

**Harris IRT Enterprises
Multi-Channel Digital Resistance Tester
Model 6012-06XR**

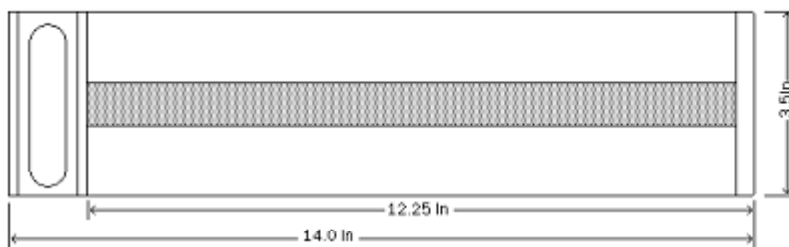
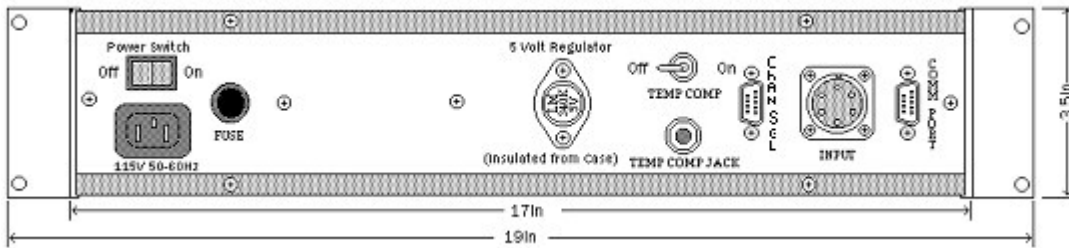


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SPECIFICATIONS

ACCURACY (% FULL SCALE)	$\pm 0.05\%$ (Includes +/- 1 digit) at 25 °C $\pm 0.001\%$ per °C from 0 to 70 °C
RANGES	0 to .1999, 1.999, 19.99, 199.9, 1.999K, 19.99K Ohms
DISPLAY	3 ½ digit LED Display and 4 ½ Digit RS-232 Output
READING RATE	4 readings per second (minimum)
TERMINALS	Max. Full-scale voltage is 2.0 Volts and less than 100 mA. Current
POWER REQUIREMENTS	117 VAC +/- 10 %, 50-60 Hz, 5 Watts. 2 amp Slo-Blo fuse (230 VAC optional)
TEST CONNECTIONS	4 wire Kelvin required
RS-232 Comm Port	9 Pin Female Min D Connector
CHANNEL SELECT	9 PIN Male Min D connector
CONNECTORS	Rear panel MS-style circular connector
LIMIT ALARM TERMINALS	Dry contacts rated at 2A. At 117 VAC

DIMENSIONS



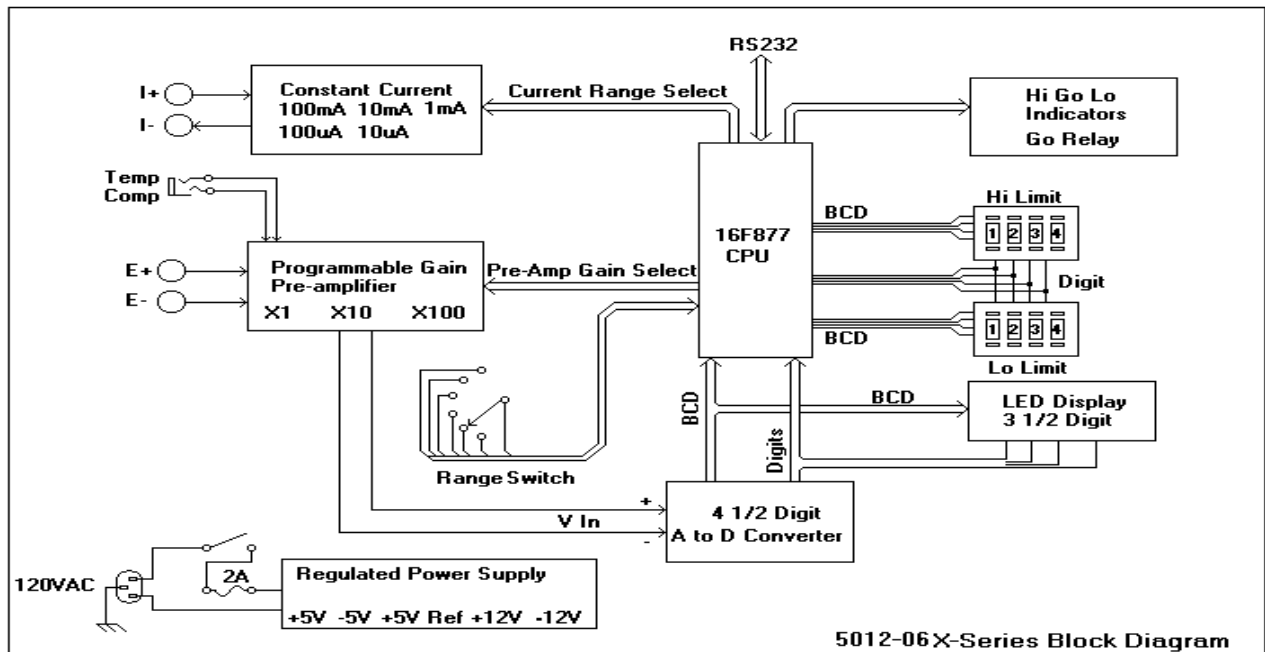
MODEL 6012-06XR Dimensions

THEORY of OPERATION

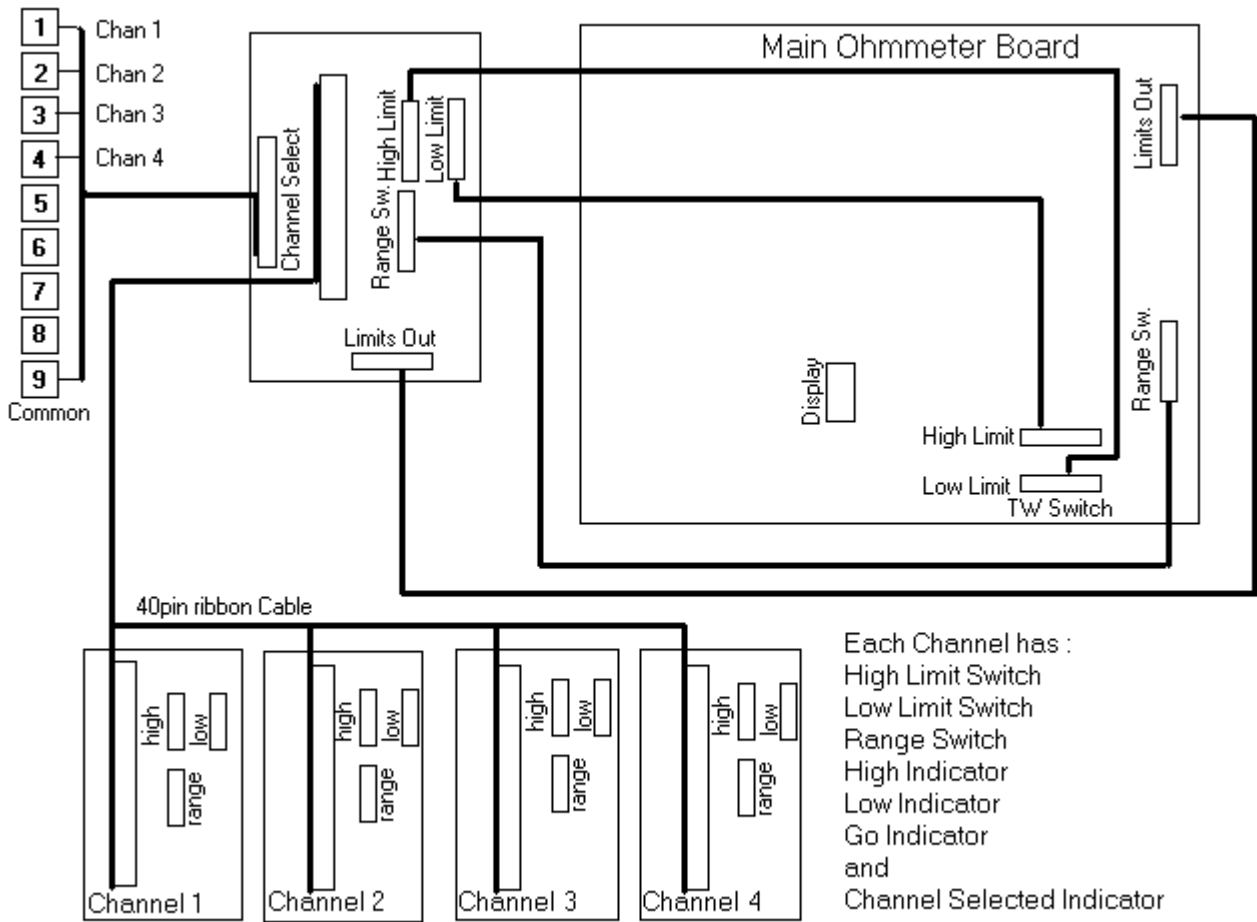
The Harris IRT Enterprises Model 6012-06XR Resistance Tester is an expansion of the basic Model 5012-06XR digital ohmmeter that includes a precision constant current source which drives a known current through an unknown resistance. It features four readings per second and a temperature compensated voltage reference serving both the DVM and the constant current source. This results in a stable calibration reference. A digital voltmeter measures the potential across the resistance and presents a digital display of the resistance in Ohms.

The 16F877 Microprocessor based circuit includes a dual limit comparator which compares the measured resistance with upper and lower tolerance values entered on four sets of front panel thumbwheels. Red and green front panel light emitting diodes indicate whether or not the resistance for each channel is within tolerance. An output relay permits the resistance tester to be converted to a rejection device. For “fail-safe” operation the contacts are normally open. The contacts close if the part is within tolerance. The Microprocessor based circuit also provides for electronic range switching and system control from the four to eight multiplexed channels.

BASIC 5012-06XR BLOCK DIAGRAM

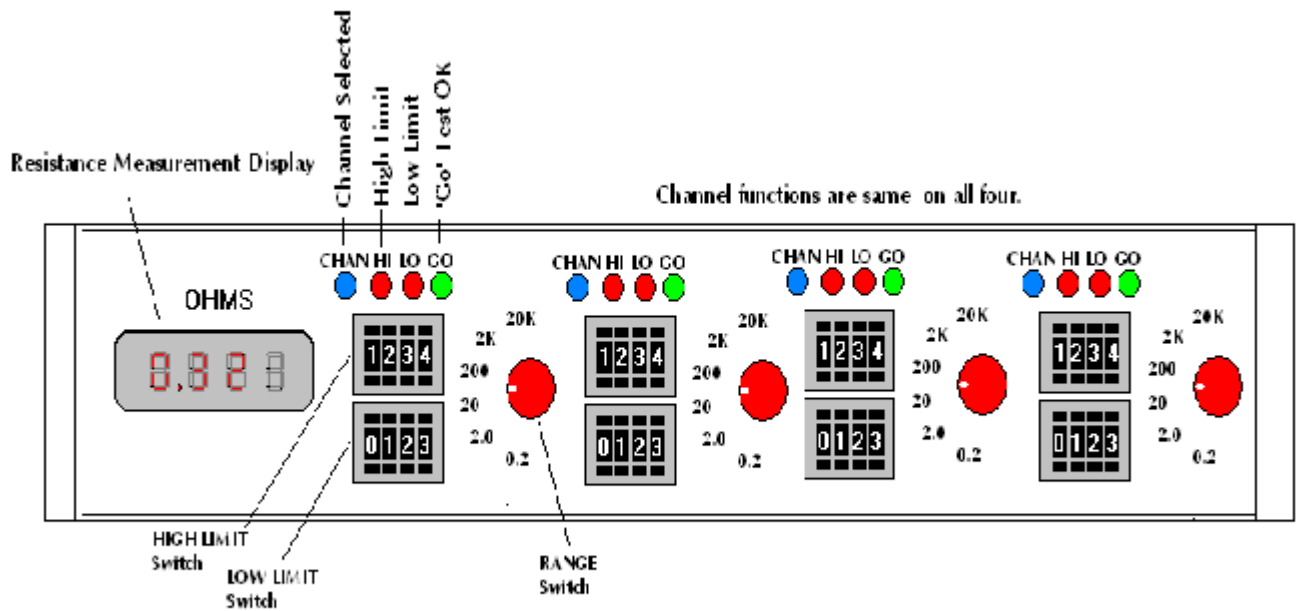


6012-06XR BLOCK DIAGRAM



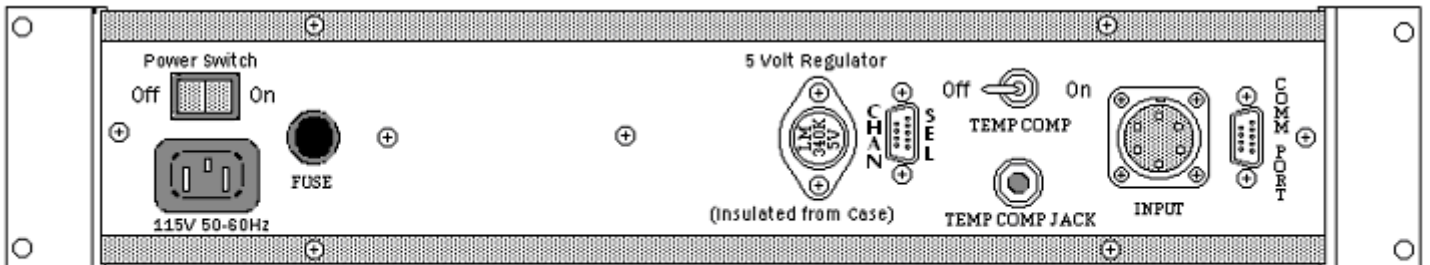
These become active when the channel is selected via 9 pin male 'Min-D' connector on rear panel.

OPERATION of UNIT



Model 6012-06XR Front Panel Functions

REAR PANEL VIEW:



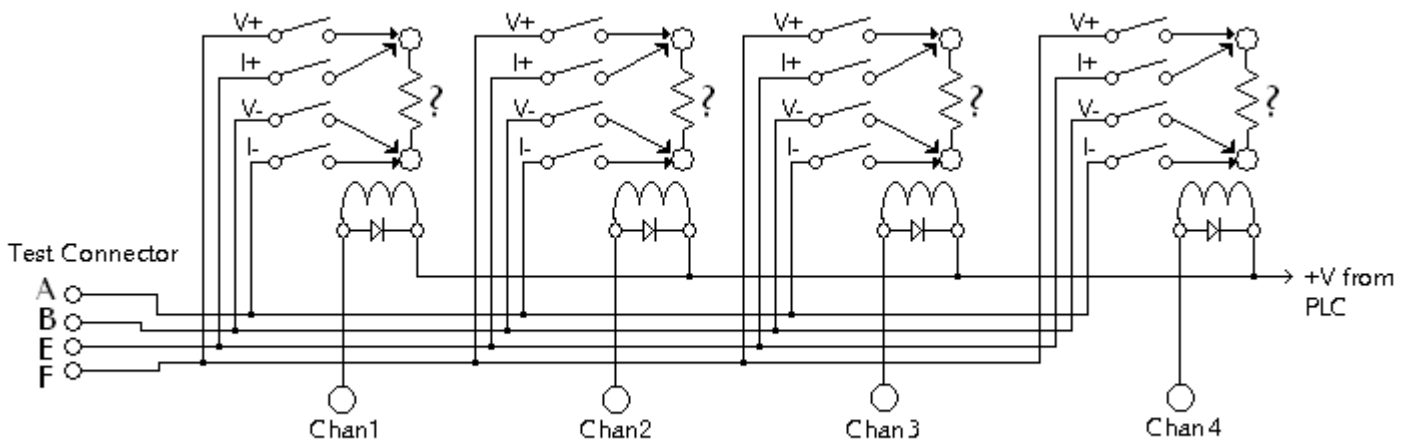
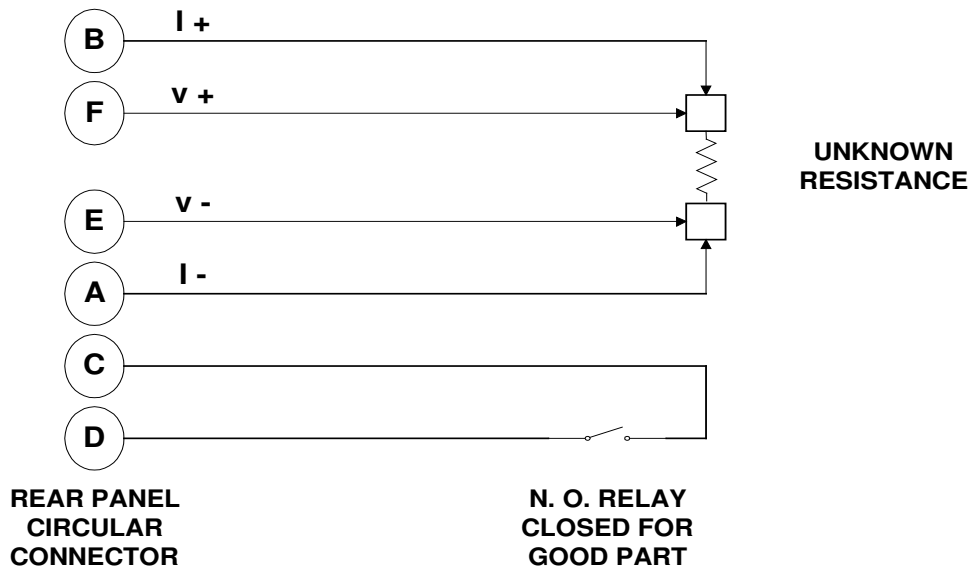
MODEL 6012-06XR

TEST CONNECTIONS:

NOTE:

For greatest accuracy each voltage and current lead must connect separately to the component under test. This is most critical in low resistance measurements.

All Test Connections are made through the single 6 pin MS Style connector on the rear panel. When testing multiple components with the Model 6012-06XR, four separate 4-Pole relays are required to individually connect each component to the Kelvin test connections. Since a Kelvin connection is being made, the contact resistance of the of the relays will not affect measurement accuracy.



6012-06XR CALIBRATION PROCEDURE

REQUIRED EQUIPMENT:

A digital voltmeter with a 4½ digit resolution and a 200 millivolt full scale range is required. You will need a set of six standard resistances, one for each range to be calibrated. A precision of at least 0.02% is necessary to calibrate this instrument to specifications. Harris IRT Enterprises can supply a 0.02% resistance set, Model 2007, with six standard resistances and switchable Kelvin connections. A zero Ohm Shunt is also included in the Model 2007.

Recommended standard resistance

Zero Ohm Shunt
199.90 Milliohms
1.9900 Ohms
19.900 Ohms
199.00 Ohms
1990.0 Ohms
19,900 Ohms

NOTE:

The resistances must be just below the full scale value of each range.

It is important to check the instrument calibration before attempting any adjustments. The Calibration check procedure is listed below. A suitable set of 4-wire Kelvin test leads will be required for connecting the standard resistances to the instrument. The rear panel MS-Style connector must be used for the Kelvin test leads.

Calibration Check: Turn Power On to the instrument and allow a five minute warm-up time before checking calibration. If the Temperature Compensation option is included on your instrument, **Be certain that temperature compensation switch is turned to the 'OFF' position while checking calibration or adjusting calibration.** Check each range using a certified standard value near full scale for the range being checked. All readings must be within 2 counts of the certified value near full scale. Next check all ranges at 10% of full scale using the certified standard for the next lower range. Again the readings must be within 2 counts of the certified value. Note that 1 additional digit of 'dither' is permitted by the specifications. **If the instrument meets these specifications on all ranges, do not perform a calibration procedure.** You will eventually wear out the adjustment potentiometers. If all of the ranges require major adjustment, there is likely a component failure or some problem in the test setup.

Calibration Procedure:

Note: Adjustment locations are shown on the next page.

1. Connect the Kelvin Test leads to the rear panel test connector. Using the Model 2007, install the Zero Ohm on the four binding posts. Select the lowest range (0.2 Ohms). Adjust the **ZERO** potentiometer for a display reading of 0000.
2. Connect a 19900-Ohm standard to the four wire Kelvin test leads and select the 20K Ohm range. Connect a 4 ½-Digit voltmeter across the standard resistor and adjust the potentiometer marked '**I x 1**' until a voltage of 1.9900-V is indicated on the voltmeter. You may also adjust the potentiometer marked **100µA** if more range is needed. With the external voltmeter removed, the 5012 display should be within a percent or so of the correct

OPTIONS

TEMPERATURE COMPENSATION (TC):

Temperature changes of a few degrees in a product can have significant effects on the product's resistance. Therefore, the need for temperature compensation may arise when the temperature of the part being tested changes over a period of time.

The benefits of temperature compensation include the saving of time, energy, and money by eliminating the need to refer to coefficient tables as the ambient plant temperature varies during the day. Before now, such compensation was available only in expensive and delicate laboratory-grade instruments. Harris IRT has now made it available in rugged resistance testers designed for use in production.

With temperature compensation, a probe sends ambient temperature data to the instrument. This temperature information is used to modify the constant current that is being passed through the part under test. The resistance then registered is the resistance the item under test would have at the specified temperature. The compensation option can be calibrated for the measurement of either of two measurement coefficients or it can be operated without any compensation. The accuracy of the compensation is within 0.2 % of the actual resistance between 0 and 50°C.

BINARY CODED DECIMAL (BCD):

BCD is not available on the portable –XP Series Ohmmeters. It is available in the Rack Mount –XR series cases. The BCD output allows the resistance tester to transmit readings to a Programmable Logic Controller (PLC). The BCD option generates a 1, 2, 4, and 8 bit for each of the 5 characters in the resistance reading. An output strobe is also provided to allow synchronization of the resistance tester with the PLC. The BCD output is a TTL logic level of 0 to 5 VDC and a maximum output current of 24 mA.

SAFETY RELAY (RY):

When a resistance tester is used in conjunction with high pot or surge tests, an internal safety relay can be provided to lock-out the resistance tester circuitry during other testing. This will protect the resistance tester from possible high-voltage or high-current damage. Due to space requirements, this is only available in the Rack Mount cases.

RS-232 COMPUTER INTERFACE (RS232):

The RS-232 feature has become a standard option on all 'X' series IRT Instruments and is included in your Model 6012-06XR. A three-wire link between the resistance tester and a computer can be made through the RS-232 port. This is a standard null-modem connection with a 9600-Baud rate, and a word length of 8 bits. The default Baud rate is set to 9600 at the factory. This permits the reading shown on the front panel display to be sent to an external computer or PLC, every time the instrument receives an ASCII from the host. This interface is useful for the statistical analysis of production, predictive control, and data logging. It is compatible with any computer or PLC having an RS-232 port.

Factory settings for the Serial Port: 9600 Baud, No stop bit, 8 bit word, No parity. (9600,N,8,1) Program changes can permit operation up to 56K Baud on special order.

NULL MODEM CONNECTIONS:

The RS-232 port is usually interfaced to a computer using terminal software and responds much like a dumb terminal. For the connecting cable use a MALE DB-9 style connector wired with the following pin configuration.

Function	Connector Pin
<i>Receive (Rx)</i>	<i>Pin 2</i>
<i>Common (Com)</i>	<i>Pin 5</i>
<i>Transmit (Tx)</i>	<i>Pin 3</i>

Whenever the host computer sends any character to the RS-232 port, it will respond by returning the 5 characters plus the decimal shown in the display of the resistance tester. In the case of the Model 5012-06X-Series resistance tester, which has only a four-digit display, a six-digit character group is still sent. The fifth digit is the least significant digit. After the five-character resistance reading is sent including the decimal point, the port will stand by, waiting to receive the next character from the computer before returning the current reading.

NOTE:

The resistance tester does not send Start Of Text (0X02 Hex), End Of Text (0X03 Hex) or a Carriage Return (0X0D Hex). The unit simply stops sending data after the 5th digit. Special ASCII characters can be appended on a custom basis.

- 2) Set the resistance tester to the 2-Ohm range. Make sure the temperature compensation switch located on the rear panel is in the OFF (center) position.
- 3) Place the TC probe and the resistance standard into the specified temperature bath. “Stir” the TC probe and the resistance standard a few times until the readings stabilize. After the display stabilizes (usually a few minutes) record the coil resistance reading.

Step #3 Reading _____

- 4) Switch the temperature compensation switch to the ON position.
- 5) Adjust the TZ Potentiometer until the display reads the same as the recorded reading in Step #3. Place the TC probe and the resistance standard into the HOT bath. “Stir” the TC probe and the resistance standard a few times until the display stabilizes (usually a few minutes), adjust POT TA until the display reads the same as the recorded reading in Step #3.
- 6) Place the TC probe and the one Ohm standard coil into the COLD bath. “Stir” the TC probe and the coil standard a few times until the display stabilizes.

Step #6 Reading _____

- 7) Subtract the reading from Step #6 from the recorded reading in Step #3. Divide the ANSWER by 2. Add this result to the original reading in Step #7, and record the result.

Step #3 reading _____	Answer/2 = _____
Step #6 reading _____	+ Step #6 + _____
Answer = _____	Step #8 result _____

- 8) Adjust potentiometer TA until the display reads the same as the recorded result in Step #8
- 9) Turn the temperature compensation switch to the OFF position. The temperature compensation procedure is completed.

TROUBLE-SHOOTING HINTS

SYMPTOM:

The Resistance Testers' display flashes "0000".

POSSIBLE SOLUTIONS:

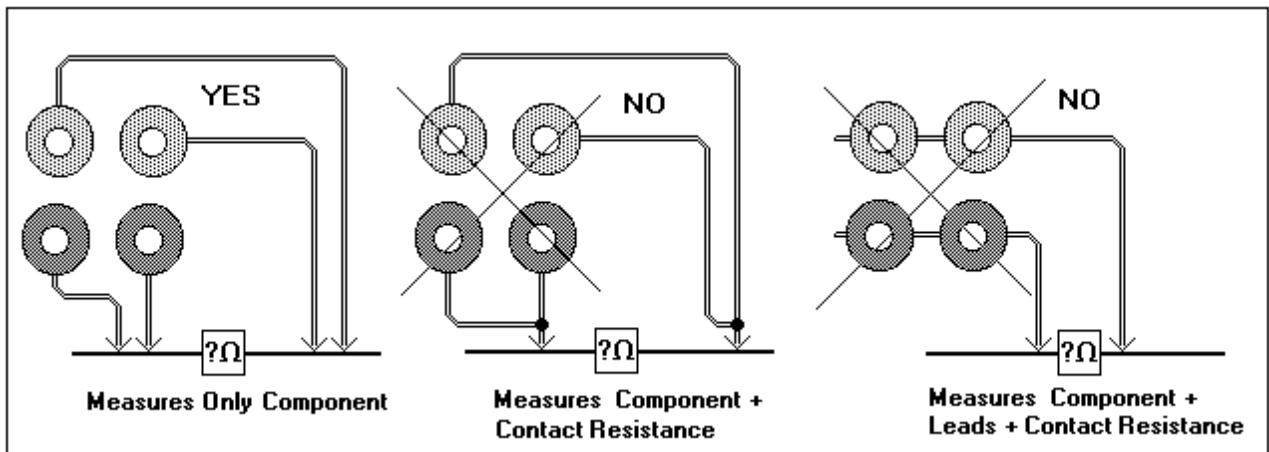
- The Resistance Tester is in over-range mode, select a higher range.
- The ICL7135 CPI A/D converter could be burned-out. This IC is socketed and can easily be replaced by the user¹.

SYMPTOM:

The Resistance Tester displays changing numbers or "garbage" readings.

POSSIBLE SOLUTIONS:

- Check to make sure a "load" is connected to the Resistance Tester via the back panel circular connector or front panel banana plugs. While the Kelvin Connection is open circuit (I+ not connected to E+ and I₋ not connected to E-) the voltage present on the Voltage input terminals will be random. Because there is a small capacitor on the input circuit, you will display any static charge that has accumulated on this capacitor. This is the normal behavior of a Kelvin input instrument.
- Check to make sure you have a valid 4 wire Kelvin connection. (*see illustration below*)



SYMPTOM:

Readings all appear to be incorrect.

POSSIBLE SOLUTIONS:

- Check to see if the Temperature Compensation switch is in the proper position and that the TC probe is completely inserted into the rear panel Jack. Is the Resistance Tester due for calibration? A calibration should be performed once a year.

¹ Opening the meter to replace any IC's could void the manufacturers warranty.

- Insure that the front panel I and E terminals are not connected to permit a 2-wire non-Kelvin test. Although the meter accuracy will be OK on the higher ranges, this will cause severe errors on the lower resistance ranges. This will be a problem even if you are using the MS-Style connector for you Kelvin Leads.
- Using the 4-wire test leads but connecting them to only two ‘pogo’ pins will leave the ‘pogo pin’ resistance and the contact resistance in the measurement. Four individual connections must be made to the test component’s terminals to get a real Kelvin connection.
- One or more of the OP177 op-amps could be burned-out. These IC’s are socketed and can easily be replaced by the user¹.
- Check to make sure you have a true 4-wire Kelvin connection.

NOTE:

Resistance changes as temperature changes. If the ambient temperature varies during the day so will the resistance of the part under test. This could make it appear that the Resistance Tester is not working properly. You may require the use of Temperature Compensation.

For Technical assistance call Harris IRT Enterprises at (740) 369-3580

RETURN POLICY

NOTE:

*Before returning a Resistance Tester for repair or calibration you must **first** call and receive an RMA#. Any package received without an RMA# will be returned to shipper. Please write the RMA# on the package and packing slip.*

To return a Resistance Tester for repair after you receive an RMA# ship to:

**Harris IRT Enterprises
155 Johnson Dr.
Delaware, Ohio 43015
Phone: (740) 369-3580
Fax: (740) 369-2653**

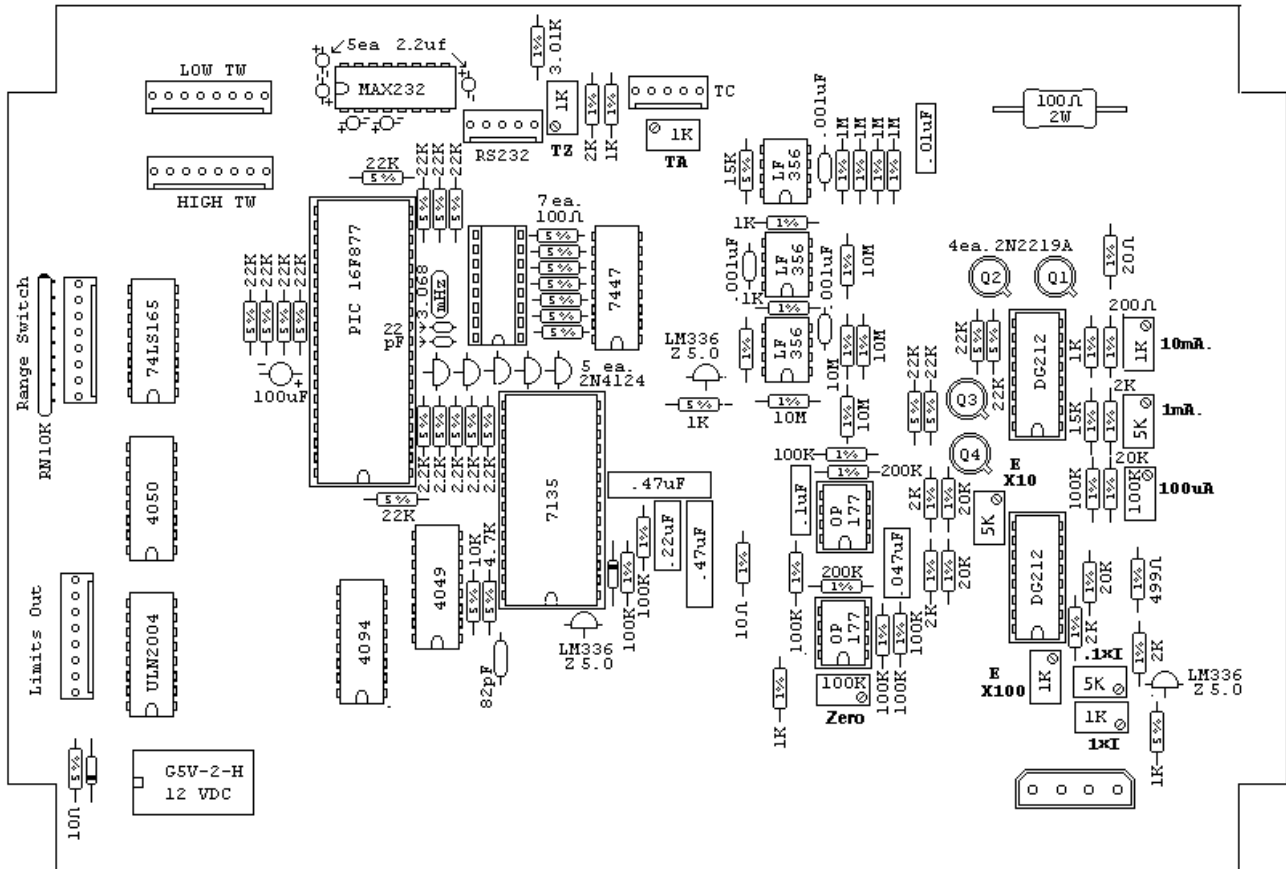
MANUFACTURER’S WARRANTY

Equipment shall meet all engineering performance data and design requirements described in the specifications. Within a period of one year from the date of shipment, if the equipment should fail to function due to a defect in parts or workmanship, Harris IRT Enterprises, at its option, will replace or repair the equipment at its facility in Powell, Ohio.

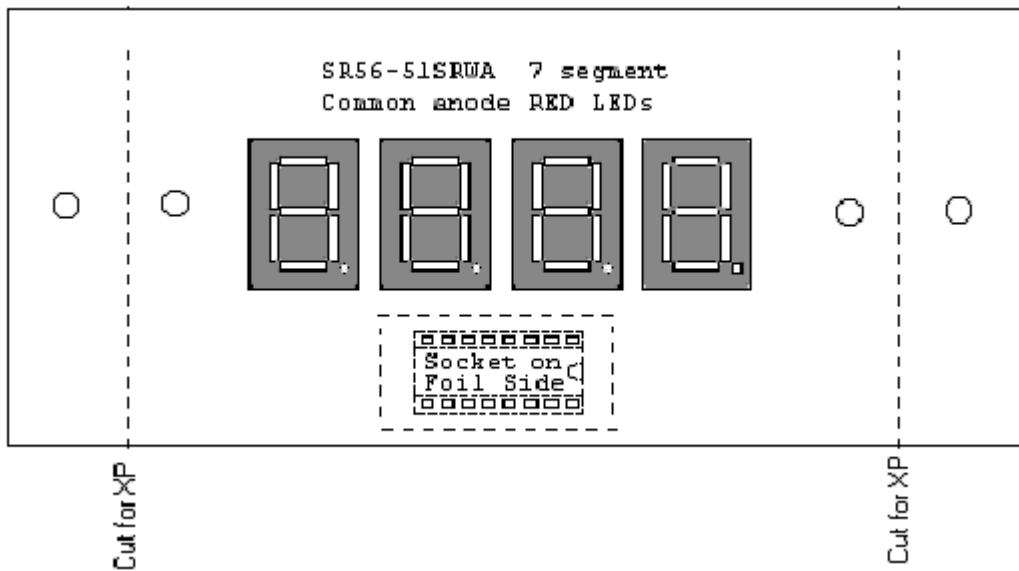
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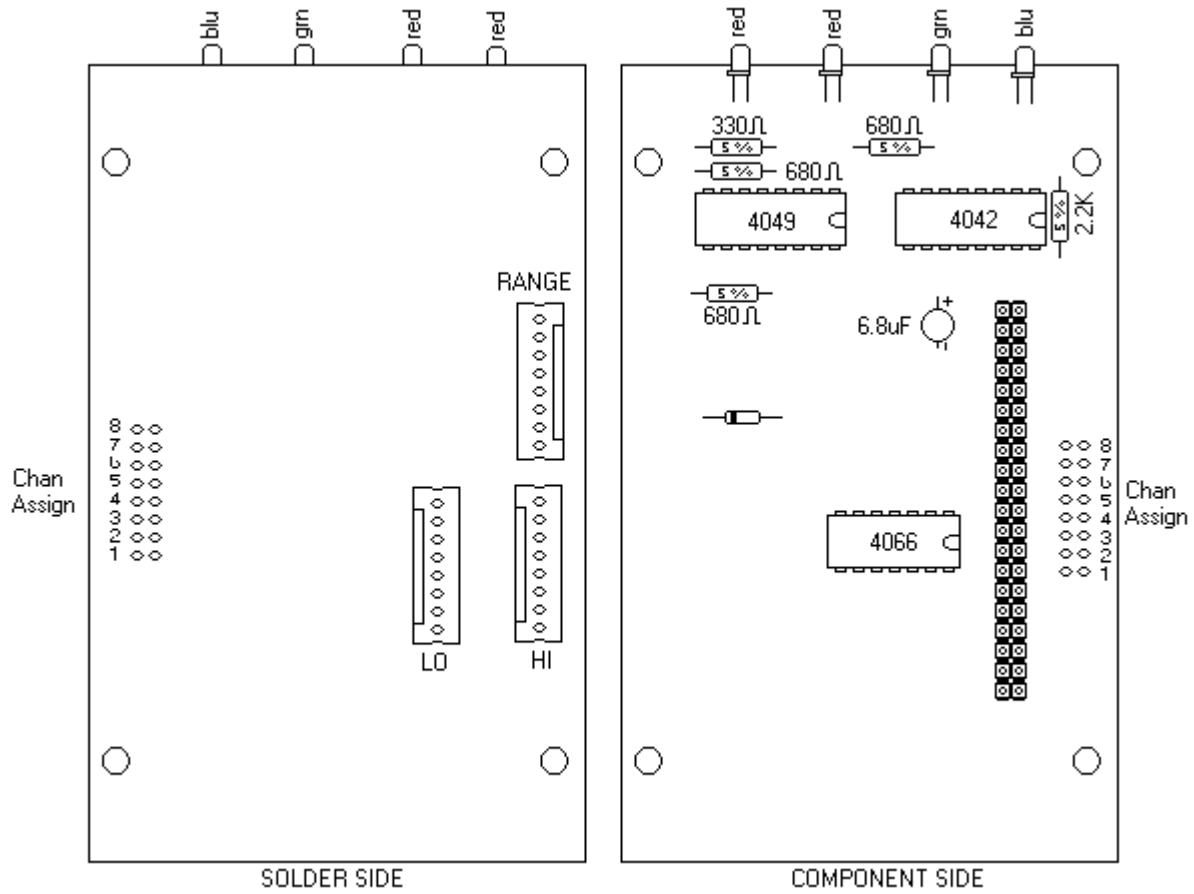
Removing the calibration seal and performing unauthorized repairs will void the calibration and could void the manufacturers warranty. Please call Harris IRT Enterprises before performing any repairs.

MODEL 6012-06X MAIN PCB ASSEMBLY DRAWING



6012X-Series Display Board





Model 6012-06XR Channel Board