display	--	--	Refresh Display
[F8]	Sound Menu	[F1]	HV Alarm On	Enable HV Alarm
		[F2]	SEQ Alarm On	Enable SEQ Alarm

**CAUTION:**  
 Software Reset will delete all data, Bin settings, Setup, etc. The RAM memory will be totally cleared.



**Figure 2-30: [alt] Menu**

## 2.9.1 Instrument Reset

### 2.9.1.1 Hardware Reset

From the front panel, access Hardware Reset using the softkeys:

Press [alt]     Alt display with several facilities

Press [F1]     Reset menu

Press [F1]     Hardware Reset

From the rear panel, press the hardware reset key placed just above the IEEE socket.

Locate the hole in the rear panel and use a pencil or similar to activate the hardware reset key. When using the Hardware Reset, the instrument must be switched ON.

### 2.9.1.2 Software Reset

From the front panel, access Software Reset using the softkeys:

Press [alt]     Alt display with several facilities

Press [F1]     Reset menu

Press [F3]     Software Reset

The 1868 Instrument clears the software parameters. **Caution:** Software Reset clears the RAM. Software Reset does not clear the user-programmed sequences. Refer to paragraph 2.3.7.

## 2.9.2 Test Program

Best advice: STAY OUT. Qualified Personnel Only.

To access Test Program, use the softkeys:

Press [alt]     Alt display with several facilities

Press [F3]     Test Program

**This Test Software is intended for calibration of the instrument only.** Altering these Test Programs affects the instrument calibration and will **void** the 1868 instrument warranty.

## 2.9.3 Display Setup

The display is of an LCD type and these types of displays have a limited display angle. To change this angle or if you prefer to see the display inverse (black on white) you may adjust the display using the softkeys:

Press [alt]     Alt display with several facilities

Press [F4]     Display Setup

Press [F2]     Cancel Display The display will return when pressing the menu key.

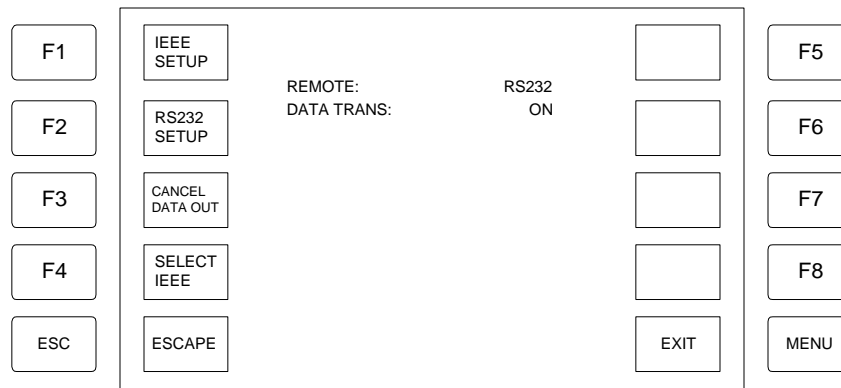
Press [F6]     Display, Black on White

This soft key is a toggle switch which will change the display to what is stated on the label on the display every second time the key is activated.

Consequently the display will change to the opposite by pressing again:  
 Press [F6] Display, White on Black  
 Display contrast may change by temperature and may be adjusted by:  
 Press [F7] Display Contrast  
 Default value is C+00 but this may be adjusted by pressing:  
 Press [F1] Display Contrast +  
 Press [F3] Display Contrast -  
 Press [F2] Display Contrast Clear Reset the selected value contrast to default C+00  
 Reset from the front panel or by remote control will also set the display value to default C+00.

## 2.9.4 Bus I/O Setup

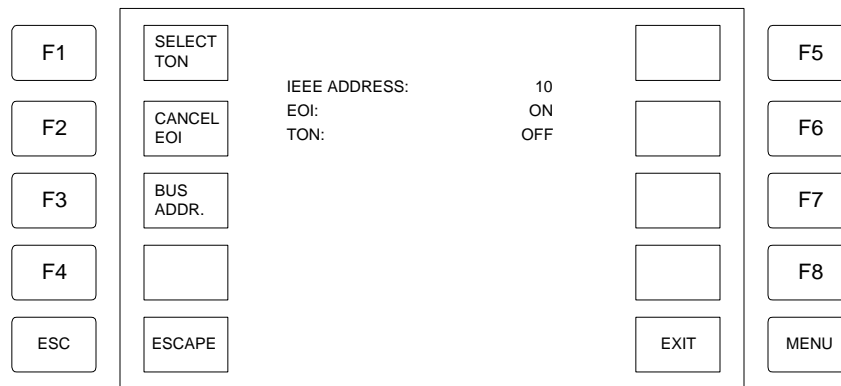
To set the parameters for the IEEE or RS232 interface, use BUS I/O Setup in the [alt] Menu.



**Figure 2-31: BUS I/O SETUP Menu**

### IEEE Interface:

Press [alt] Alt display with several facilities  
 Press [F5] BUS I/O SETUP menu  
 Press [F1] IEEE SETUP to change the address, turn EOI ON/OFF and select TON.

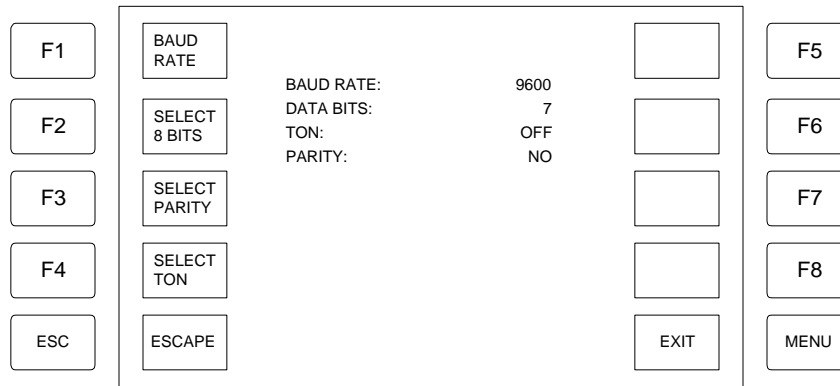


**Figure 2-32: IEEE SETUP Menu**

- Press [F3] BUS ADDR to change the IEEE address Use the numerical keys to enter an address from 01-30 then press [ent] to accept the address.
- Press [F2] CANCEL EOI to turn EOI function ON or OFF
- Press [F1] SELECT TON to turn the Talker Only function ON or OFF.

**RS232 Interface:**

- Press [alt] Alt display with several facilities
- Press [F5] BUS I/O SETUP menu
- Press [F1] RS232 SETUP to change the baud rate, data bits, parity and select TON.



**Figure 2-34: RS232 SETUP Menu**

- Press [F1] BAUD RATE to select the baud rate: 300, 600, 1200, 2400, 4800, 9600 or 19200 bps.
- Press [F2] SELECT 8 BITS to select the number of data bits. Use numerical keys to select data bits form 1-8 then press [ent] to accept value.
- Press [F3] SELECT PARITY to choose EVEN ODD OR NO parity of data bits.
- Press [F4] SELECT TON to turn the Talker Only function ON or OFF.

## 2.9.5 PC Memory Card

The PC Memory Card is used for software updating. A complete update requires two PC Cards containing software for the Measurement CPU (MCPU) and for the Control CPU (CCPU).

Insert the PC Card with the new software in the slot.

Press [alt]      Alt display with several facilities.

Press [F2]      SOFTWARE RELEASE

Press [F4]      SOFTWARE UPDATE

The 1868 instrument will display which CPU will be updated, the yellow Power ON LED above the PC Card will light up shortly and

“Warning ! updating software please wait”

will appear on the display.

The 1868 instrument is ready for use as soon as it has reset it self or for an update of the other CPU.

**WARNING!**

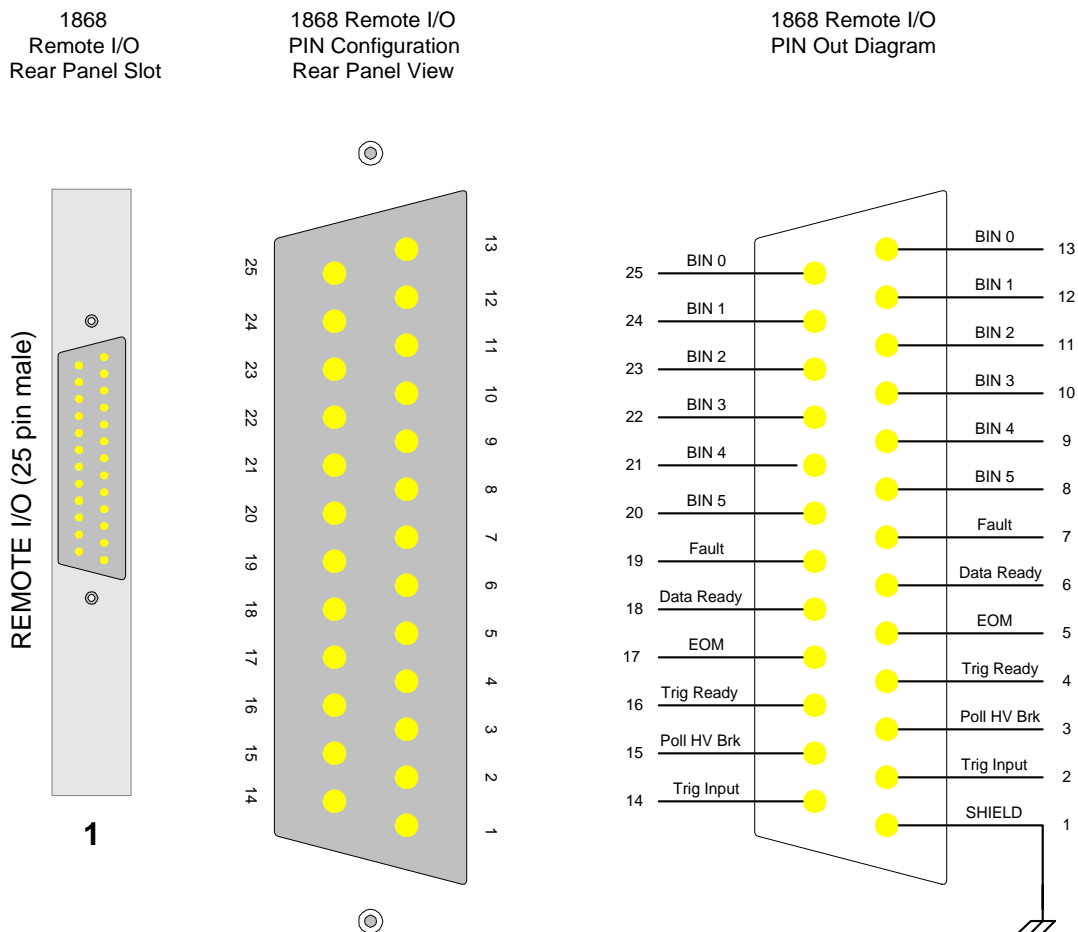
The Mains Supply must not be switch off in the time slot from when [F4] is entered until the Status LED flashes.



## Section 3 : Interface

### 3.1 Remote I/O

A 25 pin (male) remote control connector is located in Slot '1' on the rear panel of the 1868 instrument. Figure 3-1 illustrates the pin configuration of the Remote I/O and Table 3-1 lists the pin out designations.



**Figure 3-1: Remote I/O Connector**

**Table 3-1: Remote I/O Pin Designations**

PIN	Description	I/O
1	Protective Ground (Shield)	
2	Trig Input Anode	I
3	Poll for HT Break Anode	I
4	Trig Ready Emitter	0
5	Measurement End Emitter	0
6	Data Ready Emitter	0
7	Fault Emitter	0
8	Bin 5 Emitter	0
9	Bin 4 Emitter	0
10	Bin 3 Emitter	0
11	Bin 2 Emitter	0
12	Bin 1 Emitter	0
13	Bin 0 Emitter	0
14	Trig Input Cathode	0
15	Poll for HT Break Cathode	I
16	Trig ready Collector	0
17	Measurement End Collector	0
18	Data Ready Collector	0
19	Fault Collector	0
20	Bin 5 Collector	0
21	Bin 4 Collector	0
22	Bin 3 Collector	0
23	Bin 2 Collector	0
24	Bin 1 Collector	0
25	Bin 0 Collector	0

The opto-coupler Trig input triggers the 1868A by an input current of 10mA (maximum 30mA forward and maximum 6V reverse). The opto-coupler outputs are rated 25V and 10mA each.

**Table 3-2: Measuring Speed**

From trig to end of measurement:	48msec + (Average -1) * 40msec
From trig to data ready:	52msec (Average =1)
Additional time per meas. by average	40msec (33msec for 60Hz rejection)
Multiple measurements (average):	The sum of each measurement (from trig to end of measurement) + 4ms for calculation time

## **Range Selection**

When running the 1868 instrument in Trig mode, for instance on an automatic sorting machine, a fixed range should be selected.

When using auto range and continuous mode, the 1868 instrument seeks the correct range, by evaluating each measurement for over- or under flow conditions and from this it selects the range for the next measurement.

## **Control of Remote I/O Interface**

There are two ways to remote control the 1868 instrument Remote I/O: either by IEEE 488 (GPIB) or by RS232C.

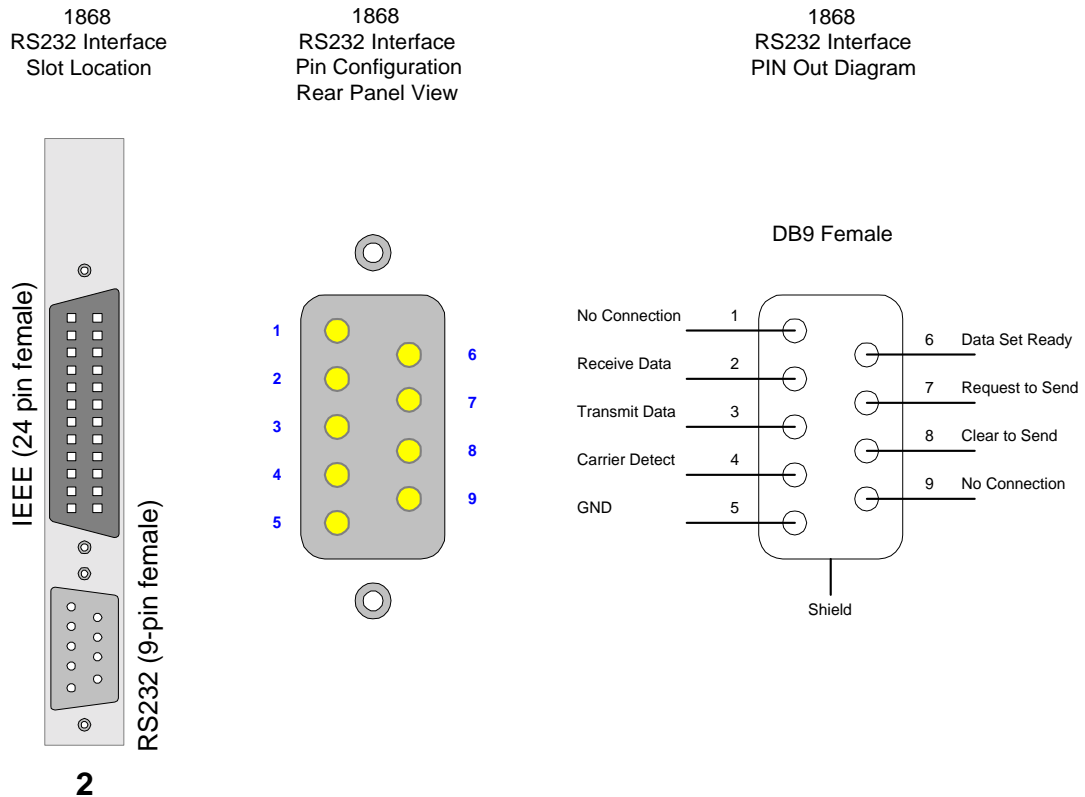
**WARNING:**

**DO NOT CONNECT ANY CABLES BETWEEN THE 1868 AND A CONTROLLER WITHOUT FIRST REMOVING THE LINE CABLES. DAMAGE CAN BE CAUSED TO THE I/O DRIVERS.**

## 3.2 RS232 Interface

### 3.2.1 PIN Configuration

The 1868 Megohmmeter includes a standard RS232 interface. Connection is through the silver 9-PIN female connector at the bottom of Slot '2' on the rear panel of the 1868 unit. Figure 3-2 illustrates the RS232 PIN configuration.



**Figure 3-2: RS232 PIN Configuration**

### 3.2.2 RS232 Specifications

The RS232 can operate with a BAUD RATE of 300 to 19200 baud, 7 or 8 data bits, EVEN - ODD or NO parity and a talker only mode.

Data bits:	8
Stop bits:	1
Parity:	None, Odd, Even
Baud Rate:	0.3/1.2/2.4/4.8/9.6/19.2 (k) Software Selectable
EOS:	CR + LF

All functions available via the keyboard are also available on the RS232C interface with the exception of the bus settings in the [alt] menu, it is necessary to select RS232C and do serial setup before it is possible to communicate with the instrument.

## Setting up RS232 Parameters

Press [alt]

Press [F5] = BUS I/O SETUP

Press [F2] = RS232 SETUP

Press [F1] = BAUD RATE

Press [F1] – [F7] to enter baud rate from 300 – 19200, respectively.

Press [F2] = SELECT 8 BITS to select the number of data bits.

Press [F3] = SELECT PARITY to select EVEN, ODD or NONE

Press [F4] = SELECT TON to ----turn test On/Off

### 3.2.3 RS232 Commands

The command set for the RS232 interface is the same as the IEEE-488 interface command set listed in paragraph 3.3.3 of this Instruction Manual. The list below shows the extra commands to be used only with the RS232 interface.

#### RS232 Only Commands:

**@DCL** Device clear.  
Clear input buffer & output buffer.

**DONE** Send DONE for command done.  
ON or 1 = Done on.  
OFF or 0 = Done off.  
When this mode is used, the instrument will always reply with an answer when a command is executed.

Example:

Command	Answer
*TRG	Measure result
RANGE 1	DONE
RANGE?	RANGE X
ZADJUST	DONE
RAN"GE	SYNTAX ERROR

**DONE?** Recall done on/off setting.

**LOCAL** Goto local.

**RSERROR** Set error message on/off.  
ON or 1 = error on.  
OFF or 0 = error off.

#### NOTE

The input and output formats are the same as for IEEE. All input data must be terminated with an LF (line feed). All output data are terminated with CR LF.

### 3.2.4 Sample QuickBasic Program

```
CLS
REM This is a simple program for the 1868 Megohmmeter
REM This is for RS232 communication and reads *idn from 1868
REM You must use a null modem cable
REM You must enable RS232 interface in Alt Menu, Bus I/O Setup of the 1868
REM baud rate = 9600, Parity No, Data Bits 8

PRINT "Calculating Delay Loops ....."
REM delay correction routine
q = 1
DO WHILE ENVIRON$(q) <> ""
  IF LEFT$(ENVIRON$(q), 7) = "MACHINE" THEN
    qq = q
    mn = VAL(RIGHT$(ENVIRON$(q), 1))
    mn$ = RIGHT$(ENVIRON$(q), 1)
  END IF
  q = q + 1
LOOP
error1:
t1 = TIMER
s = 0
FOR i = 1 TO 30000
NEXT i
t2 = TIMER
k = t2 - t1
IF k = 0 THEN GOTO error1
K2 = 40000 / k

REM ask for com port number and open com port as #1
goodcom:
CLS
PRINT ""
PRINT ""
PRINT "Enter Com Port Number (1 or 2)"
INPUT com$
IF VAL(com$) < 1 THEN GOTO goodcom
IF VAL(com$) > 2 THEN GOTO goodcom

OPEN "COM" + com$ + ":9600,n,8,1,cs,ds" FOR RANDOM AS #1:

REM Get identification string from 1868 Series
FOR J = 1 TO K2: NEXT J
PRINT #1, ";*IDN?"; CHR$(13); CHR$(10)
FOR J = 1 TO K2: NEXT J
GOSUB cget
r45$ = INPUT$(x, #1)
```

```

PRINT "Identification String is;"
PRINT r45$
PRINT ""
PRINT "Configuring Instrument"
REM bargraph off, average to 20, disp mode to R, set discharge on, Voltage to 250 and Range 3
locked.
PRINT ";BARG OFF;AVER 20;DMODE R;DISC 1;HTVO 250;RANG 3;"
PRINT #1, ";BARG OFF;AVER 20;DMODE R;DISC 1;HTVO 250;RANG 3"; CHR$(13);
CHR$(10)
FOR J = 1 TO K2: NEXT J

PRINT ""
PRINT "Enter number of measurements to make"
INPUT nummeas

FOR i = 1 TO nummeas
FOR J = 1 TO K2: NEXT J
PRINT #1, ";HTOU ON"; CHR$(13); CHR$(10)
FOR J = 1 TO K2: NEXT J
PRINT #1, ";*TRG"; CHR$(13); CHR$(10)
FOR J = 1 TO K2 * 2: NEXT J
GOSUB cget
r45$ = INPUT$(x, #1)
PRINT "Measurement" + STR$(i)
PRINT r45$
NEXT i

PRINT #1, ";HTOU 0"; CHR$(13); CHR$(10)
CLOSE #1
PRINT "End of Program"
END

cget:
' subroutine to get serial input loop until first character is received
DO WHILE (LOC(1) = 0)
FOR J = 1 TO K2: NEXT J
LOOP
' then get the rest of the string
y = x + LOC(1)
DO WHILE (x <> y)
y = x
FOR J = 1 TO K2 / 1: NEXT J
x = LOC(1)
LOOP
PRINT x
RETURN

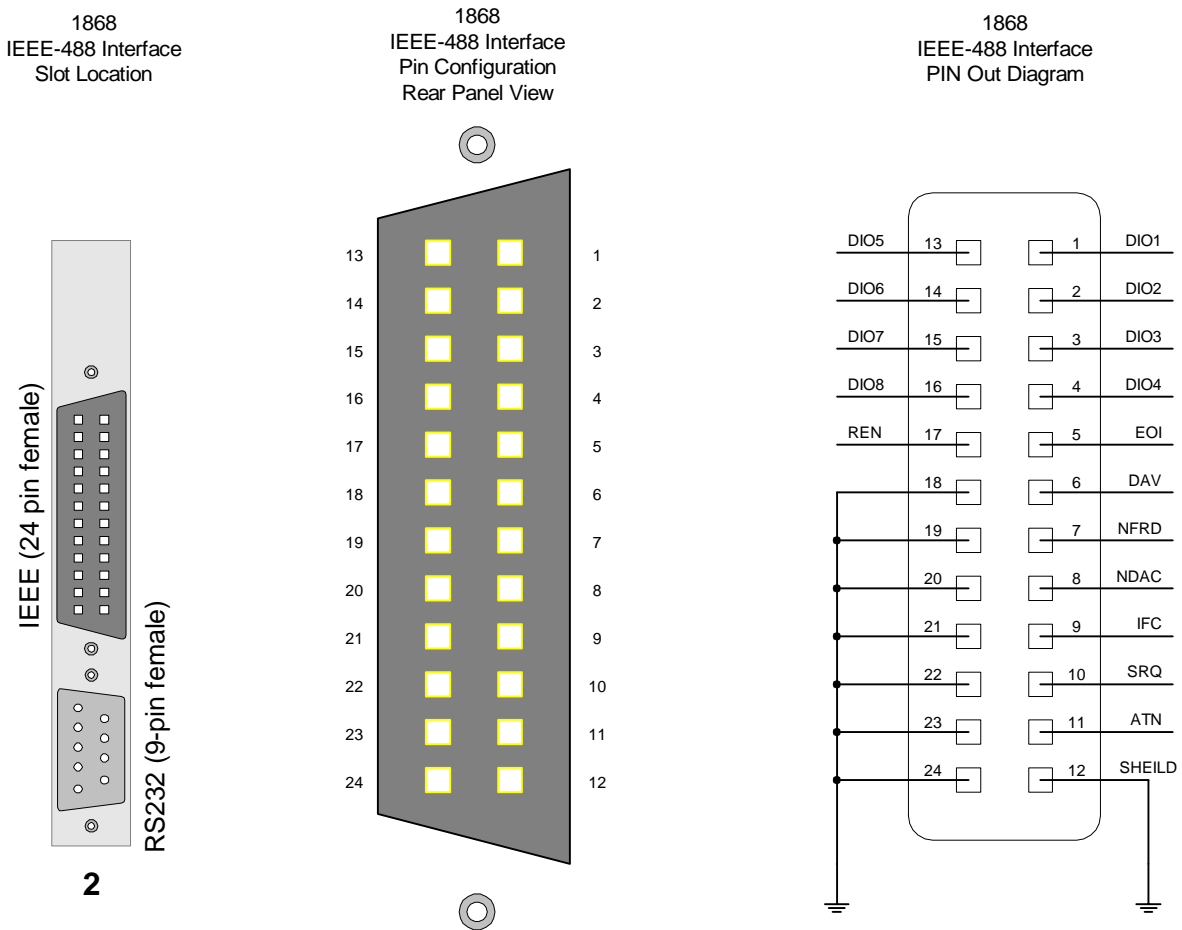
END

```

### 3.3 IEEE-488 Interface

#### 3.3.1 PIN Configuration

The 1868 Megohmmeter includes a standard IEEE-488 interface with connection through a black 24-PIN connector at the top of Slot '2' on the rear panel of the 1868 unit. 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). Figure 3-3 illustrates the PIN Configuration of the IEEE-488 interface.



**Figure 3-3: IEEE-488 Interface PIN Configuration**



### 3.3.2 IEEE-488 Interface Functions

The IEEE-488 (GPIB) address is defined in the [alt] menu. Refer to paragraph 2.9. All functions available on the keyboard are also available on the IEEE/GPIB interface as well as the RS232C with the exception of the bus settings in the [alt] menu. It is necessary to select IEEE (GPIB) and set the address, TON mode and EOI before it is possible to communicate with the instrument.

The 1868 instrument is in a remote control status when the REMOTE LED is ON. When it is in remote, all keyboard functions are disabled, except the MENU key, which is redefined as a toggle switch between the status setup display, and the measure display.

To switch to Local from Remote press the [MENU] key, disabled by LLO message.

Table 3-3 defines the IEEE-488 interface codes and their function. Table 3-2 defines the IEEE-488 interface messages and their function.

The T5 Basic Talker function is serial poll and talker only mode. If T5 is addressed to listen it will not talk. Consequently, if the L4 Listener function is addressed to talk it will not listen.

**Table 3-3 : IEEE-488 Interface Functions**

<b>Code</b>	<b>Function</b>
SH1	Source Handshake
AH1	Acceptor Handshake
T5	Basic Talker Function
L4	Basic Listener Function
SR1	Service Request Function
RL2	All Remote/Local Function
DC1	All Device Clear Function
DT1	Device Trigger Function

### 3.3.3 IEEE-488 Interface Commands

The interface function is controlled by ASCII commands which include:

{[command + parameter] ; [command + parameter] + ending code}

The length of the string is 255 characters. It is not necessary to input any sign or space between the command and parameter. Any two commands can be connected by ";" and [Ending Code]. Ending Code can be any type in Table 3-4.

**Table 3-4: IEEE-488 Interface Ending Codes**

Ending Code
LF
CR + LF
EOI
CR + LF + EOI

**NOTE**

LF is the end code for the RS232 Commands.

#### **I/O handling**

All I/O handling is done by the input and output buffers, each buffer has a maximum capacity of 255 characters.

#### **Input buffer**

Commands are entered into the input buffers and executed from there. It is therefore possible to program the 1868 instrument quickly because no command interpreting is done in the bus handler routine.

If the maximum of 255 characters is exceeded, all inputs will be lost and a command error occurs.

The command 'GET' (group execute trigger) is executed immediately, if the input buffer is empty, otherwise it is put into the buffer queue and executed later.

#### **Output buffer**

When there is an output from the 1868 (measurement result or query) it is placed into the output buffer, the MAV bit in the STATUS BYTE REGISTER is set and a service request will occur if enabled. Because of the queue system it is possible to make triggering and read results out of synchronization.

## Output buffer - continued

Therefore be careful that no result is missed, because after that the readout will always be one or more results behind. If the output buffer overflows all data stored in the output buffer will be lost, and only a part of the expected output will be transmitted.

If the 1868 is addressed as talker and the output queue is empty it will respond with an '?'.  
If the 1868 is addressed as listener and the output queue is empty it will respond with an '0'.

To clear the input and the output buffer the 'DCL' (device clear) is used.

## Input format

**NOTE:**

All characters must be in UPPERCASE.

To enter a command you must use a minimum of four characters. The command must be followed by either a '?' for a question, or a space followed by data. For Example:

```
HTVOLT?  
HTVOLT XXX  
HTVO XXX  
HTVOL XXX
```

Input data may use fixed or floating format signed or unsigned. For Example:

```
1V  
+1.0E+00  
10E-01  
0.001K  
.000001MA
```

The exponent can be replaced with a mnemonic (1E+00 or 1K) shown in Table 3.5.

**Table 3-5: Exponent Mnemonics**

Definition	Mnemonic
1E+18	EX
1E+15	PE
1E+12	T
1E+9	G
1E+6	MA
1E+3	K
1E-3	M
1E-6	U
1E-9	N
1E-12	P
1E-16	F

Using end suffixes such as V, OHM or S is optional.

Commands which are on/off commands as, for example, CCHECK the data can be ON/OFF or 0/1. 0/1 can be set as fixed or floating.

It is possible to put more than one command into a command string, the command then has to be separated by a “:” For example: RANGE A;AVERAGE 20;CCHECK

All commands / strings are terminated with and/or EOI.

If a large number of setup commands are used, it is possible to generate an input buffer overflow. A way of preventing this is always to use the short version of the commands (only the first four characters in the command name), not sending leading zeroes in the data. Use = 0/1 instead of ON/OFF and so on.

### Output format

MEASUREMENT RESULT:

CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8 CH9 CH10 CH11  
I/R +/- X . X X X E +/- X X

CH12 CH13 CH14 CH15  
, (BIN NR) CR LF

### Query commands Data

Recall of the setting information. By a question command the respond data output format is the command name followed by the data and terminated with CR LF + EOI (if requested). For example:

COMMAND	RESPOND
RANGE?	RANGE X CR LF
HTVOLT?	HTVOLT.XX CR LF
AVERAGE?	AVERAGE XX CR LF
CHTIME?	CHTIME XXXE-XX CR LF

Commands which are on/off commands will reply with 0 for OFF or 1 for ON.

### Service request

The service request system is made according to the IEEE488-2 standard. Each status registers has an enable register. Decimal data is used to set the enable register in fixed or floating format. By recall of enable or status registers, the 1868 instrument will reply in fixed decimal format. Refer to Figure 3-4.

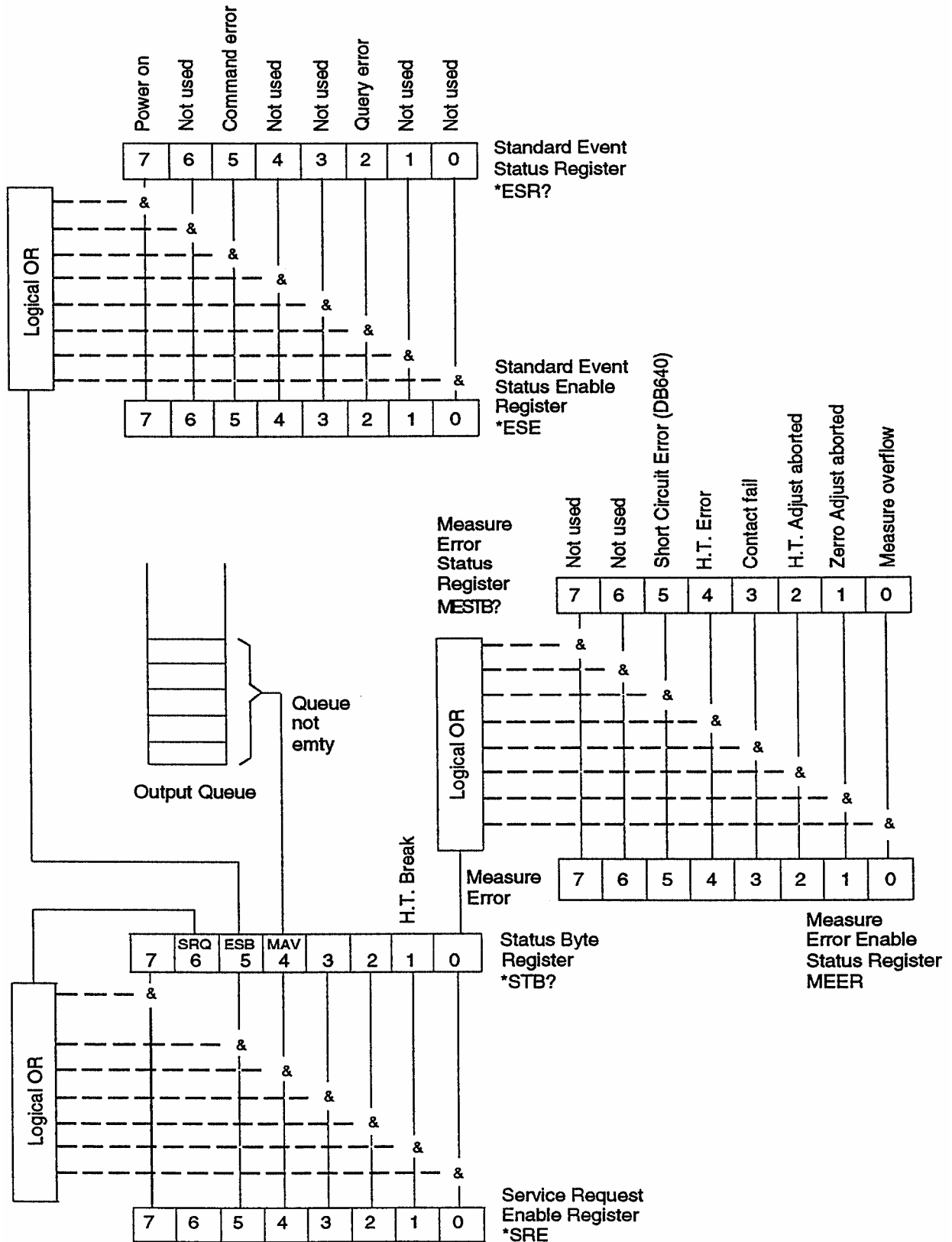
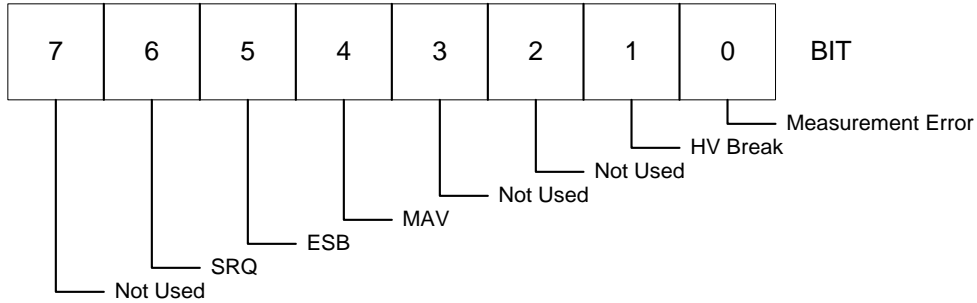


Figure 3-4: Service Request Register System

### Status Byte Register (SPOLL)

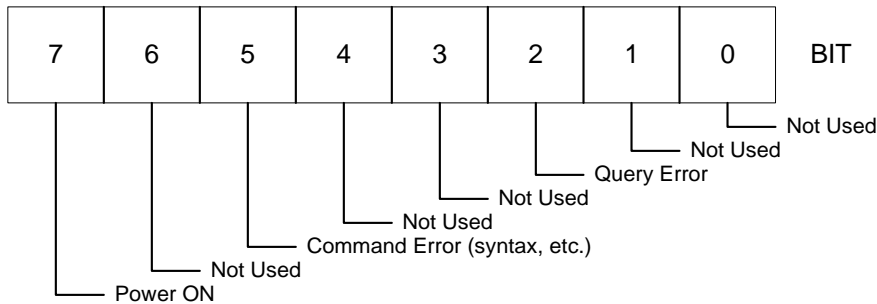
The enable register to the STATUS BYTE REGISTER is set with the command \*SRE. If an event bit is true in the status byte register, and the similar bit in the mask register is true, the 1868 will generate a service request interrupt. The STATUS BYTE REGISTER is cleared by reading it.



**Figure 3-5: Status Byte Register**

### Standard Event Status Register

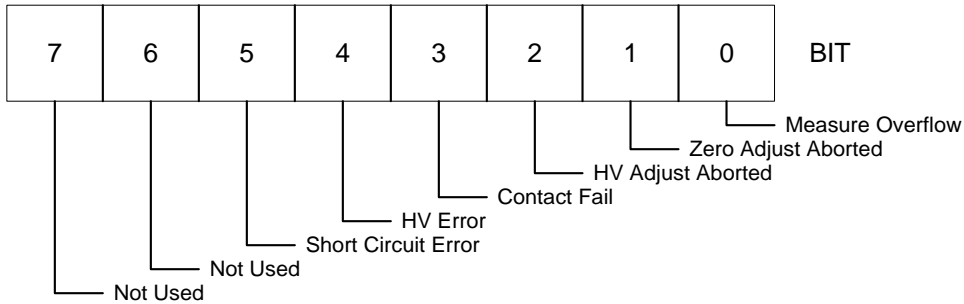
The enable register to the STANDARD EVENT STATUS REGISTER is set with the command \*ESE. If an event bit is true in the status byte register, and the similar bit in the mask register is true, the 1868 will set the ESB bit in the STATUS BYTE REGISTER. The STANDARD EVENT STATUS REGISTER is cleared by reading it.



**Figure 3-6: Standard Event Status Register**

## Measurement Error Status Register.

The enable register to the MEASUREMENT ERROR STATUS REGISTER is set with the command MEER. If an event bit is true in the status byte register, and the similar bit in the mask register is true, it will set the MEASUREMENT ERROR bit in the STATUS BYTE REGISTER. The MEASUREMENT ERROR STATUS REGISTER is cleared by reading it.



**Figure 3-7: Measurement Error Status Register**

## Input commands

### IEEE488-2 command

- \*TRG Device trigger
- \*IDN? Return device identifier.  
DANBRIDGE, DB621, 0, XXX  
XXX = Software version
- \*CLS Clear all event registers.
- \*STB? Read STATUS BYTE REGISTER (SPOLL).
- \*SRE Set SERVICE REQUEST ENABLE REGISTER (mask for SPOLL reg.).
- \*SRE? Recall SERVICE REQUEST ENABLE REGISTER Setting.
- \*ESE Set STANDARD EVENT STATUS ENABLE REGISTER.
- \*ESE? Recall STANDARD EVENT STATUS ENABLE REGISTER
- \*ESR Read STANDARD EVENT STATUS REGISTER.
- \*RST Total reset. (WAIT. 10 SEC).
- \*PSC Clear all enable registers on power on.  
0 = No change on power on.  
1 = Clear on power on.
- \*PSC? Recall \*PSC setting

**NOTE:**

All characters must be in UPPERCASE.

**Device dependent input commands**

<b>AVERAGE</b>	Set average count.
<b>AVERAGE?</b>	Recall average count.
<b>BARGRAPH</b>	Bargraph ON/OFF ON or 1 = Bargraph on OFF or 0 = Bargraph off.
<b>BARGRAPH?</b>	Recall bargraph on/off setting.
<b>BGSCALE</b>	Set bargraph scale.
<b>CURRENT:</b>	A = Auto scale 1 = 1 pA - 100 pA 2 = 10 pA - 1 nA 3 = 100 pA - 10 nA 4 = 1 nA - 100 nA 5 = 10 nA - 1 uA 6 = 100 nA - 10 uA 7 = 1 uA - 100 uA 8 = 10 uA - 1 mA
<b>RESISTANCE:</b>	A = Auto scale 1 = 10 kOhm - 1 MOhm 2 = 100 kOhm - 10 MOhm 3 = 1 MOhm - 100 MOhm 4 = 10 MOhm - 1 Gohm 5 = 100 MOhm - 10 Gohm 6 = 1 GOhm - 100 Gohm 7 = 10 GOhm - 1 Tohm 8 = 100 GOhm - 10 Tohm 9 = 1 TOhm - 100 Tohm 10 = 10 TOhm - 1 POhm
<b>BGSCALE?</b>	Recall bargraph scale setting.
<b>CCHECK</b>	Set contact check ON/OFF ON or 1 = Contact check on. OFF or 0 = Contact check off.
<b>CCHECK?</b>	Recall contact check ON/OFF setting.
<b>CHTIME</b>	Set charge time.
<b>CHTIME?</b>	Recall charge time setting.
<b>CLIM</b>	Clear all limits
<b>DISPlay</b>	Display ON/OFF. ON or 1 = Display on. OFF or 0 = Display off.
<b>DISPLAY?</b>	Recall display ON/OFF setting.



**DMODE** Set output/display mode.  
I = Current reading.  
R = Resistance reading.

**DMODE?** Recall display mode setting.

**DISCHARGE** Set discharge ON/OFF.  
ON or 1 = Discharge on.  
OFF or 0 = Discharge off.

**DISCHARGE?** Recall discharge on/off setting.

**HUMREJECT** Set humreject 50 or 60 Hz.  
50 = 50Hz.  
60 = 60Hz.

**HUMREJECT?** Recall humreject setting.

**HVADJUST** Perform an HV ADJUST

**HVCURRENT** Set HV1 current limit (2mA, 25mA, 100mA).  
Format: HVCU 2MA,XXXX (Pass word)

**HVCURRENT?** Recall HV1 current limit.

**HV2CURRENT** Set HV2 current limit (2mA, 25mA, 100mA).  
Format: HVCU 2MA,XXXX (Pass word)  
(Dual HV supply units only)

**HV2CURRENT?** Recall HV2 current limit.  
(Dual HV supply units only)

**HV EXTERNAL** Set 1868 in external HV mode.  
(internal HV supply off)  
ON or 1 = External HV is used.  
OFF or 0 = Internal HV supply is used.

**HV EXTERNAL?** Recall HV external

**HV GND** Set HV on ground feature ON/OFF. (1868A only)  
ON or 1 = HV on ground on.  
OFF or 0 = HV on ground off.

**HV GND?** Recall HV on ground ON/OFF setting.

**HV VOLT** HV voltage setting.

**HV VOLT?** Recall HV voltage setting.

**HV2VOLT** HV voltage setting.  
(Dual HV supply units only)

**HV2VOLT?** Recall HV voltage setting.  
(Dual HV supply units only)

**HV OUTPUT** Set HV output ON/OFF.  
ON or 1 = HV on.  
OFF or 0 = HV off.

**HV OUTPUT?** Recall HV output ON/OFF setting.

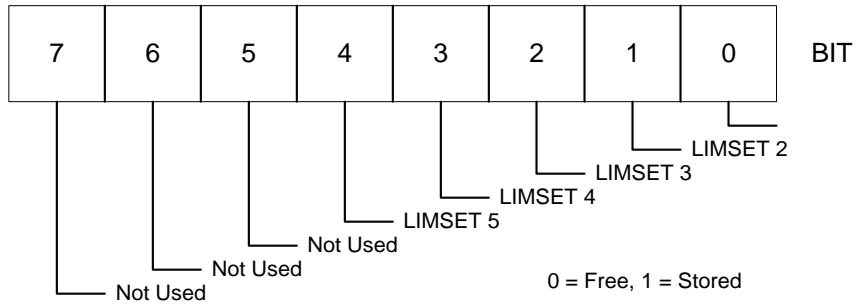
**LIM0** Enter lim0 value.  
Format: LIM0 I/R, value

**LIM0?** Recall lim0 value.

<b>LIM1</b>	Enter lim1 value. Format: LIM1 I/R, value
<b>LIM1?</b>	Recall lim1 value.
<b>LIM2</b>	Enter lim2 value. Format: LIM2 I/R, value
<b>LIM2?</b>	Recall lim2 value.
<b>LIM3</b>	Enter lim3 value. Format: LIM3 I/R, value
<b>LIM3?</b>	Recall lim3 value.
<b>LIM4</b>	Enter lim4 value. Format: LIM4 I/R, value
<b>LIM4?</b>	Recall Lim4 value.
<b>LIMIT</b>	Set limit ON/OFF. ON or 1 = Limit on. OFF or 0 = Limit off.
<b>LIMIT?</b>	Recall limit ON/OFF information.
<b>MDELAY</b>	Set measurement delay time.
<b>MDELAY?</b>	Recall measurement delay time.
<b>MESTB?</b>	Read MEASUREMENT ERROR STATUS REGISTER.
<b>MEER</b>	Set MEASUREMENT ERROR ENABLE STATUS REGISTER.
<b>MEER?</b>	Recall MEASUREMENT ERROR ENABLE STATUS REGISTER SETTING.
<b>RANGE</b>	Range setting information. 1 = Range 1 2 = Range 2 3 = Range 3 4 = Range 4 0 or A = Auto range (Continuous measurements only)
<b>RANGE?</b>	Recall range setting information.
<b>RLIMSET</b>	Recall stored limset. 1 = recall limset 1. 2 = recall limset 2. 3 = recall limset 3. 4 = recall limset 4 5 = recall limset 5.

**RLIMSET?**

Recall which limset are stored.



**Figure 3-8: RLIMSET**

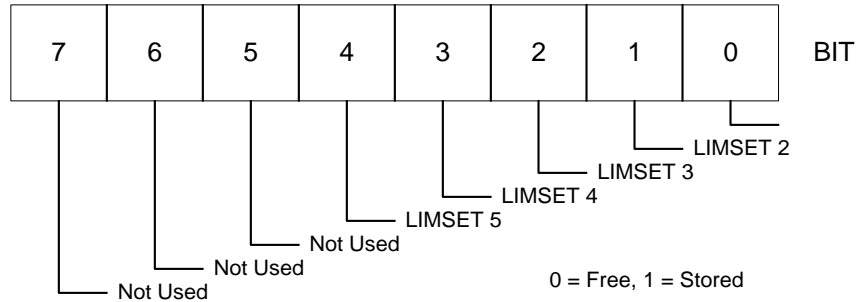
**SLIMSET**

Save limset.

- 1 = save current limset as limset 1.
- 2 = save current limset as limset 2.
- 3 = save current limset as limset 3.
- 4 = save current limset as limset 4.
- 5 = save current limset as limset 5.

**SLIMSET?**

Recall which limset are stored.



**Figure 3-9: SLIMSET**

**TRIG**

External TRIG ON/OFF.

ON or 1 = Enable external trig.

OFF or 0 = Disable external trig.

**TRIG?**

Recall External trig on/off setting.

**ZADJUST**

Perform a ZERO ADJUST.

## Scanner compatibility commands

<b>BURST</b>	Set burst mode ON/OFF ON or 1 = Burst mode on. OFF or 0 = Burst mode off.
<b>BURST?</b>	Recall burst mode ON/OFF setting.
<b>HVCVOLT</b>	HV2 voltage setting. (Dual HV supply units only)
<b>HVCVOLT?</b>	Recall HV2 voltage setting. (Dual HV supply units only)
<b>HV1VOLT</b>	HV1 voltage setting. (Dual HV supply units only)
<b>HV1VOLT?</b>	Recall HV1 voltage setting (Dual HV supply units only)

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## Section 4 : Service & Calibration

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### 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 978-461-2100 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 call our **Customer Care Center (CCC)** at **800-253-1230** for return material authorization (RMA). It will be necessary to include a Purchase Order Number 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". Return material should be sent freight prepaid, to:

QuadTech, Inc.  
5 Clock Tower Place, 210 East  
Maynard, Massachusetts 01754

Attention: RMA #

**Shipments sent collect can not be accepted.**

### 4.3 Calibration

Calibration of the 1868 Megohmmeter is recommended on an annual basis. If the unit is returned to QuadTech for factory calibration refer to paragraph 4.2 for instructions. Using the calibration procedure below the instrument can be calibrated by a qualified service person if traceable calibration equipment and standards are available. **The instrument should be powered up for a minimum of 1 hour before calibration to ensure maximum stability.**

**This Test Software is intended for calibration of the instrument only.** Altering these Test Programs affects the instrument calibration and will **void** the 1868 instrument warranty.

### 4.3.1 Verification Equipment

#### 4.3.1.1 Measurement Standards

1. Fluke 8842A Multimeter or equivalent
2. Sefelec Resistor Standards 500k to 1T
3. Valhalla 4600 Voltmeter or equivalent

#### 4.3.1.2 Other Equipment

1. Current Generator/100nF Capacitor or equivalent
2. 1868-01 Cable Set

#### 4.3.1.3 Environmental

Instrument Calibration is performed under the following conditions:  
Temperature equal to  $23^{\circ}\text{C} \pm 4^{\circ}\text{C}$  and Relative Humidity (RH)  $< 60\%$ .

### 4.3.2 Verification Procedure

To verify that the 1868 megohmmeter meets specification, complete section 4.3.2.

#### 4.3.2.1 Perform Hardware and Software Resets

Turn Power On

Press Menu key to go to measurement display

Or if at another menu screen Press esc key to go to measurement display

Press alt key to go to Alt menu

Press F1 Reset

Press F2 Hardware Reset - Unit should reset back to initial startup screen

Press Menu key to go to measurement display

Press alt key to go to Alt menu

Press F1 Reset

Press F3 Software Reset - Unit should return to measurement display

#### 4.3.2.2 Verify HV Break and Interlock work

Program 1868 for the following

HV = 100V

Meas. Mode = CONT

Result = Current

Hum Reject = 60Hz

Contact Check = Off

Press esc key to get to measurement display

Press F5 Activate HV

Press HV Break and verify Break message appears and HV Break light is no longer lit.

Press Menu to continue

Press F5 Activate HV

Remove Interlock from Back of unit

Verify Break message appears and HV Break light is no longer lit.

Press Menu to continue

#### 4.3.2.3 Check HV on Ground and Floating (1868A only)

Program 1868A for HV on Ground = NO

Press esc key

Measure Voltage using Valhalla between Chassis and HV Terminal

Press F5 Activate HV

Verify Measured Voltage is  $100V \pm 1V$

Press F5 Cancel HV

Program 1868A for HV on Ground = Yes

Measure Voltage using Valhalla between Chassis and Guard Terminal

Press F5 Activate HV

Verify Measured Voltage is  $-100V \pm 1V$

Press F5 Cancel HV

Program 1868A for HV on Ground = No

#### 4.3.2.4 Check Contact Check Function

Program 1868 for Contact Check = On

Press esc key

Press F1 Start Measure (DO NOT ACTIVATE HIGH VOLTAGE)

Verify Fault LED is on and Display shows No Contact

Connect 100nF Capacitor between HV and I IN terminals

Verify No Contact message no longer appears

Press F1 Stop Measure

Program 1868 Contact Check = OFF

#### 4.3.2.5 Autorange Check

Connect Current Generator between Iin Lead center conductor and inner screen

Press F1 Start Measure (DO NOT ACTIVATE HIGH VOLTAGE)

Check that displayed currents are within ( $\pm 10\% + 6pA$ ) of marked current values

Values are; 10pA, 100pA, 500pA, 1nA, 10nA, 500nA, 1uA, 10uA and 1mA

Press F1 Stop Measure

Turn Current Generator OFF

#### 4.3.2.6 Zero All Ranges

Press Menu key

Press F8 Zero Adj Menu

Disconnect 1868-01 Lead Set

Press F8 Zero All Ranges

#### 4.3.2.7 Measure and Record Voltage Values

Program 1868 for:

HV = 100V

Range = AUTO

Average = 20

Meas. Mode = CONT

Result = Resistance

Hum Reject = 60Hz

Contact Check = Off  
Connect Valhalla voltmeter between HV and I IN  
Press esc key  
Press F5 Activate HV  
Press F1 Start Measurement  
Record Displayed and Measured Voltage on datasheet  
Repeat for all values of voltage shown on datasheet  
Press F5 Cancel HV  
Press F1 Stop Measurement  
Verify values are within limits

#### 4.3.2.8 Measure and Record Resistance Values

Program 1868 for:  
HV = 100V  
Range = AUTO  
Average = 20  
Meas. Mode = CONT  
Result = Resistance  
Hum Reject = 60Hz  
Contact Check = Off  
Press esc when finished  
Attach each resistor between HV and I IN leads  
Press F5 Activate HV  
Press F1 Start Measure  
Record resistance value  
Press F5 Cancel HV  
Repeat for each resistor value shown on datasheet  
Verify values are within limits

#### 4.3.2.9 Noise Check

Disconnect all cables  
Program 1868 for:  
HV = 1000V  
Range = AUTO  
Average = 20  
Meas. Mode = CONT  
Result = Current  
Hum Reject = 60Hz  
Contact Check = Off  
Press esc key  
Press F5 Activate HV  
Press F1 Start Measurement  
Verify current reading is  $0\text{pA} \pm 4\text{pA}$   
Press F5 Cancel HV  
Press F1 Stop Measurement



#### 4.3.2.10 Noise Scatter 100V and 1000V

Connect cable 1868-01

Connect 100nF capacitor between HV and I IN leads

Program 1868 for:

HV = 100V

Range = AUTO

Average = 1

Meas. Mode = CONT

Result = Current

Hum Reject = 60Hz

Contact Check = Off

Set Measure Graphics for XY Graph with Time = 160s and Scale = 2

Press esc key

Press F1 Start

Verify most of scatter is below 40pA over time

Press F5 Stop

Program 1868 for:

HV = 1000V

Set Measure Graphics for XY Graph with Time = 160s can Scale = 3

Press esc key

Press F1 Start

Verify most of scatter is below 0.4pA over time

Press F5 Stop

## Test Data Sheet for Verification of 1868 Megohmmeter

Model: \_\_\_\_\_ QT S/N: \_\_\_\_\_ Date: \_\_\_\_\_

**7.2 Safety** Y/N  
 HV Break Works   
 Interlock Works

**7.3 Ground and Floating Checks (1868A only)**

HV Ground No   
 HV Ground Yes

\* Verify Measured Value is within (100V ±1V)  
 \* Verify Measured Value is within (-100V ±1V)

**7.4 Contact Check** Y/N

**7.5 Auto Range** Y/N

**7.7 Output Voltage** (Specification [ $\pm$  (2% of Voltage Setting)])

\* Verify Displayed & Measured Values are within High and Low Limits

Voltage Setting	Measured Voltage	Displayed Voltage	LOW Limit	HIGH Limit
100			98	102
200			196	204
300			294	306
400			392	408
500			490	510
600			588	612
700			686	714
800			784	816
900			882	918
1000			980	1020
2000			1960	2040
3000			2940	3060
4000			3920	4080
5000			4900	5100

**7.8 Resistance Measurement @100V** (Specification [ $\pm$  (2% of Actual Value + 5cnts)])

\* Verify Displayed Values are within High and Low Limits

Zin	Nominal Value	Standard Value	Displayed Value	LOW Limit	HIGH Limit
10k	0.5M	4.996E+05		4.846E+05	5.146E+05
10k	5M	4.997E+06		4.847E+06	5.147E+06
10k	50M	4.990E+07		4.840E+07	5.140E+07
10k	500M	5.003E+08		4.853E+08	5.154E+08
1M	5G	4.984E+09		4.834E+09	5.133E+09
1M	50G	4.933E+10		4.784E+10	5.082E+10
1M	500G	4.919E+11		4.770E+11	5.067E+11
1M	1T	9.854E+11		9.606E+11	1.010E+12

**7.9 Noise Check** Y/N

**7.10 Noise Scatter** Y/N

### 4.3.3 Calibration Equipment

#### 4.3.3.1 Measurement Standards

1. Fluke 8842A Multimeter or equivalent

#### 4.3.3.2 Other Equipment

2. 1868-01 Cable Set
3. Plastic Screwdriver

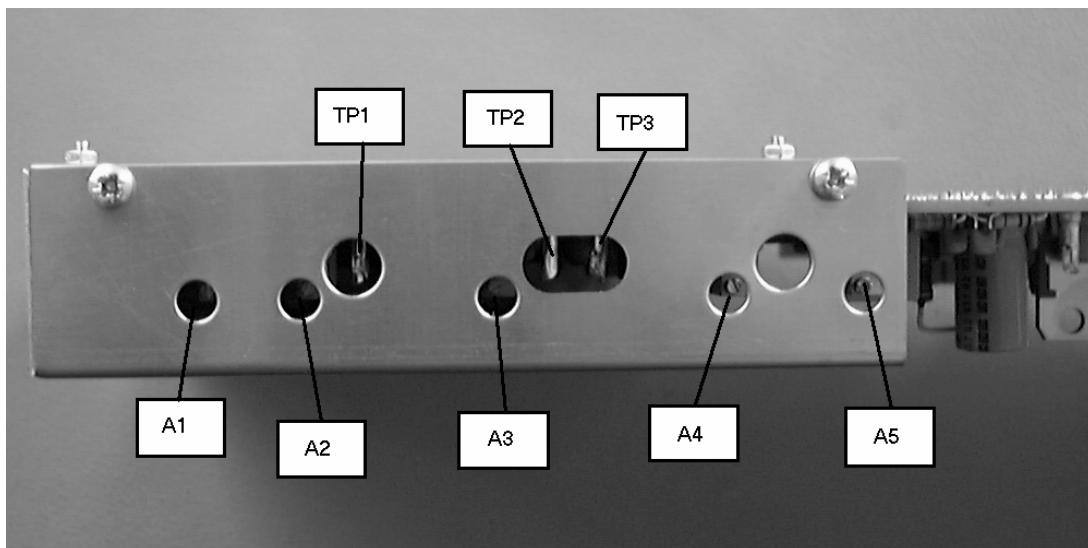
#### 4.3.3.3 Environmental

Instrument Calibration is performed under the following conditions:  
Temperature equal to  $23^{\circ}\text{C} \pm 4^{\circ}\text{C}$  and Relative Humidity (RH)  $< 60\%$ .

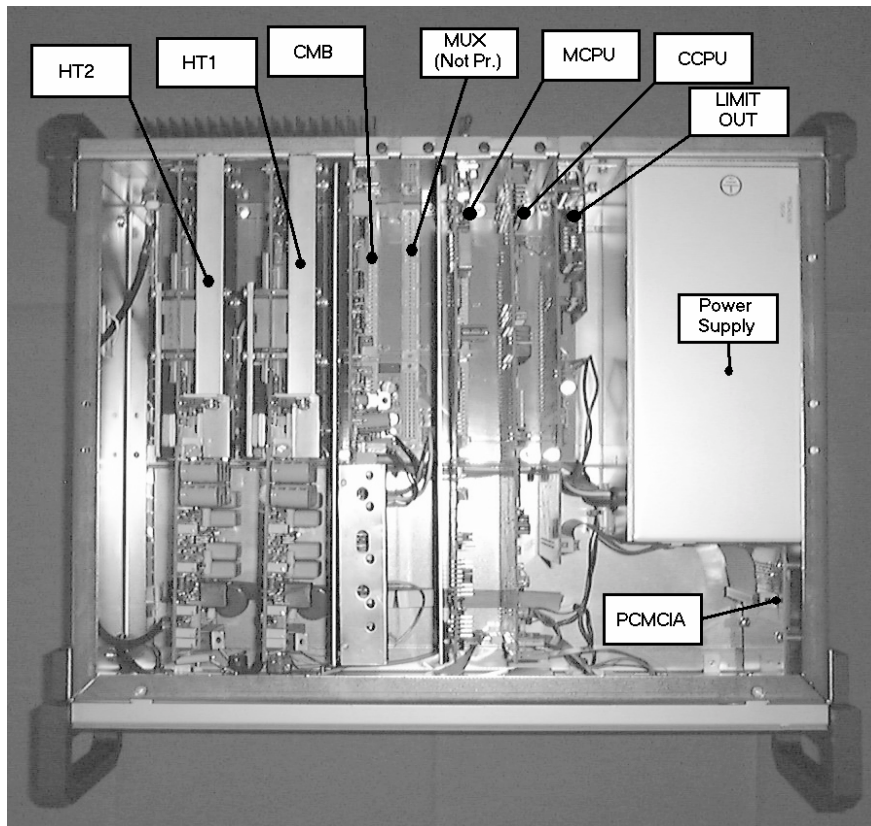
### 4.3.4 Calibration Procedure

The calibration of the 1868 instrument is detailed herein. **This Test Software is intended for calibration of the instrument only.** Altering these Test Programs affects the instrument calibration and will **void** the 1868 instrument warranty.

Remove top cover. Refer to Figures 4-1 and 4-2 for board locations, test and adjustment points.



**Figure 4-1: Test Points**



**Figure 4-2: Board Locations**

**This Test Software is intended for calibration of the instrument only.** Altering these Test Programs affects the instrument calibration and will **void** the 1868 instrument warranty.

#### 4.3.4.1 Perform Hardware and Software Resets

Turn Power On

Press Menu key to go to measurement display

Or if at another menu screen Press esc key to go to measurement display

Press alt key to go to Alt menu

Press F1 Reset

Press F2 Hardware Reset - Unit should reset back to initial startup screen

Press Menu key to go to measurement display

Press alt key to go to Alt menu

Press F1 Reset

Press F3 Software Reset - Unit should return to measurement display

- 4.3.4.2            Adjust Contrast (if necessary)  
Press alt key to go to Alt menu  
Press F4 Display Setup  
Press F7 Display Contrast  
Press F2 Contrast CLR  
Adjust Potentiometer A1 on CCPU board for best contrast
- 4.3.4.3            Delete Zero Adjustments  
Press esc key to go to measurement display  
Press Menu key  
Press F8 Zero Adj Menu  
Press F7 Delete Zero Adj  
Status Indicator should be red and Zero Adjusted: should all indicate “No”
- 4.3.4.4            Check Display Vref Value  
Press esc key to go to measurement display  
Press alt key to go to Alt menu  
Press F3 Test Program  
Make sure TEST POINT: = Vref (if not press F8 to cycle through test points)  
Press F2 Cont Start to start test  
Display should show Voltage Value at top of display  
Make sure voltage is between 8V and 12V  
No adjustment can be made
- 4.3.4.5            TP1 Offset Adjustment in CMP board  
From alt menu  
Press F6 A/D Test  
Press F2 A/D Test Setup  
Press F1 Offset Setup  
Setup 8842A for DC Voltage  
Connect 8842A between AGND1 (loop of wire between TP 1 and TP2) and TP1  
Adjust A2 potentiometer for  $0V \pm 5\mu V$   
Press F2 Bias Adj Setup  
Adjust A1 potentiometer for  $0V \pm 5\mu V$   
Repeat process, toggling between F1 Offset Setup and F2 Bias Adj Setup until both measurements are within  $0V \pm 5\mu V$
- 4.3.4.6            TP3 Adjustment and TP2 Verification  
Press F1 Offset Setup  
Connect 8842A between AGND1 (loop of wire between TP 1 and TP2) and TP3  
Adjust A3 potentiometer for  $0V \pm 5\mu V$   
Connect 8842A between AGND1 (loop of wire between TP 1 and TP2) and TP2  
Verify Voltage is  $0V \pm 100\mu V$

#### 4.3.4.7 ADC Zero Display

Press F3 ADC Zero Setup

Press menu key

Press F6 A/D Test Start

Display should show Hex value at top of display

Adjust A5 on CMB for displayed Hex value between  $\pm 0003$

Press F6 A/D Test Stop

#### 4.3.4.8 Display Vref Adjustment

Press menu key

Make sure TEST POINT: = Vref (if not press F8 to cycle through test points)

Press F2 Cont Start to start test

Display should show Voltage Value at top of display

Adjust A4 on CMB for displayed value of  $10.00V \pm 0.01V$

#### 4.3.4.9 Perform Hardware and software resets per 4.3.4.1

#### 4.3.4.10 Replace Top Cover