

Sentry 10/20/30 Hipot Tester
Sentry CE 15/25/35 Hipot Tester
Instruction Manual
Form 150460/A6

©QuadTech, Inc., 2000
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The material in this manual is for informational purposes only and is subject to change, without notice. QuadTech assumes no responsibility for any error or for consequential damages that may result from the misinterpretation of any procedures in this publication.

WARNING

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



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



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



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

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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

Sentry 10/15, 20/25 and 30/35

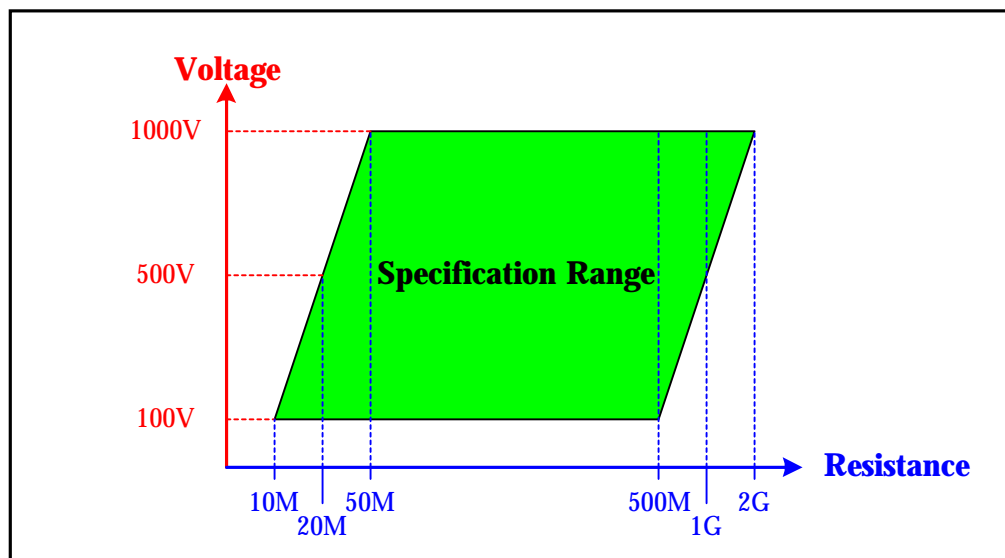
AC Output Voltage: Range: 0.1 to 5kV AC, in 10V/steps, 50/60 Hz
Accuracy Display: $\pm 1\%$ of reading +5V
Regulation: $\leq 1\%$ +5V

Sentry 20/25 and 30/35 Only

DC Output Voltage: Range: 0.1 to 6kV DC, in 10V/steps
Accuracy Display: $\pm 1\%$ of reading +5V
Regulation: $\leq 1\%$ +5V

Sentry 30/35 Only

Insulation Resistance: Range: 10M Ω - 10G Ω
Accuracy: $\pm 10\%$ of reading + 10 cts, $\geq 500V$, $< 2G\Omega$
 $\pm 15\%$ of reading + 10 cts, $< 500V$, $< 2G\Omega$
Decreased accuracy, $> 2G\Omega$
Voltage: 50 - 1000V DC in 1V steps
Accuracy: $\pm (5\%$ of setting + 5V)
Limit: High/Low
Test Time: 0.1 - 999sec ($\pm 20ms$)



Resistance Specification Range

Specifications (continued)

Features Standard On All Sentry Units

Leakage Current:	Range:	<ul style="list-style-type: none">• 0.001 to 15mA AC• 0.001 to 5.0mA DC (15/25/35)• 0.001 to 7.5mA DC (10/20/30)
	Accuracy:	± (1.5% + 5 counts)
Breakdown:	Detection:	<ul style="list-style-type: none">• I_{max}: 0.001 to 15mA AC, 5.0mA DC (15/25/35)• I_{max}: 0.001 to 15mA AC, 7.5mA DC (10/20/30)• Accuracy: ±(1% of limit + 5counts)• ΔI: 10μsec, 1mA to 15mA
	Indication:	Pass/fail light, audible sound
Minimum Threshold:		0.001mA to I _{max} limit
Test Time:		Ramp: 0.1 to 99.9sec (±20ms), Hold: 0.1 to 999sec (±20ms)
Remote Control:		Remote Start, Stop, Pass/Fail Output, Interlock
Continuity Check:		Current: 0.1A DC, Max Gnd Resistance: 1Ω ±0.1Ω
Mechanical:		Bench Mount with Carry Handle Dimensions: (w x h x d):11x4x14in (270x100x350mm) Weight: 21 lbs (10kg) net, 28 lbs (13kg) shipping
Environmental:		Meets MIL-T-28800E, Type 3, Class 5 Operating: 0°C to +40° C Humidity: <75% Storage: -10°C to +60° C
Power:		<ul style="list-style-type: none">• 90 - 130V AC • 50 or 60Hz • 200 - 250V AC • 300W max
Supplied:		<ul style="list-style-type: none">• Instruction Manual • Calibration Certificate • Test Leads • AC Cable

Ordering Information:	<u>Description</u>	<u>Catalog Number</u>
	Sentry 10 AC Hipot Tester	Sentry 10
	Sentry 15 AC Hipot Tester	Sentry 15
	Sentry 20 AC/DC Hipot Tester	Sentry 20
	Sentry 25 AC/DC Hipot Tester	Sentry 25
	Sentry 30 AC/DC/IR Hipot Tester	Sentry 30
	Sentry 35 AC/DC/IR Hipot Tester	Sentry 35

Accessories

Accessories Included

Item	Quantity	QuadTech P/N
U.S. AC Power Cable (3-prong)	1	4200-0300
International AC Power Cable (2-prong), 15/25/35 only	1	630031
High Voltage Lead Set 1m (1 Blk, 1 Red with clips)	1	S02
Continuity Check Clip Lead (White cable terminated by black banana plug and black alligator clip)	1	700100
3.15A 250V Line Fuse: 115V Operation	1	520072
1.6A 250V Line Fuse: 230V Operation	1	520074
Instruction Manual	1	150460
Calibration Certificate	1	N/A

Accessories/Options Available

Item	Quantity	QuadTech P/N
HV Lead Set High & Low, 1m (std with unit)	1	S02
HV Lead Set High & Low, 2m	1	S04
HV Lead, 1 meter unterminated	1	S09
HV Lead, 2 meters unterminated	1	S10
Corded Product Adaptor, 115V	1	S03
Corded Product Adaptor, 115V, use for GB test	1	G13
Corded Product Adaptor, 240V, use for GB test	1	G25
Foot Switch	1	S05
Power Entry Adaptor Cable	1	S07
High Voltage Probe	1	S06
Gun Probe	1	S08
Gun Probe with Remote Start	1	S11
Load Box, Resistive	1	S12
Load Box, Custom Resistors	1	S14
Interconnect Cable (To Sentry 50)	1	S15
Rack Mount Assembly	1	S16
International Power Strip	1	G16

Safety Precautions

WARNING

The Sentry Series Hipot Tester can provide an output voltage as high as 6000VDC (5000VAC) to the external device under test (DUT).

Although the Sentry unit is designed with full attention to operator safety, serious hazards could occur if the instrument is used improperly and these safety instructions are not followed.

1. The Sentry unit is designed to be operated with its chassis connected to earth ground. The Sentry instrument is shipped with a three-prong power cord to provide this connection to ground. The power cord should only be plugged in to a receptacle that provides earth ground. Serious injury can result if the Sentry unit is not connected to earth ground.
2. Tightly connect cable(s) to the (black) **GND** terminal. If this is not done, the DUT's casing can be charged to the high voltage test level and serious injury or electrical shock hazards could result if the DUT is touched.
3. Never touch the metal of the High Voltage probe directly. Touch only the insulated parts of the lead(s).
4. 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 **DANGER** LED is lit.
5. Before turning on the Sentry unit, make sure the AC power cord is plugged into the proper voltage source and that there is no device (DUT) or fixture connected to the test leads.
6. After each test, press the **[STOP]** (red) button for safety. This terminates the high voltage being applied to the output terminals.
7. When the **DANGER LED** is lit NEVER touch the device under test, the lead wires or the output terminals.
8. Before touching the test lead wires or output terminals make sure:
 - a) The red **[STOP]** button has been pressed.
 - b) The **DANGER LED** is OFF.
 - c) The output voltage display is 0 (zero).
9. **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 Sentry INSTRUMENT.**
10. If the **DANGER LED** does not go off when the **[STOP]** 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.
11. Be extremely careful when the Sentry instrument is used in remote control mode. The High Voltage Output is being turned on and off with an external signal.

Condensed Operating Instructions

WARNING

High Voltage is applied to the white H.V. output terminal anytime the red **DANGER** LED is lit or flashing. Always make sure the **DANGER** LED is OFF when connecting or disconnecting the Device under Test (DUT).

General Information

The Sentry Series AC/DC/IR testers are measuring instruments for direct readout of Hipot output voltage, leakage current and insulation resistance. The voltage applied to the device under test is adjustable from 0.1 to 5kVAC and 0.1 to 6kVDC. The current range is adjustable from 0.001 to 15mA AC and 0.001 to 5.0mA DC (15/25/35). The (10/20/30) units have a DC current range from 0.001 to 7.5mA. PASS and FAIL LEDs provide a visual display of test results based on preset limits. In FAIL mode, a buzzer gives an audible indication of test result based on preset limit.

Start-Up

The Sentry unit can be operated from a power source between 90 and 250VAC at a power line frequency of 50 or 60Hz. The Sentry (15/25/35) unit is shipped from QuadTech with a 3.15A fuse in place for AC 100-240V operation. The Sentry (10/20/30) unit contains a 4A fuse in place for AC 100-240V operation. The Sentry unit is shipped with the line voltage selector set for 108-132V. Refer to paragraph 1.4.3 to change a fuse and to change the line voltage selector.

Connect the Sentry instrument AC power cord to the source of proper voltage.

Press the [POWER] button on the front panel to apply power. To switch the power off press the [POWER] button again or if measurements are to be made proceed with Test Parameter Set-Up below. Note: the Sentry instrument should warm-up for 15 minutes prior to use.

Test Parameter Set-Up

Press [PROG] and enter the Test Parameters according to your test specification.

Test	Test Voltage (kV)	Line Frequency (50 or 60Hz)	Current HI Limit (mA) IR Test = HI R MΩ	Current LO Limit (mA) IR Test = LO R MΩ	ARC Detect	Test Time (sec)	Ramp Time (sec)
AC Hipot	SET	SET	SET	SET	SET	SET	SET
DC Hipot	SET		SET	SET	SET	SET	SET
Insulation Resistance	SET		SET	SET		SET	SET

Refer to paragraph 2.3 for full description of programming test parameters and instruction on how to store the test setup. Note: Test parameters must be set before the Sentry unit can be zeroed.

Condensed Operating Instructions

Zeroing/Offset

After setting the test parameters, zero the Sentry unit by using the automatic offset (continuity check must be set to OFF, refer to paragraph 2.12). Make sure the black ground cable is connected to the Sentry GND terminal and the red high voltage test cable is connected to the Sentry H.V output terminal and the clips are not touching. Press [ENTER] key twice then press [UP] key once. Display reads “OFSt oFF”. Press [UP] key once. Display reads “OFSt GEt”. Press [START] key once. Display shows the offset. Offset has to be recalculated each time the test parameters, test cables or test fixture are changed.

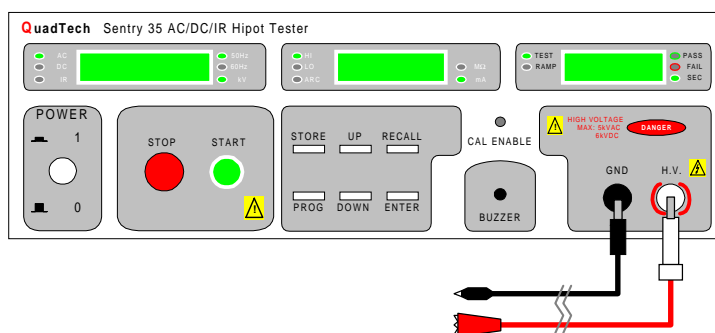


Figure COI-1: Cable Connection for Offset Function

Measurement Mode

- 1 Turn [POWER] ON.
- 2 Let Sentry unit warm-up 15 minutes.
- 3 Connect Black ground cable to Sentry GND terminal.
- 4 Connect Red high voltage cable to Sentry H.V. terminal.
- 5 Press [PROG] and enter your Test Parameters Press [PROG] again to accept it.
- 6 [STORE] Test set-up (If desired).
- 7 Zero the Sentry unit (OFFSET).
- 8 Select Continuity Check OFF (¶ 2.12).
- 9 Connect Device Under Test (DUT).
- 10 Press [START].
- 11 Record Readings.
- 12 Press [STOP] .

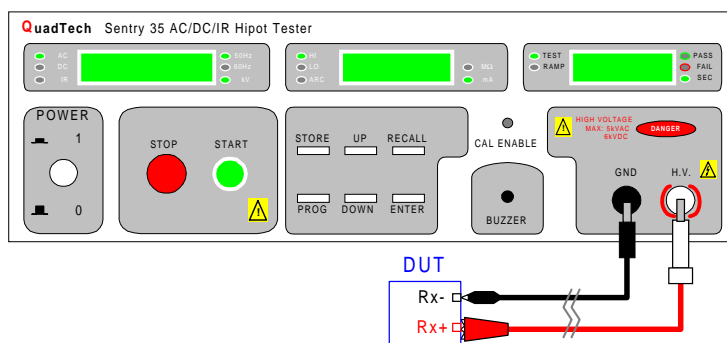


Figure COI-2: Cable Connection To Device Under Test

Section 1: Introduction

1.1 Unpacking and Inspection

Inspect the shipping carton before opening. If the carton is damaged, contact the carrier agent immediately. Inspect the Sentry 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 materials for future use such as returning for recalibration or service.

1.2 Product Overview

The Sentry is available in six models, all of which provide AC Hipot testing capability. Additionally, the Sentry 20/25 provide DC Hipot testing, and the Sentry 30/35 provide DC Hipot testing and Insulation Resistance testing. The hipot test can be programmed over a voltage range of 0.1 to 5kV AC and 0.1 to 6kV DC with a min/max leakage current detection range of 10 μ A to 15mA AC and 5.0mA DC (15/25/35), 7.5mA DC (10/20/30). Insulation resistance measurements are possible to 10G Ω at programmable DC test voltages between 50 and 1000V. Each instrument comes standard with ground continuity check, internal storage of 10 test setups, and interface with remote start/stop inputs and pass/fail outputs.

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 Sentry 35 AC/DC/IR Hipot Tester. Table 1-1 identifies them with description and function.

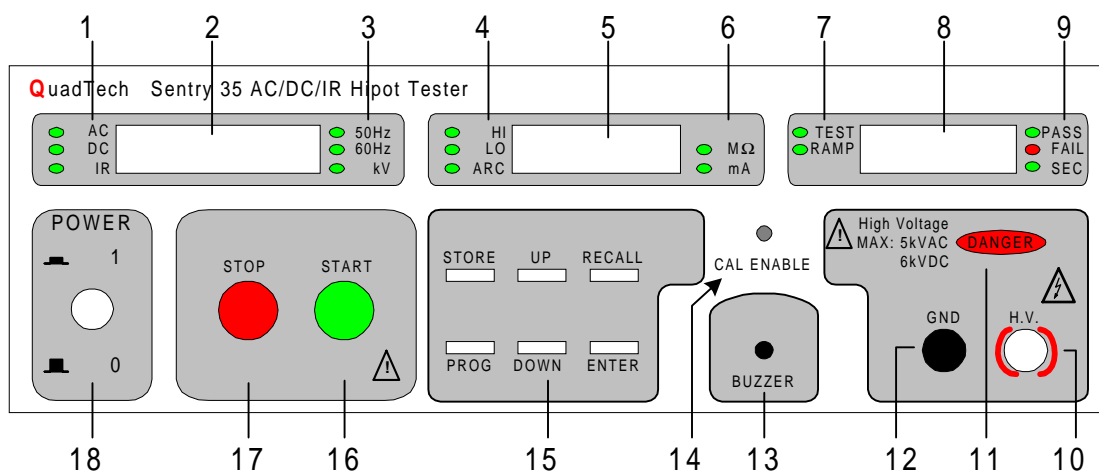


Figure 1-1: Sentry Series Front Panel Controls and Indicators

Table 1-1: Sentry Series Front Panel Controls and Indicators

Reference Number Figure 1-1	Name	Type	Function
1	AC/DC/IR	Green LED	When lit indicates that tester is in AC Hipot, DC Hipot or Insulation Resistance Mode
2	Voltage	4 Digit Display Green LEDs	Indicates voltage setting when test is not in process. Indicates output voltage when test is in process. AC 0.1-5kV, DC 0.1-6kV, IR 0.05-1kVDC
3	Frequency	Green LED	Indicates output frequency (50/60Hz) when an AC Hipot Test is selected
4	Limit Indicator	Green LED	Indicates the function of the limit shown on the Limit Display (HI, LO or ARC)
5	Limit/Measure Display	4 Digit Display Green LEDs	Indicates Limit Setting when test is not in process. Indicates Testing Value when test is in process. WAC: HI (0-15mA) LO (0-5.0mA: 15/25/35), (0-7.5mA: 10/20/30) ARC (1-15mA) WDC: HI (0-5mA) LO (0-3.75mA) ARC (1-5mA: 15/25/35), (1-7.5mA: 10/20/30) IR: HI (1-9999MΩ), LO 1-9999MΩ)
6	Display Units	Green LED	Indicates the units for the Limit Display (mA: AC/DC Hipot , MΩ : IR)
7	Timer Indicator	Green LED	Indicates the Timer Display (Test or Ramp Time)
8	Timer Display	3 Digit Display Green LED	Indicates the time countdown. Ramp is the rising time of the Voltage (0-99.9sec) and Test is the measure time (0-999sec). Setting the Test time equal to 0 places the unit in continuous measure mode.
9	PASS/FAIL	Grn/Red LEDs	Indicates a pass or fail based on the preset limits.
10	H.V.	White 4-point Receptacle	High Voltage output terminal
11	DANGER	Red LED	When lit, high voltage is present on the output terminals
12	GND	Blk Female receptacle	Ground Terminal. Low potential terminal for high voltage output.
13	BUZZER	Hole	Audible output indicates test complete. Remains on until STOP pressed on FAIL condition.
14	CAL ENABLE	Hole	For Qualified Service Personnel to use during instrument calibration.
15	Data Entry Keys STORE UP RECALL ENTER DOWN PROG	White Push Button Switches	6 keys to enter test conditions PROG Press to enter Test Condition Change mode, Press again to exit ENTER Press to confirm the entered Test Condition ↑ and ↓ Select step 1 or step 2 with unit in standby status (Refer to ¶ 2.5) ↑ and ↓ Increase/decrease selected parameter when programming test cond. STORE Press to initiate storage of 1 to 40 2-Step or 80 1-Step test set-ups RECALL Press to initiate recall of 1 to 40 2-Step or 80 1-Step test set-ups
16	START	Green P-B Switch	It starts a test and applies High Voltage to the Test Terminals
17	STOP	Red P-B Switch	It stops the test in progress. Must be pressed before a test is started (reset)
18	POWER	Grey P-B Switch	To Turn Power On (push button IN) or OFF (push button OUT)

1.3.2 Rear Panel Controls and Connectors

Figure 1-2 illustrates the controls and connectors on the rear panel of the Sentry Series unit. Table 1-2 identifies them with description and function.

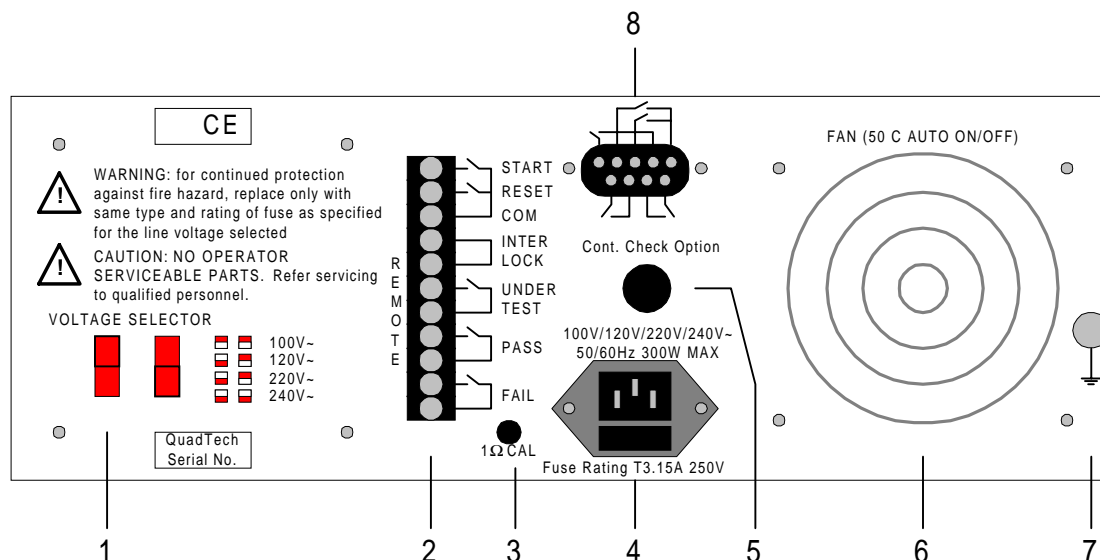


Figure 1-2: Sentry Series Rear Panel Controls & Connectors

Table 1-2: Sentry Series Rear Panel Controls & Connectors

Reference Number Figure 1-2	Name	Type	Function
1	VOLTAGE SELECTOR	2 Red slide switches	To select range of AC power source Set to 100V position for 90-100VAC Set to 120V position for 110-130VAC Set to 220V position for 200-240VAC Set to 240V position for 220-250VAC
2	REMOTE	11 Slot Screw Panel	Terminals for remote control connections (§ 2.17)
3	1Ω CAL	Black Screw	Calibration for Continuity
4	AC Line Output	3-wire AC Receptacle and Fuse Drawer	Connection for AC power source and Replace Fuse 3.15A, 250V SB for 115V Operation (15/25/35) 1.6A, 250V SB for 230V Operation (15/25/35) 4A, 250V SB for 115V Operation (10/20/30) 2A, 250V SB for 230V Operation (10/20/30)
5	CONT. CHECK OPTION	Black Banana Plug Receptacle	Connection for Continuity Check
6	FAN	115V 50-60Hz 0.1A fan	Temperature controlled fan ON > 50°C OFF < 50°C
7	Ground	Silver Screw Banana Plug Receptacle	Earth (Chassis) Ground Connection
8	Remote	9 Pin D-Type	Remote control connections (§ 2.17)

1.4 Installation

1.4.1 Dimensions

The Sentry unit is supplied in a bench configuration, i.e., in a cabinet with resilient feet or placement on a table. Flip feet are provided under the front feet so that the Sentry instrument can be tilted up for convenient operator viewing.

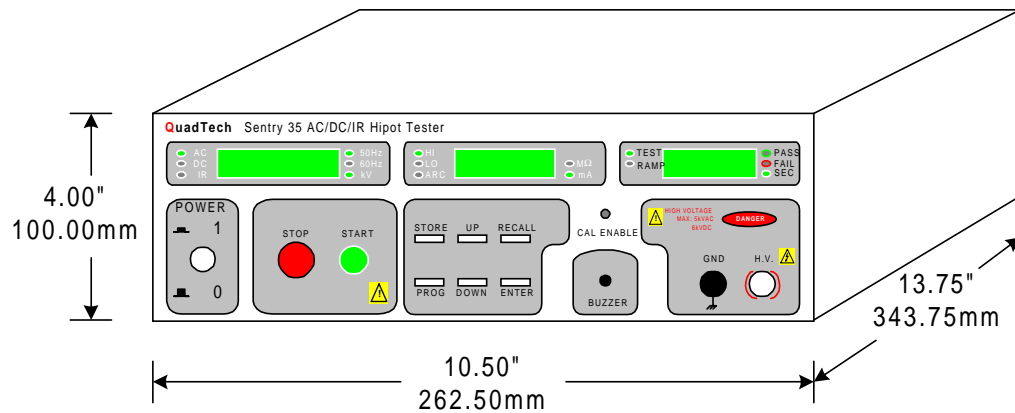


Figure 1-3: Sentry Instrument Dimensions

1.4.2 Instrument Positioning

The Sentry unit contains three (3) digital meters for direct readout of measured parameters. The optimum angle for viewing is slightly down and about 10 degrees either side of center. For bench operation the front flip feet should always be used to angle the instrument up. In bench or rack mount applications the instrument should be positioned with consideration for ample air flow around the rear panel fan ventilation hole. An open space of at least 3 inches (75mm) is recommended behind the rear panel.

1.4.3 Power Requirements

The Sentry can be operated from a power source of 90 to 130 VAC or 200 to 250 VAC. Power connection is via the rear panel through a standard receptacle. Before connecting the 3-wire power cord between the unit and AC power source, make sure the voltage selection switches on the rear panel (as indicated) are in accordance with the power source being used. 4A or 3.15A, 250V, 5x20mm, for 90-130V source and 2A or 1.6A, 250V, 5x20mm, for 200-250V source. Always use an outlet that has a properly connected protection ground.

WARNING

MAKE SURE THE UNIT HAS BEEN DISCONNECTED FROM ITS AC POWER SOURCE FOR AT LEAST FIVE MINUTES BEFORE PROCEEDING.

Procedure For Changing A Sentry Fuse

Remove the fuse drawer, by inserting a flat head screwdriver behind the small tab located just below the 3-prong receptacle, and force outward.

Once the fuse drawer has been removed from the instrument snap the fuse from the holder and replace. Make sure the new fuse is of the proper rating. Note that the fuse drawer can also be used to store a spare fuse.

Install the fuse drawer back in the inlet module (fuse down) by pushing in until it locks securely in place.

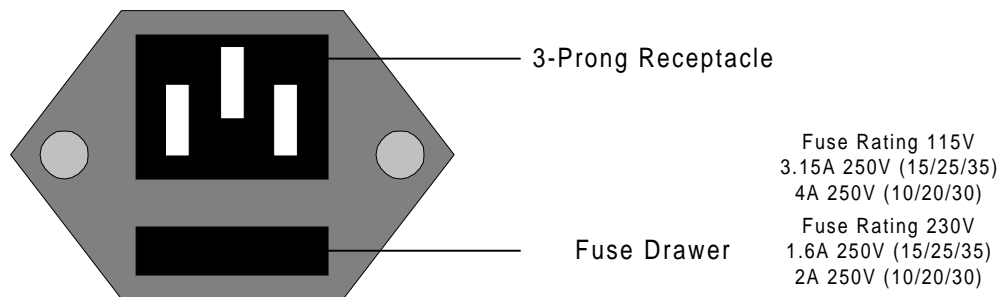


Figure 1-4: Fuse Replacement Rear Panel Sentry Unit

1.4.4 Safety Inspection

Before operating the instrument inspect the power inlet module on the rear of the Sentry to ensure that the properly rated fuse is in place, otherwise damage to the unit is possible. Refer to paragraph 1.4.3.

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

The surrounding environment should be free from excessive dust to prevent contamination of electronic circuits. The surrounding environment should also be free from excessive vibration. Do not expose the Sentry 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

<u>Multiple</u>	<u>Scientific</u>	<u>Engineering</u>	<u>Symbol</u>
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
.00000000000001	10^{-15}	femto	f

Dielectric Strength: The ratio between the voltage at which breakdown of the insulating material occurs and the distance between the two points subject to the applied voltage.

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, and 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.

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.

Leakage Current: The steady state current that flows through the insulation. Leakage current is equal to the applied voltage divided by the insulation resistance.

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.
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.
ARCing:	Sparkling or ‘flashing over’ caused by a breakdown of electrical insulation.
RAMPing:	The gradual increase or decrease of voltage or current over a period of time (step).
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 Frequency = 50 or 60 Hz.
Ground:	The base reference from which voltages are measured, nominally the same potential as the earth. Also the side of a circuit that is at the same potential as the base reference.
Ground Continuity Test:	Test to verify that all conductive parts of a product that are exposed to user contact are connected to the power line ground. GC test is normally performed with a low current DC signal that checks to ensure the ground connection has a resistance of $<1\Omega$.
Mode:	The test which is to be performed such as AC hipot (WAC), DC hipot (WDC) or Insulation Resistance (IR).
Step:	The Sentry instrument can perform up to 2 tests in a sequence. The step number indicates in which order the tests will be performed. For example, if Step 1 is an AC hipot test and Step 2 is an insulation resistance test, then when the [START] button is pressed, the Sentry instrument will perform an AC hipot test followed by an insulation resistance test.
High Limit:	The upper value for a test to be considered a PASS. If the measured value is higher than the high limit, the test is considered a FAIL. In hipot, leakage current and ground bond test modes, a high limit is required.
Low Limit:	The lower value for a test to be considered a PASS. If the measured value is lower than the low limit, the test is considered a FAIL. In IR test mode, a low limit is required.

2.2 Start-Up

Check to make sure the Voltage Selector Switch on the rear panel agrees with the power source available (Depending on the power source the switch positions should be in the up or down positions as shown on the instrument rear panel).

WARNING

When the high voltage is applied and red **DANGER** light **ON**
Never touch the test leads in any manner (this includes insulation on all wires and clips).
Use all precautions necessary to avoid touching the device under test when the red **DANGER**
light is ON or flashing.

Before connecting the instrument to its power source the **interlock function** on the rear panel remote connector must be properly utilized. **This is an important safety feature for the protection of the operator.** Turn on of the instrument's high voltage is inhibited with no interlock connection and is functional with the interlock jumper in place (as shipped from the factory).

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

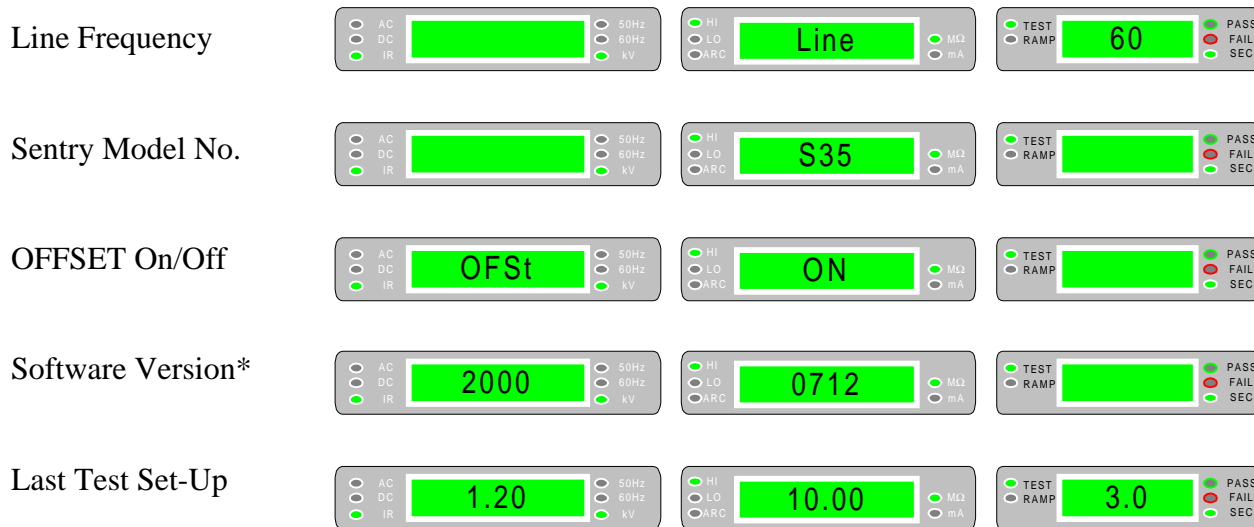
Power is applied to the Sentry instrument by pressing the [POWER] button on the front panel.

WARNING

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

Power Up Display

When powered-up the unit immediately indicates the line frequency, the model number (S10, S15, S20, S25, S30 or S35), whether the OFFSET is on/off and is automatically set for those test conditions when the unit was last powered down.



AC Hipot, 60 Hz, 1.20kV, 10.00mA HI Limit, 3.0 sec TEST time.

* The Software Version comes up only when you turn ON the unit and immediately press [ENTER]. Otherwise it is not shown.

2.3 Programming Hipot Test Parameters

Figure 2-1 illustrates the three front panel displays on a Sentry instrument. Table 2-2 defines the steps necessary to program the AC hipot, DC hipot and IR test parameters.

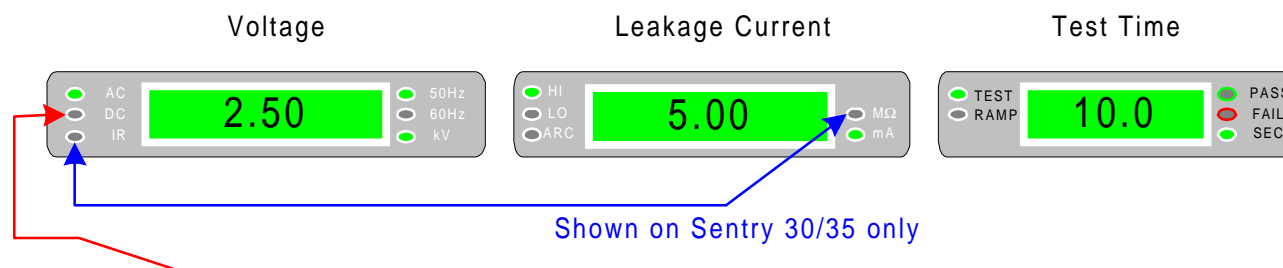


Figure 2-1: AC/DC Hipot Test Parameter Display

NOTE

Before programming an AC, DC or IR test, select Continuity Check OFF (CONt oFF, ¶2.12)

Table 2-2: Programming Test Parameters

STEP	Test Parameter	AC Hipot	DC Hipot	IR	Range
1	To enter Test Parameters	[PROG]	[PROG]	[PROG]	
2	Set MODE	[UP] or [DOWN] To AC [ENTER]	[UP] or [DOWN] To DC [ENTER]	[UP] or [DOWN] To IR [ENTER]	
3	Set TEST VOLTAGE	[UP] or [DOWN] To value (kV) [ENTER]	[UP] or [DOWN] To value (kV) [ENTER]	[UP] or [DOWN] To value (kV) [ENTER]	0.1-5kV AC 0.1-6kV DC 0.05-1.00kV IR
4	Set LINE FREQUENCY	[UP] or [DOWN] To 50 or 60 Hz [ENTER]			50 Hz or 60 Hz
5	Set HI LIMIT	[UP] or [DOWN] To high value (mA) [ENTER]	[UP] or [DOWN] To high value (mA) [ENTER]	[UP] or [DOWN] To high value (MΩ) [ENTER]	0.001-15mA AC 0.001-5.0mA DC LO limit-9999MΩ
6	Set LO LIMIT	[UP] or [DOWN] To low value (mA) [ENTER]	[UP] or [DOWN] To low value (mA) [ENTER]	[UP] or [DOWN] To low value (MΩ) [ENTER]	0.001-HI Limit mA 1-9999MΩ
7	Set ARC	[UP] or [DOWN] To arc value (mA) [ENTER]	[UP] or [DOWN] To arc value (mA) [ENTER]		1-15.00mA AC 1-5.0mA DC
8	Set TEST TIME	[UP] or [DOWN] To test time (sec) [ENTER]	[UP] or [DOWN] To test time (sec) [ENTER]	[UP] or [DOWN] To test time (sec) [ENTER]	0.1-999sec
9	Set RAMP TIME	[UP] or [DOWN] To ramp time (sec) [ENTER]	[UP] or [DOWN] To ramp time (sec) [ENTER]	[UP] or [DOWN] To ramp time (sec) [ENTER]	0.1-99.9sec
10	To Accept SETUP	[PROG]	[PROG]	[PROG]	

2.3.1 Programming an AC Hipot Test

- | | |
|------------------------------------|---|
| • Press [PROG] key once. | AC LED is flashing. |
| • Press [ENTER] key once. | kV LED is lit and voltage display is flashing. |
| • Enter Test Voltage in (kV) | (Use UP or DOWN keys). |
| • Press [ENTER] key once | 50Hz/60Hz LED is flashing. |
| • Enter Line Frequency in (Hz) | (Use UP or DOWN keys). |
| • Press [ENTER] key once | HI LED is lit and current display is flashing. |
| • Enter High Current Limit in (mA) | (Use UP or DOWN keys). |
| • Press [ENTER] key once | LO LED is lit and current display is flashing. |
| • Enter Low Current Limit in (mA) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | ARC LED is lit and current display is flashing. |
| • Enter ARC Setting in (mA) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | TEST LED is lit and time display is flashing. |
| • Enter Test Time in (sec) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | RAMP LED is lit and time display is flashing. |
| • Enter Ramp Time in (sec) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | AC LED is flashing. |
| • Press [PROG] key once to accept. | |

To **STORE** the present set of test conditions proceed as follows:

- Press the [STORE] key.
- Press the **UP ▲** key or the **DOWN ▼** key to the setup number desired.
- Press [ENTER] to store the present test conditions.

Before programming an **AC Hipot** Test, please **NOTE** the following limits:

<u>Test Voltage:</u>	Range: 0.1-5kV AC	
<u>Frequency:</u>	50Hz or 60Hz	
<u>HI Limit:</u>	Range: 0.001-15.00mA AC	Any measured value of leakage current above set limit will result in a FAIL decision.
<u>LO Limit:</u>	Range: 0.001mA – HI Limit	Any measured value of leakage current below set limit will result in a FAIL decision. To DISABLE the limit function, press DOWN key to display [----].
<u>ARC:</u>	Range: 1-15.00mA AC	Any measured value of arc current above set limit will result in a FAIL decision.
<u>TEST Time:</u>	Range: 0.1-999sec	To set TEST Time to Continuous Mode , Press DOWN key to a display of [----].
<u>RAMP Time:</u>	Range: 0.1-99.9sec	To set RAMP Time = 0, Press DOWN key to a display of [----].

WARNING

EXTREME CAUTION MUST BE USED BY THE OPERATOR.
IN CONTINUOUS MODE, HIGH VOLTAGE IS APPLIED TO THE TEST TERMINALS UNTIL THE
[STOP] BUTTON IS PRESSED OR A HIGH CURRENT LIMIT IS EXCEEDED.

2.3.2 Programming a DC Hipot Test

- Press [PROG] key once.
- Enter Test Mode(AC/DC/IR)
- Press [ENTER] key once.
- Enter Test Voltage in (kV)
- Press [ENTER] key once.
- Enter High Current Limit in (mA)
- Press [ENTER] key once.
- Enter Low Current Limit in (mA)
- Press [ENTER] key once.
- Enter ARC Setting in (mA).
- Press [ENTER] key once.
- Enter Test Time in (sec).
- Press [ENTER] key once.
- Enter Ramp Time in (sec).
- Press [ENTER] key once.
- Press [PROG] Key once to accept.

AC LED is flashing
(Use UP or DOWN keys).
Voltage Display is flashing.
(Use UP or DOWN keys).
HI LED is lit and current display is flashing.
(Use UP or DOWN keys).
LO LED is lit and current display is flashing.
(Use UP or DOWN keys).
ARC LED is lit and current display is flashing.
(Use UP or DOWN keys).
TEST LED is lit and time display is flashing.
(Use UP or DOWN keys).
RAMP LED is lit and time display is flashing.
(Use UP or DOWN keys).
DC LED is flashing.

To STORE the present set of test conditions proceed as follows:

- Press the [STORE] key.
- Press the **UP ▲** key or the **DOWN ▼** key to the setup number desired.
- Press [ENTER] to store the present test conditions.

Before programming a DC Hipot Test, please NOTE the following limits :

<u>Test Voltage:</u>	Range: 0.1-6kV DC	
<u>HI Limit:</u>	Range: 0.001-5.0mA DC Range: 0.001-7.5mA (10/20/30)	Any measured value above set limit will result in a FAIL decision
<u>LO Limit:</u>	Range: 0.001mA- HI Limit	Any measured value below set limit will result in a FAIL decision. To DISABLE limit function, Press DOWN key to display [----].
<u>ARC:</u>	Range: 1-5.0mA DC Range: 1-7.5mA (10/20/30)	Any measured value above set limit will result in a FAIL decision
<u>TEST Time:</u>	Range: 0.1-999sec	To set TEST Time to Continuous Mode , Press DOWN key to a display of [----].
<u>RAMP Time:</u>	Range: 0.1-99.9sec	To set RAMP Time = 0, Press DOWN key to a display of [----].

WARNING

EXTREME CAUTION MUST BE USED BY THE OPERATOR.
IN CONTINUOUS MODE, HIGH VOLTAGE IS APPLIED TO THE TEST TERMINALS UNTIL THE [STOP] BUTTON IS PRESSED OR A HIGH CURRENT LIMIT IS EXCEEDED.

2.4 Programming An Insulation Resistance Test (Sentry 30/35 only)

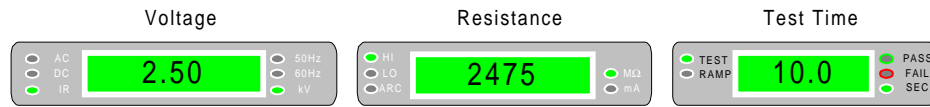


Figure 2-2: IR Test Parameter Display

Figure 2-2 shows the IR test parameter display. The sequence of steps in Table 2-2 is shown below.

- | | |
|------------------------------------|---|
| • Press [PROG] key once. | AC LED is flashing. |
| • Enter Test Mode (IR) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | IR & kV LEDs are lit and voltage display is flashing. |
| • Enter Test Voltage in (kV). | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | LO & MΩ LEDs are lit and display is flashing. |
| • Enter Low Limit in MΩ. | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | HI & MΩ LEDs are lit and display is flashing. |
| • Enter High Limit in MΩ | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | TEST LED is lit and time display is flashing. |
| • Enter Test Time in (sec) | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | RAMP LED is lit and time display is flashing. |
| • Enter Ramp Time in (sec). | (Use UP or DOWN keys). |
| • Press [ENTER] key once. | IR LED is flashing. |
| • Press [PROG] key once to accept. | |

To STORE the present set of test conditions proceed as follows:

- Press the [STORE] key.
- Arrow UP ▲ or arrow DOWN ▼ to the setup number desired.
- Press [ENTER] to store the present test conditions.

Before programming an IR Test, please NOTE the following limits :

<u>Test Voltage:</u>	Range : 0.05-1.00kV DC	
<u>LO Limit:</u>	Range : 1-9999MΩ	
<u>HI Limit:</u>	Range : LO Limit – 9999MΩ	Any measured value above set limit will result in FAIL decision. To Disable limit function, Press DOWN key to display [----].
<u>Test Time:</u>	Range : 0.1-999sec	Any measured value below set limit will result in FAIL decision. To set TEST Time to Continuous Mode , Press DOWN key to a display of [----].
<u>Ramp Time:</u>	Range : 0.1-99.9sec	To set RAMP Time = 0, Press DOWN key to a display of [----].

WARNING

Setting TEST TIME to CONTINUOUS MODE means HIGH VOLTAGE is applied to test terminals UNTIL the [STOP] button is pressed or an Insulation Resistance Limit is exceeded.

CAUTION

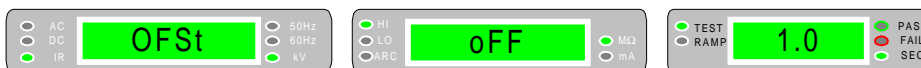
When programming an Insulation Resistance (IR) test, set the RAMP TIME >1sec, or inconsistent test results may occur.

2.5 Instrument Zeroing/Offset

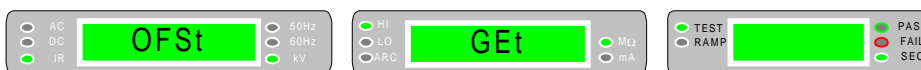
The Sentry instrument provides automatic zeroing/offset for lead or fixture effects. During the zeroing/offset process a correction is made (subtracted out) as the result of lead leakage current and stored in instrument memory to be applied to ongoing measurements. For maximum measurement accuracy it is recommended that the unit be zeroed after power-up, any time the test parameters are changed and any time the test leads or fixture is changed. **The instrument should warm-up for at least 15 minutes prior to zeroing.**

PROCEED AS FOLLOWS FOR AUTOMATIC ZEROING/OFFSET:

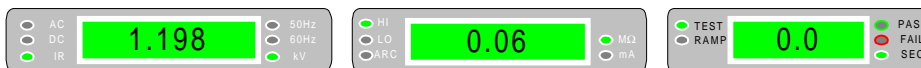
- Continuity Check must be set to OFF (paragraph 2.12).
- Plug the cable set (or other leads/fixture) into the front panel GND and H.V. connectors.
- With the instrument in the power-up state, Press **[ENTER] 2X**. Press **[UP ▲] 1X**.
- Press **[UP ▲]** key **1X**, (or **[DOWN ▼]** key 1X) display should read : **OFSt** and **oFF**.



- Press **[UP ▲]** key **1X** (or **[DOWN ▼]** key 1X) display should read : **OFSt** and **GEt**.



- Push the **[START] 1X** and the unit will perform a measurement and automatically store the offset value.



- The offset will remain **ON** until turned off by pressing the **[ENTER]** key 2X, and the **[UP ▲]** key 1X (or **[DOWN ▼]** key 1X) to **oFF**. If the instrument is powered down with the offset on it remains in effect when the unit is again powered up.

The following formulas apply to the offset function:

For AC offset current < 50μA:

$$\text{Display current} = \sqrt{(\text{current read})^2 - (\text{offset current})^2}$$

For DC offset or AC offset current ≥ 50μA:

$$\text{Display current} = (\text{current read}) - (\text{offset current})$$

2.6 Connection to Device Under Test

Before connecting the device for test, **press the [STOP] key** and make sure the red **DANGER** light is **OFF**.

Connect the black test cable to the front panel GND connector. The metal retaining bracket attached to this cable is intended to lock behind the connector and prevent this cable from accidentally coming loose. Make sure this bracket is locked in place. Rotate the outer portion of the black connector counter clockwise (ccw) to loosen and rotate clockwise (cw) to lock the retaining bracket in place.

Plug the red test cable into the H.V. connector on the front panel.

Connect the black test cable (GND) to one side of the device under test and the red test cable (High Voltage) to the other side of the device under test.

The Continuity Check Connector is connected to exposed metal on the chassis of the device under test (DUT).

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

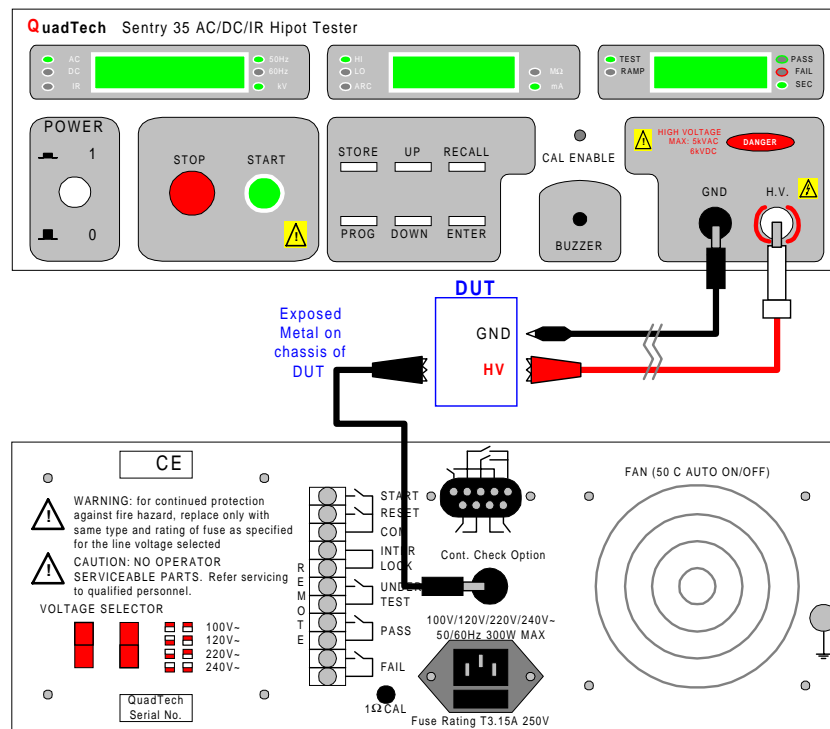


Figure 2-3: Connection To Device Under Test (DUT)

2.7 Measurement Procedure

Before a measurement is made verify the following:

- 1 Sentry instrument [POWER] ON
- 2 15 minute warm-up
- 3 Test parameters programmed
- 4 Test setup stored
- 5 Offset function initiated
- 6 Continuity Check selected OFF
- 7 Device Under Test (DUT) connected

The operator has the choice of performing a test at **power-up conditions** (test conditions at which the instrument was last powered down), or recalling one of 40 2-step or 80 single-step **stored setups**. Refer to paragraph 2.3, 2.4 or 2.8 for instructions to change the test mode and/or test conditions.

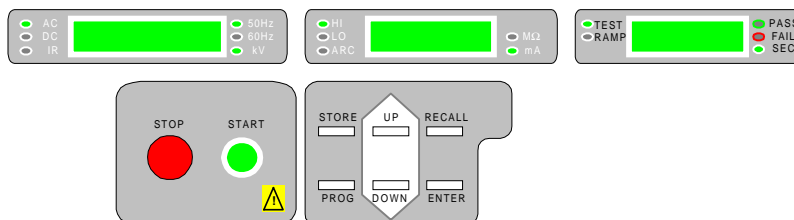
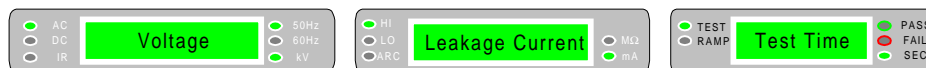


Figure 2-4: Instrument Control Keys

To initiate a test at “power up conditions” proceed as follows:

- Press **[STOP]** (red button) to place the instrument in its standby ready-to-test state.
- Press **[START]** (green button) to start the test. When this button is pressed the high voltage is turned on. This is indicated by the **DANGER** light being ON to warn the operator that high voltage is present at the test leads. The voltage display will indicate the voltage value, the measure display will show current leakage value and the timer will show a countdown.



- Depending on the test conditions, the test voltage will cut off if a limit is exceeded or cut off when the test time has expired. In the case of a FAIL situation press the **[STOP]** button once to stop buzzer and test.
- The **[STOP]** button can be pressed at any time to stop the test.

To initiate a test with “stored setup” proceed as follows :

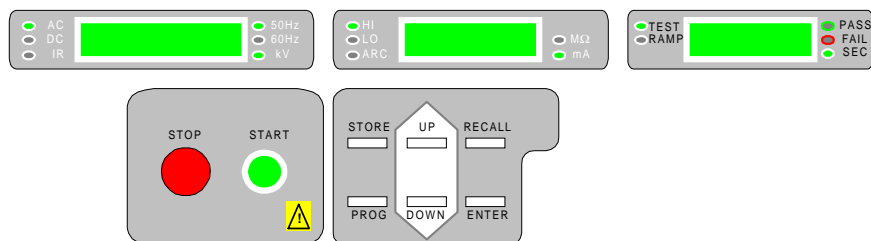


Figure 2-5: Instrument Control Keys in RECALL mode

Sentry Hipot Testers with software version 2000-07-12 (or later) installed have the following memory enhancement:

40 Memory Locations with 2-Steps each

or

80 Memory Locations with 1-Step each

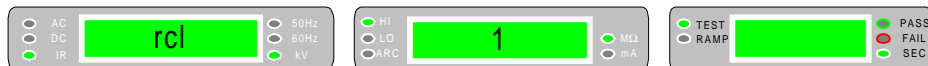
An additional menu selection has been added to allow selection of either single or dual step memory locations. To change between the two modes Press [ENTER] key three times and then press [↓] key. Press [ENTER] key 4 times. Display will show Step No “1” or “2”. Use [↓] to change between 1 step or 2 steps per memory location. Storing and recalling of setups is performed as in the standard Sentry except rather than memory location 1 through 10, there will be locations 1 through 40 or 1 through 80 depending upon the number of steps chosen.

NOTE:

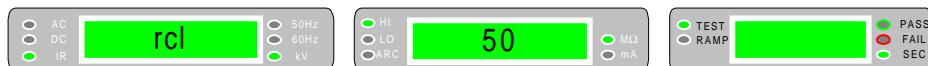
When a setup is stored with OFFSET set to ON, the offset value is stored in memory.

To recall one of the forty (or 80) setups proceed as follows:

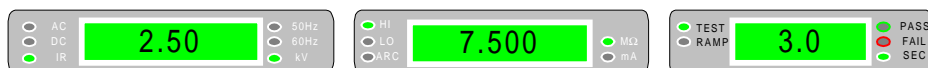
- Press the [RECALL] key 1X.



- Press Arrow [UP ▲] (or arrow [DOWN ▼]) to the setup number desired (Location X).



- Press [ENTER] to load the stored test conditions and then initiate a test as just described.



- Press [STOP] key 1X.
- Press [START] key 1X. Record Readings.
- At ANY time, press [STOP] key 1X to terminate HV to output terminals.

2.8 Programming A Two-Step Test

Each test can consist of one or two steps in sequence, for example, a typical two step test might be an AC hipot test followed by an IR test. Each step may be programmed for any available function (AC, DC or IR) with programmed test conditions independent from the other step.

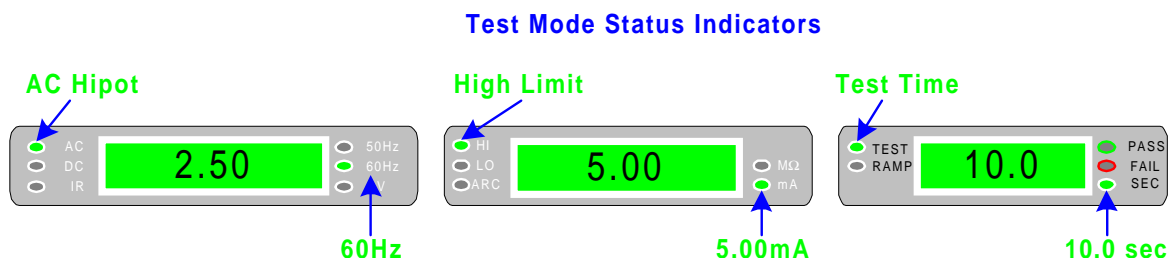


Figure 2-6: Test Mode Status Indicators

To change the test mode proceed as follows:

- With the instrument in standby status ([STOP] button previously pressed and no lights flashing).
- Press the [UP ▲] key to select or examine step 1.
- Press the [DOWN ▼] key to select or examine step 2.
- **NOTE : For a single step test, the test voltage for step 2 must be set to 0.00, setting the test voltage for step 1 to 0.00 will inhibit all testing.**
- To change a test mode select the step to be changed (1 or 2) as described above.
- Press [PROG] (the AC/DC /IR light will be blinking).
- Press [UP ▲] key (or [DOWN ▼] key) to the newly desired test mode (AC, DC or IR).
- Enter your Test Parameters (Refer to Table 2-2).
- Press [PROG] to accept these Test Parameters.
- Press [STORE] to store this Test Setup.

Example of test mode change:

With no light flashing if [UP ▲] key selects AC and [DOWN ▼] key selects DC this means that an AC Hipot and then a DC Hipot test would be performed in sequence (providing neither test voltage is set to 0.00)

Let's assume it's desirable to change the DC Hipot test to an IR test so that an AC hipot and IR test are performed sequence. With no light flashing arrow [DOWN ▼] to DC, press [PROG], arrow [DOWN ▼] to IR and press [PROG] again.

2.9 Special Function Key Lock

In the key lock mode the program function (ability to change test conditions) of the instrument is disabled. It is however possible to recall any of the 10 setups and test. To activate or deactivate the key lock function proceed as follows:

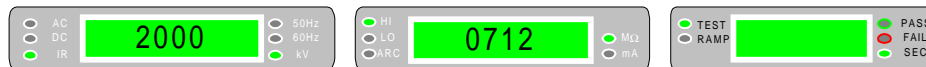
- Instrument [POWER] should be **OFF**.
- Press both the **[POWER]** and **[STOP]** buttons at the same time.
- Hold until display indicates KEY LOCK ON or OFF.
- Press **[UP]** key (or **[DOWN]** key) to select desired state.
- Press **[ENTER]**.

2.10 Software Version Display

The version of software, installed in the instrument, can be displayed on the front panel.

To display software version:

- Press the front panel [POWER] switch to **ON** and **immediately** press the **[ENTER]** key. The year will be shown in the left display and the month and day in the right display as illustrated below. This software version display is only held for a couple of seconds.



2.11 Clear Setup Memory

All stored test conditions in instrument memory (10 setups) can be cleared with a few key strokes.

To clear setup memory:

- Instrument in standby status (Stop button previously pressed and no lights flashing).
- Press the **[ENTER]** key three times.
- Press the **[UP ▲]** key one time.
- Press **[ENTER]** to clear memory.
- Press **[PROG]** to cancel.

2.12 Continuity Check

When activated the Sentry instrument provides an automatic continuity check preceding the Hipot or IR tests. The continuity check verifies the resistance to be less than 1 ohm between the rear panel continuity check connection and instrument ground. When the continuity function is turned on the Sentry will proceed into the normal Hipot or IR test only if the continuity check is good (pass condition).

Proceed as follows for Continuity Check ON or OFF:

- Instrument in the power-up state.
- Press **[ENTER]** key two times.
- Press **[DOWN ▼]** key once.
- Display reads “CONT OFF” (Unless continuity is already selected ON).
- Press **[UP ▲]** key (or **[DOWN ▼]** key) to display **CONT ON**.
- Press **[ENTER]** to accept.

The continuity check will remain ON until turned off by using the procedure above and selecting “CONT OFF”. If the instrument is powered down with the continuity check on it remains in effect when the unit is again powered up. Continuity is not stored as part of test setups.

2.13 Fail Continuous Mode

When activated the Sentry instrument provides a continuous test mode where the test voltage does **NOT** shut down on a FAIL condition.

WARNING
THIS MODE IS NOT RECOMMENDED AS A NORMAL OPERATING MODE.
(On the remote control connector, one FAIL contact must be connected to START and the other FAIL contact connected to COM)

Proceed as follows for Fail Continuous mode ON or OFF:

- Instrument in the power-up state.
- Press **[ENTER]** key three times.
- Press **[DOWN ▼]** key once.
- Display reads “FAIL Cont OFF” (Unless Fail Continuous mode is already selected ON).
- Press **[UP ▲]** key once (or **[DOWN ▼]** key) to display “FAIL Cont ON”.
- Press **[ENTER]** to accept.

The fail continuous mode will remain ON until turned off by using the procedure above and selecting “FAIL Cont OFF”. If the instrument is powered down with fail continuous ON it remains in effect when the unit is again powered up. Fail continuous mode is not stored as part of test setups.

2.14 Beeper Setup Mode

When activated the Sentry instrument provides a beep or audible sound for pass/fail indication and also when any one of six data entry key is depressed.

Proceed as follows for beeper ON or OFF:

- Instrument in the power-up state.
- Press **[ENTER]** key three times.
- Press **[DOWN ▼]** key once.
- Display reads “FAIL Cont OFF” (or FAIL Cont ON”).
- Press **[ENTER]** key once.
- Display reads “bEEp Off” (Unless Beep is already selected ON).
- Press **[UP ▲]** key once (or **[DOWN ▼]** key) to display “bEEp ON”.
- Press **[ENTER]** to accept.

The beeper will remain ON until turned off by using the above procedure and selecting “bEEp OFF”. If the instrument is powered down with beeper on it remains in effect when the unit is again powered up. The beeper setup is not stored as part of test setups.

2.15 Auto Range Mode

When Auto Range selection is turned on the full scale current range (above or below 3mA) is selected automatically based on measured current. When the selection is turned off the full scale current range is determined by the user programmed maximum current limit. The low current range (3mA full scale) results in increased measurement resolution.

Proceed as follows for auto range mode ON or OFF:

- Instrument in the power-up state.
- Press **[ENTER]** key three times.
- Press **[DOWN ▼]** key once.
- Display reads “FAIL Cont OFF” (or “FAIL Cont ON”).
- Press **[ENTER]** key two times.
- Display reads “Auto CHAN OFF” (Unless Auto Range is already selected ON).
- Press **[UP ▲]** key once (or **[DOWN ▼]** key) to display “Auto CHAN ON”
- Press **[ENTER]** key to accept.

The auto range mode will remain ON until turned off by using the above procedure and selecting “Auto CHAN OFF”. If the instrument is powered down with auto range on it remains in effect when the unit is again powered up. Auto range mode is not stored as part of test setups.

2.16 Software Automatic Gain Control

The Sentry instrument is equipped with software automatic gain control (AGC) to ensure the output voltage is at the correct value. The normal default is AGC ON which is okay when measuring resistors. Under special circumstances, when measuring large capacitive devices it is best to select “SOft AGC OFF”.

Proceed as follows for Software AGC mode ON or OFF:

- Instrument in the powered-up state.
- Press **[ENTER]** key three times.
- Press **[DOWN ▼]** key once.
- Display reads “FAIL Cont OFF” (or “FAIL Cont ON”).
- Press **[ENTER]** key three times.
- Display reads “SOft AGC OFF”.
- Press **[UP ▲]** key once (or **[DOWN ▼]** key) to display “ SOft AGC ON”.
- Press **[ENTER]** key to accept.

The software automatic gain control (AGC) remains ON until turned off by using the above procedure and selecting “SOft AGC OFF”. If the instrument is powered down with software AGC on it remains in effect when the unit is powered up again. Software AGC is not stored as part of test setups.

2.17 Pass/Fail Modes

The Sentry instrument will display FAIL indicators under certain test setup conditions. In a WAC or WDC test, setting the current limits ARC, High and Low incorrectly can result in FAIL indicators. In a WAC, WDC or IR test, if Continuity Check is selected ON and the continuity check clip lead set is not connected properly to the rear panel or there is greater than 1Ω between rear panel and instrument ground, the Sentry will display a FAIL indicator. Table 2-3 defines the limits for the test parameters listed above. Paragraphs 2.17.1 – 2.17.5 illustrate examples of FAIL indicators.

The Sentry instrument will not allow the operator to input a low limit that is greater than the high limit. The Sentry instrument will allow the operator to input an ARC limit that is greater than the low limit or the high limit.

Table 2-3: Test Parameter Limits

Sentry Model #	Parameter	WAC	WDC	IR
(10/20/30)	High Limit	0-15mA	0-7.5mA	1-9999MΩ
	Low Limit	0-7.5mA(<High Limit)	0-3.75mA(<High Limit)	1-9999MΩ
	ARC Limit	1-15mA	1-7.5mA	N/A
	Continuity Check	ON or OFF	ON or OFF	ON or OFF
(15/25/35)	High Limit	0-15mA	0-5mA	1-9999MΩ
	Low Limit	0-5.0mA(<High Limit)	0-3.75mA(<High Limit)	1-9999MΩ
	ARC Limit	1-15mA	1-5.0mA	N/A
	Continuity Check	ON or OFF	ON or OFF	ON or OFF

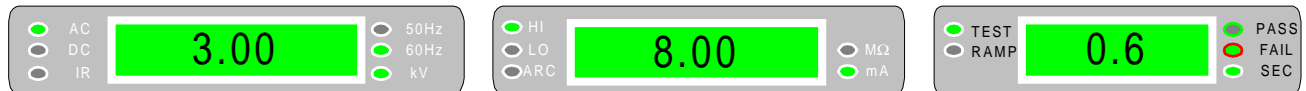
2.17.1 High Limit Failure

Example: WAC Test: 3kV, 60Hz, 7mA(H), 5mA(L), 5mA(ARC), 1.0s (Test), 0.0s (Ramp)

High Limit is set equal to 7mA

Device under Test (DUT) consistently measures 8mA

Sentry Display Panels will read:



Buzzer sounds. The FAIL LED and HI LED are lit. Press [RESET] to stop test.

The High Limit has been set too low. Reprogram High Limit value.

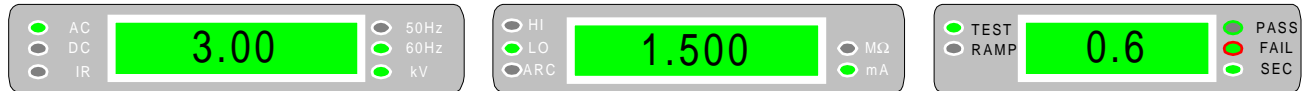
2.17.2 Low Limit Failure

Example: WAC Test: 3kV, 60 Hz, 7mA(H), 2mA(L), 2mA(ARC), 1.0s (Test), 0.0s (Ramp)

Low Limit is set equal to 2mA

Device under Test (DUT) consistently measures 1.5mA

Sentry Display Panels will read:



Buzzer sounds. The FAIL LED and LO LED are lit. Press [RESET] to stop test.

The Low Limit has been set too high. Reprogram Low Limit value.

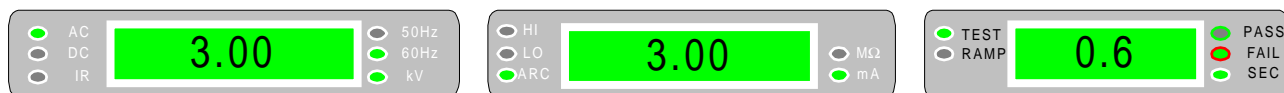
2.17.3 ARC Limit Failure

Example: WAC Test: 3kV, 60Hz, 7mA(H), 3mA(L), 2mA(ARC), 1.0s (Test), 0.0s (Ramp)

ARC Limit is set equal to 2mA

Device under Test (DUT) consistently measures 3mA

Sentry Panels will read:



Buzzer sounds. The FAIL LED and ARC LED are lit. Press [RESET] to stop test.

The ARC Limit has been set too low. Reprogram ARC Limit value.

NOTE:

Although the ARC detect limit can be programmed down to the 10uA level (or lower depending upon the instrument), the instrument will only detect (measure) the ARC value at $\geq 1\text{mA}$.

2.17.4 CONt Ck Failure

Example: WDC Test as specified in ¶ 2.17.4.

Continuity Check selected ON.

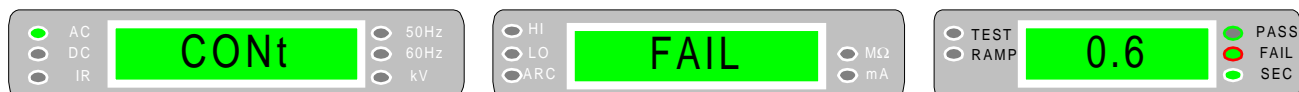
Sentry unit will perform Continuity Check preceding WAC, WDC or IR Tests.

The Continuity Check Clip lead set is NOT connected to Sentry rear panel “CONT. CHECK”

OR

Sentry measures greater than 1Ω between rear panel and instrument ground.

Sentry Display Panels will read:



Buzzer sounds. The FAIL LED is lit. Press [RESET] to stop test.

Select Continuity Check OFF (¶ 2.12):

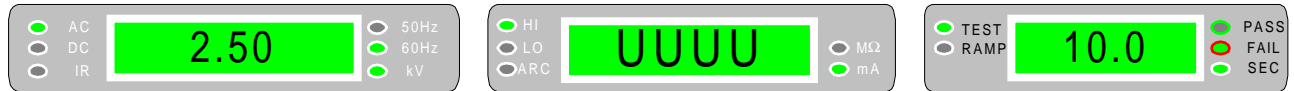
- Press [ENTER] key two times.
- Press [DOWN ▼] key once.
- Display reads “CONt ON” (Unless continuity is already selected OFF).
- Press [UP ▲] key (or [DOWN ▼] key) to display **CONt OFF**.
- Press [ENTER] to accept.

2.17.5 Exceed Upper Measurement Range

Example: WAC Test: 2.5kV, 60Hz, 7mA(H), 2mA(L), 2mA(ARC), 10.0s (Test), 0.0s (Ramp)

Upper Limit that Sentry instrument can measure is equal to 15mA.

Device under Test (DUT) has leakage current that consistently measures 17mA.



The display as indicated means that the unit has exceeded the upper measurement limit for leakage current or insulation resistance.

Buzzer sounds. The FAIL LED is lit. Press [RESET] to stop test.

The Sentry instrument cannot measure AC current greater than 15mA. Refer to Table 2-3 for Test Parameter Limits.

2.18 Remote Control

Two remote control connectors are located on the rear panel of the instrument with input connections for starting and stopping the unit externally and output connections indicating instrument status and a safety interlock connection.

The **interlock function** on the rear panel remote connector must be properly utilized. **This is an important safety feature for the protection of the operator.** Turn on of the instrument's high voltage is inhibited with no interlock connection and is functional with the interlock jumper in place (as shipped from the factory).

Inputs require a contact closure to ground. Outputs are normally open contacts and are closed when 'true'. Refer to Figures 2-7 and 2-8 for a description of the Sentry rear panel remote connectors and a timing diagram of the remote control feature.

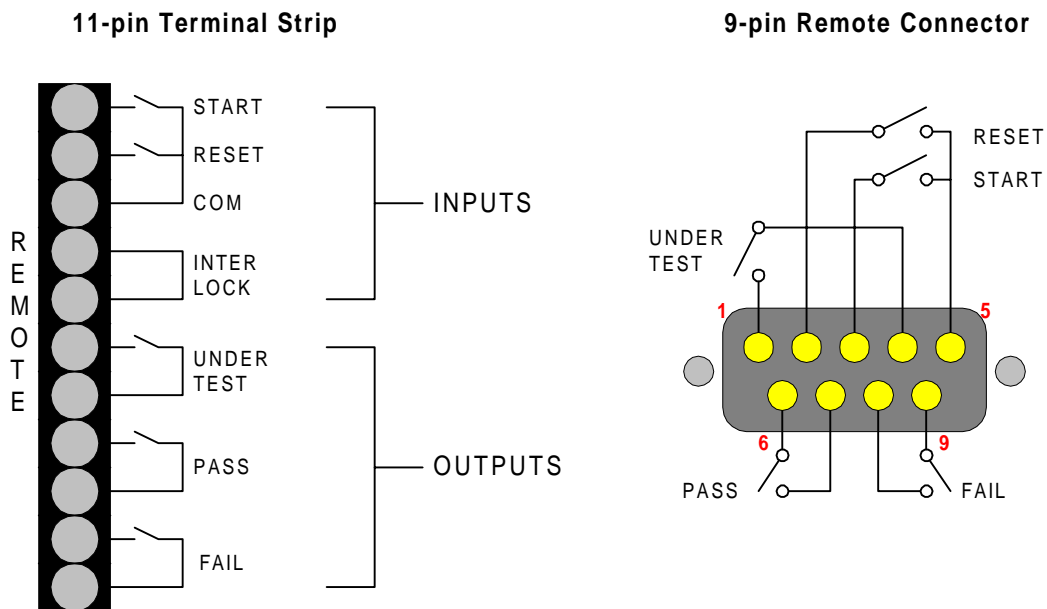


Figure 2-7: Rear Panel Remote Connectors

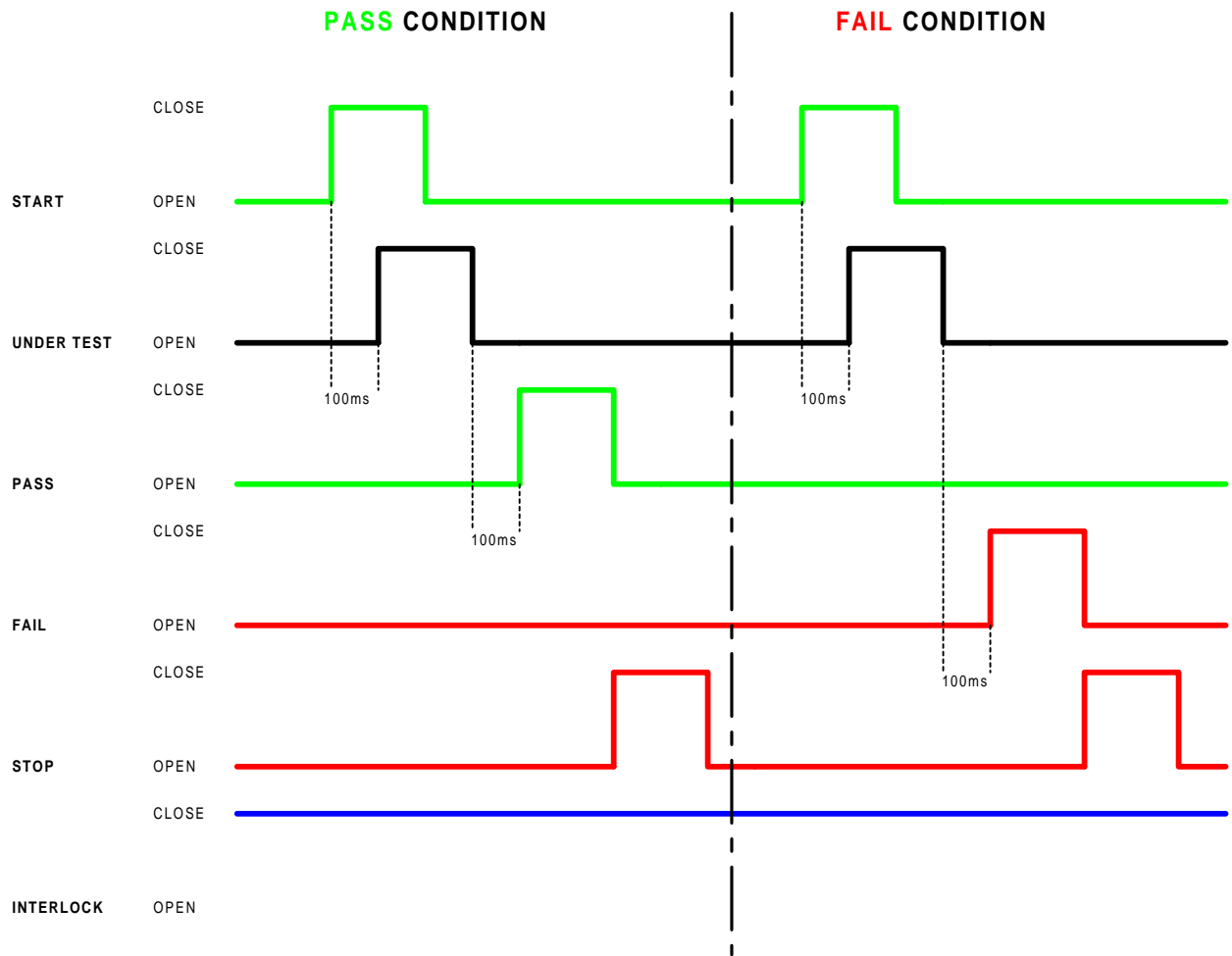


Figure 2-8: Remote Control Timing Diagram

2.19 G16 International Power Strip

The G16 International Power Strip allows connection of standard corded products from several different countries. These being:

* Australia	* United Kingdom	* Denmark
* North America	* Norway	* Finland
* Sweden	* Germany	* Netherlands
* Austria	* Switzerland	* Italy

Figure 2-9 illustrates the connection of the G16 International Power Strip to the Sentry instrument. The 3 G-16 Ground Connectors are connected to the Sentry black GND terminal.

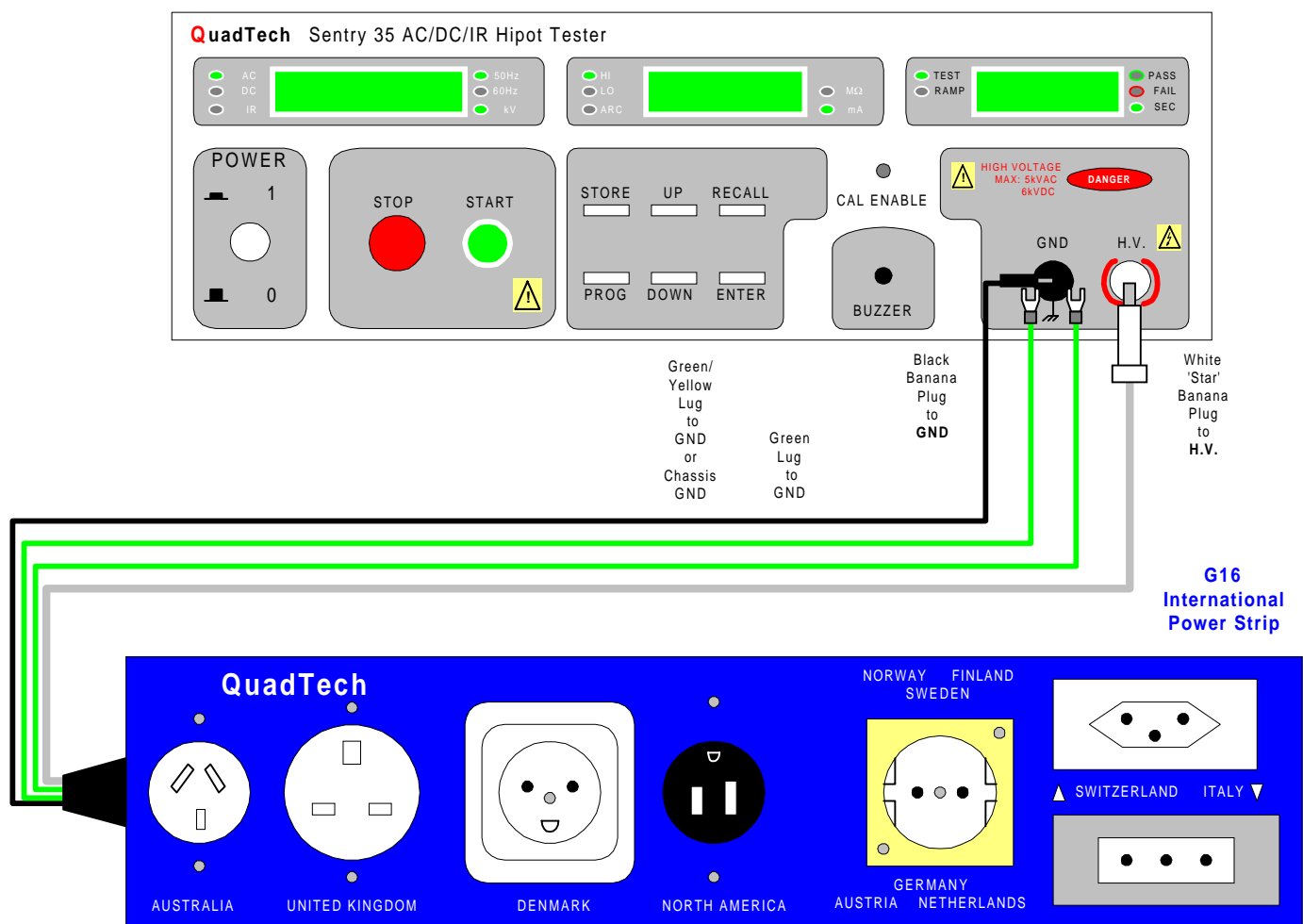


Figure 2-9: G16 International Power Strip Connection

2.20 Corded Product Adaptor

The S03 Corded Product Adaptor provides a three-prong receptacle connection for a product to the Sentry unit through a three-lead set. The leads consist of a white banana plug for connection to the HV output terminal, a black banana plug for connection to the GND terminal and a black clip for connection to the GND terminal. Figure 2-10 illustrates the connection of the S03 Corded Product Adaptor to the Sentry instrument.

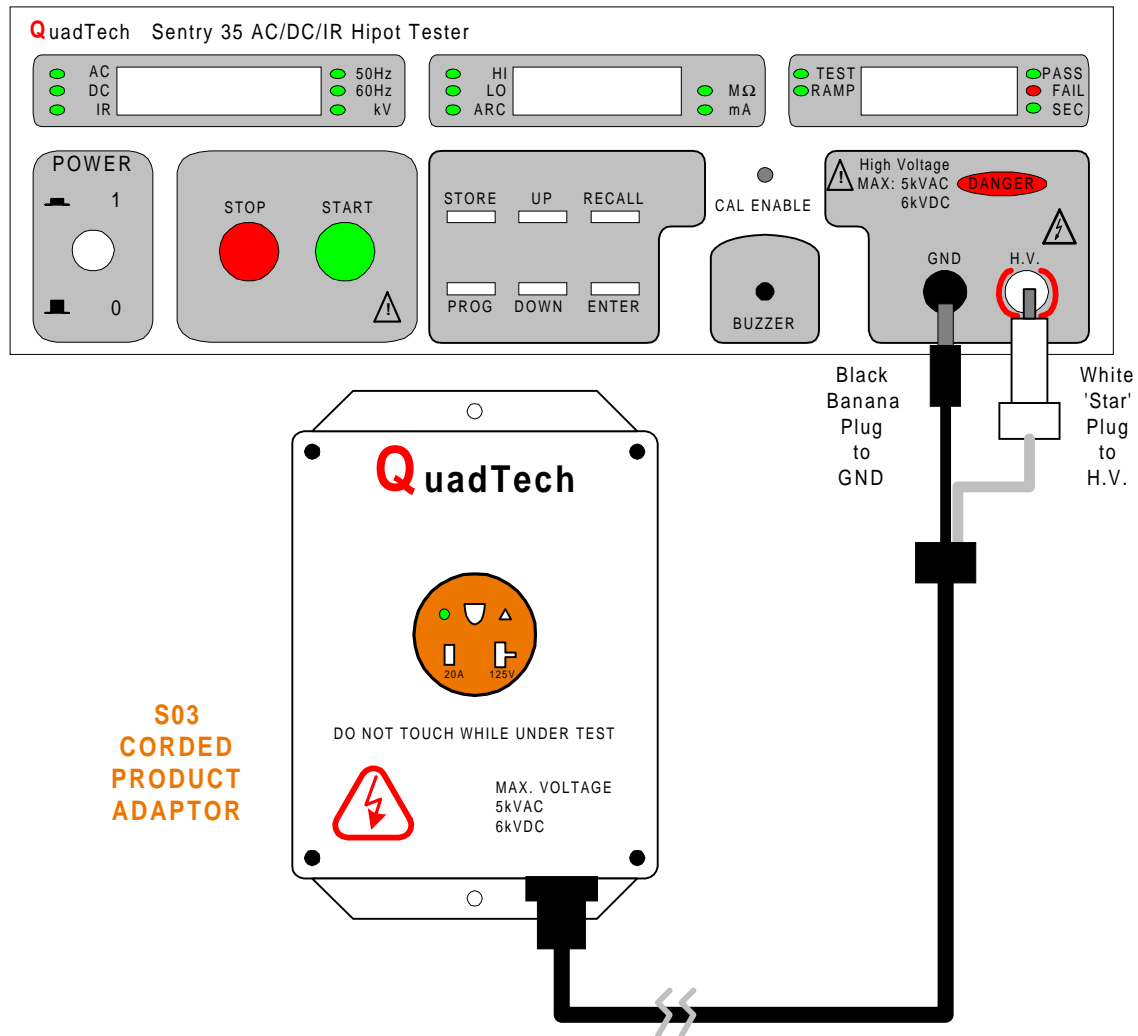


Figure 2-10: S03 Corded Product Adaptor connection to Sentry Instrument

2.21 S05 Foot Switch

The S05 Foot Switch provides hands-free remote testing capability. The spade leads on the S05 Foot Switch are connected (screwed) to the terminal strip on the rear panel of the Sentry instrument. Figure 2-11 illustrates the connection of the S05 Foot Switch to the Sentry instrument.

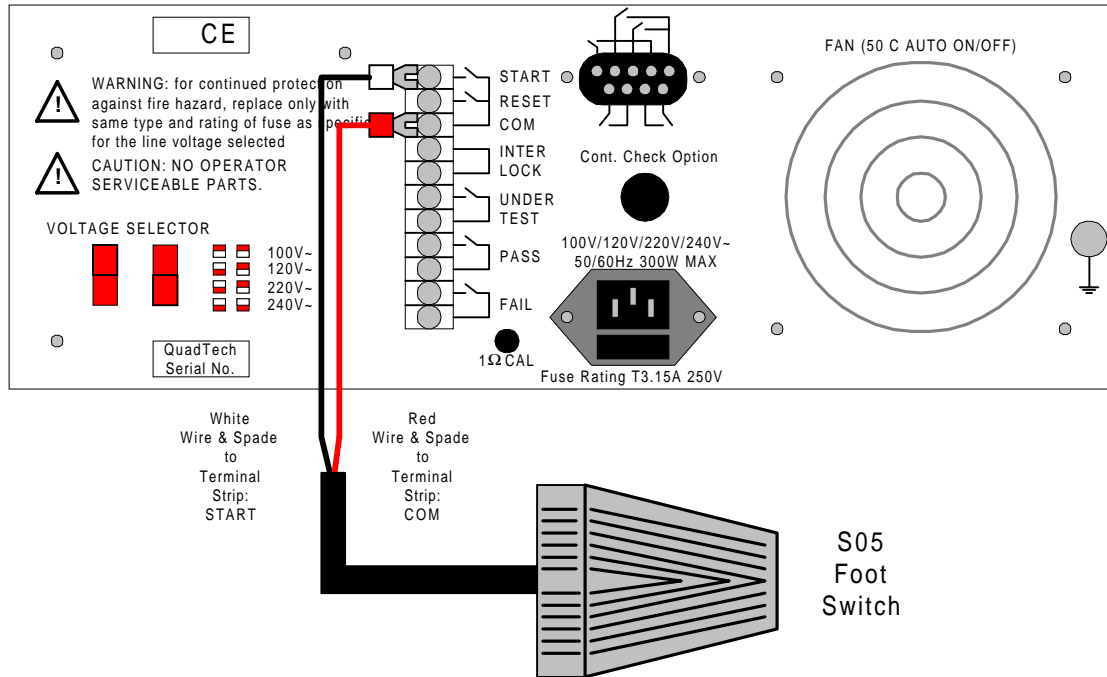


Figure 2-11: S05 Foot Switch

2.22 S06 High Voltage Probe

The S06 High Voltage Probe provides fast testing capability with pinpoint control. The white 'star' banana plug lead on the S06 High Voltage probe is connected to the HV output terminal on the front panel of the Sentry instrument. Figure 2-12 illustrates the connection of the S06 High Voltage Probe to the Sentry instrument.

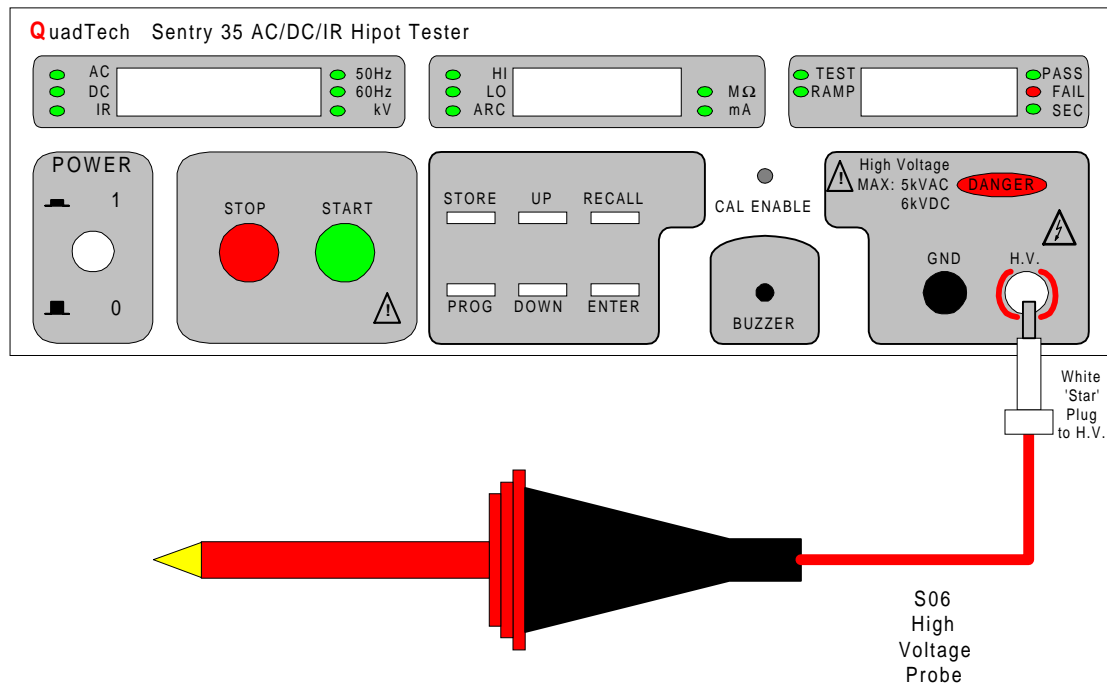


Figure 2-12: S06 High Voltage Probe

2.23 S07 Power Entry Adaptor Cable

The S07 Power Entry Adaptor Cable provides an AC inlet receptacle for connection of a three-wire product to the Sentry instrument through a two-lead set. The leads consist of a white 'star' banana plug for connection to the HV output terminal and a black banana plug with retaining bracket for connection to the GND terminal. Figure 2-13 illustrates the connection of the S07 Power Entry Adaptor Cable to the Sentry instrument.

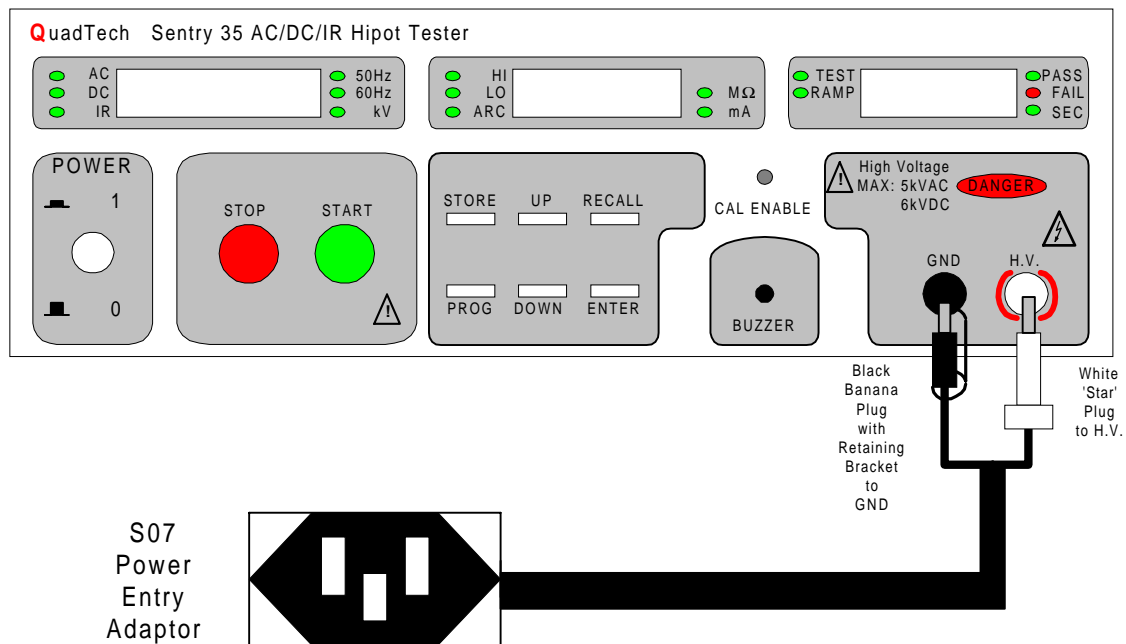


Figure 2-13: S07 Power Entry Adaptor Cable

2.24 S08 Gun Probe

The S08 Gun Probe provides fast testing capability with pinpoint control. The white banana plug lead on the S08 Gun Probe is connected to the HV output terminal on the front panel of the Sentry instrument. Figure 2-14 illustrates the connection of the S08 Gun Probe to the Sentry instrument.

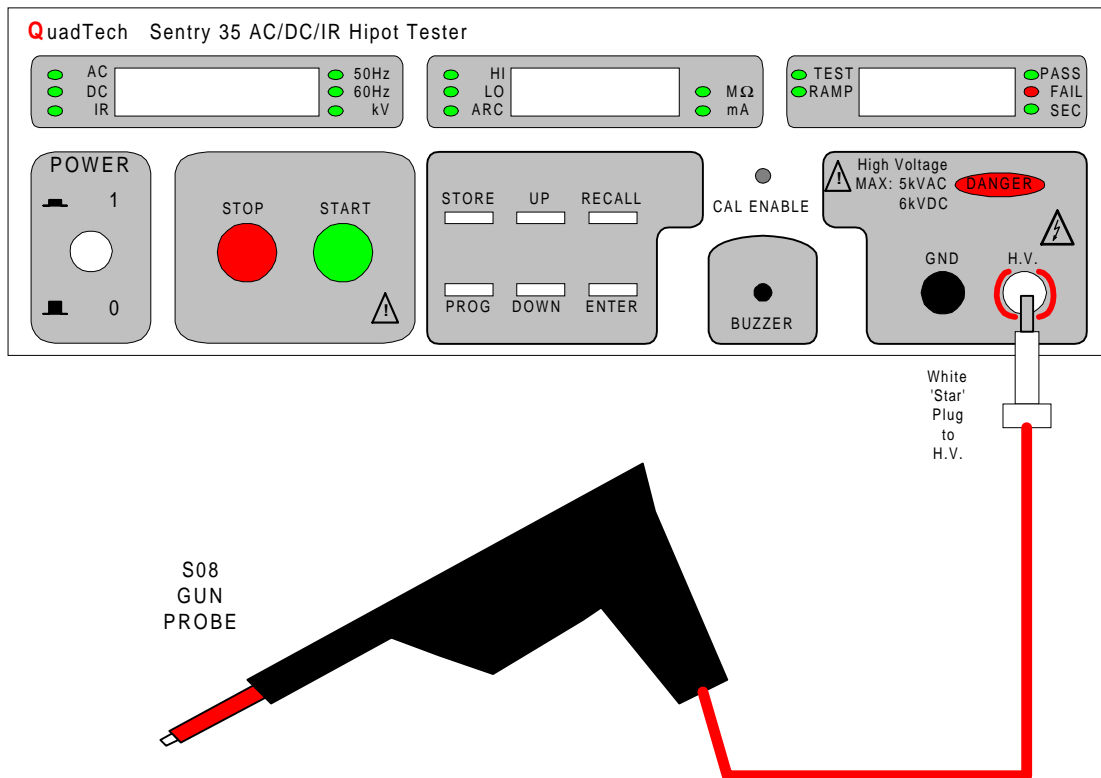


Figure 2-14: S08 Gun Probe connection to Sentry instrument

2.25 Connection to Sentry 50 Ground Bond Tester

The Sentry 50 instrument provides high current testing of ground continuity between chassis and power cord ground. The Sentry 50 Ground Bond tester can be connected to the Sentry Series instrument (10/15, 20/25, 30/35) for complete product testing with the push of one button. When the Sentry 50 has completed a continuity test, with PASS indication, it can remotely start the Sentry 10/15, 20/25 or 30/35 for a hipot test in sequence. The rear panel REMOTE connectors on the two Sentry instruments are connected via the S15 interconnection cable. Figure 2-15 illustrates the connection of a Sentry 50 Ground Bond tester to a Sentry 35 AC/DC/IR tester.

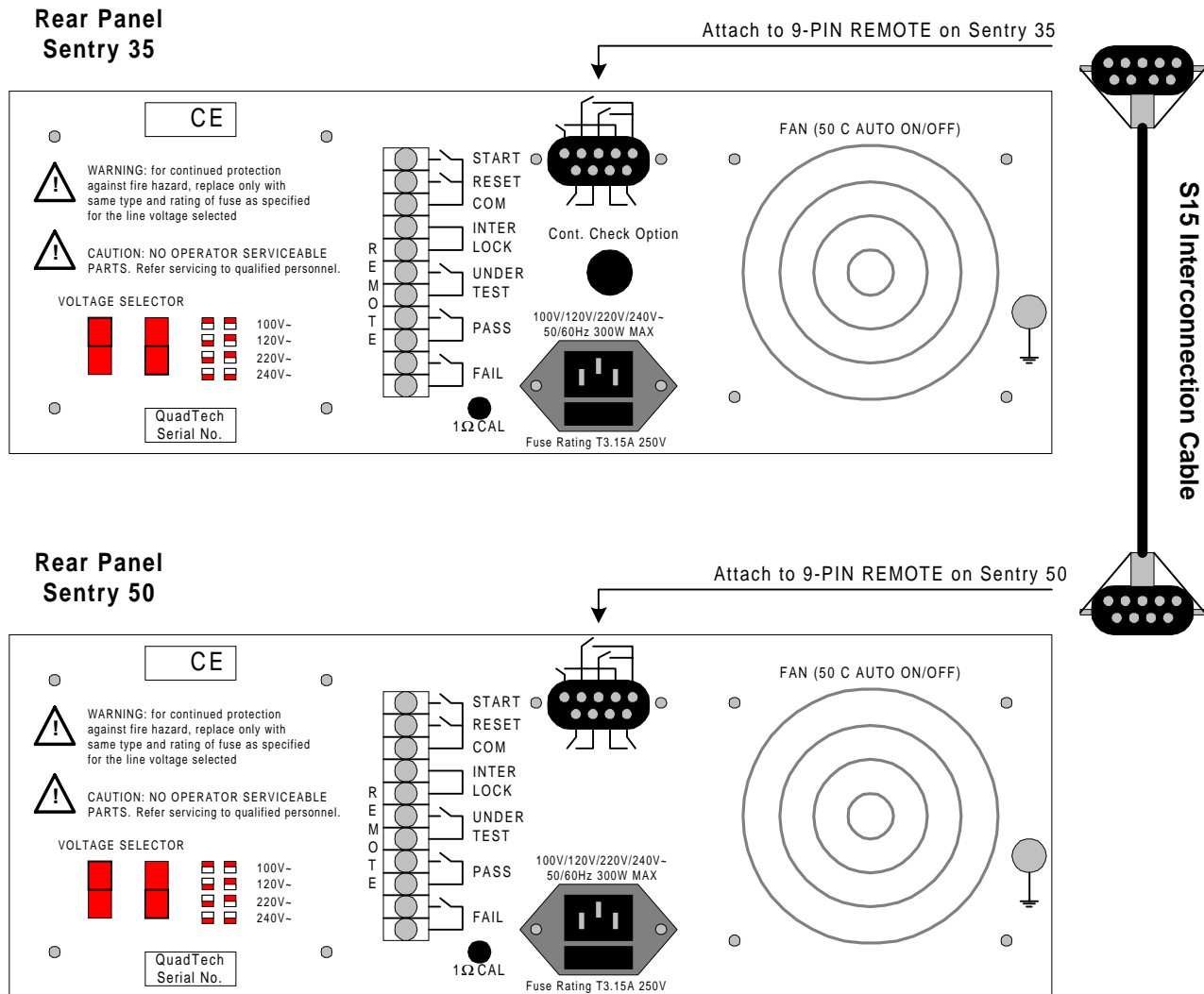


Figure 2-15: S15 Cable Connecting Sentry 50 to Sentry 35

Section 3 : Service & Calibration

3.1 General

Our warranty (at the front of the 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.

3.2 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, MA 01754

Attention: RMA #

Shipments sent collect can not be accepted.

3.3 Calibration

3.3.1 Sentry 10/20/30

3.3.1.1 Equipment Required

Table 3-1: Calibration Equipment

Equipment	Requirements
AC/DC High Voltage Voltmeter	Measure Range : 0 to 4KV, 0.1% accuracy
AC/DC Current Meter	Measure Range : 0.1 to 10mA, 0.15% accuracy
12M Ω Resistance Standard	1200V, 0.1mA (0.12W), 5% accuracy
80K Ω Resistance Standard	1200V, 15mA (20W), 5% accuracy
240K Ω Resistance Standard	1200V, 5mA (6W), 5% accuracy
480K Ω Resistance Standard	1200V, 3mA (4W), 5% accuracy

3.3.1.2 Procedure

Table 3-2: Sentry 10/20/30 Calibration Parameters

Step #	Value	Value	Description	Sentry
1	0.05 KV)	OFST	ACV (AC Voltage Offset)	10,20,30
2	4.00	FULL	ACV (AC Voltage Full Scale)	10,20,30
3	0.05	OFST	DCV (DC Voltage Offset)	20,30
4	4.00	FULL	DCV (DC Voltage Full Scale)	20,30
5	0.05	OFST	IR V (IR Voltage Offset)	30
6	1.00	FULL	IR V (IR Voltage Full Scale)	30
7	OFST	0.1 (mA)	ACA (AC Current Offset) 2.99mA Range	10,20,30
8	FULL	2.5 (mA)	ACA (AC Current Full Scale) 2.99mA Range	10,20,30
9	OFST	2.5 (mA)	ACA (AC Current Offset) 15mA Range	10,20,30
10	FULL	12 (mA)	ACA (AC Current Full Scale) 15mA Range	10,20,30
11	OFST	0.1 (mA)	DCA (DC Current Offset) 2.99mA Range	20,30
12	FULL	2.5 (mA)	DCA (DC Current Full Scale) 2.99mA Range	20,30
13	OFST	2.5 (mA)	DCA (DC Current Offset) 7.5mA Range	20,30
14	FULL	5.0 (mA)	DCA (DC Current Full Scale) 7.5mA Range	20,30

3.3.1.2.1 Voltage Calibration

Connect the HV output terminal of the Sentry 10/20/30 unit to the input terminal of the AC/DC high voltage meter. Connect the GND terminal of the Sentry to the GND terminal of the voltmeter. Using a pen point or tip of a small screwdriver, depress the [CAL ENABLE] switch on the front panel above the buzzer. (Note : To disable CAL merely push the switch a second time).

Press [ENTER] four times.

--	--	--

Press [DOWN] once.

CAL	ON	
-----	----	--

Press [DOWN] until display reads CAL tEst.

CAL	tEst	
-----	------	--

Press [PROG] to enter into calibration.

0.05	OFSt	ACU
------	------	-----

Press [ENTER] to enter step 1

0.05	0.500	0.0
------	-------	-----

Press [START]

0.049	0.060	0.0
-------	-------	-----

Press [UP] or [DOWN] to input reading from the voltmeter.

0.05	0.500	0.0
------	-------	-----

Press [ENTER] then [STOP] to accept reading.

4.00	FULL	ACU
------	------	-----

Press [DOWN] to go to next step.

Continue as described above with calibration steps 2-6 (Table 3-2). After pressing [DOWN] to select the next step, Press [ENTER], [START], [UP] or [DOWN] to input voltmeter reading, then [ENTER] & [STOP] for each step.

NOTE: The values in the boxes next to [START] are examples.

NOTE: Once in the calibration mode ([ENTER] 4x, [DOWN] until CAL tESt, then [PROG]), any or all of the steps (1-14) can be calibrated using the [DOWN] key to scroll through the steps and pressing [ENTER] to select a step to calibrate.

3.3.1.2.2 Current Calibration

Table 3-3 :Resistance Loads

Mode	Step #	Voltage	Range	Calibration Point	Resistance (Load)
AC	7	1200 V	2.99	0.1 mA	12 M Ω
AC	8	1200 V	2.99	2.5 mA	480 K Ω
AC	9	1200 V	15	2.5 mA	480 K Ω
AC	10	1200 V	15	12 mA	80 K Ω
DC	11	1200 V	2.99	0.1 mA	12 M Ω
DC	12	1200 V	2.99	2.5 mA	480 K Ω
DC	13	1200 V	7.5	2.5 mA	480 K Ω
DC	14	1200 V	7.5	5.0 mA	240 K Ω

Connect the HV output terminal of the Sentry 10/20/30 to a resistance box or resistance. Connect an AC/DC current meter in series between the resistance (box) and GND terminal.

To continue calibration from step 6 proceed as follows:

Press [DOWN]

OFS t	0.120	ACA
-------	-------	-----

Press [ENTER]

1.20	2.999	0.0
------	-------	-----

Press [START]

1.996	2.771	0.0
-------	-------	-----

Press [UP] or [DOWN] to input reading from current meter.

Press [ENTER] then [STOP] to accept reading.

1.20	2.999	0.0
------	-------	-----

Press [DOWN] to go to next step.

FULL	2.50	ACA
------	------	-----

Continue as described above with steps 8-14 (Table 3-2). After pressing [DOWN] to select the next step, press [ENTER], [START], [UP] or [DOWN] to enter current meter reading, then [ENTER] & [STOP] for each step.

When all calibration steps are complete:

Press [STOP]

Press [ENTER] four times

Press [DOWN] once

Press [DOWN] until display reads [CAL ON].

Press [PROG]

Release [CAL ENABLE] switch using a pen point or tip of small screwdriver.

3.3.2 Sentry 15/25/35

3.3.2.1 Equipment Required

Table 3-4: Calibration Equipment

Equipment	Requirements
AC/DC High Voltage Voltmeter	Measure Range : 0 to 6KV, 0.1% accuracy
AC/DC Current Meter	Measure Range : 0.1 to 15mA, 0.15% accuracy
12M Ω Resistance Standard	1200V, 0.1mA (0.12W), 5% accuracy
80K Ω Resistance Standard	1200V, 15mA (20W), 5% accuracy
240K Ω Resistance Standard	1200V, 5mA (6W), 5% accuracy
480K Ω Resistance Standard	1200V, 3mA (4W), 5% accuracy

3.3.2.2 Procedure

Table 3-5: Sentry 15/25/35 Calibration Parameters

Step #	Value	Value	Description	Sentry CE
1	0.05 KV)	OFST	ACV (AC Voltage Offset)	15,25,35
2	4.00	FULL	ACV (AC Voltage Full Scale)	15,25,35
3	0.05	OFST	DCV (DC Voltage Offset)	25,35
4	4.00	FULL	DCV (DC Voltage Full Scale)	25,35
5	0.05	OFST	IR V (IR Voltage Offset)	35
6	1.00	FULL	IR V (IR Voltage Full Scale)	35
7	OFST	0.12 mA)	ACA (AC Current Offset) 2.99mA Range	15,25,35
8	FULL	2.5 (mA)	ACA (AC Current Full Scale) 2.99mA Range	15,25,35
9	OFST	2.5	ACA (AC Current Offset) 15mA Range	15,25,35
10	FULL	12	ACA (AC Current Full Scale) 15mA Range	15,25,35
11	OFST	0.12	DCA (DC Current Offset) 2.99mA Range	25,35
12	FULL	2.5	DCA (DC Current Full Scale) 2.99mA Range	25,35
13	OFST	0.12	DCA (DC Current Offset) 7.5mA Range	25,35
14	FULL	5.00	DCA (DC Current Full Scale) 7.5mA Range	25,35

3.3.1.2.3 Voltage Calibration

Connect the HV output terminal of the Sentry 15/25/35 unit to the input terminal of the AC/DC high voltage meter. Connect the GND terminal of the Sentry to the GND terminal of the voltmeter.

Using a pen point or tip of a small screwdriver, depress the [CAL ENABLE] switch on the front panel above the buzzer. (Note : To disable CAL merely push the switch a second time).

Press [ENTER] four times.

--	--	--

Press [DOWN] once.

CAL	ON	
-----	----	--

Press [DOWN] until display reads CAL tEst.

CAL	tEst	
-----	------	--

Press [PROG] to enter into calibration.

0.05	OFSt	ACU
------	------	-----

Press [ENTER] to enter step 1

0.05	0.500	0.0
------	-------	-----

Press [START]

0.049	0.060	0.0
-------	-------	-----

Press [UP] or [DOWN] to input reading from the voltmeter.

0.05	0.500	0.0
------	-------	-----

Press [ENTER] then [STOP] to accept reading.

4.00	FULL	ACU
------	------	-----

Press [DOWN] to go to next step.

Continue as described above with calibration steps 2-6 (Table 3-5). After pressing [DOWN] to select the next step, Press [ENTER], [START], [UP] or [DOWN] to input voltmeter reading, then [ENTER] & [STOP] for each step.

NOTE: The values in the boxes next to [START] are examples.

NOTE: Once in the calibration mode ([ENTER] 4x, [DOWN] until CAL tESt, then [PROG]), any or all of the steps (1-14) can be calibrated using the [DOWN] key to scroll through the steps and pressing [ENTER] to select a step to calibrate.

3.3.1.2.4 Current Calibration

Table 3-6: Resistance Loads

Mode	Step #	Voltage	Range	Calibration Point	Resistance (Load)
AC	7	1200 V	2.99	0.12 mA	10 MΩ
AC	8	1200 V	2.99	2.5 mA	480 KΩ
AC	9	1200 V	15	2.5 mA	480 KΩ
AC	10	1200 V	15	12 mA	100 KΩ
DC	11	1200 V	2.99	0.12 mA	10 MΩ
DC	12	1200 V	2.99	2.5 mA	480 KΩ
DC	13	1200 V	7.5	0.12 mA	10 MΩ
DC	14	1200 V	7.5	5 mA	240 KΩ

Connect the HV output terminal of the Sentry 15/25/35 to a resistance box or resistance. Connect an AC/DC current meter in series between the resistance (box) and GND terminal.

To continue calibration from step 6 proceed as follows:

Press [DOWN]

OFS	0.120	ACA
-----	-------	-----

Press [ENTER]

1.20	2.999	0.0
------	-------	-----

Press [START]

1.996	2.771	0.0
-------	-------	-----

Press [UP] or [DOWN] to input reading from current meter.

Press [ENTER] then [STOP] to accept reading.

1.20	2.999	0.0
------	-------	-----

Press [DOWN] to go to next step.

FULL	2.50	ACA
------	------	-----

Continue as described above with steps 8-14 (Table 3-5). After pressing [DOWN] to select the next step, press [ENTER], [START], [UP] or [DOWN] to enter current meter reading, then [ENTER] & [STOP] for each step.

When all calibration steps are complete:

Press [STOP]

Press [ENTER] four times

Press [DOWN] once

Press [DOWN] until display reads [CAL ON].

Press [PROG]

Release [CAL ENABLE] switch using a pen point or tip of small screwdriver.