MODEL 5894
DIGITAL MILLIOHMMETER
FEATURING 4 POLE MEASURING METHOD WITH PT100 TEMPERATURE PROBE

USER GUIDE

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PRECISION INSTRUMENTS

SUBJECT TO CHANGE WITHOUT NOTICE
This manual superseded all previous versions – please keep for future reference

TINSLEY, A DIVISION OF HARTEST PRECISION INSTRUMENTS LTD

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PRODUCT SAFETY PRECAUTIONS

Before installing the product, please read the precautions for installing and using carefully, to avoid conflicts on occupational savety as well as to assure the product keeps fully operational.

- Follow all warnings and instructions marked on the product.
- Do NOT use this product near water
- The device should be installed on a SOLID base.
- To protect from electrical shock, unplug display from the wall outlet before relocating or cleaning.

When cleaning, use only a soft damp cloth. Do NOT spray with liquid or aerosol cleaners.

- Adequate ventilation must be maintained to ensure reliable and continued operation and to protect the product from overheating. Do not install the product in a place where ventilation may be hindered.
- This product should ONLY be operated from the type of power source indicated on the rear panel of the instrument.
- Do NOT attempt to service this product yourself. Removal of the cover may expose you to dangerous voltages or other risks. Refer all servicing to qualified service personnel.
- Unplug this product from the wall outlet and refer servicing to qualified service personnel in the event that:

  - Power cord or plug is damaged or frayed.
  - Liquid is spilled into the product or the product is exposed to rain or water.
  - The product does not operate properly when the operating instructions are followed.
  - The product exhibits a distinct change in performance, indicating a need for service.
  - The product has been dropped or the cabinet has been damaged.

ISSUE 1: UK1

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INTRODUCTION

Owing to its high measuring rate, its compact and robust design, it's accuracy and long-term stability, the digital ohmmeter MODEL 5894 can be used in applications with high requirements concerning the measuring stability and reliability. This is guaranteed by the integrating measuring method according to the quotient principle, the compensation of all thermoelectric forces and other offset voltages, as well as the suppression of interference voltages in the measuring and data lines.

The sophisticated recognition of contact errors at the holding device itself is one of the most important features, as it enables you to distinguish between such errors and actual defects of the test object. The corresponding error messages, as well as the actual defects of the test object are not only transferred to the control system, but also displayed clearly on the MODEL 5894 front panel.

All measuring conditions set are stored internally, and are preserved even when the MODEL 5894 is switched off. For this reason it is only necessary to program the instrument once via the RS232C interface, in order to operate the instrument with these parameters at manual measuring setups or with an industrial PLC system.

The instrument can fully be remote controlled via a V24 RS232C complianced interface. For manual control, a optional footswitch can be connected to the PLC port or the keypad on the front panel can be used.

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1. INSTALLATION

1.1 Power supply

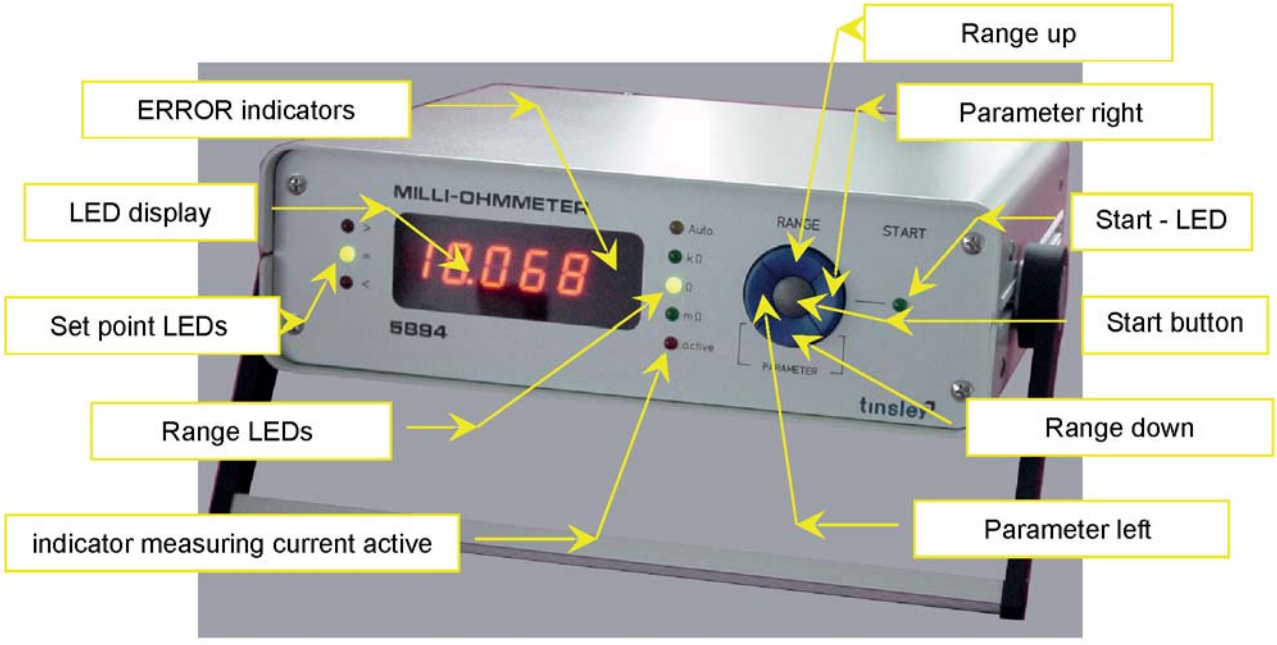
Connect the power cable to the according connector on the rear panel of the instrument. There, you also find the power switch as well as the fuse. Connect the power cable to a grounded electrical outlet supporting the voltage shown on the type plate of the instrument. The model 5894 works with a mains supply voltage from 100 VAC up to 240 VAC with 50Hz or 60Hz The specification of the fuse (e.g. Si 0.8AT) is also printed on the type plate. Note that only fuses matching this specifications are allowed to be used with the instrument. A new fuse that is destroyed just after turning on the instrument indicates a serious malfunction inside the device!

1.2 On / Off switch

Use the On / Off switch on the rear panel to turn the instrument on or off. After turning on, the LED display shows the internal software revision for a short period, followed by a short beeptone sequence. Then, the LED display shows a ‚LLLL' for inductive test mode or ‚EEEE' for resistive test mode. The Model 5894 is now ready for operation.

1.3 Basic controls

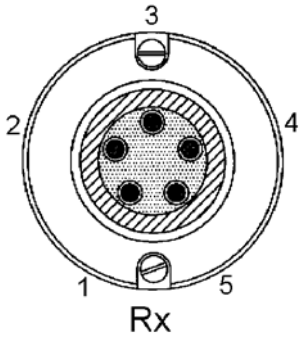
- Use the range buttons (‚RANGE'), to select an appropiate measuring range. The actual measuring range is shown by the range LEDs and the decimal point of the LED display. (see 2.2).
- The parameter buttons (‚PARAMETER') are used to set the actual set points (see 2.5) as well as the configuration menu (see 2.7).
- Use the start button to start measurement. While the instrument is measuring, the STARTLED lights up (see 2.3).
- The range LEDs are used to show the actual measuring range. Please note that the resolution in between the actual range is shown by the decimal point of the LED display.
- The set point LEDs are used to show if the actual result is in between the actual set points (= green), smaller (< red) or greater (> red) than the actual set points.



2. MEASURING

2.1 Measuring connector

Use a 4-pole shielded cable for measurement. Using this technique, all feed line resistances have no influence on the measuring result. Connect the test object as shown to the Amphenol connector marked, RX‘ on the rear panel of the instrument.



Pins: 1 Current (+)
2 Sense (+)
3 Ground (Chassis)
4 Sense (-)
5 Current (-)

2.2 Range selection, overrange and test object type selection

Before starting measurement, a proper range using the range up / down buttons should be selected. Note that the maximum overrange for every selection you make is 80% (17999). In cases where the measured resistance is too high, the LED display show a ‚OVL‘ error. So the actual range should be greater than the expected result (e. g. 100 mW when expecting about 57 mW). If the selected range is too high, resolution will decrement and therefore the result is shown with a smaller resolution.

Check the selected type of test object (resistive or inductive) before starting the measurement. Measurements at inductive test objects yields a wrong result using resistive mode in most cases. Set the parameter ‚EEEE/LLLL‘(see 2.7 configuration menu) to the appropriate value before starting the measurement. Measuring resistive test objects in inductive mode yields correct results, but wastes measuring time.

2.3 Starting measurement

Use the start button to start measurement. During process, the start LED lits up. The LED labelled active indicates an active measuring current. The measurement result is valid only when this LED is turned off. When process has finished, the result is shown on the LED display. If the start button is not released after measurement has been finished, the instrument will continue measuring until the start button is released. (This behaviour can be changed in the configuration menu, see 2.7).

2.4 Error messages

If an error has been detected during measuring process, the LED display shows the appropiate message:

- Error ‚OVL.‘: The actual measuring range is too low. Select a higher measuring range and restart measurement to receive a proper result.
- Error ‚CUR‘: Current contact failure detected (no connection between Rx connector pin 1 and 5). Check connectors and cabling and restart measurement.
- Error ‚SEN‘: Sense contact failure detected (no connection between Rx connector pin 2 and 4). Check connectors and cabling and restart measurement.

2.5 Set points

This instrument suports the definition of set points to quickly determine deviation conditions during manufacturing process and similar applications. 3 LEDs are mounted on the front panel of the instrument to show such conditions. If the current result is smaller ‚<' than the lower set point or greater ‚>' than the upper set point, the corresponding LED lits up. If the actual result is in between the set points, the LED ‚=' (ok) lits up. You can change the actual set points by using the keys on the front panel of the instrument:

- Change upper set point: Press parameter right button.
- Change lower set point: Press parameter left button.

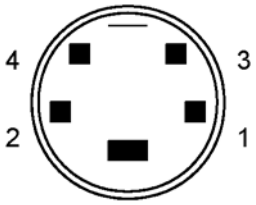
Using the range buttons up / down, the single digits of the set point can be changed. The actual digit that can be changed is flashing. To select another digit, use the parameter left / right buttons. When finished, wait a few seconds or directly press the start button to start measurement.

Please note that the set points are handled as plain numbers. When changing the measurement range, the decimal adequation is changed as well. For example, a set point set to 12000 in measuring range 1 W expresses 1.2000 W. When changing measuring range to 100 mW, the setpoint value now expresses 120.00 mW.

2.6 Temperature compensation

The MODEL 5894 is capable of determining an external temperature using an PT100 probe when plugged to the connector marked ‚d' on the rear panel of the instrument. Please note that the temperature is used for temperature compensation (the temperature is used to recalculate the resistance measurement values to 20 °C). For this, it is important that the PT100 probe is connected to the instrument, as otherwise the resistance results are falsified due to an invalid temperature! If the PT100 probe is not used during measuring, disable temperature compensation using the configuration menu (see 2.7, Option P5) and disconnect the probe. If the temperature compensation is enabled, the display indicator ‚TC' lights up.

Pins:		
	1	I (+)
	2	I (-)
	3	V(+)
	4	V(-)



2.7 Setting options – the configuration menu

To enter the configuration menu, press both parameter buttons for approx. 2 s until the display shows, 11111'. To flip through the available options, use the parameter buttons left or right. To change anoption, use the range buttons up or down:

- Option ‚lower set point' see 2.5
- Option ‚upper set point' see 2.5
- Option ‚19.11 / 24.11 / ...' RS232 Settings: 24.11 to 38.12 Delivery state: 96.11 Controls the settings for the RS 232C port. The numbers in front of the dot corresponds to the baud rates 1200 / 2400 / 4800 / 9600 / 19200 / 38400. The last number after the dot corresponds to the number of stop bits 1 or 2. All other settings are fixed at: 8 data bits, no parity and RTS / CTS handshake.
- Option ‚20 mV +/-' 20 mV limiter on / off Delivery state: off
  Turns the 20 mV limiter on (+) or off (-). This option must be explicitly enabled using RS232 command ‚E-MV2-1'.

2.7 Setting options – the configuration menu (continued)

- Option ‚EEEE / LLLL‘ — Selects the type of test object Delivery state: EEEE
  Switches between resistive test object mode (EEEE) and inductive test object mode (LLLL).
- Option ‚P1 +/-‘ — Automatic range detection Delivery state: off
  Turns the automatic measuring range detection on (+) or off (-).
- Option ‚P2 +/-‘ — Contineous measuring Delivery state: off
  Toggles start button behaviour. When the start button is not released after measurement has been finished, the measurement is repeated until the button is released (on +) or the instrument remains in stop mode (off -).
- Option ‚P3 +/-‘ — Set point beeptone Delivery state: off
  When the actual measurement result is not in between the actual set points, a beeptone is generated (on +) or not (off -).
- Option ‚P4 +/-‘ — Automatic remote state Delivery state: off
  If this option is set to on (+), the instrument remote state is Initialized by any valid command. If set to off (-), remote state is only initialized by the REM command.
- Option ‚P5 +/-‘ — Temperature probe on / off Delivery state: off
  If no PT100 temperature probe is connected to the instrument, this option must be set to off (-). If set to on(+), temperature compensation is applied to the resistance measurement results relying on the temperature fetched by the probe, which has to be connected to the instrument.
- Special option ‚P5 -‘ — Cyclic temperature measurement every x cycles
  When P5 is set to off (-), it is possible to set the number of cycles that have to pass until the temperature is measured (press the range button again to set). Valid settings are: Every cycle (1) or every 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 2048 / 4096 / 8192 th cycle.
- Special option ‚P5 +‘ — Show actual temperature
  When P5 is set to on (+), the actual temperature fetched by the probe at present can be displayed by pressing the range button after 2 s again. Hold the button to see the result. Release the button to return to the menu.
- Option ‚P6 +/-‘ — Set temperature coefficient (-9.99 to +9.99)
  Used to set the actual temperature coefficient in per mille / K.
  Example: For Cu (copper) set +3.92 for +3.92 per mille / K.
  Note: If temperature should be measured, but temperature compensation is not needed, set this value to 0.00.
- Option ‚311 / 411 / ...‘ — GPIB adress 1 to 16 Delivery state: 3
  Sets the GPIB address

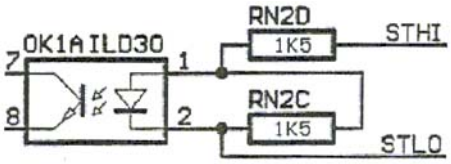
3. PORTS

3.1 PLC (SPS) port

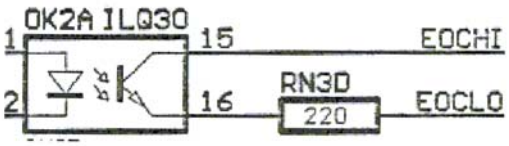
The PLC (SPS) 15 pole D-SUB HD connector is located on the rear panel of the instrument (marked, STEUERUNG‘). The following table describes the pins:

PIN	Function	PIN	Function
1	24 V DC PLC (SPS)	8	Result < set point (c)
2	START (+), STHI see pic. 1	9	Result < set point (e)
3	START (-), STLO see pic. 1	10	Result in between set point (c)
4	REMOTE (+)	11	Result in between set point (e)
5	REMOTE (-)	12	Result > set point (c)
6	EOC (c), EOCHI see pic. 2	13	Result > set point (e)
7	EOC (e), EOCLO see pic. 2	14	12 V DC PLC (SPS)
15	GND PLC (SPS)		

Pic. 1 – PLC (SPS) input



Pic. 2 – PLC (SPS) output



3.2 RS 232C port

The RS 232C 9 pole D-SUB connector is located on the rear panel of the instrument (marked, RS232‘). The following table describes the pins and the connection to a PC:

PIN	Function	9 pole to PC	25 pole to PC
1	Not connected	-	-
2	RXD – Data input	3	2
3	TXD – Data output	2	3
4	DTR – Data Terminal Ready	6	6
5	GND	5	7
6	DSR – Data Set Ready	4	20
7	RTS – Ready to Send – Data flow control	8	5
8	CTS – Clear to Send – Data flow control	7	4
9	Not connected	-	-

For the RS 232C control commands see chapter 4.

3.3 Printer port

The parallel printer port connector is located on the rear panel of the instrument (marked, PRINTER‘). Any ASCII compatible, parallel printer can be directly connected.

4. RS 232 C – CONTROL COMMANDS

Remote:		
Command:	REM	Function: Initialize RS232 remote state.
Reply:		V24 (accepted)
Command:	EXX	Function: End RS232 remote state.
Reply:		X24 (accepted)
Command:	S8; S9	Function: Remote by REM (S8) or any valid command (S9).
Reply:		OK (accepted); NK (not accepted)
Measuring range:		
Command:	Rx	x = 2 ... 10 (1 mOhm .. 100 kOhm)
Function:		Switches to measuring range x
Reply:		OK (accepted); NK (not accepted)
Command:	k	Function: shows actual measuring range
Reply:		actual range
Command:	A1; A0	Function: Automatic range detection on (A1) or off (A0).
Reply:		OK (accepted); NK (not accepted)
Command:	S16	Function: Use last detected range for new autom. range detection.
Command:	S17	Function: Use first given range for new automatic range detection.
Reply:		OK (accepted); NK (not accepted)
Test object type:		
Command:	S18	Function: Selects inductive test mode
Command:	S19	Function: Selects resistive test mode
Reply:		OK (accepted); NK (not accepted)
Set points:		
Command:	Uxxxxx	x = 00000 ... 18000
Function:		Sets upper set point to x. The decimal point is set by range. Always input full set of digits, Example: 12000
Reply:		OK (accepted); NK (not accepted)
Command:	Lxxxxx	x = 00000 ... 18000
Function:		Sets lower set point to x. Decimal point is set by range. Always input full set of digits, Example: 00900
Reply:		OK (accepted); NK (not accepted)
Command:	u, l	Function: show upper / lower set point.
Reply:		actual set point
Measuring:		
Command:	G	Function: Start measurement
Reply:		Result (M1.2345E-0) or error condition (EOVL, ECUR, ...)
Command:	cn	Function: Start temperature measurement
Command:	c	Function: Show last temperature
Reply:		xx.xG (e. g. 23.6G)
Command:	S0; S1	Function: Send result when finished on (S1) or off (S0).
Command:	S6; S7	Function: Continous measuring by start button on (S6) or off (S7).
Reply:		OK (accepted); NK (not accepted)

4. RS 232 C – CONTROL COMMANDS (CONTINUES)

Temperature:

Command:	TSx	Temperature not measured (x=0), measured by PT100 probe (x=1)
Reply:		OK (accepted); NK (not accepted)
Command:	TAxxx	xxx = 1 .. 999
Function:		Temperature measurement after xxx cycles.
Reply:		OK (accepted); NK (not accepted)
Command:	TK+xxx; TK-xxx	xxx = 001 .. 999 (equates to -9.99 to +9.99 per mille / K)
Function:		Set up temperature coeffiecient. Default: +3.92 (Cu)
Reply:		OK (accepted); NK (not accepted)

PLC (SPS) - Settings:

Command:	ETxxx	xxx = 0 .. 255 (for 1 .. 255 ms or 0 = until next measurement)
Function:		Sets the PLC (SPS) EOC – length (0 = until next measurement)

Measuring current settings:

Command:	WTxxx	xxx = 0 .. 250 (for 0.0 .. 25.0 seconds)
Function:		Sets time to establish measuring current before measuring.
Reply:		OK (accepted); NK (not accepted)

Overview S - commands:

Command:	S0; S1	Function: Send result when finished on (S1) or off (S0).
Command:	S2; S3	Function: Front panel locked (S2) or unlocked (S3).
Command:	S6; S7	Function: Contineous measuring by start button on (S6) or off (S7).
Command:	S8; S9	Function: Remote by REM (S8) or any valid command (S9).
Command:	S10; S11	Function: Reply with OK / NK on (S10) or off (S11).
Command:	S12; S13	Function: 20 mV - limiter on (S12) or off (S13).
Command:	S14; S15	Function: Show CUR (S14) or OVL (S15) on current errors.
Command:	S16	Function: Use last detected range for new autom. range detection.
Command:	S17	Function: Use first given range for new automatic range detection.
Reply of S - commands:		OK (accepted); NK (not accepted)

E - Commands:

Command:	E-C23-x	Function: Recalculation to 20 °C (x = 0) or 23 °C (x = 1).
Command:	E-MV2-x	Function: disables (x = 0) or enables (x = 1) the 20mV limiter option.
Reply:		OK (accepted); NK (not accepted)

Note:
Changed E or S commands are lost when turning off the device. To prevent this, the actual configuration can be stored inside the device (in non-volatile memory):

Command:	SAVE	Function: save actual S – command settings.
Reply:		SAVED (accepted); NK (not accepted)
Command:	SET	Function: save actual E – command settings.
Reply:		SETOK (accepted); NK (not accepted)

5. TECHNICAL DATA

Resistance measurement

Range	1.0000 mW – 100.00 kW, decadic
Resolution	0.1mW
Overrange	+80%, to 18.000
Max. measurement error	± 0.03% of reading ± 0.02% of range
Measuring method	integrating dual slope quotient
Measuring current	

Range	resistive mode	inductive mode
1mW	1A	1A
10mW	1A	1A
100mW	100mA	1A
1W	10mA	100mA
10W	1mA	100mA
100W	1mA	10mA
1kW	100mA	1mA
10kW	100mA	100mA
100kW	10mA	10mA

Measuring voltage 4V or 20mV limit for contacts
Max.inductive power < 100VA
Range selection automatically, using keypad, via RS232
Display LED, 4 ½ digits
Measuring duration 100ms in resistive mode or
1s .. 25.5s in inductive mode depending on measuring object and instrument settings

Temperature measurement
Programable cycles every 1st to 8192th measurement
Reference conversion to 20 °C or 23 °C
Inputs PT 100 probe, using keypad, via RS232

Error detection prior to every single measurement
Current connection errors display: ‚CUR', RS232: ‚ECUR'
Sense connection errors display: ‚SEN', RS232: ‚ESEN'
Overrange >80% display: ‚OVL', RS232: ‚EOVL'
Thermoelectric force compens. prior to every single cycle, automatically

Limit values
Input using keypad, via RS232
Off - limit condition visible by LEDs, via RS232, via PLC

Start of measurement using keypad
via RS232 and IEEE - 488
via PLC (potential free contact)

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Ports RS232C (full device control)
PLC (<,=,>,OVL,CUR,SEN,EOC,GO,REM)
printer (parallel, ANSI standard)

Power supply 100 – 240 VAC 0.7A 50/60Hz

Environment -10°C to 40°C working,
-20°C to 60°C storing,
< 95% humidity, not condensing

Dimensions 260 x 80 x 240 mm (WxHxD)

Weight approx. 3 kg

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