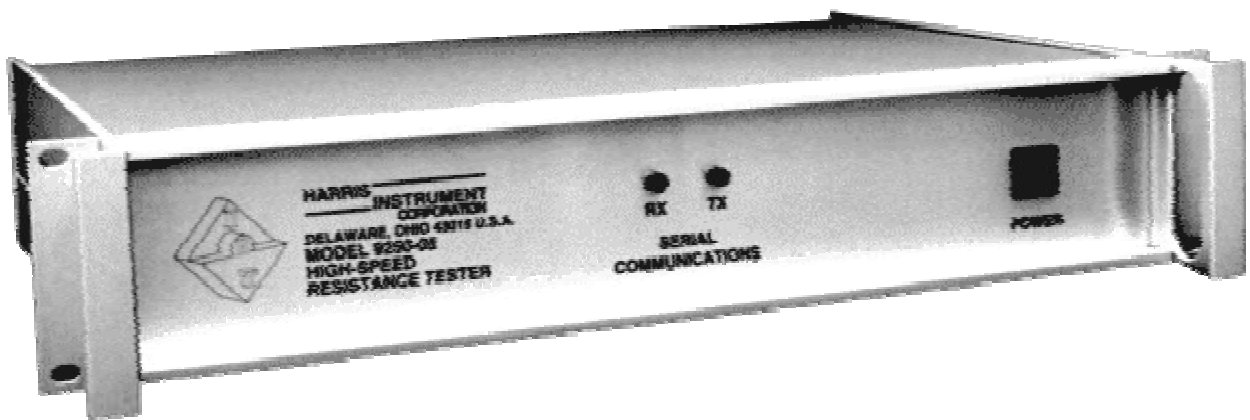


# HARRIS INSTRUMENT

## INDUSTRIAL RESISTANCE TEST EQUIPMENT

### Model 9250-05 High-Speed Resistance Tester



### Operators Manual

# High-Speed Resistance Tester – Model 9250-05 Operators Manual

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## Introduction

The Harris Instrument Corporation High-Speed Resistance Tester – Model 9250-05 is designed for high-volume testing of the resistance of the parts and components manufactured in industrial environments. It is a high-resolution ohmmeter that couples laboratory precision with the durability and speed required by industry.

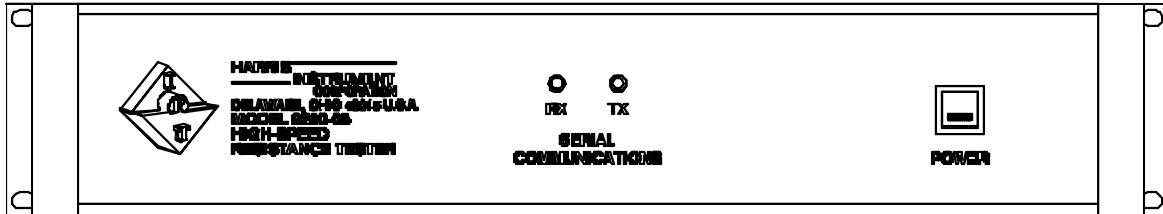


Figure 1: Typical Model 9250-05 Front Panel

Utilizing a powerful digital signal processor (DSP) micro-controller, the Model 9250-05 is capable of 250 readings per second over a serial communications link (RS-232) or via a remote LED Display/Keypad Customer interface (DK Option). The Model 9250-05 responds to a variety of ASCII commands and includes a help screen for operator assistance. The resistance tester requires connection to a host computer or any device capable of transmitting commands via RS-232. Calibration is software controlled.

## Product Overview

The Model 9250-05 performs a 4½-digit, 4-wire Kelvin-based resistance measurement. The use of a four-terminal resistance measurement system eliminates the inaccuracies introduced by test lead resistance. All functions of the Model 9250-05 are selected and data is returned by commands across the serial communications link.

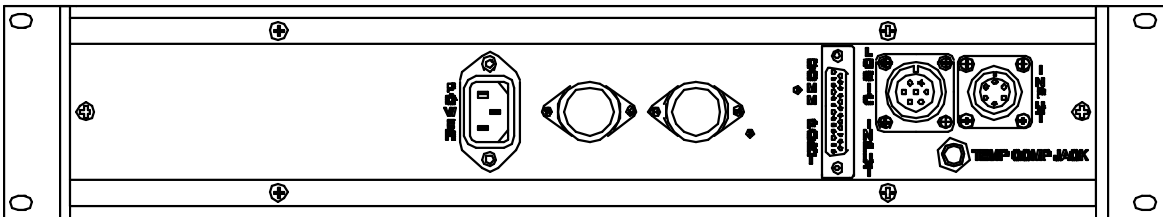


Figure 2: Typical Model 9250-05 Back Panel

The measurement ranges are selectable via instructions from the host computer (or optional LED Display/Keypad Customer Interface). Resistance ranges of 0.20000Ω, 2.0000Ω, 20.000Ω, 200.00Ω, and 2,000.0Ω are available and can be operator selectable or can be set up for auto-range selection. Auto-ranging selects the range when the resistance falls below 10% of the current range and automatically switches to the lower range. A lighted ON/OFF push-button switch is mounted on the front panel of the unit, along with two red LED lamps that indicate when the serial communications link is functioning.

The Model 9250-05 also includes a relay output which may be triggered via high/low limits (set via the computer interface) permitting the automated rejection (GO/NO-GO) of unacceptable components. To protect the instrument from high voltage damage, there is a safety relay that locks out the resistance tester during high-pot or surge tests.

A Temperature Compensation probe input is available for measuring the ambient temperature. An infrared Temperature Compensation Probe is available for measuring the temperature of the part under test by the Model 9250-05. The temperature range is 0 - 120°C with an accuracy of  $\pm 2^\circ\text{C}$ . The temperature is available over the serial communications link.

### ***Computer Interface***

The resistance ranges are selected and data returned by ASCII commands via the serial communications link to either a host computer or the LED Option Customer Interface. The unit requires a RS-232 command to begin sending, and to stop, resistance readings. The Model 9250-05 returns the measured data within 10msec over the RS-232 communications link (format X.XXXX followed by a carriage return/line feed) with a floating decimal point matching the selected range. Resistance range changes and temperature readings may be polled from the link. Calibration is performed by placing a calibration standard for each range across the resistance tester inputs and transmitting a calibration command for each range.

## **Operational Considerations**








The Model 9250-05 is highly resistant to most of the industrial environments that can cause problems with resistance test equipment. The operating temperature of the Model 9250-05 is 32°F to 122°F [0°C to 50°C]. Operations outside this range should be avoided. Temperature compensation for resistance readings is detailed in the TC Option section (if applicable).

### **NOTE:**

*If any welding is to be performed near the Model 9250-05, or anywhere on the process line where the Model 9250-05 is installed, disconnect ALL cables from the Model 9250-05. This prevents system overload by the current generated from welding.*

## **Manual Conventions**

Throughout this manual section, there are many keyboard commands that will be used to signify command sequences. Different fonts will be used for the keyboard commands. The following table describes these commands and keystrokes.

<b>Key</b>	<b>Description</b>
	<i>Space Bar</i>
	<i>Enter Key</i>
	<i>Command Sequence Start</i>
	<i>Backspace</i>
	<i>Caps Lock</i>
	<i>Keystroke</i>
<b>* S</b>	<i>Communications Software Response</i>
	<i>Mouse Action on Host Computer</i>
<i>Table 1: Manual Conventions</i>	

## **Power Switch**

A lighted push-button power switch is located on the front panel of the Model 9250-05. This switch is the master power switch for the unit. If this switch is pushed in, the green LED lamp should light. If the lamp does not illuminate, check the power line cord connections to ensure that the unit has power. If the unit does have power and the lamp will still not illuminate, contact Harris Instrument Corporation IRT Service for more information.

## Product Specifications

The Model 9250-05 is available with a variety of standard and optional features which allow the unit to meet a wide range of industrial resistance testing requirements.

### Power

Power Supply (rated at 122°F [50°C]):

**105VAC - 125VAC @ 50Hz - 60Hz, 2.0Amp Maximum, 250Watts Maximum;**

**208VAC - 248VAC @ 50Hz - 60Hz, 1.0Amp Maximum, 250Watts Maximum.**

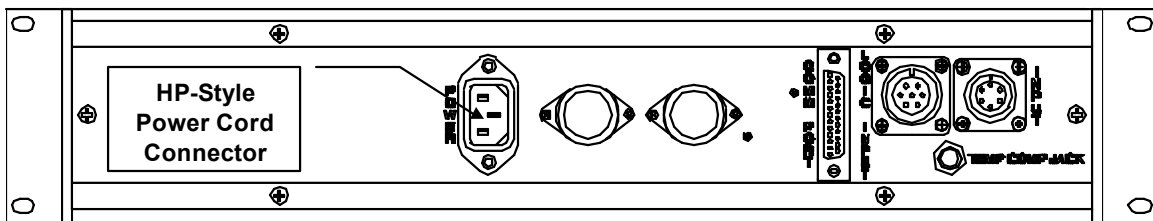


Figure 3: Power Connection for Model 9250-05

Power connection is via a three-prong HP-style enclosed connector on the back panel of the unit.

The power line is filtered to suppress power line transient noise and power line induced RF interference. Quick disconnect power line connections are made directly to the internal power line filter inside the enclosure. The input power is fused with a 2Amp Slo-Blo type 3AG fuse. See Figure 4 for fuse location.

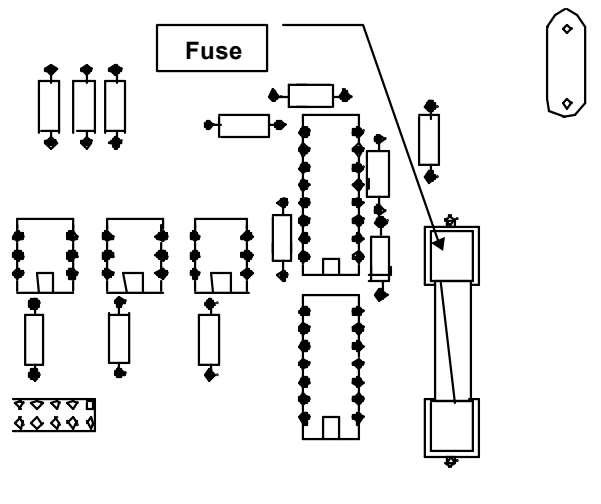


Figure 4: Fuse Location on 3696032 Board

### Accuracy

±0.02% of Full Scale

±1 digit at 25°C

±0.02% per °C for 0°C - 50°C.

## Resolution

The resolution of the Model 9250-05 is based upon the range of resistance tests being performed.

Range	Resolution (4½-digit)	Range Number
0	None	0
0 - 0.2Ω	0.00001Ω	1
0 - 2.0Ω	0.00010Ω	2
0 - 20.0Ω	0.00100Ω	3
0 - 200.0Ω	0.01000Ω	4
0 - 2000.0Ω	0.10000Ω	5

*Table 2: Resolution Specifications and Range Numbers*

The Range Number in Table 2 is the value (X) entered with the Set Range command.

## Connections

There are several connectors on the back panel of the Model 9250-05 for attachment of terminals, RS-232, resistance inputs, and logic inputs.

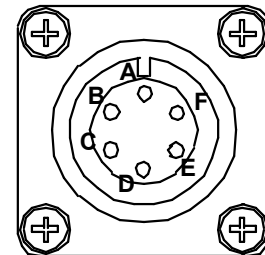
### Terminal INPUT Connector

The six-pin MS-Style female circular connector on the back panel of the unit is for the current and voltage terminals, and the GO/NO-GO relay (dry contact closure) output. A 4-wire Kelvin connection is required. No internal snubbing is provided for the relays. All voltages are compliance voltages.

Pin #	Term	Function
A	I -	Current Minus – 5VDC @ 1Amp Full Scale
B	I +	Current Plus – 5VDC @ 1Amp Full Scale
C	---	GO/NO-GO Relay – 2A @ 30VDC, 1/2A @ 120VAC
D	---	GO/NO-GO Relay – 2A @ 30VDC, 1/2A @ 120VAC
E	V -	Voltage Minus – 5VDC @ 1Amp Full Scale
F	V +	Voltage Plus – 5VDC @ 1Amp Full Scale

*Table 3: 6-pin Terminal INPUT Circular Connector Pinouts*

Figure 5: INPUT Connector



## Serial Communications Connector

The Serial Communications Connector is a female D-Shell Sub-Miniature 25-pin connector (DB-25) for the Serial Communication Link. This connector uses the RS-232C protocol.

Pin #	Term	Function
2	TX	Transmit Data
3	RX	Receiver Data
5	CTS	Clear-to-Send
7	GND	Signal Ground
20	DTR	Data-Terminal Ready
Table 4: DB-25 Connector Pinouts		

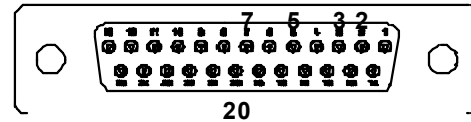


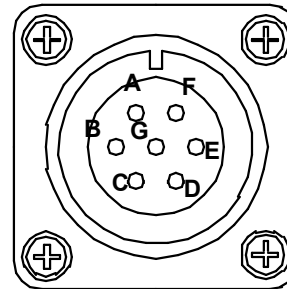
Figure 6: DB-25 Connector Pinouts

## LOGIC INPUT Connector

Several logic inputs to the Model 9250-05 are available via the 7-pin MS-style female circular connector on the back panel {Figure 7}. These inputs are not currently defined and will be available by custom order in the first quarter of 1998.

Pin #	Function
A	Input 1
B	+5VDC
C	Input 4
D	Input 3
E	Input 2
F	LOGIC COMMON
G	GROUND
Table 5: 7-pin Logic INPUT Circular Connector Pinouts	

Figure 7: Logic Input Circular Connector



## Physical Dimensions

The standard Model 9250-05 is provided in a 19 inch [483mm] rack mount case.

View	Dimension
Front Panel	19.00" [483mm] wide x 3.50" [89mm] tall
Side Panel	14.00" [356 mm]
Back Panel	17.00" [432mm]
Table 6: Rack Mount Case Dimensions	



A bench top model is also available (optional).

View	Dimension
Front Panel	11.25" [286mm] wide x 3.75" [95mm] tall
Side Panel	14.00" [356mm]
Back Panel	11.00" [279mm]
Table 7: Bench-top Case Dimensions	

### Optional Configurations

Option	Description
TC Option	Temperature Compensation – Measures ambient temperature.
IRTC Option	Infrared Temperature Compensation – Measures temperature of part under testing by Model 9250-05.
MPI Option	Multiplexing Input – Multiple test input.
LED Option	LED Display/Keypad Customer Interface – Remote display and keypad for entry of commands and control of the Model 9250-05.
LCD Option	LCD Touchscreen Customer Interface – Remote touch screen for entry of commands and control of the Model 9250-05 (available first quarter 1998).
HR Option	High Resistance Testing (available first quarter 1998).
LR Option	Low Resistance Testing (available first quarter 1998).
Table 8: Options for Model 9250-05	

### Accessories

Several accessories for the Model 9250-05 are available from Harris Instrument Corporation.

Accessory	Name
Circular Mating Connector for INPUT 6-pin MS-Style circular connector (supplied with every Model 9250-05).	-97
Circular Mating Connector for LOGIC INPUT 7-pin MS-Style circular connector (supplied with every Model 9250-05 in first quarter 1998).	-97/7
Table 9: Accessories for Model 9250-05	

## **Model 9250-05 Commands**

The Model 9250-05 is controlled by a host computer. A remote LED Display/Keypad is also available and is detailed in the DK Option section of this manual (if applicable).

The following commands *must be entered in FULL CAPITAL LETTERS*, preceded by an asterisk symbol (\*). The command sequencer is case sensitive, so setting the CAPS LOCK key to ON with the host computer is recommended.

<b>Command Sequence</b>	<b>Description</b>
	Set Averaging: Number of averages (1 - 10000, <u>60</u> ).
	Set Baud Rate: <u>9600</u> , 19200, 38400, 57600.
	Calibrate: Calibrate current range at XXXXXX $\Omega$ .
	Set Line SYNC: Power line SYNC set OFF.
	Set UPPER Limit: Set high limit at XXXXXX $\Omega$ .
	Start Readings: Begin sending resistance readings.
	Display Help Screen.
	Set Line SYNC: Power line SYNC set ON.
	Set LOWER Limit: Set the low limit at XXXXXX $\Omega$ .
	Set Range: Change to x resistance range (0, 1, 2, 3, 4, 5).
	Stop Readings: Stop sending resistance readings.
	Set Auto-Range: Auto-range mode set ON.
	Set Auto-Range: Auto-range mode set OFF.
	Diagnostics – Displays the raw counts from the analog-to-digital converter for calibration and troubleshooting.
	Reset: Sets all user selected variables to factory default.

*Table 10: Command Sequence Listing*


Commands for Temperature Compensation – TC & IRTC Options, can be found in the TC Option section. Commands for the Multiplex Input Option – MPI Option, can be found in the MP Option section. Operation with the LED Display/Keypad – LED Option, is documented in the DK Interface section, while operation with the LCD Touchscreen Display – LCD Option, is covered in the LCD Section.

## ***Data Entry Conventions***

All data entered in XXXXXX entries (LOW Limit, HIGH Limit, etc.) may be entered as 1 to 10 digits with a decimal point if necessary. The decimal point position on all displayed variables matches current customer selected decimal point position. Up to ten command sequences may be sent in rapid succession by the terminal device EXCEPT the calibration command and the factory default command.

## Invalid Command Response

Any time an invalid command is sent via the serial communications link to the Model 9250-05, the system will respond with a “What?” statement. The following example shows the Set LOW Limit command being used with an improper sequence.

  
**Command> \*M ABCDEF**  
**What?**

Any time a “What?” response is received in the communications terminal software, check the command sequence that was previously entered and re-enter the command sequence properly.

**Averaging Setting:** 

The Set Average command will change the number of averages that will be used to calculate the resistance reading using the example formula (XXXXXX = number of readings, factory default value is 60 readings) on the next page.

The averaging value will affect the update rate as shown in Table 11 (9600 baud):

Setting	Update Rate
1	110Hz
100	83Hz
200	33Hz
500	15Hz
1000	8Hz
10000	0.8Hz

*Table 11: Update Rates with Averaging Settings*

Higher baud rate settings will increase the update rate.

**Example:** 57600 baud with averages @ 1 = 250Hz update rate.

Averaging Formula:

Output reading = (SUM of readings) divided by setting value.

**Example:** A total of 100 readings is required for averaging. Enter the following command sequence for setting the averaging:

  
**Command> \*A 100**

The 100 readings are totaled and divided by 100 to give the average readings. With no averaging, the actual readings will be displayed.

Typically, the averaging setting is 60 with Line SYNC set on. This gives the best overall output for the system.

**Baud Rate Setting:**

The Set Baud Rate command will change the serial communications baud rate (bps). The valid baud rates are (underlined rate is the factory default):

**9600, 19200, 38400, 57600.**

**Example:** Setting the baud rate to 19200

**Command> \*B 19200**

See System Operation – Serial Communications for more information on the serial communications link.

**Resistance Calibration:**

**NOTE:**

*Any units delivered from the factory with certified calibration  
SHOULD NOT BE RE-CALIBRATED by the operator.  
This WILL void the certified calibration.*

Calibration of the Model 9250-05 is performed by placing a calibration standard, near the full scale resistance for each range, across the meter inputs and transmitting a calibration command for the current selected range over the serial communications link.

**Command>\*C XXXXXX**

When the full scale reading is complete, the unit will prompt the operator to insert a lower (10% of first standard) resistance standard across the meter inputs. This will assure an accurate zero reference point for each range.

**Example:** Calibrating to a 1.9Ω resistance standard.

**Command>\*C 1.9000**

**Command> Please insert a low resistance  
standard**

### **Line SYNC Commands**

There are two commands for setting line SYNC, ON or OFF.

**Line SYNC ON:**

This command turns the power line synchronization ON (maximum update rate is now 60Hz). This allows the Model 9250-05 to give steady readings output.

All Set Averaging values from 1 to 60 will output at 60Hz with Line SYNC set ON. Averaging values higher than 60 will result in update rates lower than 60 Hz with Line SYNC set ON.

**Line SYNC OFF:**   

This command will turn the power line synchronization off. Line SYNC ON is the factory default for the Model 9250-05.










### Limit Settings

High and low limit settings are available with the Model 9250-05. The Set UPPER Limit command sets the high limit and the Set LOWER Limit command sets the low limit.

**Set UPPER Limit:**         

Enter the UPPER Limit in OHMS, with the appropriate decimal point. When resistance = 1.5000Ω and the high limit = 1.4900Ω the “GO” relay will be open.










**Example:** Set UPPER Limit to 20.500Ω.

          
**Command> \*E 20.500**

**Set LOWER Limit:**         

Enter the LOWER Limit in OHMS, with the appropriate decimal point. When resistance = 1.0999Ω and the low limit = 1.1000Ω the “GO” relay will be open.

**Example:** Set LOWER Limit to 10.500Ω.

          
**Command> \*M 10.500**

**Start Readings:**   

The Start Readings command will initiate the sending of resistance readings for the current range. The measured data will be in the following format (this reading is for Range One):

**.XXXXX**

Note that the decimal point will move, depending upon which range is being tested (i.e. Range Two = X.XXXX, for Range Three = XX.XXX, etc.).

**HELP Screen:**    or   

This displays a screen with all of the command sequences listed with short descriptions and value ranges. Also displayed is a short summary of many of the settings for the system under Current Settings.

Sample HELP Screen output:



```

Command> *H
*A_XXXXX - Number of averages (1-10000).
*B_XXXXX - Set baud rate (9600, 19200, 38400, 57600).
*C_XXXXXX - Calibrate current range at XXXXXXohms.
*E_XXXXXX - Set the UPPER Limit at XXXXXXohms.
*G - Output resistance readings, *S - Stop sending readings.
*H - (Help) Sends this output.
*K_XXXXXX - Set temperature coefficient.
*I - Temperature Compensation ON, *J - Temperature Compensation OFF.
*L - Line SYNC ON, *D - Line SYNC OFF.
*M_XXXXXX - Set the LOWER Limit at XXXXXXohms.
*Q_XX.X - Set reference temperature for compensation.
*RX - Change to X resistance range (0, 1, 2, 3, 4, 5).
*T - Output the current temperature.
*U - Auto-range mode ON, *V - Auto-range mode OFF.
*X - Multiplexer command string, *X 1-2R4,4-9R1,3-7R2.
*Y_XX.X - Temperature calibration point.
Current Settings - Range: 2 ohm
                    Averages: 00060      Baud rate is now: 9600
                    High Limit: 1999.99  Low Limit: .000
                    The line synchronization is: ON
                    Temp. Compensation: OFF
                    Temperature Coefficient: .00393
                    Reference Temperature: 25.0

```

**Set Resistance Range:**

The resistance range may be changed by the Set Resistance Range command. Valid settings are:

Setting	Range
0	Turns off Safety Relay
1	0.20000Ω
2	2.0000Ω
3	20.000Ω
4	200.00Ω
5	2000.0Ω

Table 12: Resistance Range Settings

If an invalid range for the test is selected, the unit will default to Range 2 (2Ω). The unit will default to no relays on (Range 0) at power up.

**Stop Readings:**

When the Model 9250-05 is powered on, the unit is in IDLE Mode. It is taking no readings in this mode. After the Start Readings command or the Send Temperature command are given, the unit

can be returned to IDLE Mode with the Stop Readings command. Also, any command entered (except Start Readings or Send Temperature) will return the unit to the IDLE Mode.

### **Auto-Range Selection**

One of the premiere features of the Model 9250-05 is the Auto-Range Selection. The Auto-Range command begins the automatic selection of the resistance range. When the measured resistance falls below 10% of the current range, the meter will automatically switch to the next lower range.

**Set Auto-Range ON:**   

Turn on the automatic ranging feature.

**Set Auto-Range OFF:**   

Disables the automatic range selection. The meter will remain on the last selected range until a new range command is issued. Auto-Range OFF is the factory default.

**Diagnostic Output:**   

Displays the raw counts from the analog-to-digital converter. Used in calibrating the system.

**Restore Factory Defaults:**         

This command will reset the stored system settings to the factory defaults. Calibration values are not affected by this command.

Factory Default System Settings are:

Serial Communications:	9600 Baud Rate
Resistance Range:	Range 0
Auto-Range:	OFF
Averages:	60
Power Line SYNC:	ON
Temperature Compensation:	OFF

## **System Operation**

Before applying power to the Model 9250-05, set up the communications software that will be used to interface with the Model 9250-05. Also be sure that the communications lines are installed and attached to the Model 9250-05 and the host computer.

### ***Serial Communications***

The host computer serial communications interface for the Model 9250-05 is based upon the *DEC VT-100 (ANSI) terminal emulation for the IBM PC®* for RS-232 communications. The RS-232 output communications port operates as the DCE, with the host computer as the DTE. Any ANSI terminal emulator will probably function with the Model 9250-05 as a terminal emulator, as well as many commercial communications software packages (such as PROCOMM®).

Communications protocol for the serial output are RS-232C ASCII, six-characters with a decimal point, space padded with a carriage-return and line feed in a **10-bit frame** running:

**No Parity, Eight Data Bits and One Stop Bit (N,8,1)  
with One Start Bit.**

The communications can be set for a baud rates of (underlined is factory default):

**9600bps, 19200bps, 38400bps, 57600bps.**

When setting up for operation with a personal computer (PC), be sure that no other serial devices are sharing the communications port on the PC. The Model 9250-05 requires a standard communications port for operation.

For this manual, the Windows® TERMINAL program will be used as an example communications program for interfacing with the Model 9250-05. The Windows® TERMINAL communications program must be configured to operate with the Model 9250-05.

### ***RX/TX Lamps***





















In the middle of the front panel of the Model 9250-05 are two red lamps labeled RX and TX. These lamps will illuminate when RS-232 communications are in operation. Whenever commands are being received by the Model 9250-05, the RX lamp will illuminate and whenever the unit is transmitting data to the host computer (or LED Display/Keypad Customer Interface – DK Option section), the TX lamp will illuminate.

If these lamps do not light when power is on to the unit AND the host computer is sending commands to the Model 9250-05, verify that the serial communications cable is properly attached at both ends. If the lamps still will not illuminate, contact Harris Instrument Corporation IRT Service for more information.



## Configuring Windows® **TERMINAL**

The following example on the next page is based upon the Microsoft® Windows® for Workgroups TERMINAL software program. This program is used because of the commonplace occurrence of it on most DOS-based computer systems today. Any DEC VT-100 (ANSI) compatible terminal emulation program can be used to communicate with the Model 9250-05 RS-232 customer interface.

	<i>Terminal</i>	Start TERMINAL.EXE (located in the Accessories or Main Program Group).
	<i>Settings</i>	Open the Settings Menu and select Terminal Emulation...
	<i>Terminal Emulation...</i>	Verify that the DEC VT-100 (ANSI) Terminal Emulation is selected. If it is not selected, click on the DEC VT-100 (ANSI) choice.
	<i>OK</i>	Click on OK to close the Terminal Emulation dialog box.
	<i>Settings</i>	Open the Settings menu again and select Communications...
	<i>Communications</i>	Select under the CONNECTOR Scroll Box the proper communications port on the host computer that is connected to the Model 9250-05. Typically, this will be COM2 as the mouse for Window s® is typically on COM1 .
	<i>COM2</i>	Select the 9600 Radio Button in the BAUD RATE area.
	<i>9600</i>	Select the 8 Radio Button in the DATA BITS area.
	<i>8</i>	Select the 1 Radio Button in the STOP BITS area.
	<i>1</i>	Select the None Radio Button in the PARITY area.
	<i>None</i>	Select the None radio button in the FLOW CONTROL area.
	<i>None</i>	Click on OK to Close the COMMUNICATIONS Dialog Box.
	<i>SETTINGS</i>	Open the Settings menu.
	<i>Modem Commands</i>	Select Modem Commands...
	<i>None</i>	Select the None radio button in the Modem Defaults area.
	<i>OK</i>	Close the Modem Commands dialog box.
	<i>File</i>	Save the settings for operating the Model 9250-05 by choosing the Save As function under the File menu.
	<i>Save As...</i>	Save file as 9250.TRM
		
	<i>OK</i>	Click on OK to close the File dialog box.

Now, whenever starting Terminal to operate the Model 9250-05, load the file 9250.TRM and the settings for the Model 9250 factory defaults will be available.

## **Verify Communications**

If the Model 9250-05 is connected correctly to the host computer and the TERMINAL or other communications software is configured properly, when power is applied to the Model 9250-05 the communications software should respond within ten seconds with:

### **Warm up!**

After approximately four to five seconds, the output will read:

### **Power up!**

Once the power up message is displayed, the unit is in IDLE Mode. It is not taking readings from the terminal probes. To start taking readings, issue the Start Readings command; or configure the unit with one of the other commands.

### **NOTE:**

*The Model 9250-05 is a precision resistance measurement instrument and requires a warm-up period of approximately five minutes BEFORE readings should be taken.*

Also, verify that the RX and TX lamps on the front of the Model 9250-05 are illuminating when the unit is receiving commands (RX) or transmitting data (TX).

If the unit will not issue the power up messages within ten to twenty seconds, check the serial communications cable to ensure that it is connected properly. Also check that power is applied to the unit (green LED indicator on ON/OFF push-button switch is illuminated). If both of these checks are valid, contact Harris Instrument Corporation IRT Service for more information.

## **Model 9250-05 Calibration**

Calibration of the Model 9250-05 is relatively simple as the adjustments to the system are all software-controlled. The following example details the calibration of the unit.

### **NOTE:**

*Any units delivered from the factory with certified calibration  
SHOULD NOT BE RE-CALIBRATED by the operator.  
This WILL void the certified calibration.*

To perform the following Calibration Procedure later in this manual, it is suggested that you obtain six resistors or resistance standards. The values of these standards for this example are:

1.9K $\Omega$   $\pm$ 10%, 190 $\Omega$   $\pm$ 10%, 19 $\Omega$   $\pm$ 10%, 1.9 $\Omega$   $\pm$ 10%, 0.19 $\Omega$   $\pm$ 10%, and 0.019 $\Omega$   $\pm$ 10%.

Almost any standard or resistor can be used for the Calibration Procedure, as long as they match the ranges of the meter and are 10% of the higher standard.

### **Calibration Example**

- 1) Apply power to the Model 9250-05.

**WARM UP!**

**POWER UP!**

The unit will respond with “WARM UP!” within ten seconds and “POWER UP!” in another four to five seconds.

- 2) Perform the Set Averaging command and set the number of readings to average to 60.



**Command> \*A 60**

The Averaging value is now set to 60.

- 3) Set Line SYNC ON.



**Command> \*L**

The Line Sync is now enabled.

- 4) Disable the Auto-Range function.



**Command> \*V**

The Auto-Range command has been disabled.

5) Disable Temperature Compensation, if applicable.



**Command> \*J**

Temperature Compensation is now disabled.

6) Place a  $1.9\text{K}\Omega \pm 10\%$  resistance standard on the resistance test inputs to the Model 9250-05.

7) Perform the Set Resistance Range command for the  $2\text{K}\Omega$  range – Range 5.



**Command> \*R5**

The unit is now set for testing in the  $2\text{K}\Omega$  range.

8) Display the Diagnostic Output for verification of resistance reading.



**Command> \*Z 61,234**

Verify that the reading output is  $60,000 \pm 3,000$ . If out of range, then verify connections to the resistance tester and that the range is set correctly.

9) Stop diagnostic readings.



**Command> \*S**

10) Begin the Resistance Calibration command.



**Command> \*C 1900.0**

The unit will now prompt you to connect a lower resistance standard ( $199\Omega \pm 10\%$ ) to the unit and then enter the value of the low resistance standard.

**Command> Please insert a low resistance standard**

11) Enter the value of the  $1.9\Omega$  standard.



**Command> 1.9**

The  $2\text{K}\Omega$  range is now calibrated.

12) Repeat steps 6 through 11 to calibrate the remaining ranges substituting the following values for step 6 and step 7.

Step 6	Step 7	Step 11
$199\Omega \pm 10\%$	*R4	199.00
$19\Omega \pm 10\%$	*R3	19.000
$1.9\Omega \pm 10\%$	*R2	1.9000
$0.19\Omega \pm 10\%$	*R1	0.1900

Re-enable any applicable functions and options.

13) Enable the Auto-Range function.



**Command> \*U**

The Auto-Range command has been re-enabled.

14) Enable Temperature Compensation, if applicable.



**Command> \*I**

Temperature Compensation, if applicable, is now re-enabled.

The Model 9250-05 is now calibrated and ready for use.

**NOTE:**

*The standard resistors should be measured as accurately as possible, usually one more digit of accuracy than the unit will display.*