1868 A-D
Megohmmeter
Instruction Manual

Form 150753/A2

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.

Contents

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Warranty

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

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

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

This warranty is in lieu of all other warranties, expressed or implied, including, but not limited to any implied warranty or merchantability 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 (Minimum Obtainable)
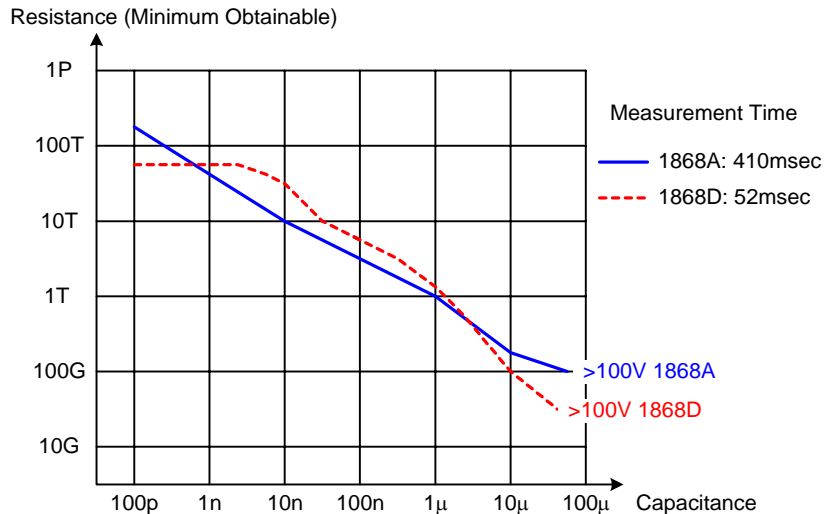
Resistance Accuracy: For Rx < 20GΩ(Vx): ±(2% of reading + 5cnts)
For Rx > 20GΩ(Vx): ±(Vx/1pA) in ohms. Max reading: Vx/0.1pA
Rx = Measured resistance in ohms
Vx = Programmed voltage in volts

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

Voltage Accuracy: 2% of setting
±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: ±[2% of reading + 5cnts + 1pA]

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

Specifications (Continued)

Test Speed: Trigger Mode: 40msec
Continuous Mode: 90-4000msec depending on #to Average

Test Time: 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

Delay Time: 0 – 9999msec

Display: 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

Input Terminals: Two BNC Connectors, One sheathed banana plug terminal

**Standard
Interfaces:**   • RS232   • IEEE-488   • Remote I/O

Dimensions: 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)

Weight: 12.7 kg (28lbs) – Net; 18.6 kg (41lbs) – Ship

Environmental: Operating: 10°C to 40°C, RH 80%

Power: • 110 - 240V   • 50 - 60Hz
• 400W Max (1.8A at 220VAC, 3.2A at 125VAC)

General: • Fully programmable via menu
• Zeroing
• Stored test conditions and results

**Accessories
Supplied:**   • Instruction Manual   • AC Power Cable
• Calibration Certificate   • Lead Set: 1.5m coax cable HV/BNC

**Ordering
Information:**

Description	Catalog No.
Megohmmeter: 2/25/100mA, 1kV	1868A
Megohmmeter: 2/10/18mA, 5kV	1868D

Accessories

Accessories Included

Item	Quantity	QuadTech P/N
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 with black loop wire	1	1868-04
Opto-Couple Plug without wires	1	N/A
Instruction Manual	1	150753
Calibration Certificate	1	N/A

Accessories/Options Available

Item	Quantity	QuadTech P/N
PCMCIA Memory Card (2Meg SRAM) (For memory expansion of setups & downloading of instrument firmware)	1	2100-04
Resistivity Test Cell for use with 1868A Megohmmeter	1	1868-11
1868A Alligator Clip Lead Set (std w/unit)	1	1868-01
1868D Alligator Clip Lead Set (std w/unit)	1	1868-03

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.

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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.

Condensed Operating Instructions

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 10kΩ to 1PΩ 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 <u>before</u> 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.
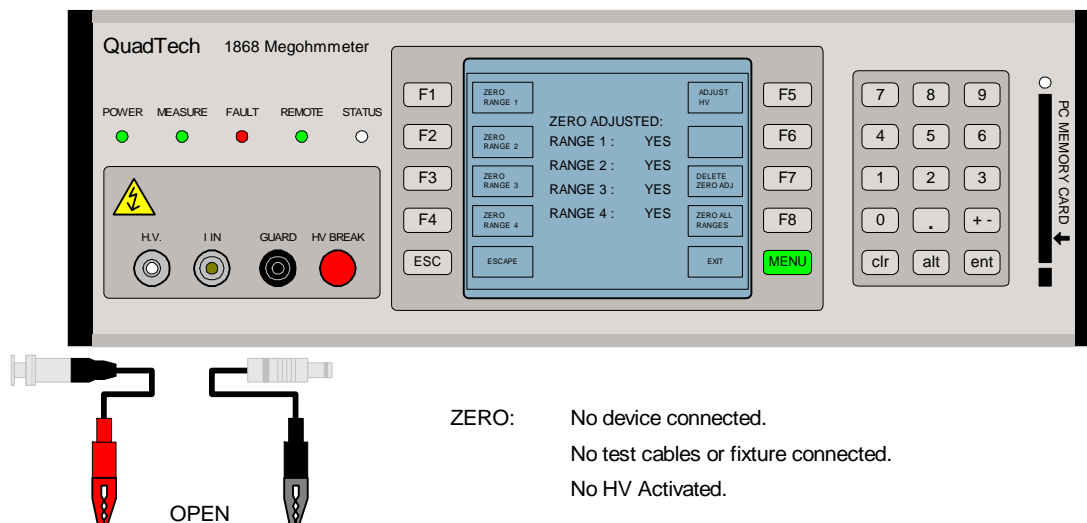
Figure COI-1: Zero Adjustment

Condensed Operating Instructions

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 <u>not</u> 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".
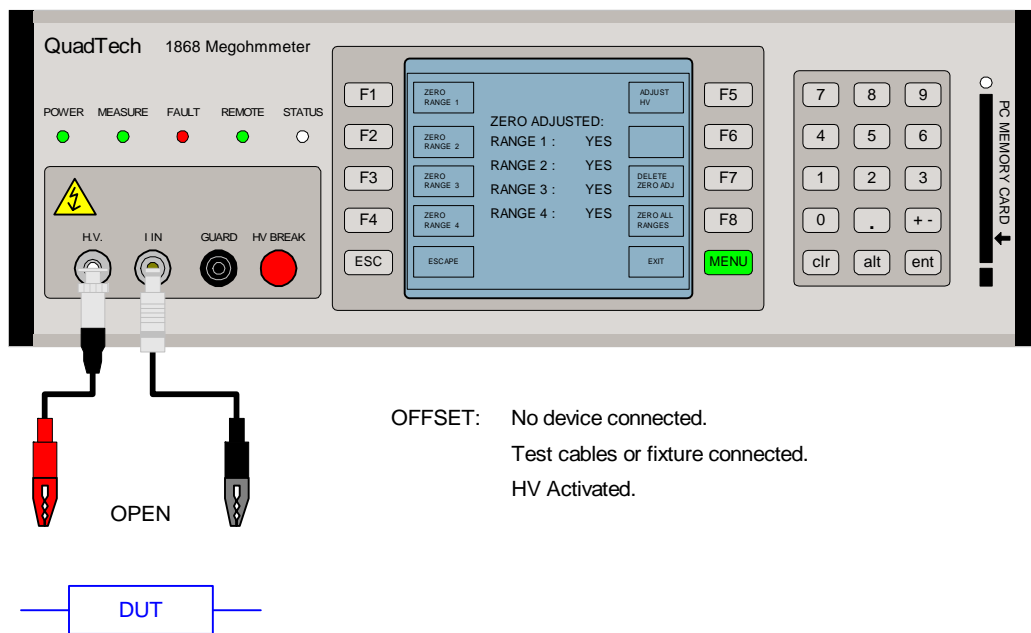
Figure COI-2: Zero/Offset Adjustment

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.

Condensed Operating Instructions

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. Connect black loop interlock.
      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. Press [F8]. Press [F8]. Press [MENU] = EXIT.
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 tme, press red [HV BREAK] button to stop test.
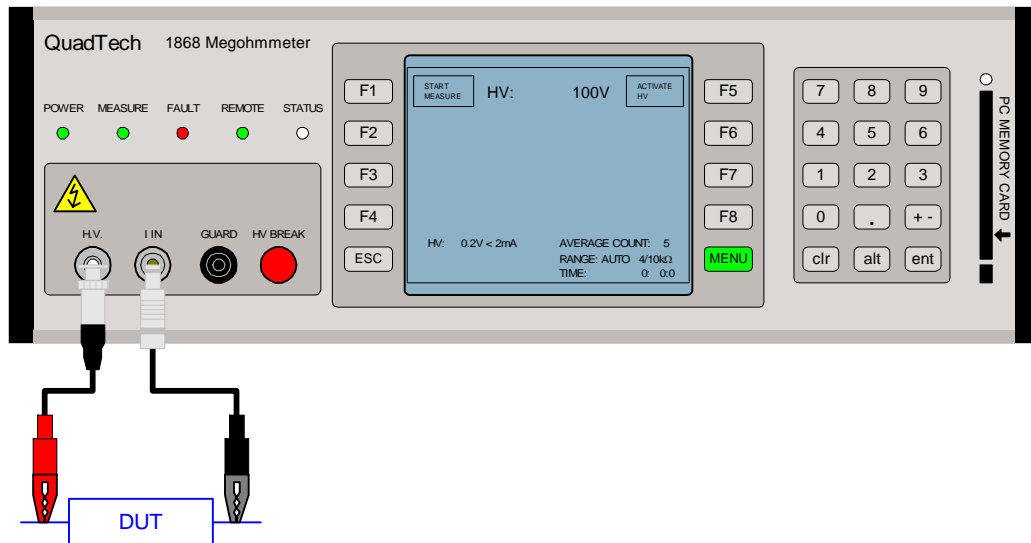
Figure COI-3: 1868-01 Cable Connection To Device Under Test

Condensed Operating Instructions

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 $\boxed{\text{Empty Sequence 1}}$.
        Press [F2] = EDIT SEQUENCE.
        Press [F1] = EDIT STEP.
        Press [F1] = SELECT COMMAND to select highlighted parameter $\boxed{\text{CHARGE}}$.
        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 $\boxed{2}$.
        Press [F1] = EDIT STEP.
        Press [F6] = NEXT COMMAND to move highlighted box to $\boxed{\text{M. DELAY}}$.
        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 $\boxed{3}$.
        Press [F1] = EDIT STEP.
        Press [F6] = NEXT COMMAND to move highlighted box to $\boxed{\text{MEASURE}}$.
        Press gray softkeys [0] [ent] = Range 0 = AUTO RANGE
        Press gray softkeys [0] [ent] = Zi: 0 = 1MΩ 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 $\boxed{4}$.
        Press [F1] = EDIT STEP.
        Press [F6] = NEXT COMMAND to move highlighted box to $\boxed{\text{DISCHARGE}}$.
        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.

Section 1 : Introduction

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 10kΩ to 1PΩ 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.

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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).

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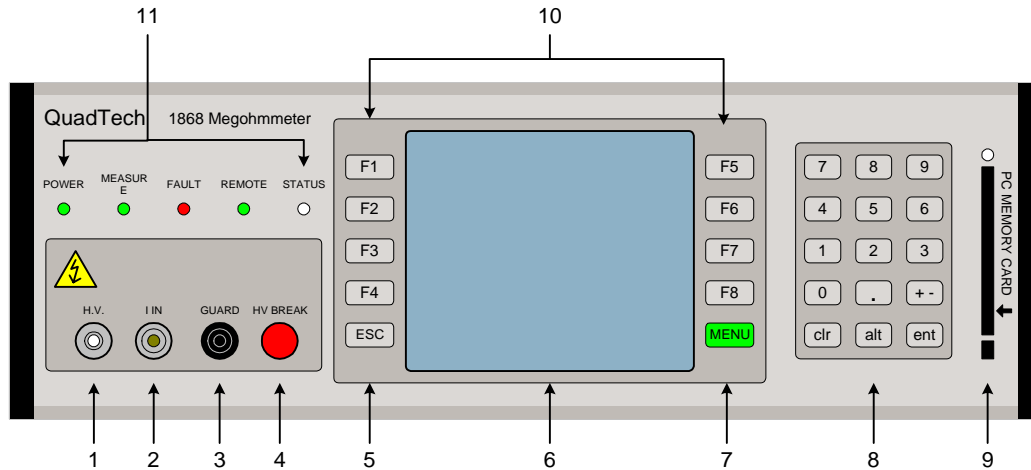
Figure 1-1: 1868 Front Panel Controls & Indicators

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 Recptacle	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 Recptacle	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:
a) Output voltage is lower than programmed voltage due to short, DUT capacitance or fault.
b) A/D overflow due to incorrect range setting or insufficient charge time due to DUT capacitance.
c) 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.
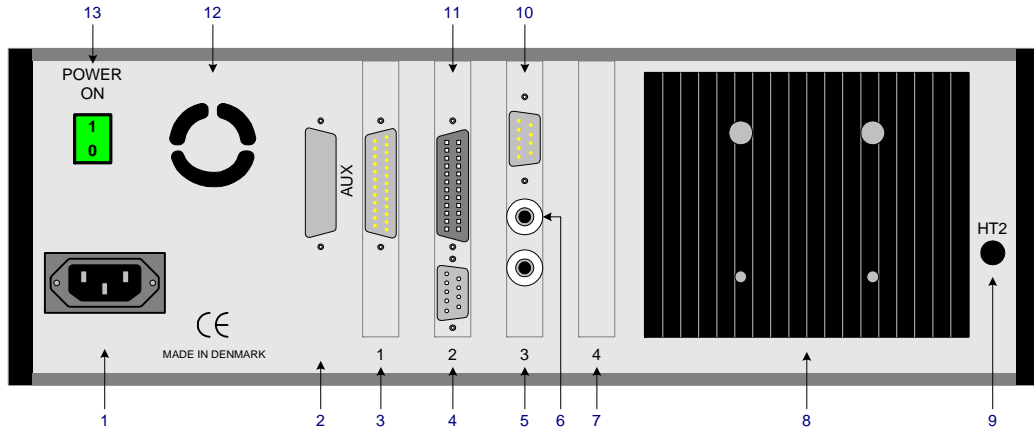
Figure 1-3: 1868 Rear Panel Controls and Connectors
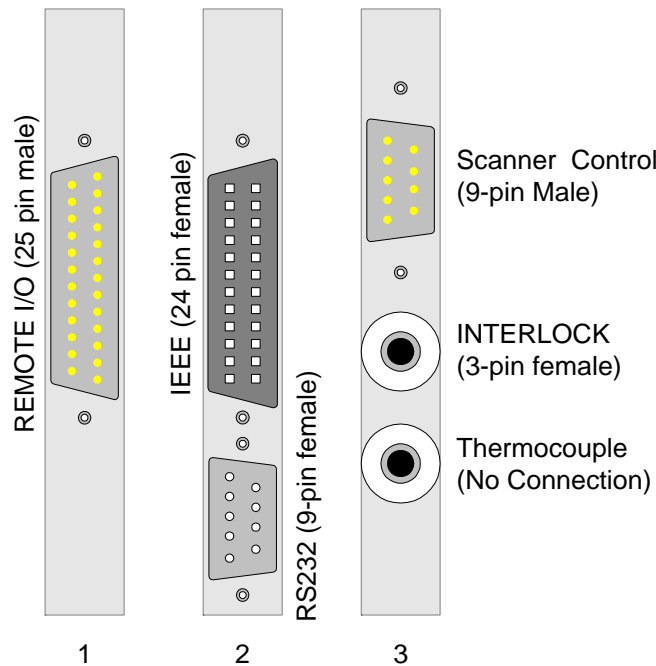
Figure 1-4: Detail 1868 Interface Connectors

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.

Introduction

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 ≥50°C, OFF <50°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.
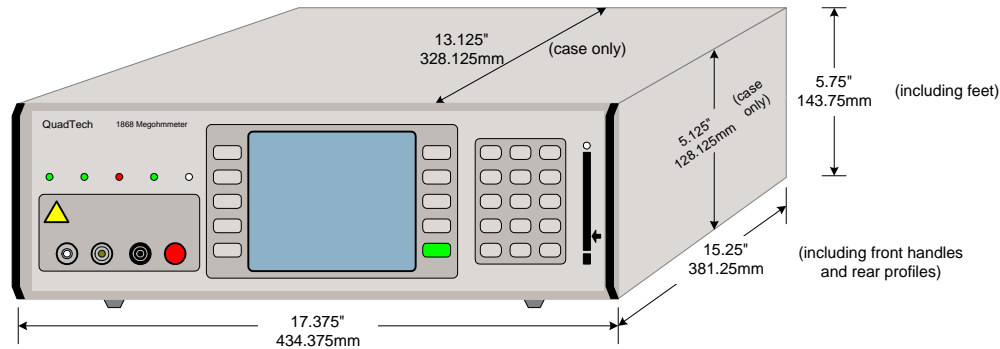
Figure 1-5: 1868 Instrument Dimensions

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° 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 ventillation 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.

Section 2 : Operation

2.1 Terms and Conventions

Table 2-1 : Measurement Unit Prefixes

Multiple	Scientific	Engineering	Symbol
1000000000000000	10^{15}	Peta	P
1000000000000	10^{12}	Tera	T
1000000000	10^{9}	Giga	G
1000000	10^{6}	Mega	M
1000	10^{3}	Kilo	k
.001	10^{-3}	milli	m
.000001	10^{-6}	micro	u
.000000001	10^{-9}	nano	n
.000000000001	10^{-12}	pico	p
.000000000000001	10^{-15}	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 100kΩ 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.
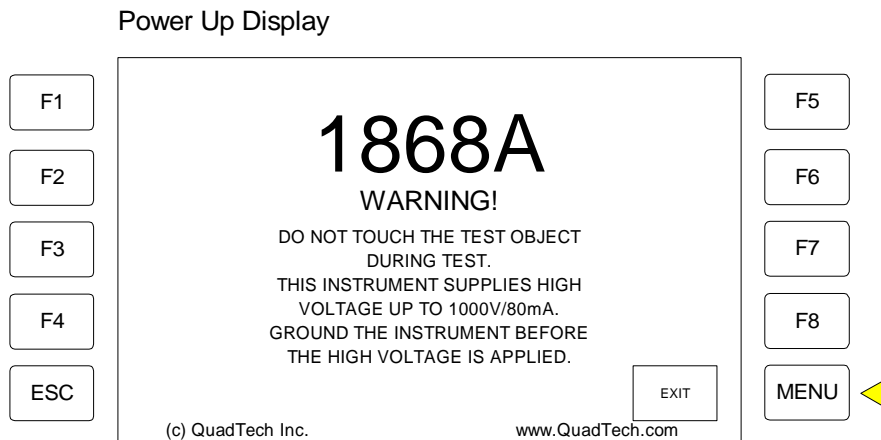
Power Up Display

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.

Measure Display

F1	START MEASURE	HV:	100V	ACTIVATE HV	F5
F2					F6
F3					F7
F4					F8
ESC	HV:	0.0V < 2mA	AVERAGE COUNT: 20 RANGE: AUTO/10kΩ TIME: 0 : 0:0		MENU
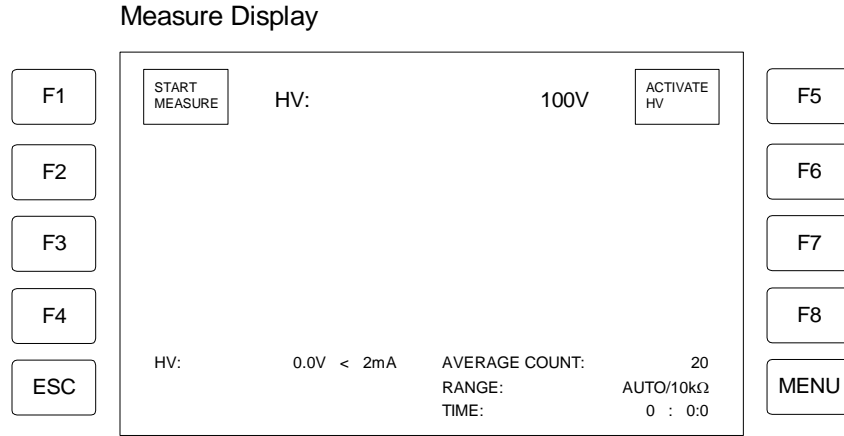
Figure 2-2: Measure Display

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).

Programming MENU

F1	MEASURE SETUP	HT: 10V/OFF		SETUP STATUS	F5
F2	SEQUENCE SETUP	HT. CURRENT: 2mA RANGE: AUTO AVERAGE COUNT: 20 MEAS. MODE: CONT RESULT: CURRENT		SETUPS	F6
F3	LIMIT SETUP	MEAS. DELAY: 0ms CHARGE TIME: 0ms HUM REJECT: 60Hz			F7
F4	MEASURE GRAPHICS	CONTACT CHECK: OFF SHORTCIR. CHECK: OFF LIMITS: OFF		ZERO ADJ MENU	F8
ESC	ESCAPE			EXIT	MENU
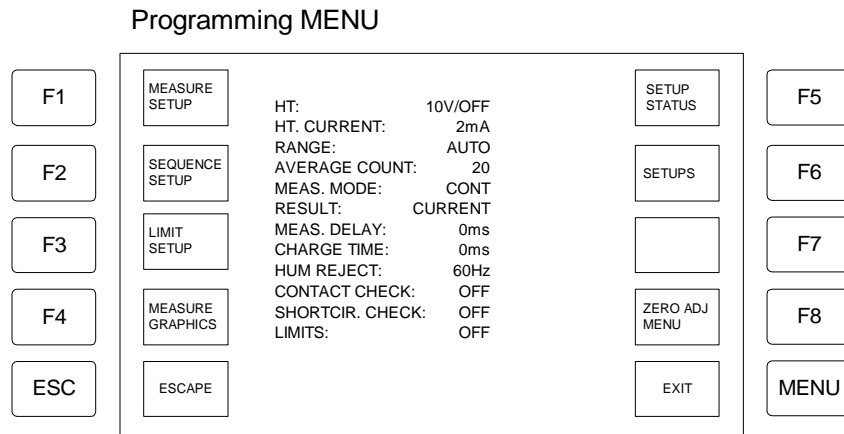
Figure 2-3: Program Display

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

2.3 Menus

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

Programming MENU

F1	MEASURE SETUP	HT: 10V/OFF
		HT. CURRENT: 2mA
F2	SEQUENCE SETUP	RANGE: AUTO
		AVERAGE COUNT: 20
		MEAS. MODE: CONT
		RESULT: CURRENT
F3	LIMIT SETUP	MEAS. DELAY: 0ms
		CHARGE TIME: 0ms
		HUM REJECT: 60Hz
		CONTACT CHECK: OFF
F4	MEASURE GRAPHICS	SHORTCIR. CHECK: OFF
		LIMITS: OFF
ESC	ESCAPE	

SETUP STATUS — F5
SETUPS — F6
— F7
ZERO ADJ MENU — F8
EXIT — MENU

F1
MEASURE SETUP

HT Control
  HT Voltage: 10-1kV, -5kV
  HT Source: INT/EXT
  HT Grounded: On/Off
  Discharge: On/Off
  Maximum Current:
    1868A: 2, 25, 80mA
    1868D: 2,10, 20mA
Range
  Select: AUTO, 1-4
  Select Input Impedance Zi= 10k or 1M
Select (Meas. Value):RES/CUR
Measure Timing
  Measure Delay: 0-10,000msec
  Charge Time: 0-10,000msec
  Hum Reject: 50Hz/60Hz
    (Reject the Noise from 50 or 60Hz line)
Select (Meas. Mode): TRIG'D/CONT
Average Count: 1-100
Contact Check On/Off

F2
SEQUENCE SETUP

Activate Sequence
Edit Sequence
  Edit Step
    Select Command
      Charge: V, T
      Meas. Delay: V, T
      Measure: Range, Z, #Avg, Lim
      Discharge: T
      Meas. To Go: Range, Z, Lim
Select Sequence
Clear Sequence
Previous Sequence
Next Sequence
Copy Sequence
Paste Sequence

F3
LIMIT SETUP

Activate Limits: On/Off
Edit Limits
  R Limits
  I Limits
Delete Limits
Limit Set Setup
  Save Limit Set: 1-5
  Recall Limit Set: 1-5
  Delete Limit Set: 1-5
Reject -Res: On/Off
BIN OUT Cont.: On/Off

F4
MEASURE GRAPHICS

Normal Text
XY Graph Setup
  Set X scale: Time (sec)
  Select Y scale:Current: 10pA - 1mA
Bar Graph Setup
  Select Scale: AUTO, plus:
    10kΩ - 1MΩ   100kΩ - 10MΩ
    1MΩ - 100MΩ   10MΩ - 1GΩ
    100MΩ - 10GΩ   1GΩ - 100GΩ
    10GΩ - 1TΩ   100GΩ - 10TΩ
    1TΩ - 10TΩ   10TΩ - 1PΩ

F8
ZERO ADJ MENU

Zero Range 1
Zero Range 2
Zero Range 3
Zero Range 4
Adjust HT
Delete Zero Adjust
Zero All Ranges

F5
SETUP STATUS

View Test Setup (List)

F6
SETUPS

Save Setup: 1-2 Internal, 3-20 PCMCIA Card
Recall Setup
Delete Setup

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 <u>manual</u> 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.

MEASURE SETUP MENU

F1	HT CONTROL	HT:	10V/OFF	SELECT CONT	F5
		HT. CURRENT:	2mA		
F2	RANGE	RANGE:	AUTO	AVERAGE COUNT	F6
		AVERAGE COUNT:	20		
		MEAS. MODE:	CONT		
F3	SELECT CUR MEAS	RESULT:	CURRENT	CONTACT CHK. ON	F7
		MEAS. DELAY:	0ms		
		CHARGE TIME:	0ms		
		HUM REJECT:	60Hz		
F4	MEASURE TIMING	CONTACT CHECK:	OFF		F8
		SHORTCIR. CHECK:	OFF		
ESC	ESCAPE			EXIT	MENU

F1

HT CONTROL

Set Voltage Parameters
HT Voltage: Set Test V
  1868A: 10 - 1kV
  1868D: 50 - 5kV
HT Source: Set V source
  INT = Internal voltage source
  EXT = External voltage source
HT Grounded: Set V connection
  ON = HV is grounded
  OFF = HV is floating
Discharge: On/Off
Maximum Current:
  1868A: 2, 25, 80mA
  1868D: 2, 5, 18mA
HT2 CUR: Select current for rear panel HT2 output

F2

RANGE

Set Measurement Range
  AUTO
  Range 1: 1pA - 10nA
  Range 2: 2nA - 100nA
  Range 3: 20nA - 10uA
  Range 4: 2uA - 1mA
Set Input Impedance (Zi)
  Zi = 10kΩ or 1MΩ

F3

SELECT CUR MEAS

Select Measured Value:
  RES = Resistance
  CUR = Current

F4

MEASURE TIMING

Set Test Times
  Measure Delay: 0-10,000msec
  Charge Time: 0-10,000msec
Hum Reject: 50Hz/60Hz
  (Reject the Noise from
  50 or 60Hz line)

F5

SELECT CONT

Set Measurement Mode:
  TRIG'D = Triggered
  CONT = Continuous

F6

AVERAGE COUNT

Average Count: 1-100
(# of measurements to take before the total is averaged then displayed)

F7

CONTACT CHK. ON

Contact Check On/Off

Figure 2-5: Measure Setup Menu

2.3.1.1　　　HV CONTROL

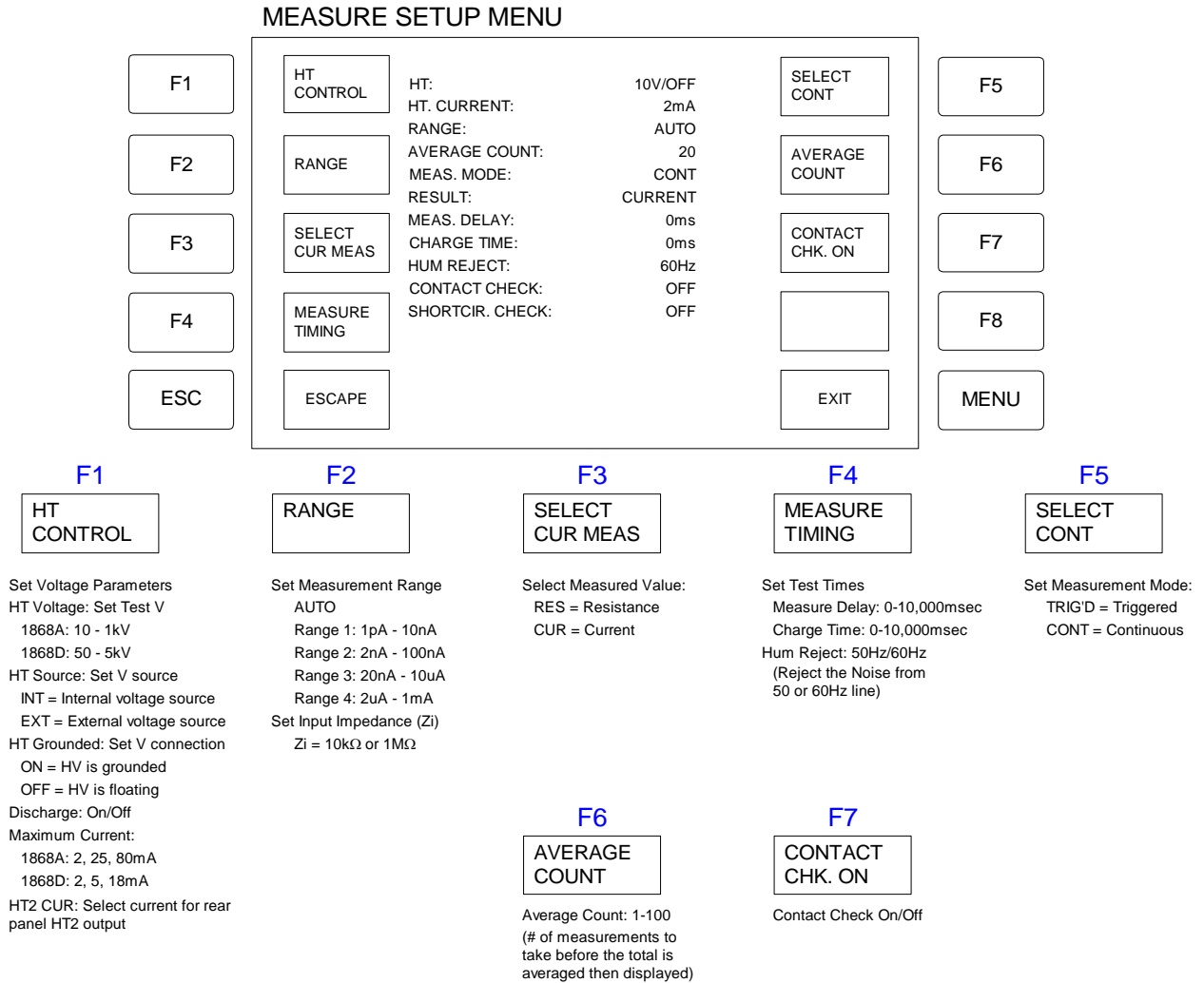In the Measure Setup menu, press [F1] = HV CONTROL to program the test voltage level, source and connection to ground. Set the discharge function and select the maximum current. If the optional HV2 rear panel output is installed and to be used, select the HV2 CUR output current.
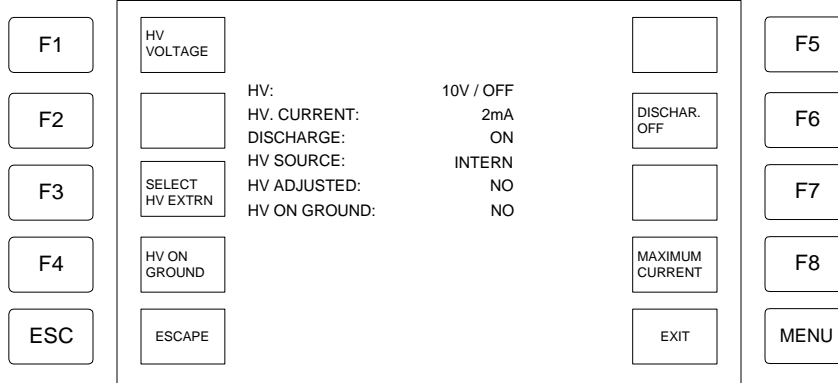

F1	HV VOLTAGE			F5
F2		HV: 10V / OFF HV. CURRENT: 2mA DISCHARGE: ON HV SOURCE: INTERN HV ADJUSTED: NO HV ON GROUND: NO	DISCHAR. OFF	F6
F3	SELECT HV EXTRN			F7
F4	HV ON GROUND		MAXIMUM CURRENT	F8
ESC	ESCAPE		EXIT	MENU

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.

<div style="border:1px solid black; padding:10px;">

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

</div>

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.
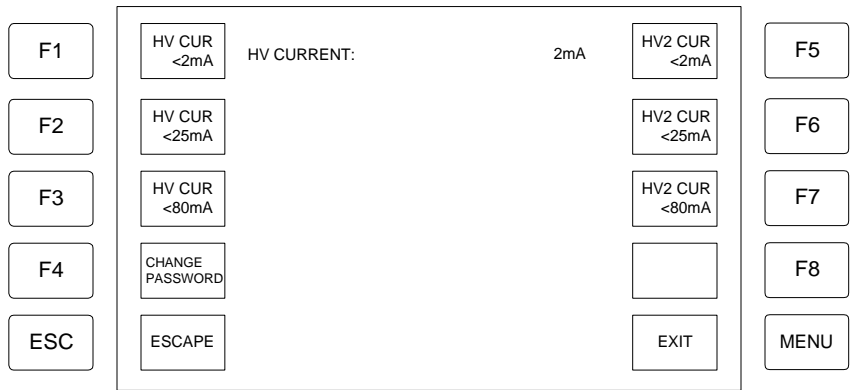
Figure 2-7: Maximum Current Menu

<div style="border:1px solid black; padding:10px;">

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

</div>

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.
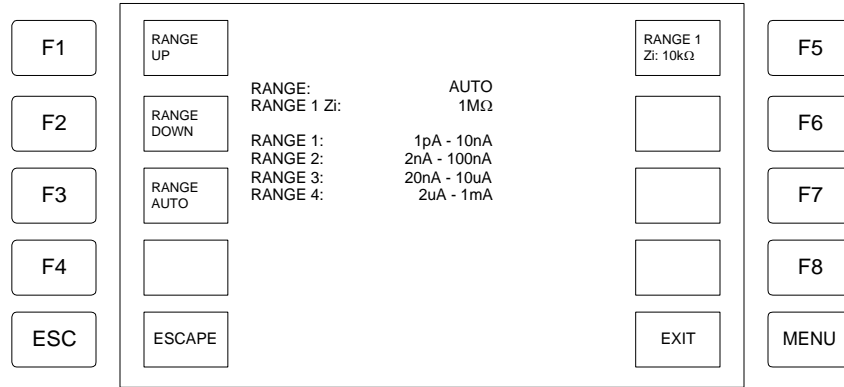
Figure 2-8: Range Menu

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).

```
┌─────┐   ┌──────────────────────────────────────────────────┐   ┌─────┐
│ F1  │   │ ┌────────┐                          ┌────────┐     │   │ F5  │
└─────┘   │ │MEASURE │                          │REJECT  │     │   └─────┘
          │ │DELAY   │                          │60Hz    │     │
┌─────┐   │ └────────┘                          └────────┘     │   ┌─────┐
│ F2  │   │ ┌────────┐  MEAS DELAY:      0ms    ┌────────┐     │   │ F6  │
└─────┘   │ │CHARGE  │  CHARGE TIME:     0ms    │        │     │   └─────┘
          │ │TIME    │  HUM REJECT:      50Hz   └────────┘     │
┌─────┐   │ └────────┘                                         │   ┌─────┐
│ F3  │   │ ┌────────┐                          ┌────────┐     │   │ F7  │
└─────┘   │ │        │                          │        │     │   └─────┘
          │ └────────┘                          └────────┘     │
┌─────┐   │ ┌────────┐                          ┌────────┐     │   ┌─────┐
│ F4  │   │ │        │                          │        │     │   │ F8  │
└─────┘   │ └────────┘                          └────────┘     │   └─────┘
┌─────┐   │ ┌────────┐                          ┌────────┐     │   ┌─────┐
│ ESC │   │ │ESCAPE  │                          │EXIT    │     │   │MENU │
└─────┘   │ └────────┘                          └────────┘     │   └─────┘
          └──────────────────────────────────────────────────┘
```
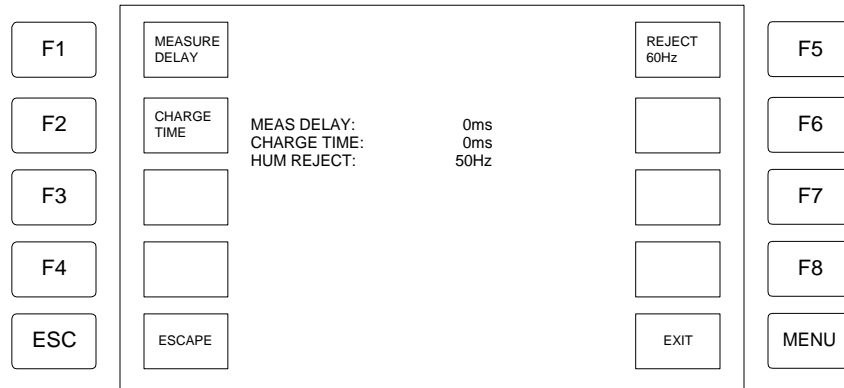
Figure 2-9: Measure Timing Menu

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 (Zi) 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.
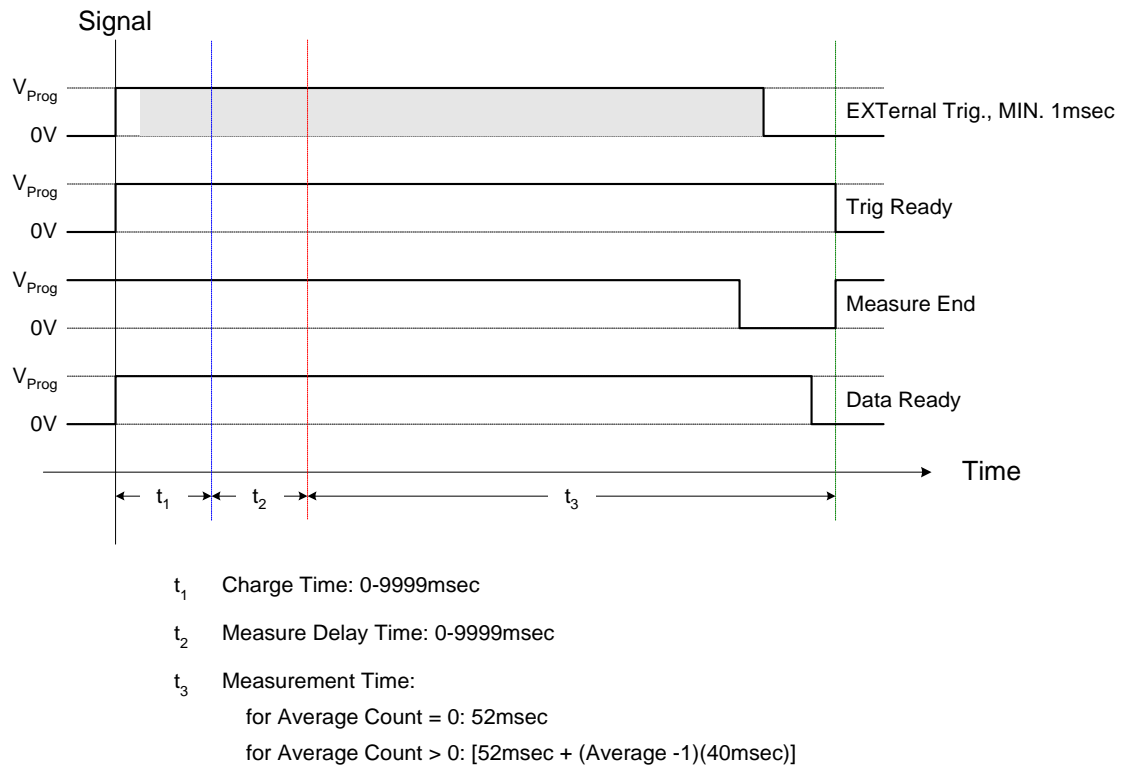

t_1 Charge Time: 0-9999msec

t_2 Measure Delay Time: 0-9999msec

t_3 Measurement Time:
         for Average Count = 0: 52msec
         for Average Count > 0: [52msec + (Average -1)(40msec)]

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 <u>multi-step</u> test.   From the initial menu, press [F2] = SEQUENCE SETUP. Figure 2-11 illustrates the Sequence Setup menu.

<div style="text-align:center">NOTE:</div>

If a user sequence has <u>not</u> been programmed, the Sequence Setup display will <u>not</u> 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.
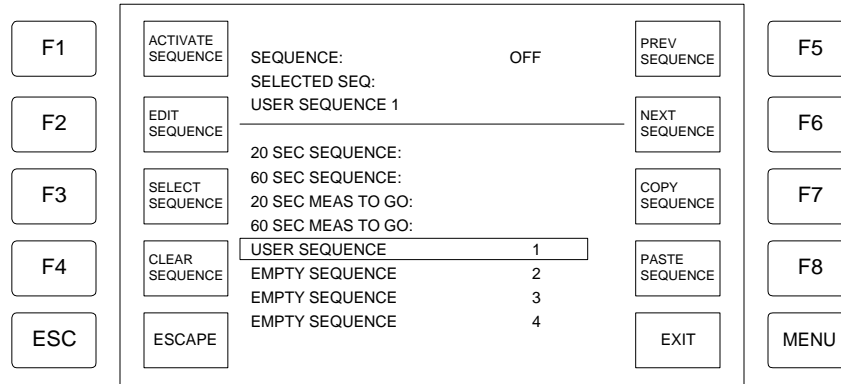

F1	ACTIVATE SEQUENCE	SEQUENCE:	OFF	PREV SEQUENCE	F5
		SELECTED SEQ:			
		USER SEQUENCE 1			
F2	EDIT SEQUENCE			NEXT SEQUENCE	F6
		20 SEC SEQUENCE:			
		60 SEC SEQUENCE:			
F3	SELECT SEQUENCE	20 SEC MEAS TO GO:		COPY SEQUENCE	F7
		60 SEC MEAS TO GO:			
		USER SEQUENCE	1		
F4	CLEAR SEQUENCE	EMPTY SEQUENCE	2	PASTE SEQUENCE	F8
		EMPTY SEQUENCE	3		
		EMPTY SEQUENCE	4		
ESC	ESCAPE			EXIT	MENU

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.
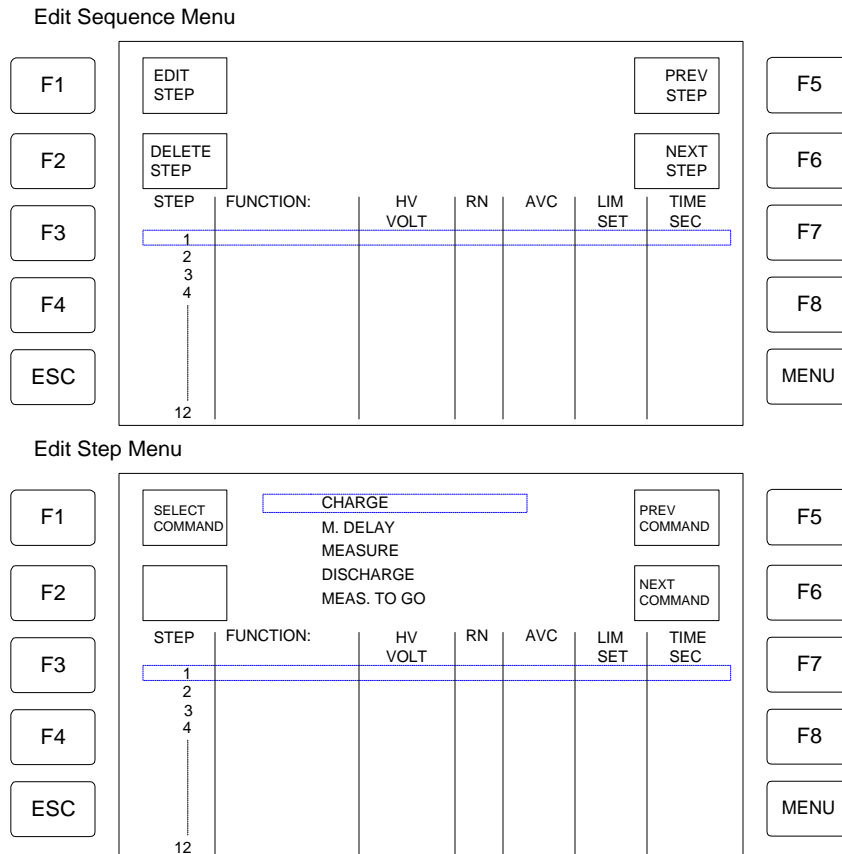 4. Discharge: discharge DUT through 100kΩ resistor.

Edit Sequence Menu

F1	EDIT STEP						PREV STEP	F5
F2	DELETE STEP						NEXT STEP	F6
	STEP	FUNCTION:	HV VOLT	RN	AVC	LIM SET	TIME SEC	
F3	1							F7
	2							
	3							
F4	4							F8
ESC								MENU
	12							

Edit Step Menu

F1	SELECT COMMAND	CHARGE M. DELAY MEASURE DISCHARGE MEAS. TO GO				PREV COMMAND	F5
F2						NEXT COMMAND	F6
	STEP	FUNCTION:	HV VOLT	RN	AVC	LIM SET	TIME SEC	
F3	1							F7
	2							
	3							
F4	4							F8
ESC								MENU
	12							

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.
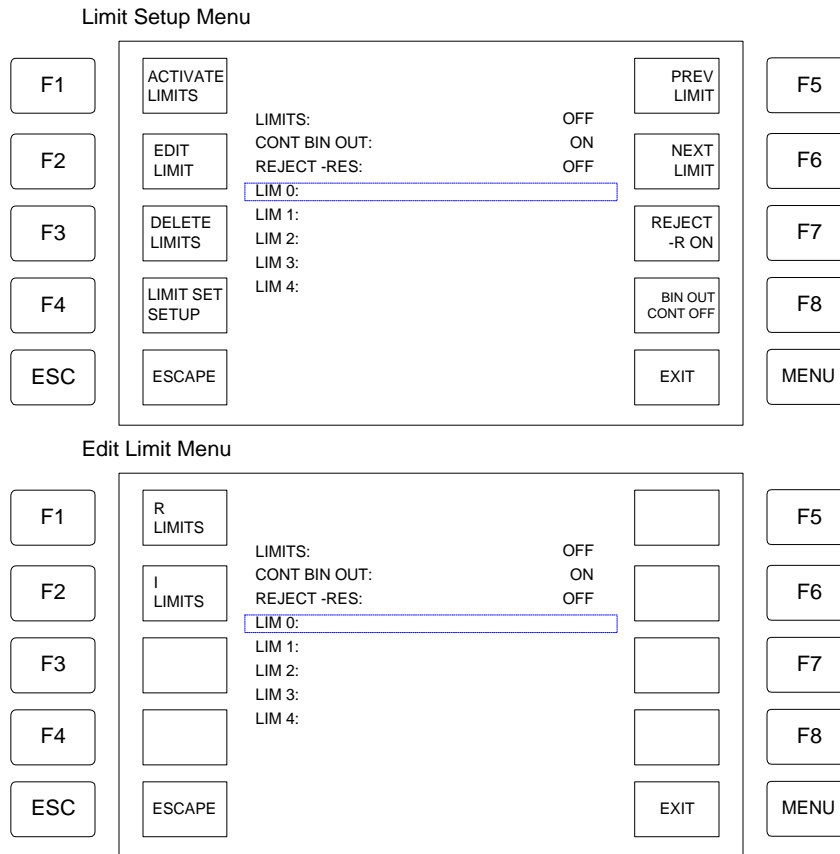
Limit Setup Menu

Edit Limit Menu

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 = 1000kΩ, Lim 1 = 100MΩ, Lim 2 = 100GΩ, Lim 3 = 100TΩ and Lim 4 = 500TΩ, follow these steps:

In the Limit Setup Menu, with LIM 0 highlighted:
Press [F2] = EDIT LIMITS
Press [F1] = R LIMITS
Press [F1] = kΩ
Press [1] [0] [0] [0] [ent] = 1000kΩ (= 1.000MΩ)
Press [F6] = NEXT LIMIT until LIM 1 is highlighted
Press [F2] = EDIT LIMITS
Press [F1] = R LIMITS
Press [F1] = MΩ
Press [1] [0] [0] [ent] = 100MΩ
Press [F6] = NEXT LIMIT until LIM 2 is highlighted
Press [F2] = EDIT LIMITS
Press [F1] = R LIMITS
Press [F1] = GΩ
Press [1] [0] [0] [ent] = 100GΩ
Press [F6] = NEXT LIMIT until LIM 3 is highlighted
Press [F2] = EDIT LIMITS
Press [F1] = R LIMITS
Press [F1] = TΩ
Press [1] [0] [0] [ent] = 100TΩ
Press [F6] = NEXT LIMIT until LIM 4 is highlighted
Press [F2] = EDIT LIMITS
Press [F1] = R LIMITS
Press [F1] = TΩ
Press [5] [0] [0] [ent] = 500TΩ

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

F1	kΩ	_____	kΩ		F5	R Limits Menu
F2	MΩ	LIMITS: CONT BIN OUT: REJECT -RES:	OFF ON OFF		F6	[F1] [1][0][0][0][ent] = 1000kΩ
F3	GΩ	LIM 0: LIM 1: LIM 2:			F7	[F6], Select Lim 1then [F2] Edit Limit [F2] [1][0][0][ent] = 100MΩ
F4	TΩ	LIM 3: LIM 4:			F8	[F6], Select Lim 2 then [F2] Edit Limit [F3] [1][0][0][ent] = 100GΩ
ESC	ESCAPE		EXIT		MENU	[F6], Select Lim 3 then [F2] Edit Limit

[F4] [1][0][0][ent] = 100TΩ

F1	ACTIVATE LIMITS		PREV LIMIT	F5	[F6], Select Lim 4 then [F2] Edit Limit
F2	EDIT LIMITS	LIMITS: OFF CONT BIN OUT: ON REJECT -RES: OFF	NEXT LIMIT	F6	[F4] [5][0][0][ent] = 500TΩ
F3	DELETE LIMITS	LIM 0: 1000kΩ LIM 1: 100MΩ LIM 2: 100GΩ	REJECT -R ON	F7	Complete Lim Set Display
F4	LIMIT SET SETUP	LIM 3: 100TΩ LIM 4: 500TΩ	BIN OUT CONT OFF	F8	[F4] = LIMIT SET SETUP to save limits
ESC	ESCAPE		EXIT	MENU	

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 Setip 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.
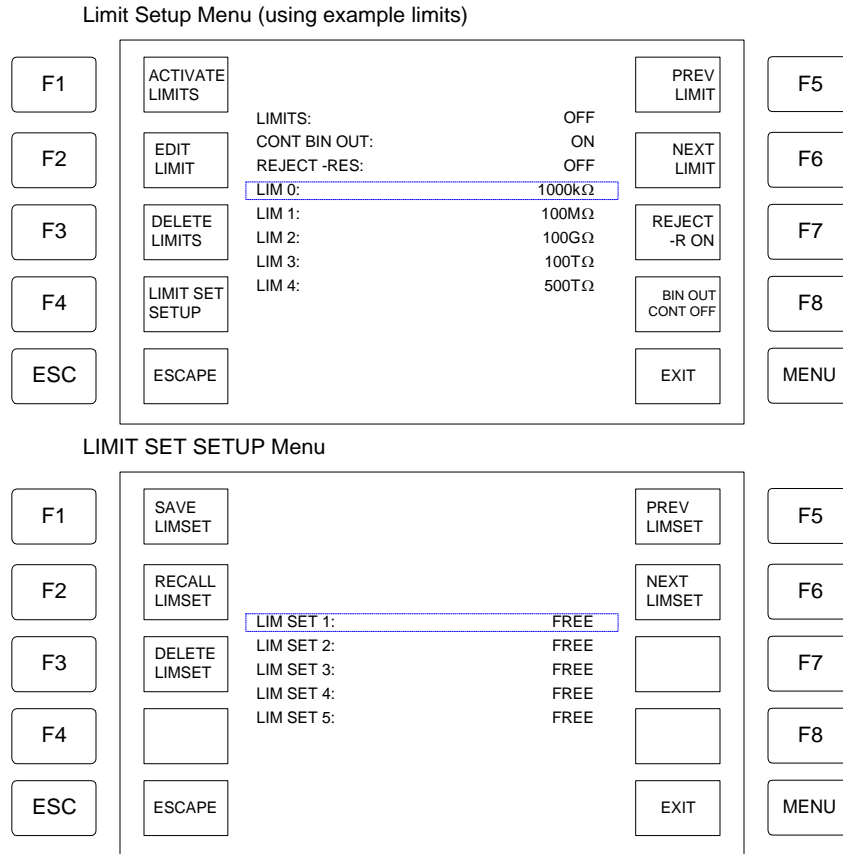
Limit Setup Menu (using example limits)

F1	ACTIVATE LIMITS		PREV LIMIT	F5
		LIMITS: OFF		
		CONT BIN OUT: ON		
F2	EDIT LIMIT	REJECT -RES: OFF	NEXT LIMIT	F6
		LIM 0: 1000kΩ		
		LIM 1: 100MΩ		
F3	DELETE LIMITS	LIM 2: 100GΩ	REJECT -R ON	F7
		LIM 3: 100TΩ		
F4	LIMIT SET SETUP	LIM 4: 500TΩ	BIN OUT CONT OFF	F8
ESC	ESCAPE		EXIT	MENU

LIMIT SET SETUP Menu

F1	SAVE LIMSET		PREV LIMSET	F5
F2	RECALL LIMSET		NEXT LIMSET	F6
		LIM SET 1: FREE		
		LIM SET 2: FREE		
F3	DELETE LIMSET	LIM SET 3: FREE		F7
		LIM SET 4: FREE		
F4		LIM SET 5: FREE		F8
ESC	ESCAPE		EXIT	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.
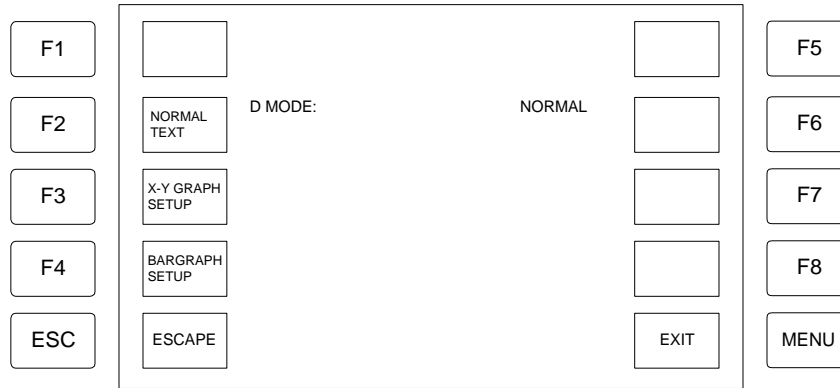

Figure 2-16: Measure Graphics Display

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.
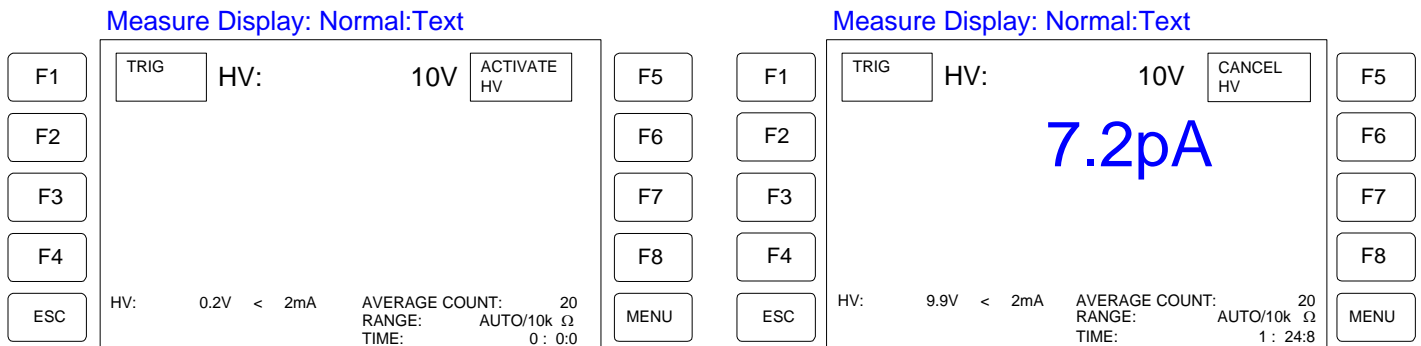

Figure 2-17: Text Display

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 1MΩ to 1PΩ 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.
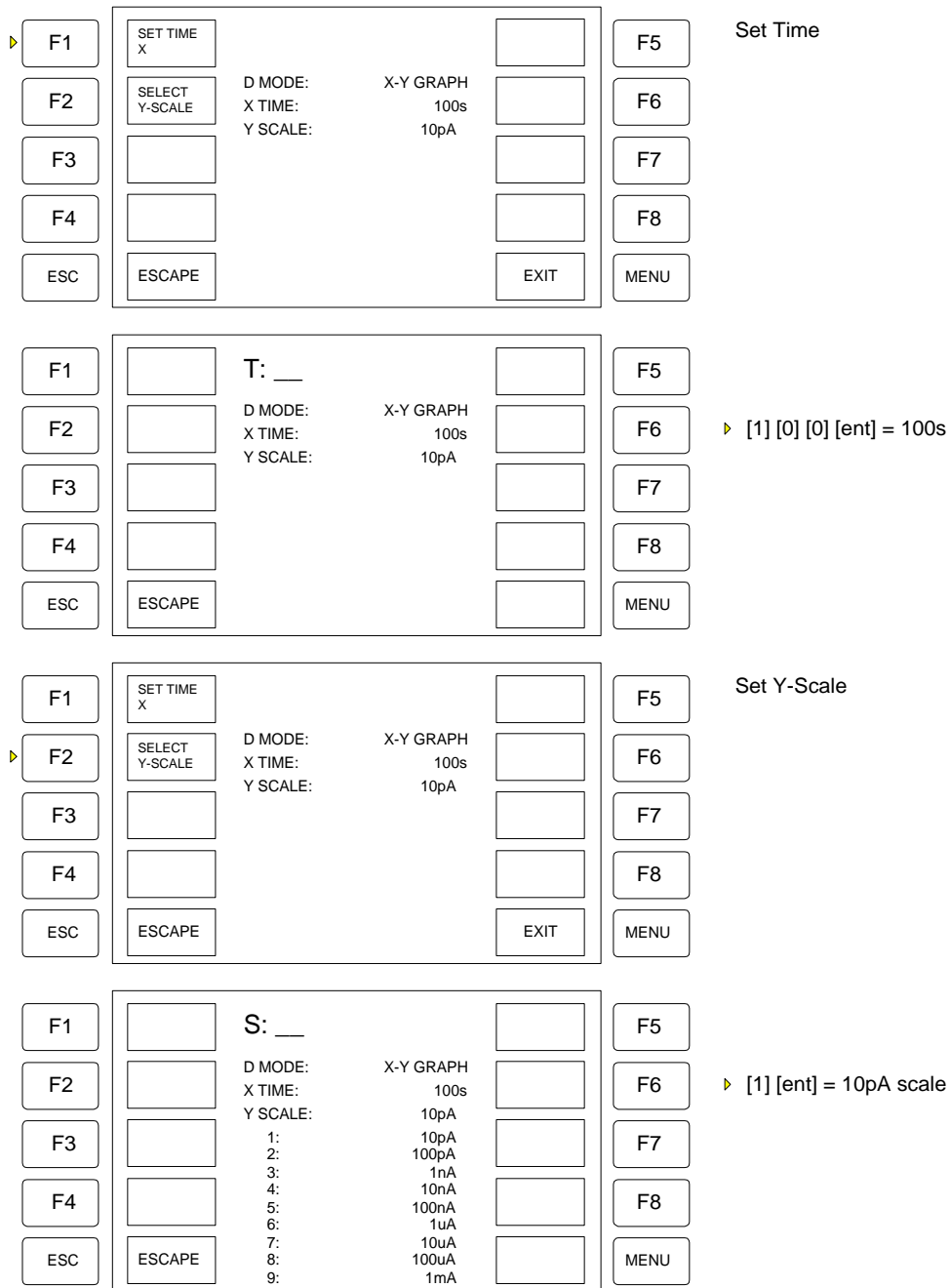

Figure: 2-18: X-Y Graph Setup Menus

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.
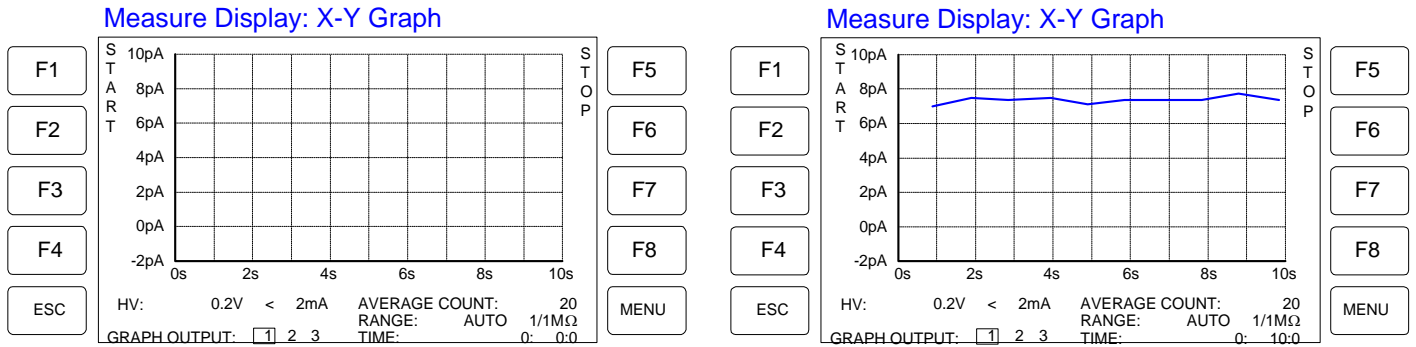

Figure 2-19: X-Y Graph Display

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.
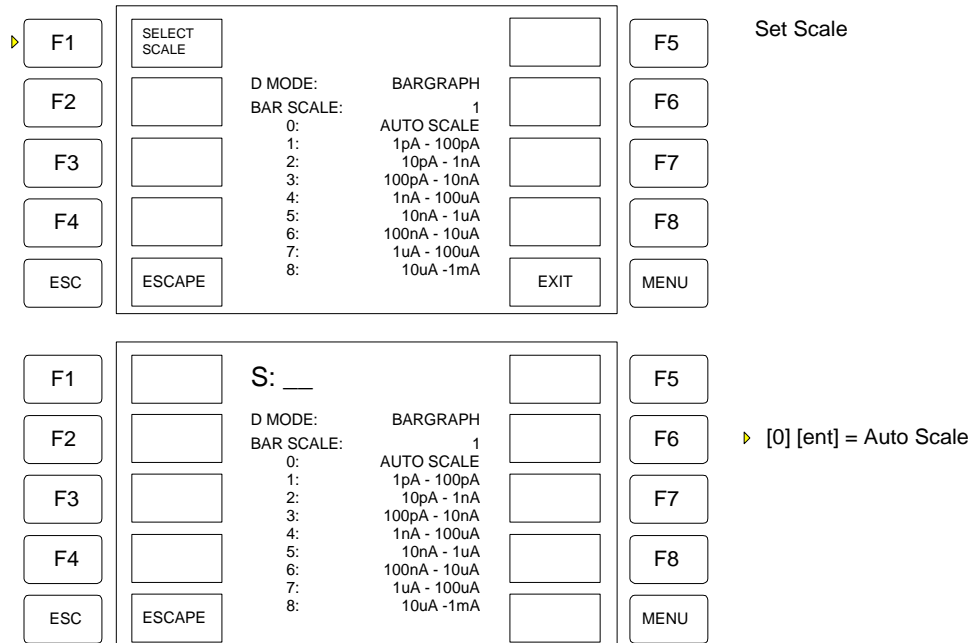

Figure 2:20: Bar Graph Setup Menus

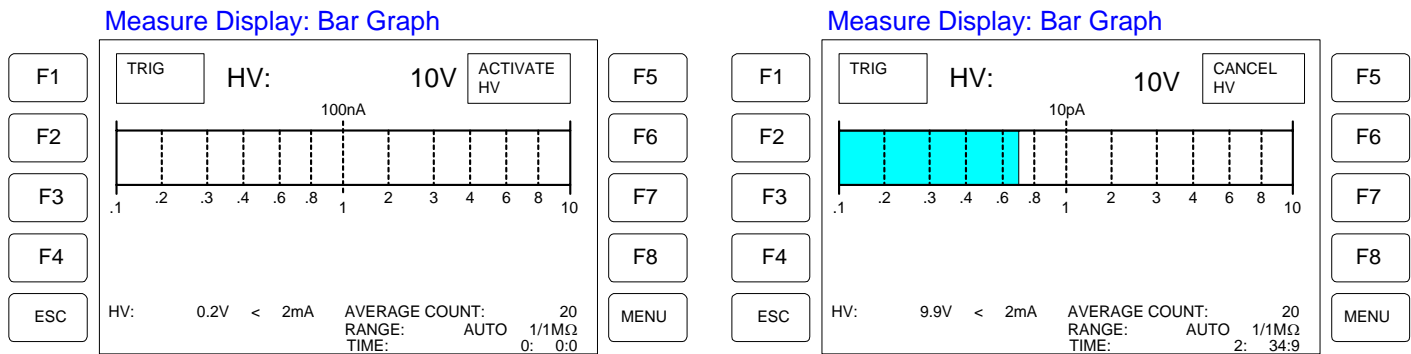Figure 2-21 illustrates a bargraph display setup and result.

Measure Display: Bar Graph

| F1 | | | TRIG | HV: | 10V | ACTIVATE HV | | F5 |

100nA

.1 .2 .3 .4 .6 .8 1 2 3 4 6 8 10

HV: 0.2V < 2mA AVERAGE COUNT: 20
RANGE: AUTO 1/1MΩ
TIME: 0: 0:0

Measure Display: Bar Graph

TRIG HV: 10V CANCEL HV

10pA

.1 .2 .3 .4 .6 .8 1 2 3 4 6 8 10

HV: 9.9V < 2mA AVERAGE COUNT: 20
RANGE: AUTO 1/1MΩ
TIME: 2: 34:9

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.
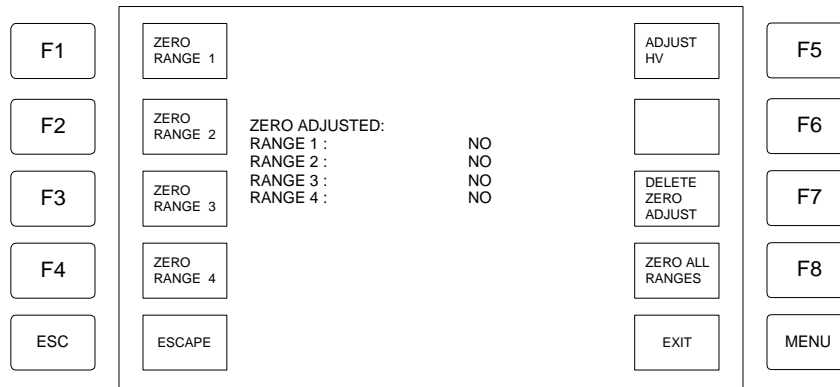
F1	ZERO RANGE 1		ADJUST HV	F5
F2	ZERO RANGE 2	ZERO ADJUSTED: RANGE 1 : NO RANGE 2 : NO RANGE 3 : NO RANGE 4 : NO		F6
F3	ZERO RANGE 3		DELETE ZERO ADJUST	F7
F4	ZERO RANGE 4		ZERO ALL RANGES	F8
ESC	ESCAPE		EXIT	MENU

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.
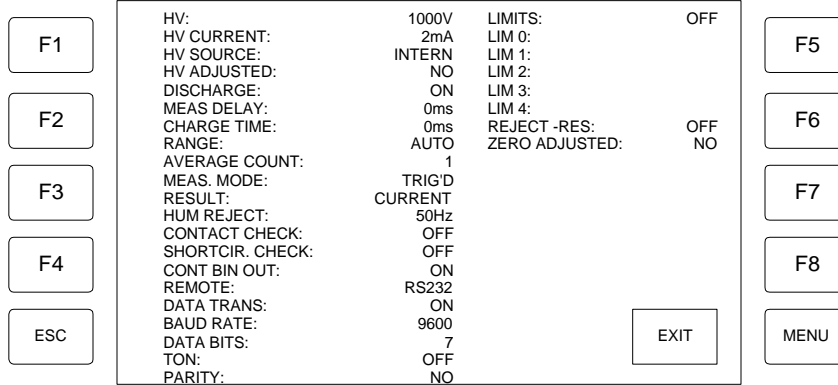

F1	HV: 1000V	LIMITS: OFF		F5
	HV CURRENT: 2mA	LIM 0:		
	HV SOURCE: INTERN	LIM 1:		
	HV ADJUSTED: NO	LIM 2:		
	DISCHARGE: ON	LIM 3:		
F2	MEAS DELAY: 0ms	LIM 4:		F6
	CHARGE TIME: 0ms	REJECT -RES: OFF		
	RANGE: AUTO	ZERO ADJUSTED: NO		
	AVERAGE COUNT: 1			
F3	MEAS. MODE: TRIG'D			F7
	RESULT: CURRENT			
	HUM REJECT: 50Hz			
	CONTACT CHECK: OFF			
F4	SHORTCIR. CHECK: OFF			F8
	CONT BIN OUT: ON			
	REMOTE: RS232			
	DATA TRANS: ON			
ESC	BAUD RATE: 9600		EXIT	MENU
	DATA BITS: 7			
	TON: OFF			
	PARITY: NO			

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 exisiting instrument setup status. From the initial menu, press [F6] = SETUPS to store/recall setups form memory. Figure 2-24 illustrates the Setups menu.
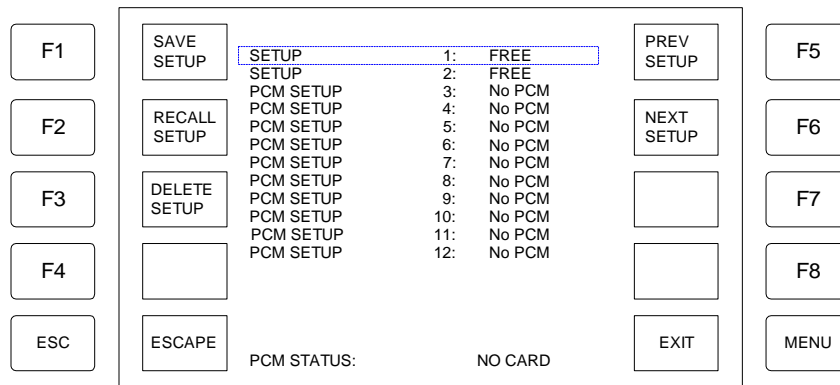

F1	SAVE SETUP	SETUP 1: FREE	PREV SETUP		F5
		SETUP 2: FREE			
		PCM SETUP 3: No PCM			
F2	RECALL SETUP	PCM SETUP 4: No PCM	NEXT SETUP		F6
		PCM SETUP 5: No PCM			
		PCM SETUP 6: No PCM			
		PCM SETUP 7: No PCM			
F3	DELETE SETUP	PCM SETUP 8: No PCM			F7
		PCM SETUP 9: No PCM			
		PCM SETUP 10: No PCM			
		PCM SETUP 11: No PCM			
F4		PCM SETUP 12: No PCM			F8
ESC	ESCAPE	PCM STATUS: NO CARD	EXIT		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.

F1	HV CONTROL	HV: 10V/OFF	SELECT CONT	F5
		HV. CURRENT: 2mA		
		RANGE: AUTO		
F2	RANGE	AVERAGE COUNT: 20	AVERAGE COUNT	F6
		MEAS. MODE: CONT		
		RESULT: CURRENT		
F3	SELECT CUR MEAS	MEAS. DELAY: 0ms	CONTACT CHK. ON	F7
		CHARGE TIME: 0ms		
		HUM REJECT: 50Hz		
		CONTACT CHECK: OFF		
F4	MEASURE TIMING	SHORTCIR. CHECK: OFF		F8
ESC	ESCAPE		EXIT	MENU
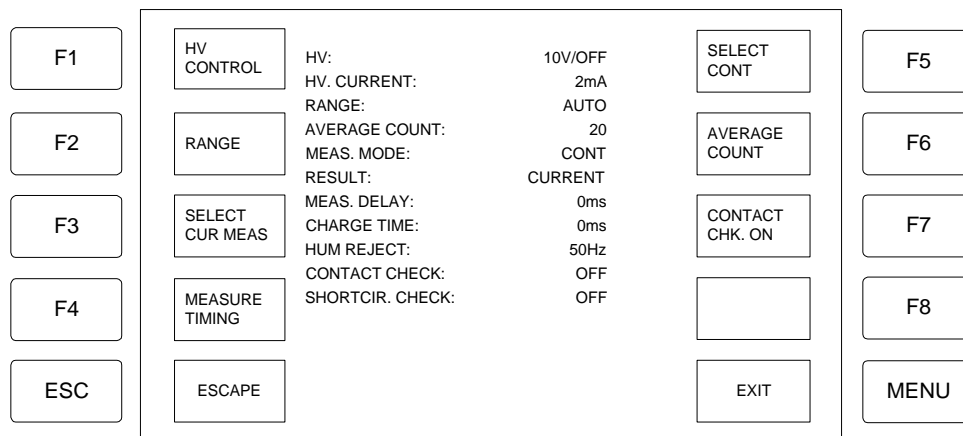
Figure 2-25: Measure Setup

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.

```
┌─────┐   ┌──────────┐                                   ┌──────────┐   ┌─────┐
│ F1  │   │ ACTIVATE │  SEQUENCE:              OFF        │ PREV     │   │ F5  │
└─────┘   │ SEQUENCE │                                   │ SEQUENCE │   └─────┘
          └──────────┘  SELECTED SEQ:
                        USER SEQUENCE 1
┌─────┐   ┌──────────┐  ─────────────────────────────    ┌──────────┐   ┌─────┐
│ F2  │   │ EDIT     │                                   │ NEXT     │   │ F6  │
└─────┘   │ SEQUENCE │  20 SEC SEQUENCE:                 │ SEQUENCE │   └─────┘
          └──────────┘  60 SEC SEQUENCE:
┌─────┐   ┌──────────┐  20 SEC MEAS TO GO:               ┌──────────┐   ┌─────┐
│ F3  │   │ SELECT   │  60 SEC MEAS TO GO:               │ COPY     │   │ F7  │
└─────┘   │ SEQUENCE │ ┌────────────────────────┐        │ SEQUENCE │   └─────┘
          └──────────┘ │ USER SEQUENCE       1  │
┌─────┐   ┌──────────┐ └────────────────────────┘        ┌──────────┐   ┌─────┐
│ F4  │   │ CLEAR    │  EMPTY SEQUENCE        2           │ PASTE    │   │ F8  │
└─────┘   │ SEQUENCE │  EMPTY SEQUENCE        3           │ SEQUENCE │   └─────┘
          └──────────┘  EMPTY SEQUENCE        4
┌─────┐   ┌──────────┐                                   ┌──────────┐   ┌─────┐
│ ESC │   │ ESCAPE   │                                   │   EXIT   │   │MENU │
└─────┘   └──────────┘                                   └──────────┘   └─────┘
```
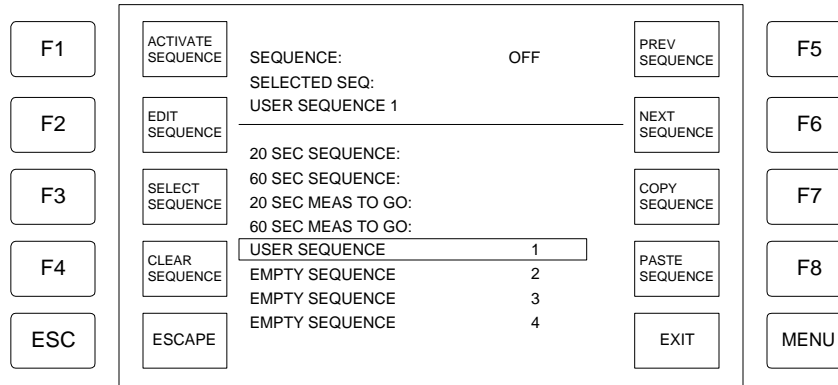
Figure 2-26: Sequence Setup

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 = 1MΩ 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

F1	EDIT STEP	CHARGE M. DELAY MEASURE			PREV STEP	F5
F2	DELETE STEP	DISCHARGE MEAS. TO GO			NEXT STEP	F6

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
12						

F3 F7
F4 F8
ESC MENU ◁

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

F1	START SEQUENCE HV:	1000V STOP SEQUENCE	F5
F2			F6
F3			F7
F4			F8

HV: 9.9V < 2mA   AVERAGE COUNT: 15
                             RANGE: AUTO   1 / 1MΩ
                             TIME: 0 : 20 : 6
CHARGE 999V, M. DELAY 999V, MEASURE 0.2V

ESC   MENU

Figure 2-27: Result of Example Sequence Setup

2.5.1 Additional Sequence Programming Information

The 1868 megohmmeters can be programmed to run a sequence of measurements after being triggered from the keyboard or remotely. The measurements can be compared with limits and set the bin out signals to approve or reject the device under test. In order to avoid some of the pitfalls associated with this, especially when testing capacitors, a basic understanding of the functions of the megohmmeter is required.
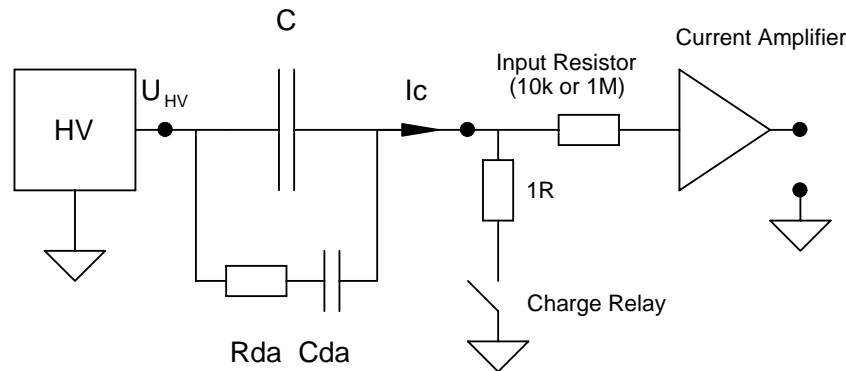
Figure 2-28a

Figure 2-28a shows the HV supply and the input stage of the current amplifier. The test object is a capacitance. First, the capacitance is charged, the start current limited by the current limit setting of the HV supply. In order to speed up charging and to protect the current amplifier, the charge relay short circuits the input during charging. The charge relay is controlled by an internal signal ILIM which is high when the output current of the HV supply is larger than 2mA. In sequence mode, the charge relay remains activated if the preset charge time exceeds the time it takes for the current to fall below 2mA (the charge relay is active until both ILIM is reset AND charge time has expired). The charge relay is also activated during discharge.

When measuring capacitance's the effect of "dielectric absorption" must be considered. This effect is also referred to as "soaking". It can be described with the equivalent shown in Figure 2-28b. Cds will typically have a value of 0.1 - 1% of C and the time constant of Rda and Cda will be app. 1 - 10 sec. This means that after C has been fully charged a current larger than the leakage current will flow into the capacitor. However, just after the charge relay is deactivated the absorption current is delivered by the main capacitance and the current amplifier measures a very small value. 1 to 3 seconds later the absorption current is measured. It is clear that care has to be taken when planning the timing of the sequence.

The figure below shows a typical sequence when measuring the leakage current (or IR) of a foil capacitor with dielectric absorption.
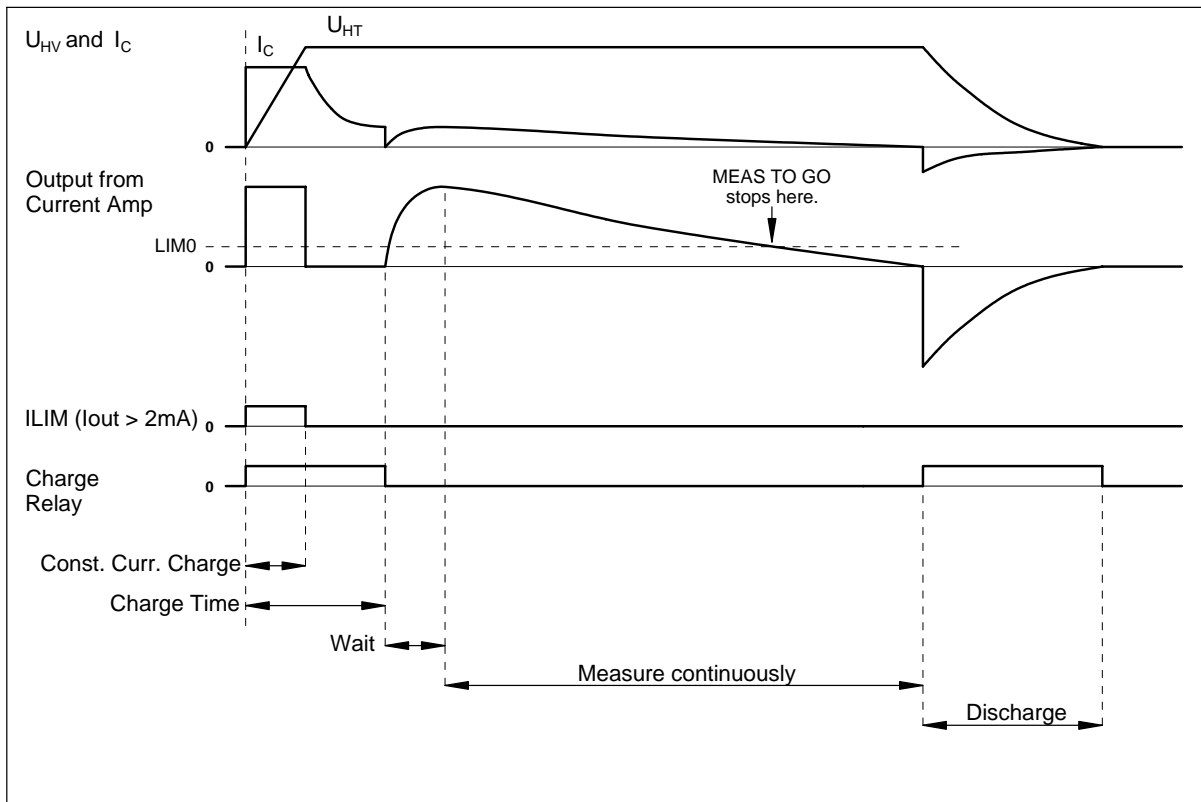
Figure 2-28b: Measuring LC of Foil Capacitor

The charge relay is activated during the preset charge time, which is longer than it takes for the current to fall below 2mA. When the charge time expires, the charge relay is deactivated. Immediately after this the measured current is very low (and hence the calculated resistance very high), but in the period after the absorption current begins to flow through the capacitor. To avoid premature approval of a component measurement should not start until typically 1-3 sec. after the charge relay has been deactivated.

In the following the sequence commands are described.

CHARGE   Charge the DUT

                Input param.:   HV voltage
                                Time in ms

Maximum CHARGE current is set in:

MENU > MEASURE SETUP > HT CONTROL > MAXIMUM CURRENT

the constant current charge time can be calculated from:

$$T_{Limit} = \frac{C \cdot U}{I_{Lim}}$$

WAIT   Wait without comparing the measurements with the limits

                Input param.:   HV Voltage
                                Time in ms

MEASURE   Make a single measurement

                Input param.:   Range (RN)
                                Average Count (AVC)
                                Limitset (0: limits disabled)
                                (Time is calculated as AVC × 40ms)

The ranges are as follows:

Range 1:   1pA   - 10nA
Range 2:   2nA   - 100nA
Range 3:   20nA - 10uA
Range 4:   2uA   - 1mA

In range 1 an input resistance of either 10kohm or 1Mohm can be chosen.

BIN out will be updated after the measurement when a limit set different from 0 is selected.

MEAS. CONT. Measure continuously (similar to the earlier MEAS. DELAY except that range, avc and limitset can be specified)

      Input param.: HV Voltage
             Range (RN)
             Average Count (AVC)
             Limitset (0: limits disabled)
             Time in ms

      BIN out will be updated continuously when a limit set different from 0 is selected.

MEAS. TO GO Measure continuously until limit is met, then stop and discharge (see Figure 2-28b: **Measuring LC of** Foil Capacitor).

      Input param.: Range (RN)
             Average Count (AVC)
             Limitset (0: limits disabled)
             Time in ms

      The limitset should only contain one limit (LIM0). If the limit is not met the sequence will continue until the set time. BIN out will be updated continuously when a limitset different from 0 is selected.

FLASH TEST Measure current, if the current exceeds the first limit then stop and set BIN 0

             Range (RN)
             Limitset (0: limits disabled)
             Time in ms

      This instruction is intended to register flash-over at extended voltage. Please note, that the Bin Out signal has been reversed (BIN 0 means "bad component") compared to the normal current mode. This is because the flash test normally is followed by an insulation resistance test which sets BIN 0 for a "bad" component.

DISCHARGE Turn off HV and discharge DUT (internal 10kohm)

      Input param.: Time in ms

      If 0ms is set AUTO discharge has been selected. This will discharge the DUT until the voltage is below app. 7V in HT High Range and 0.7V in Low Range.

Example 1: 20 sec. Measure to Go

STEP	FUNCTION	HV VOLT	RN	AVC	LIM SET	TIME SEC
1	CHARGE	500	N/A.	N/A.	N/A.	1.0s
2	WAIT	500	N/A.	N/A.	N/A.	1.0s
3	MEAS. TO GO		1H	4	1	18.0s
4	DISCHARGE					2.0
5						

The megohmmeter is in resistance mode and a limit LIM0 of say 500Gohm is stored in LIMSET 1.

The DUT is charged to 500V for 1 sec. second, then there is a wait state of 1 sec. before measurement starts. If the measured resistance exceeds 500Gohm within 18 sec. BIN5 is set, the sequence is stopped and the DUT is discharged for 2 sec. If the resistance do not exceed 500Gohm the actual value is measured after a total of 20 sec., BIN0 is set and the DUT is discharged.

Example 2: Flash Test followed by IR test

STEP	FUNCTION	HV VOLT	RN	AVC	LIM SET	TIME SEC
1	CHARGE	400	N/A.	N/A.	N/A.	1.0s
2	WAIT	400	N/A.	N/A.	N/A.	1.0s
3	FLASH TEST		3	1	1	2.0s
4	DISCHARGE					AUTO
5	CHARGE	100	N/A.	N/A.	N/A.	1.0s
6	WAIT	100	N/A.	N/A.	N/A.	1.0s
7	MEAS. TO GO		1H	4	2	18.0
8	DISCHARGE					AUTO

LIMSET 1 is a current limit for the flash test. It should be larger than the absorption current in order not to detect a flash over immediately after the wait state. If a flash over occurs, the sequence is stopped and BIN0 is set. If the DUT passes the flash test, BIN5 is set. Then an insulation resistance test is performed at the rated voltage. LIMSET2 is a resistance limit. If the IR is to low, BIN0 is set, otherwise BIN5 is set.

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.
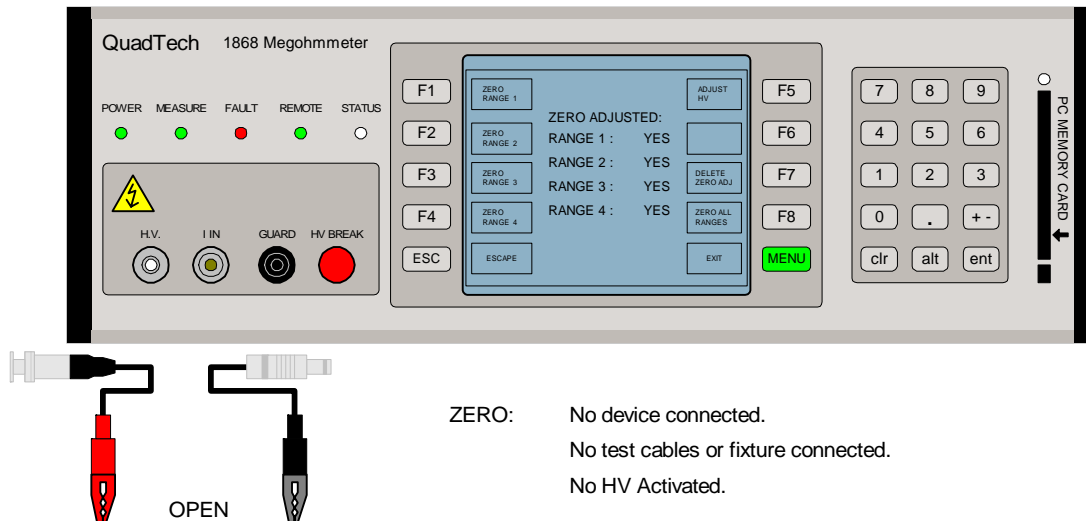
Figure 2-29a: ZERO Adjustment

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 <u>not</u> 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".
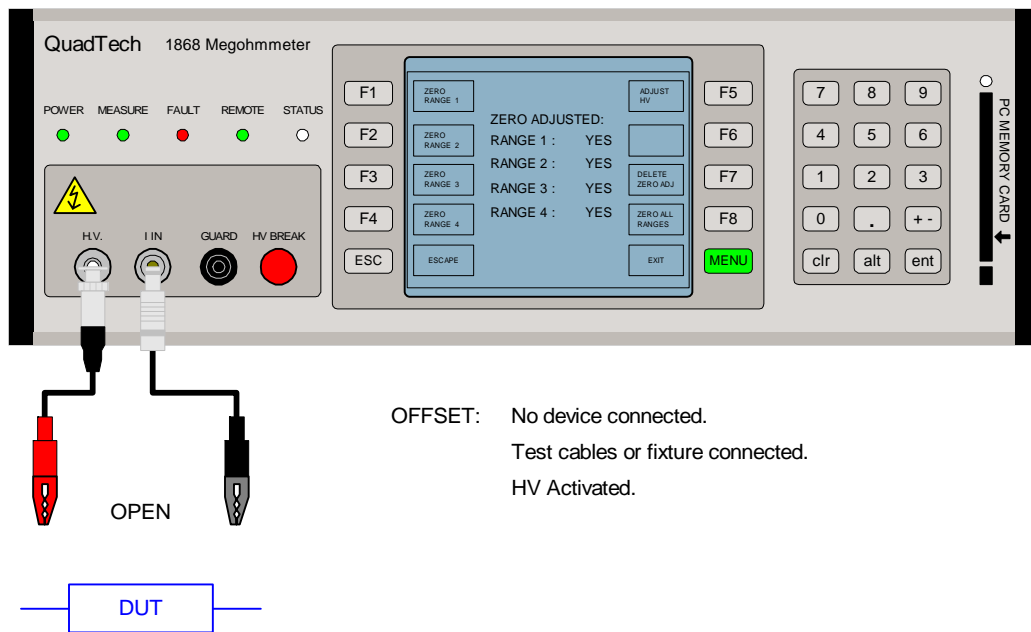
Figure 29b: Zero/Offset Adjustment

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 2-30 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 Intput. The GUARD terminal is the shield. The HV and I IN circuits have a floating (isolated) ground.
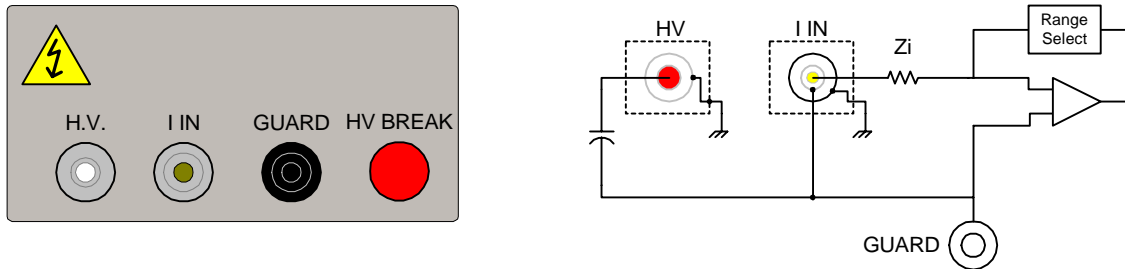
Figure 2-30a: Output Terminals and Block Diagram

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.

HV and **I IN** are connected to DUT

HV connected to **GND**

2-Terminal Grounded

HV and **I IN** are connected to DUT

GUARD shorted to **GND** (optional)

2-Terminal UnGrounded
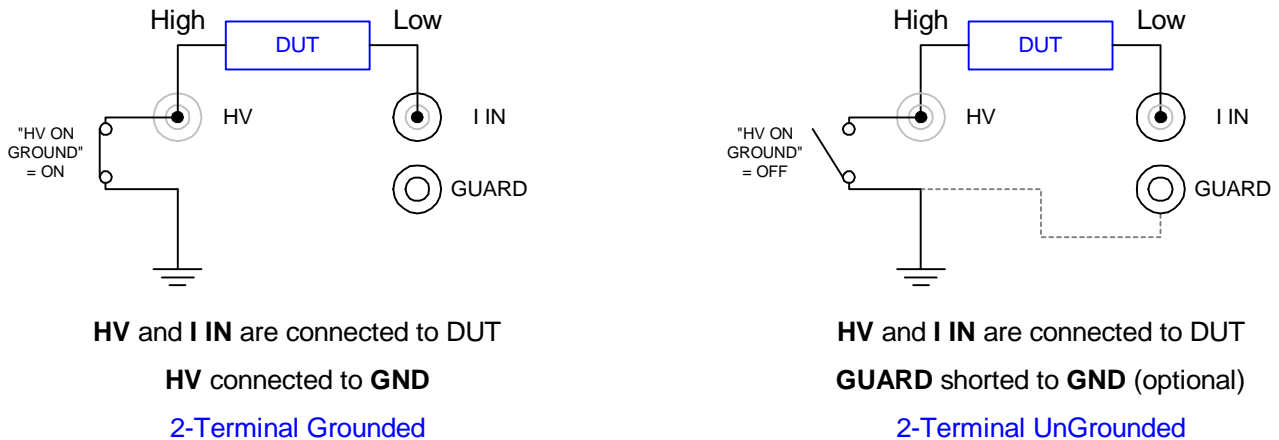
Figure 2-30b: 2-Terminal Measurement

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.

a) 3-Terminal DUT Grounded   b) 3-Terminal DUT Ungrounded

HV and I IN are connected to DUT, GUARD to DUT Guard Point

HV shorted to GND   OR   GUARD shorted to GND
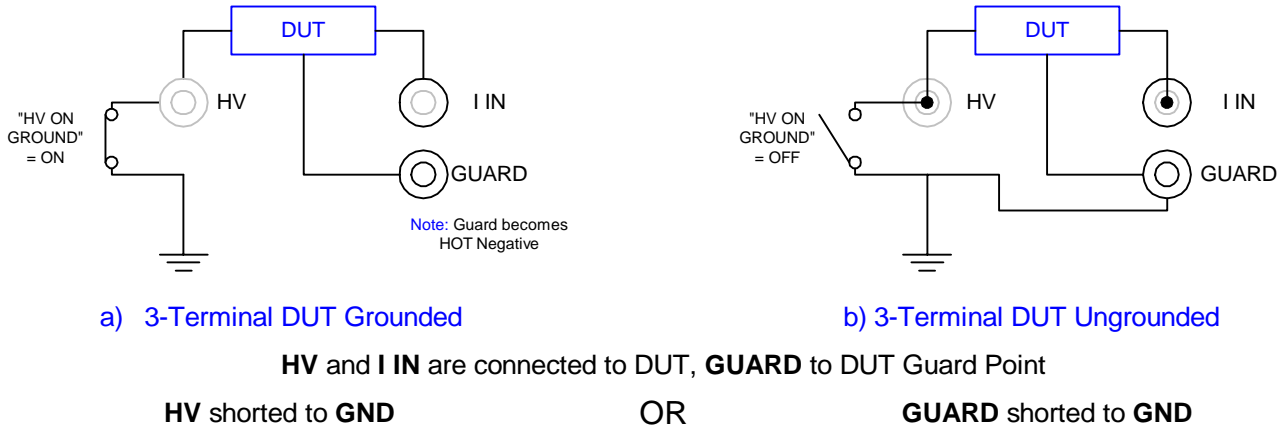
Figure 2-31: 3-Terminal Measurement

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 1.25MΩ. 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 its better to have the higher of the two stray resistances connected to R_B.
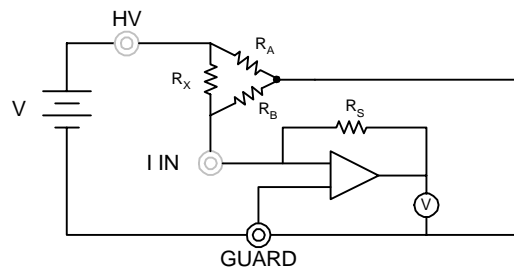
Figure 2-32: Guard Point

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.
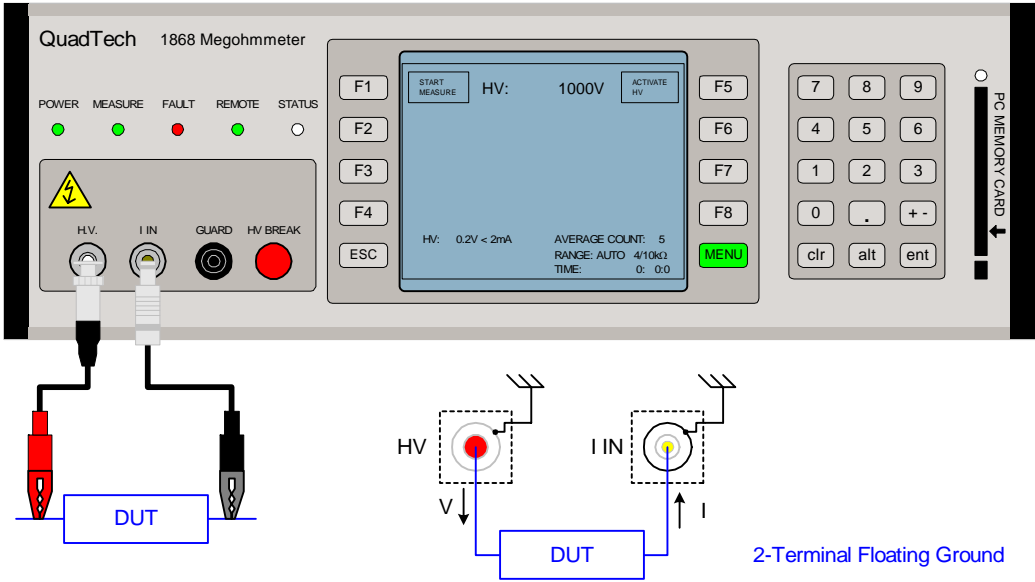
Figure 2-33: 2-Terminal Connection using 1868-01 Cable Lead Set
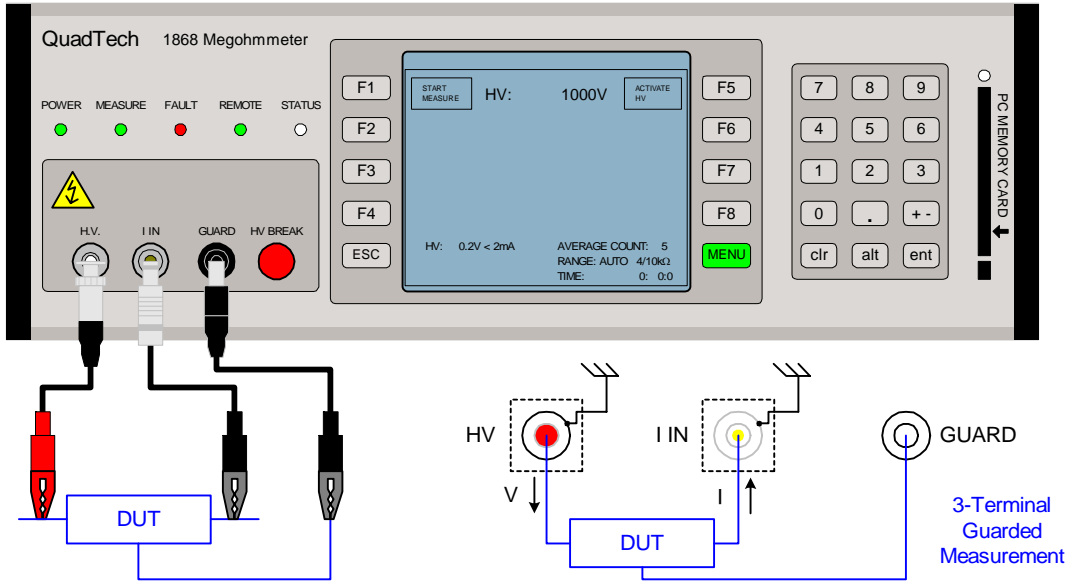
Figure 2-34: 3-Terminal Guarded Connection

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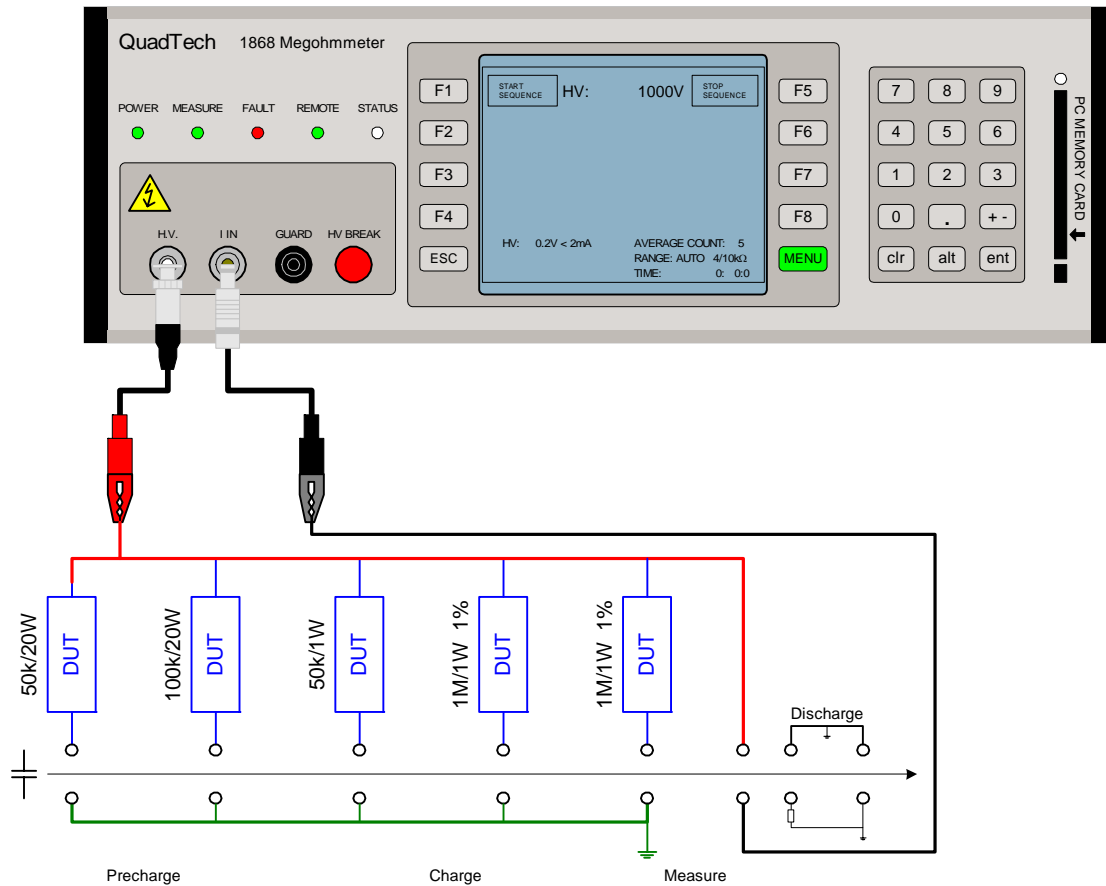
Figure 2-35: Multiple Device Connection

The 1868A Megohmmeter can be used with the 1868-11 Resistivity Test Cell to make surface and volume resistivity measurements on flat plate samples. Make connections carefully as illustrated in Figure 2-36. It is important to follow these directions exactly to avoid improper measuring techniques and damage to the test fixture. Proper knowledge of material and fixture allows the DUT to be measured accurately while taking into account correct polarity. **To connect the fixture to an 1868A Megohmmeter:**

1. First remove any DUT/Cables from the 1868A instrument and 1868-11 fixture.
2. Carefully insert the 1868-11 BNC Male into the mating connector on the 1868A labeled **HV**.
3. Insert the 1868-11 tri-axial plug into the tri-axial jack labeled **I IN** on the 1868A.
4. For accurate measurements perform a zero each time the voltage is changed and each time the Rs/Rv switch setting on the fixture is changed. Refer to Figure 2-36.
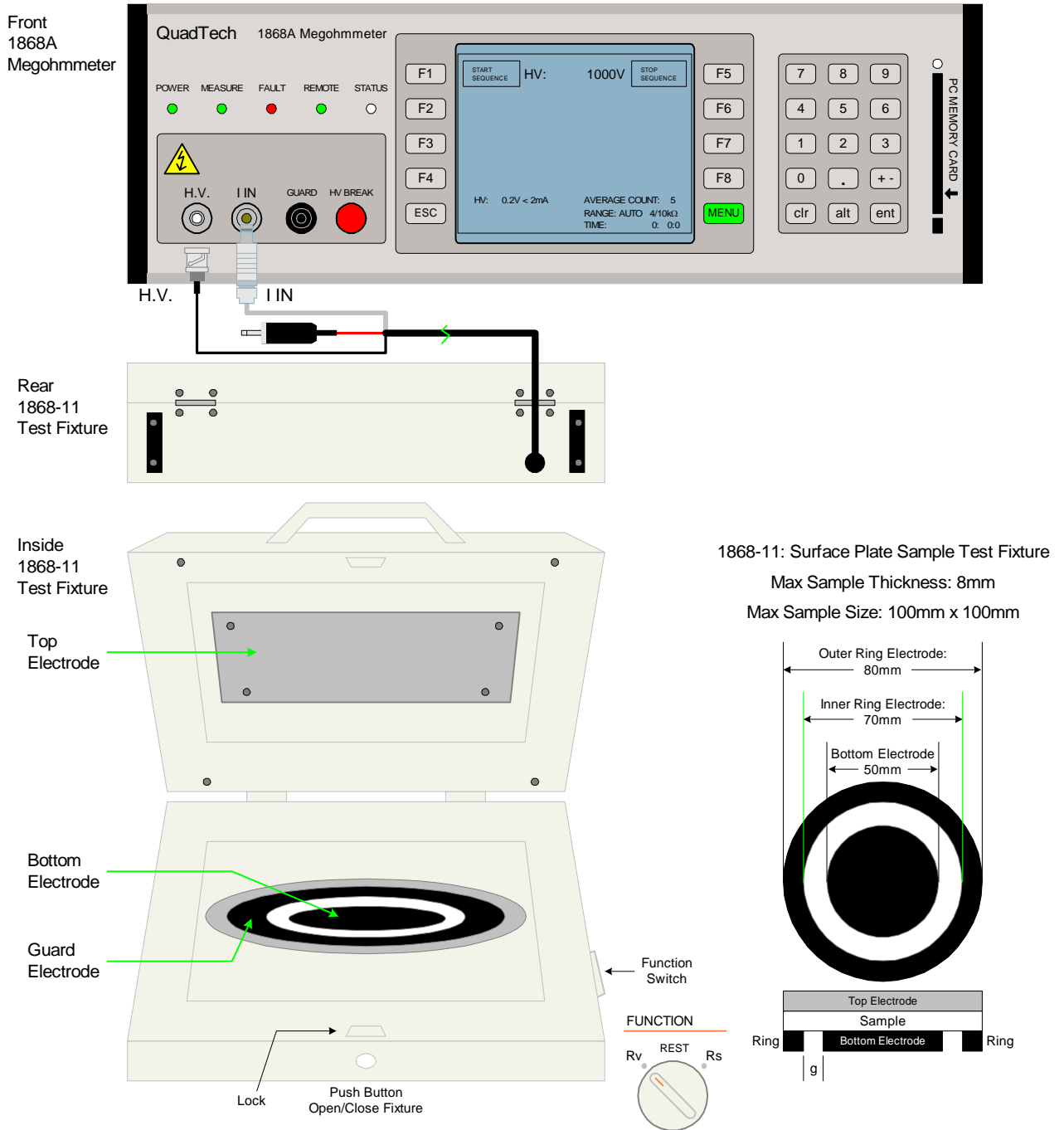
Figure 2-36: 1868A connected to 1868-11 Resistivity Test Cell

Surface Resistivity

Surface **Resistance** (also known as sheet resistance) is defined as the electrical resistance between two points or electrodes on one side of a material. This resistance is calculated using the simplified version of Ohm's law.

Rs = V/Is where: Rs = Surface Resistance; Is = Surface Current ; V = Applied Voltage

Surface **Resistivity** is defined as the electrical resistance between two points or electrodes on one side of a material with respect to the area of a "flat" annulus. In other words the megohmmeter reads the current that skids or travels on the surface of the material with respect to a distance. The surface resistivity can be calculated in two ways, hard or easy. The hard way means substituting the 1868-11 test cell dimensions into formulas for Current Density and Surface Current Density. Pull out the old Calculus and Physics books and convert these formulas for a circular electrode configuration.

The easy is way is finding the area of two different circles and subtracting them. The space between two concentric objects is known as the annulus. This resistivity is calculated using the modified version of Ohm's law where ρs = Rs x L x W for a quadrilateral or in the case of the QuadTech Resistivity Test Cell, an annulus.

ρs = Rs x A (Ω)   where: $A = \pi (a^2 - b^2)$ and a > b.
                           a = 3.5 cm radii for the outer electrode
                           b = 2.5 cm radii for the inner electrode

Supplementing values into the equation it gives a constant value of 18.84955. Therefore, if the measuring device reads 2.20 MΩ for the Rs value then multiply that value by 18.84955.

ρs = Rs x A = 2.20 MΩ x 18.84955 cm = 41.46901 MΩ

According to the ASTM D257 – 99 (2005) standard, the formula for Surface Resistivity of a circular electrode is:

ρs = Rs x P/g (Ω) where: $P = \pi (D_o)$
                           $D_o = (D1+D2)/2$
                           D1= diameter of inner electrode
                           D2= diameter of outer electrode
                           g = is the distance between them

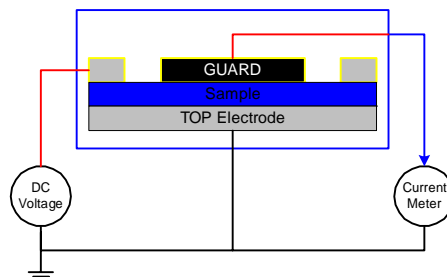| |
|---|
| Note: g can be factored out only if the thickness of the sample is much smaller than g. i.e.: t<<g ~ <8mm.   8mm is the max thickness of the QuadTech Resistivity Test Cell. |

Figure 2-37: Surface Resistance

Volume Resistivity

Volume **Resistance** is defined as the electrical resistance between opposite faces of an insulating material. This resistance is calculated using the simplified version of Ohm's law.

$Rv = V/Iv$ where: Rv = Volume Resistance
                             Iv = Volume Current
                             V = Applied Voltage

Volume **Resistivity** is defined as the electrical resistance through a specific volume on one side of a material to the opposite side. In other words the measured resistance is multiplied by the cross sectional area and divided by the trajectory path the current must travel.   This resistivity is calculated using the modified version of Ohm's law where ρ = [Rv x L x W]/t for a quadrilateral electrode or in the case of the QuadTech Resistivity Cell, a cylinder.

ρ = [Rv x A]/t (Ω-cm) where: $Av = \pi (b^2)/t$ or $\pi (D1^2)/4t$
                             $b = 2.5$ cm radii for the inner electrode
                             $D1 = 5$ cm diameter of inner electrode
                             t = thickness of sample; needs to be << 8mm

Supplementing values into the equation it gives a constant value of $19.634554 cm^2/t$ (cm). Therefore, if the measuring device reads 20.20 MΩ for the Rv value and the sample has a thickness of 3mm (.33cm) then multiply that value by $19.634554 cm^2/t$.

 ρ = [Rv x A]/t = [20.20 MΩ x 19.634554]/.33cm = 1.201872TΩ-cm

According to the ASTM D257 – 99 (2005) standard, the formula for Volume Resistivity of a circular electrode is:

 ρ = [Rv x A]/t (Ω-cm) where: $A = [\pi (D1+g)^2]/4$
                             $D1$= diameter of inner electrode
                             $D2$= diameter of outer electrode
                             g = is the distance between inner & outer electrode

> Note: g can be factored out only if the thickness of the sample is much smaller than g.
> i.e.: t<<g ~ <8mm.   8mm is the maximum thickness of the QuadTech Resistivity Cell.
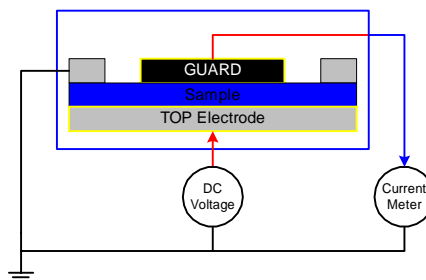

Figure 2-38: Volume Resistance

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

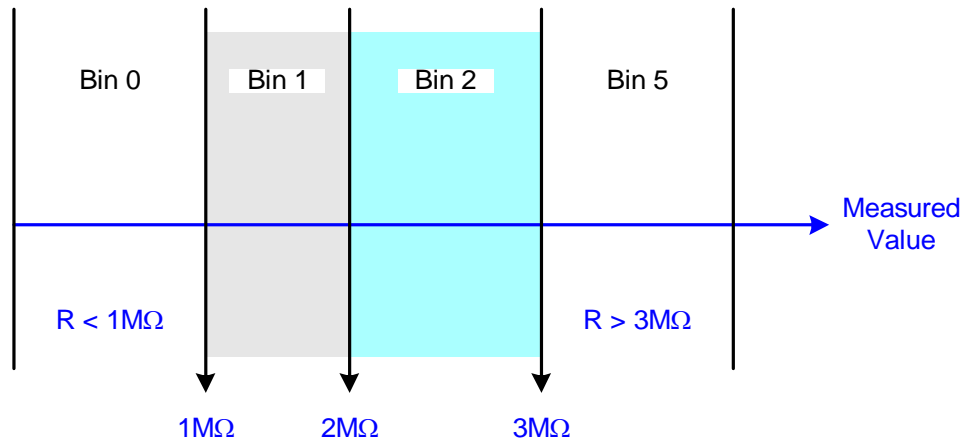Bins will be shown as follows:
R< 1M Bin 0 is displayed
R >= 1M < 2M Bin 1 is displayed
R >= 2M < 3M Bin 2 is displayed
R >= 3M Bin 5 is displayed

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

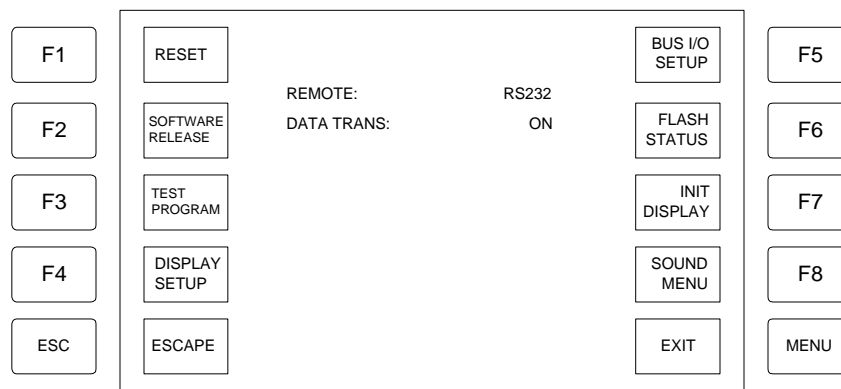| CAUTION: |
| --- |
| Software Reset will delete all data, Bin settings, Setup, etc.   The RAM memory will be totally cleared. |

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]
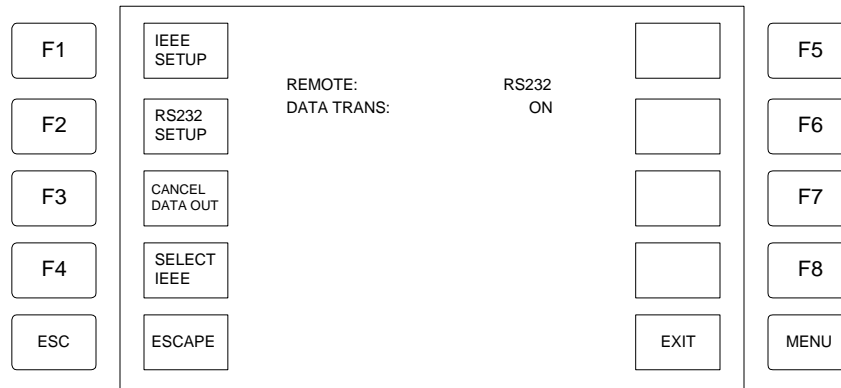Menu.

F1	IEEE SETUP				F5
F2	RS232 SETUP	REMOTE:	RS232		F6
F3	CANCEL DATA OUT	DATA TRANS:	ON		F7
F4	SELECT IEEE				F8
ESC	ESCAPE			EXIT	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.

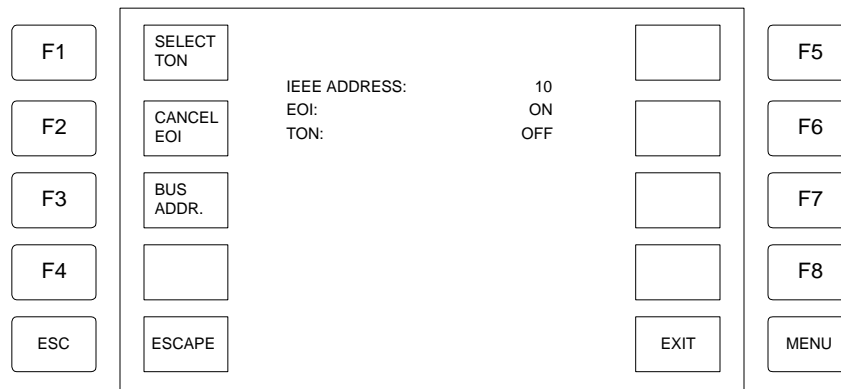| F1 | SELECT TON | | | | F5 |
F2	CANCEL EOI	IEEE ADDRESS:	10		F6
		EOI:	ON		
		TON:	OFF		
F3	BUS ADDR.				F7
F4					F8
ESC	ESCAPE			EXIT	MENU

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.
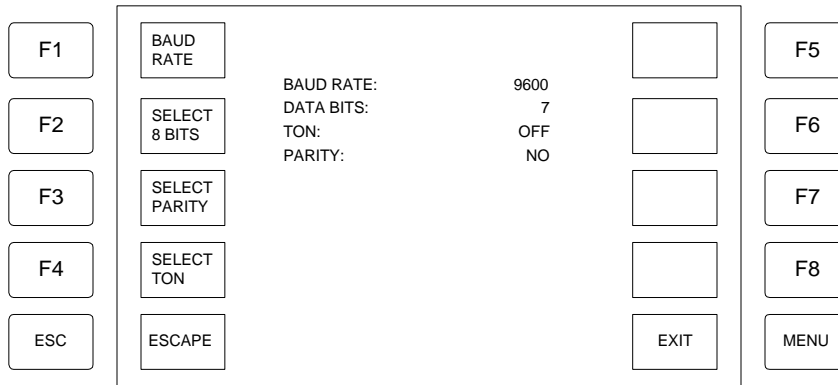
```
  ┌─────┐   ┌─────────┐                          ┌─────┐      ┌─────┐
  │ F1  │   │ BAUD    │                          │     │      │ F5  │
  └─────┘   │ RATE    │    BAUD RATE:      9600   │     │      └─────┘
            └─────────┘    DATA BITS:         7
  ┌─────┐   ┌─────────┐    TON:             OFF   ┌─────┐      ┌─────┐
  │ F2  │   │ SELECT  │    PARITY:           NO   │     │      │ F6  │
  └─────┘   │ 8 BITS  │                           └─────┘      └─────┘
            └─────────┘
  ┌─────┐   ┌─────────┐                          ┌─────┐      ┌─────┐
  │ F3  │   │ SELECT  │                          │     │      │ F7  │
  └─────┘   │ PARITY  │                          └─────┘      └─────┘
            └─────────┘
  ┌─────┐   ┌─────────┐                          ┌─────┐      ┌─────┐
  │ F4  │   │ SELECT  │                          │     │      │ F8  │
  └─────┘   │ TON     │                          └─────┘      └─────┘
            └─────────┘
  ┌─────┐   ┌─────────┐                        ┌──────┐     ┌──────┐
  │ ESC │   │ ESCAPE  │                        │ EXIT │     │ MENU │
  └─────┘   └─────────┘                        └──────┘     └──────┘
```

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.
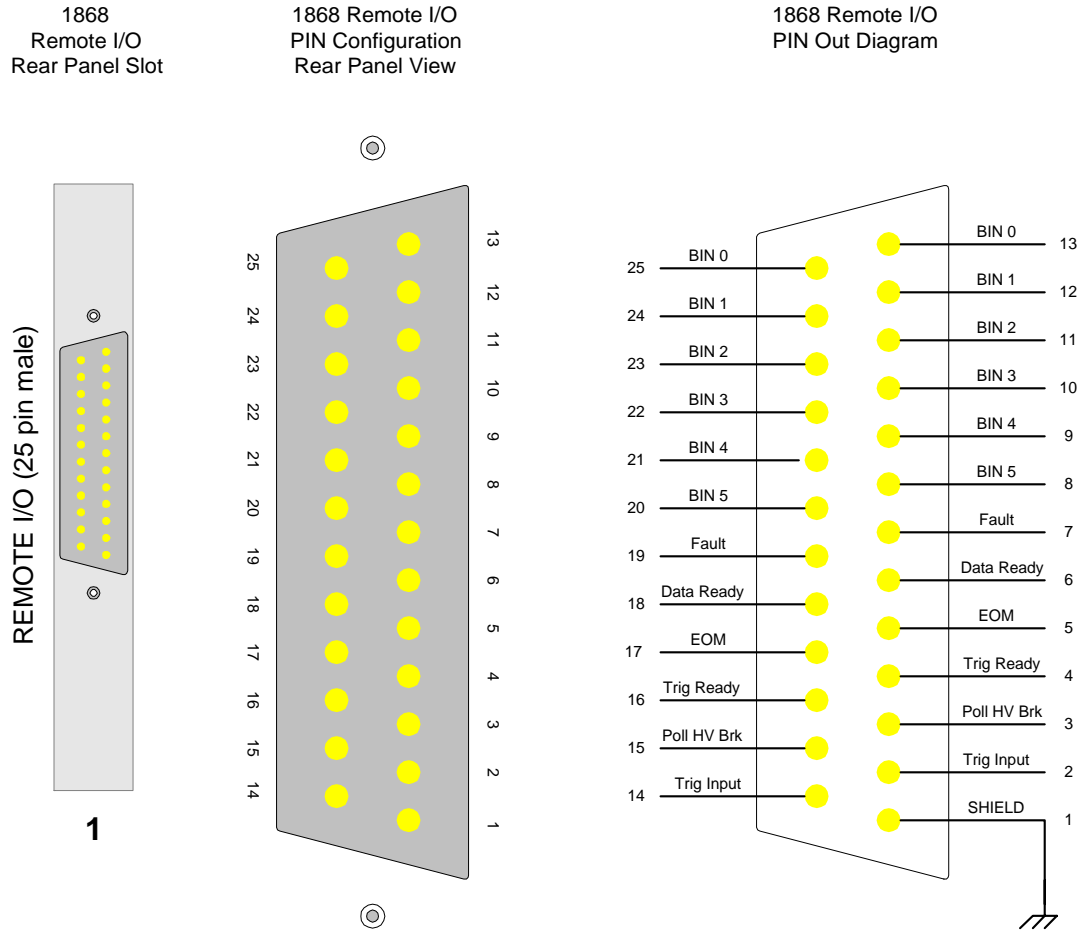
Figure 3-1: Remote I/O Connector

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

Limits and BIN Out Function:

As stated previously, the Remote I/O connector is used to for external triggering of the instrument and to output "bin" signals in accordance with predefined limits. Figure 3-1b shows the layout of the connector.
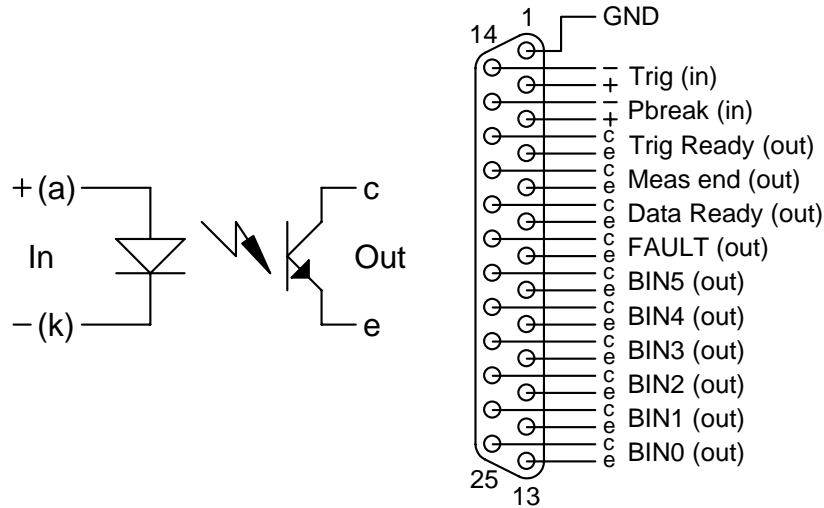

GND
Trig (in)
Pbreak (in)
Trig Ready (out)
Meas end (out)
Data Ready (out)
FAULT (out)
BIN5 (out)
BIN4 (out)
BIN3 (out)
BIN2 (out)
BIN1 (out)
BIN0 (out)

Figure 3-1b: Remote I/O Connector

The Pbreak input is used to shut down the high voltage supply without having to restart the instrument, as is the case when activating HV Break.

The optocoupler input triggers the 1868 by an input current of 10mA (maximum 30mA forward and maximum 6V reverse). The optocoupler outputs are rated 25V and 10mA each. Both input and output require external power and series resistors.

Figure 3-1c shows how the Remote I/O signals for Bin Out are set in accordance with the Limits. If the value is between LIM1 and LIM2, the BIN2 output is active (the output phototransistor is on).
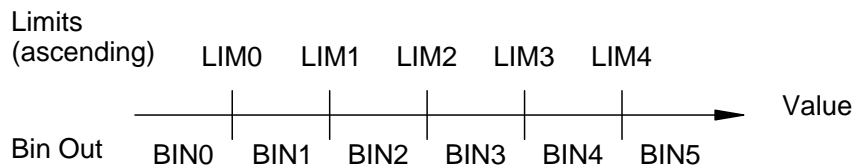
Figure 3-1c: Limits and Bin Out Function

Resistance mode

Limits
(ascending) 100Gohm

Bin Out   BIN0   BIN1   BIN2   BIN3   BIN4   BIN5   Value

"Bad"   "Good"
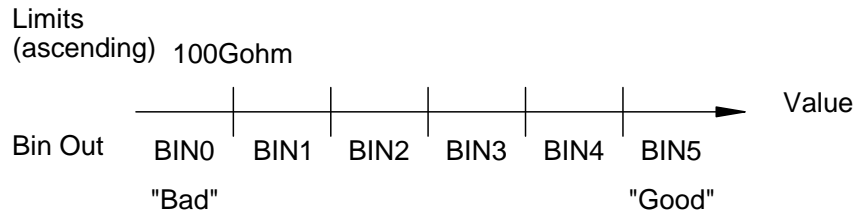
Figure 3-1d: Limits in IR Mode

Current mode

Limits
(ascending)   5nA

Bin Out   BIN0   BIN1   BIN2   BIN3   BIN4   BIN5   Value

"Good"   "Bad"
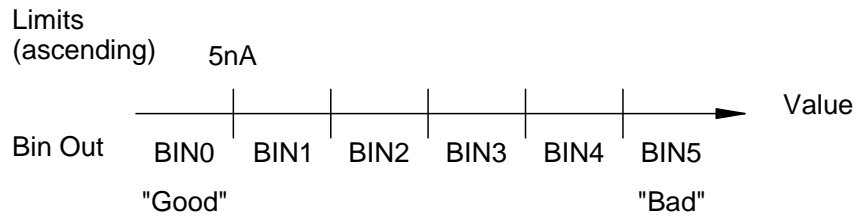
Figure 3-1e: Limits in Current Mode

Both in resistance (Figure 3-1d) and in current (Figure 3-1e) mode the limits should be organized in ascending order. This means that in resistance mode and with only one LIM defined a "good" component will set BIN 5, in current mode it will set BIN 0. More limits could be used to exclude shorted or open components.

When using resistance limits the instrument must be in resistance measuring mode, when using current limits it must be in current measuring mode.

SETUP FOR IR AND FLASH TEST

Figure 3-1f shows an example of a setup that can be used to perform flash test and/or IR test. In both cases the BIN0 is set if there is a flash over or if the insulation resistance is too low. Otherwise the BIN5 is set if the component is approved. The series resistances is calculated from:

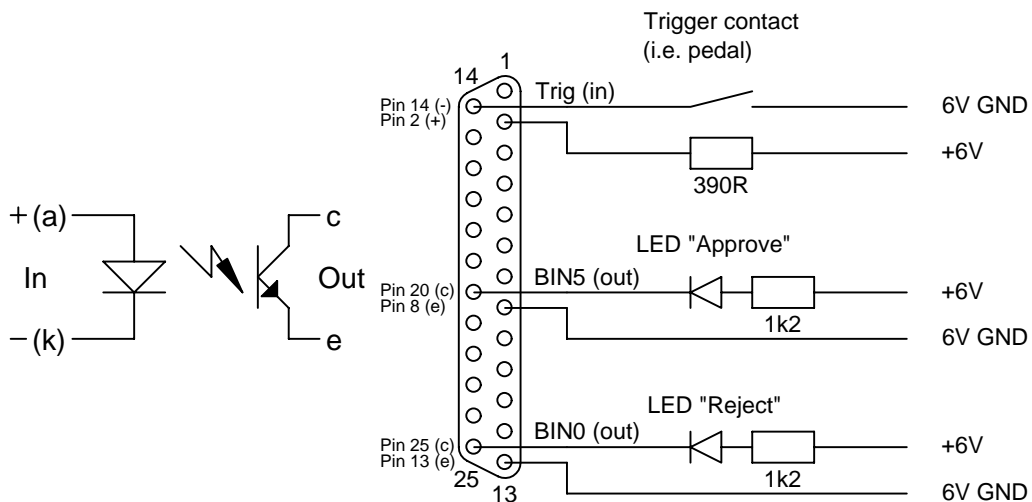$$R_{Trig} = \frac{6V - 2V}{10mA} \quad R_{LED} = \frac{6V - 2V}{3mA}$$

Figure 3-1f: Flash Test Mode

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 WTHOUT 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.
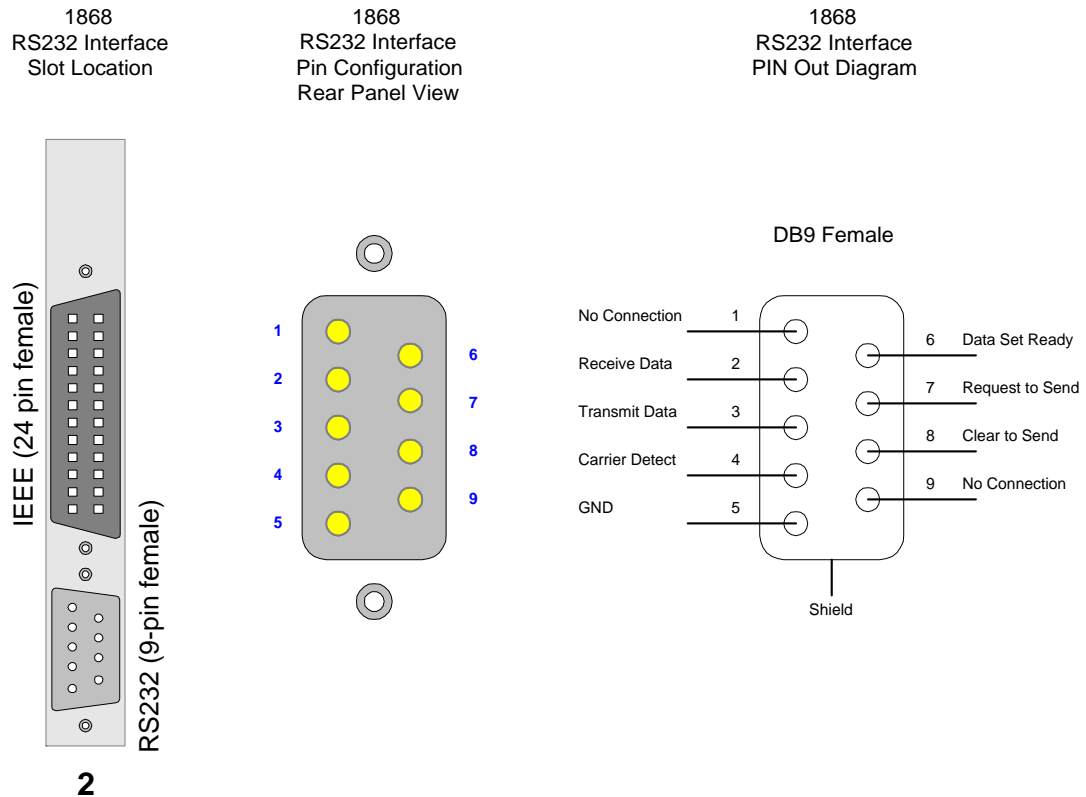
Figure 3-2: RS232 PIN Configuration

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 theRS232C 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 O = 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 dischage 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.
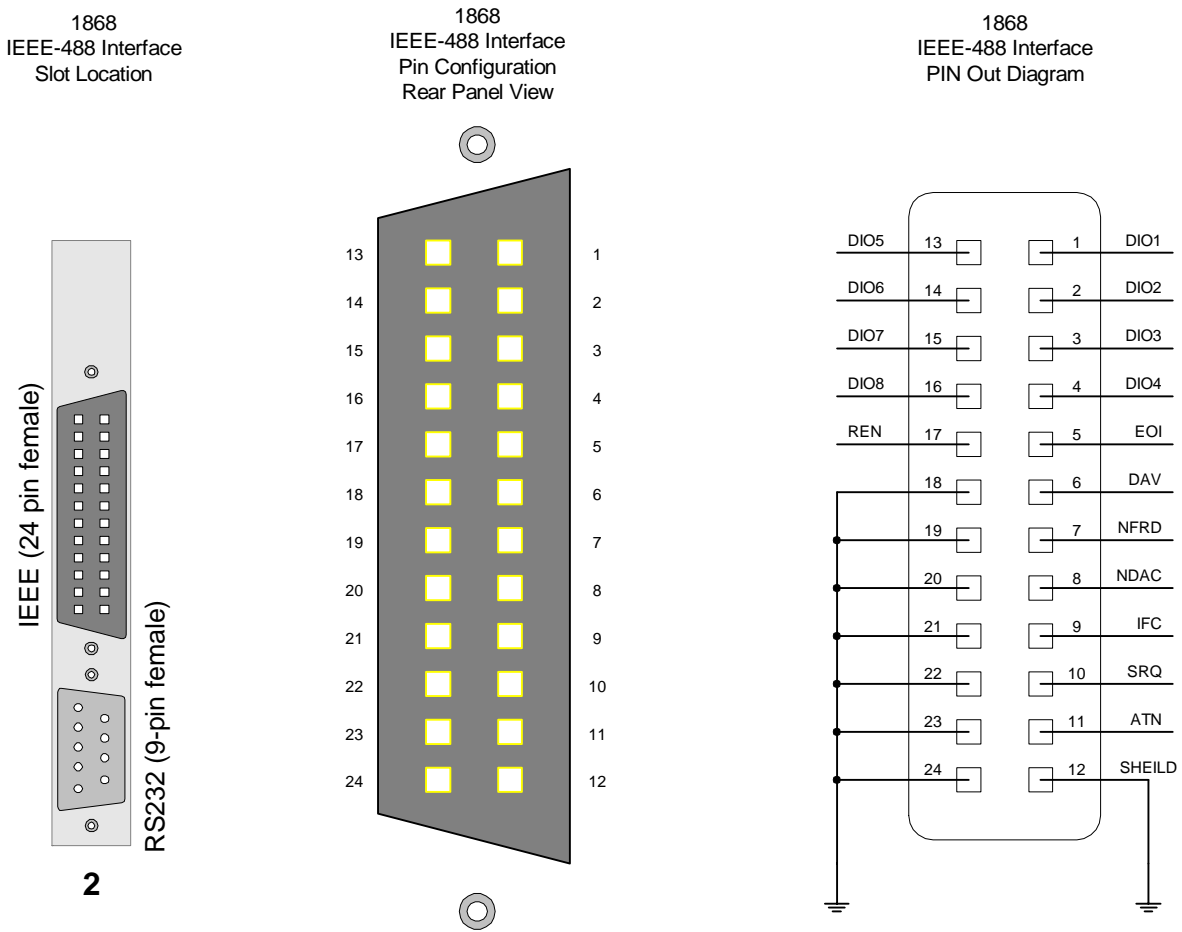

Figure 3-3: IEEE-488 Interface PIN Configuration

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

Code	Function
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

<div style="border:1px solid">

NOTE

LF is the end code for the RS232 Commands.

</div>

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 '?'.

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 off 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?	HTVOLTX.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.
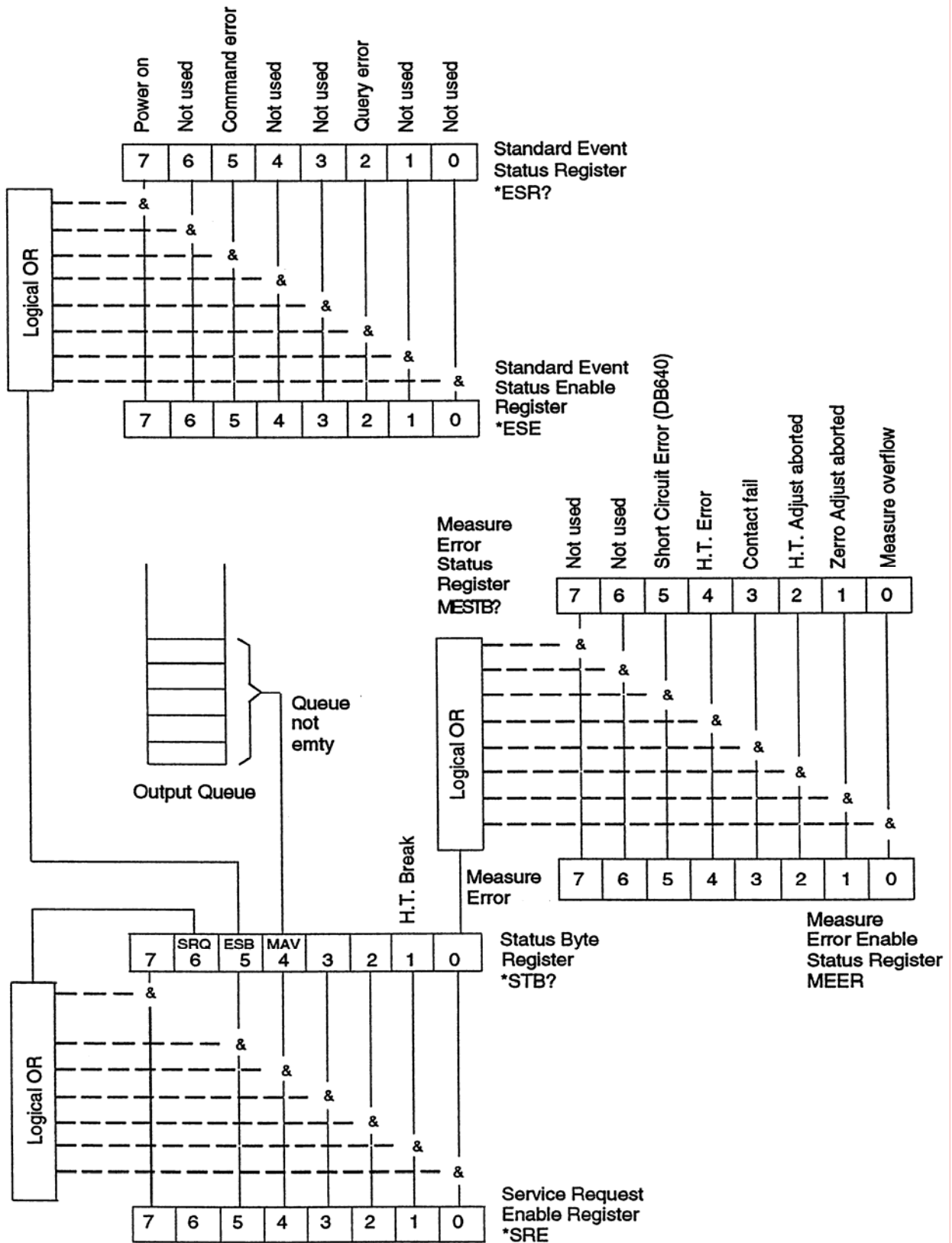
Figure 3-4: Service Request Register System

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

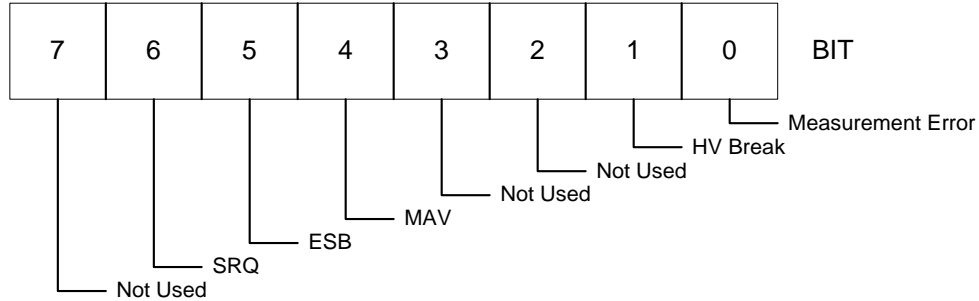## Standard Event Status Register

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.
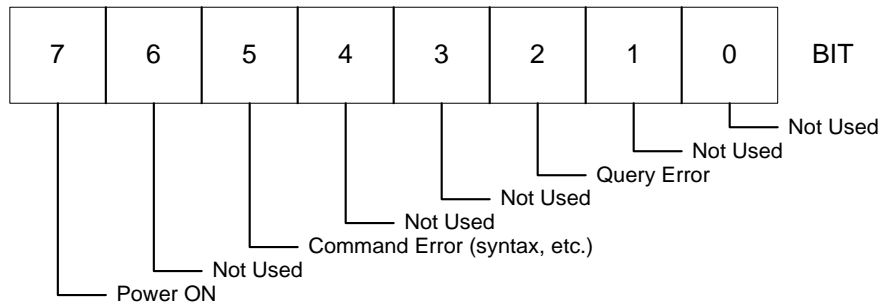

Figure 3-6: Standard Event Status Register

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.
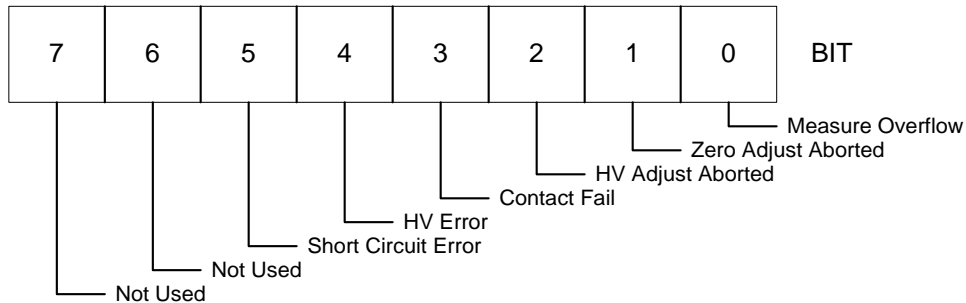

| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | BIT |

Measure Overflow
Zero Adjust Aborted
HV Adjust Aborted
Contact Fail
HV Error
Short Circuit Error
Not Used
Not Used

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

Device dependent input commands

AVERAGE	Set average count.
AVERAGE?	Recall average count.
BARGRAPH	Bargraph ON/OFF
	ON or 1 = Bargraph on
	OFF or 0 = Bargraph off.
BARGRAPH?	Recall bargraph on/off setting.
BGSCALE	Set bargraph scale.
CURRENT:	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
RESISTANCE:	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
BGSCALE?	Recall bargraph scale setting.
CCHECK	Set contact check ON/OFF
	ON or 1 = Contact check on.
	OFF or 0 = Contact check off.
CCHECK?	Recall contact check ON/OFF setting.
CHTIME	Set charge time.
CHTIME?	Recall charge time setting.
CLIM	Clear all limits
DISPlay	Display ON/OFF.
	ON or 1 = Display on.
	OFF or 0 = Display off.
DISPLAY?	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
HVCURENT	Set HV1 current limit (2mA, 25mA, 100mA). * See Note page 96
	Format: HVCU 2MA,XXXX (Pass word)
HVCURENT?	Recall HV1 current limit.
HV2CURENT	Set HV2 current limit (2mA, 25mA, 100mA).
	Format: HVCU 2MA,XXXX (Pass word)
	(Dual HV supply units only)
HV2CURENT?	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.

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

7	6	5	4	3	2	1	0	BIT

- 0 → LIMSET 2
- 1 → LIMSET 3
- 2 → LIMSET 4
- 3 → LIMSET 5
- 4 → Not Used
- 5 → Not Used
- 6 → Not Used
- 7 → Not Used

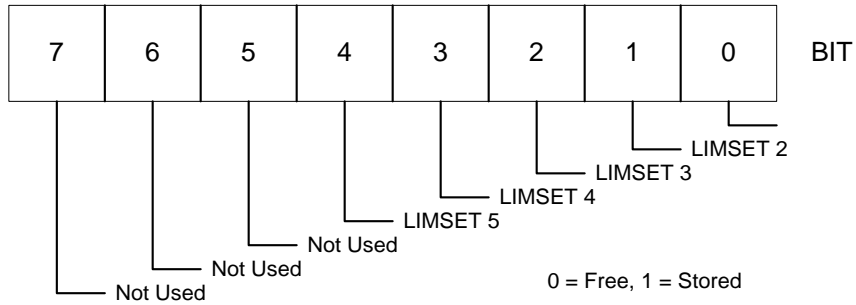0 = Free, 1 = Stored

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.

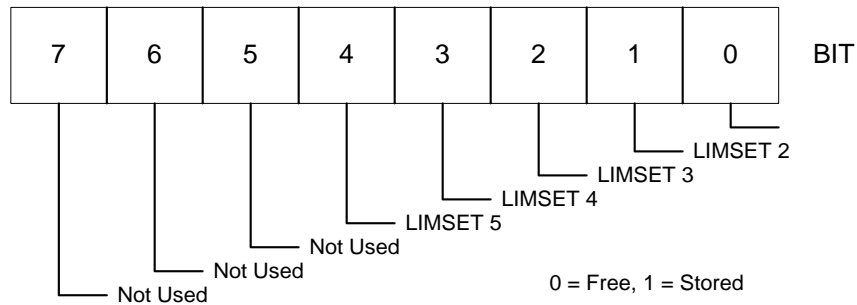**SLIM**SET?   Recall which limset are stored.

7	6	5	4	3	2	1	0	BIT

- 0 → LIMSET 2
- 1 → LIMSET 3
- 2 → LIMSET 4
- 3 → LIMSET 5
- 4 → Not Used
- 5 → Not Used
- 6 → Not Used
- 7 → Not Used

0 = Free, 1 = 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

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

NOTE:
* Changed HT Current Commands:

HTCU 0	Sets Current to <2mA on 1868A and 1868D
HTCU 1, 1234	Sets Current to 25mA on 1868A and to 5mA on 1868D
HTCU 2, 4321	Sets Current to 80mA on 1868A and to 18mA on 1868D

Section 4 : Service & Calibration

4.1 General

Our warranty (at the front of this manual) attests to the quality of materials and workmanship in our products. If malfunction should be suspected or other information be desired, applications engineers are available for technical assistance. Application assistance is available in the U.S. by calling 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°C ± 4°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 ± 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 ± 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 (± 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 0pA ± 4pA
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)

Meas Volt (V)

HV Ground No   * Verify Measured Value is within (100V ±1V)

HV Ground Yes   * Verify Measured Value is within (-100V ±1V)

7.4   Contact Check   Y/N   **7.5 Auto Range**   Y/N

7.7   Output Voltage (Specification [± (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 [± (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°C ± 4°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.

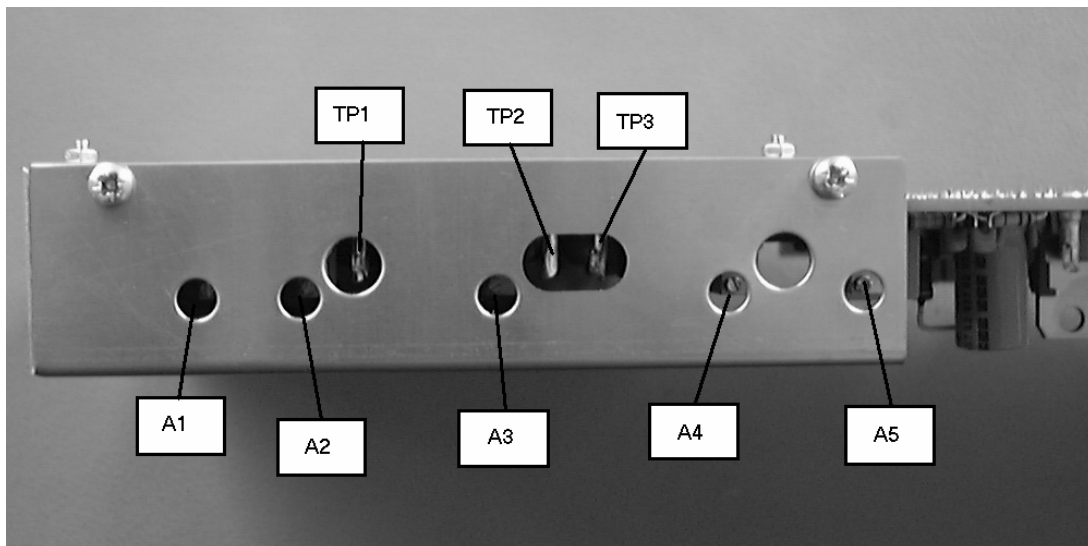Remove top cover. Refer to Figures 4-1 and 4-2 for board locations, test and adjustment points.
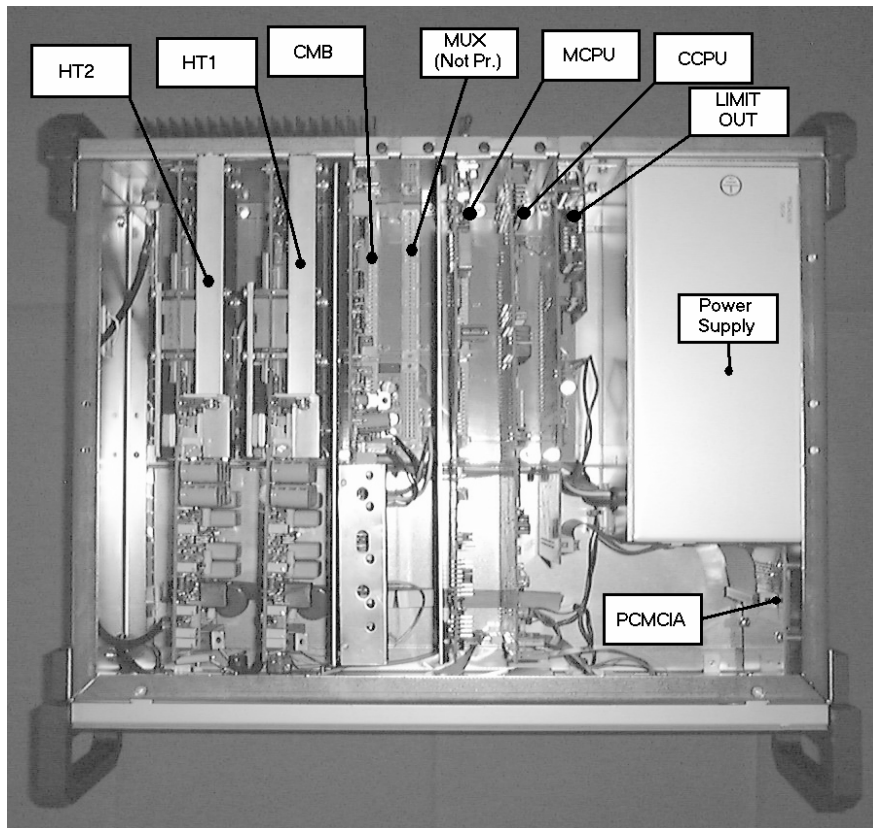

Figure 4-1: Test Points

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 ± 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 ± 0.01V

4.3.4.9   Perform Hardware and software resets per 4.3.4.1

4.3.4.10   Replace Top Cover