4300E

Programmable Digital micro-Ohmmeter

User Manual

Rev. 72.1

VALHALLA SCIENTIFIC

Certification

Valhalla Scientific, Inc. certifies that this instrument has been tested and verified to meet all published specifications at the time of shipment.

Calibration measurements are traceable to the National Institute of Standards and Technology (NIST) in accordance with established calibration procedures and to the extent permitted by its facilities.

Valhalla Scientific, Inc. reserves the right to modify product specifications and design without notice as part of ongoing product improvements.

Warranty

The warranty period for this instrument is specified on the invoice and packing list provided at the time of shipment.

During the warranty period, Valhalla Scientific, Inc. will, at its option, repair or replace the instrument provided it is returned freight prepaid. This warranty is limited to repair or replacement at the factory. No other warranties, expressed or implied, are provided.

Valhalla Scientific, Inc. shall not be liable for any consequential or incidental damages.

A Return Material Authorization (RMA) number must be obtained from the factory prior to returning any instrument for service. Returns received without an RMA may not be accepted.

Valhalla Scientific, Inc. reserves the right to modify product specifications and design without notice.

Support

For repair and calibration services, contact:

- Phone: 800-548-9806
- Website: https://www.valhallascientific.com
- Email: support@valhallascientific.com

General Warnings

Grounding
For Safety Class I equipment, a protective earth ground must be provided from the main power source to the product through the supplied power cable or input wiring terminals. Do not operate the instrument without a proper earth ground.

Explosive Environments
Do not operate the product in the presence of flammable gases, vapors, or explosive atmospheres.

Fuses
Replace fuses only with the same type, voltage, and current rating. Do not use repaired fuses or bypass fuse holders.

Enclosures and Covers
Do not remove covers or protective shields during operation. Internal access is intended for service-trained personnel only. Hazardous voltages may be present even when the instrument is powered off.

Damaged Equipment
If the instrument is damaged, exposed to excessive moisture, or suspected of impaired safety protection, remove power immediately. Do not operate the unit until it has been inspected by qualified service personnel.

Servicing
Do not perform internal service or adjustments unless another person capable of providing first aid and resuscitation is present.

Modification
Do not substitute parts or modify the instrument. Unauthorized changes may introduce hazards and void safety protections. Return the instrument to Valhalla Scientific, Inc. for service.

Hazardous Voltages
Input terminals must be considered hazardous when voltages greater than 42 V (DC or peak) are present. Use appropriate caution and safety procedures when making measurements.

High Energy Sources
Circuits capable of delivering more than 150 VA must be properly protected against accidental contact or equipment failure through fusing, labeling, or other safeguards.

Live Terminals
Do not leave measurement terminals energized when not in use.

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General Information

Instrument Overview

The Model 4300E Programmable Digital Micro-Ohmmeter is designed for precise measurement of low resistance in demanding applications. It is well suited for testing components such as coils, transformers, bus bars, switch contacts, heater elements, and other resistive devices requiring high test current and accurate measurement.

The 4300E combines high-current sourcing, 4-wire Kelvin measurement techniques, and advanced measurement control to deliver fast, stable, and repeatable results in both laboratory and production environments.

Key Features

- Full 4-wire Kelvin measurement configuration
- Selectable test currents up to 10 A
- High-speed measurement modes for reduced settling time
- Temperature Compensation (TCM)
- Internal Hi/Lo limit comparator with pass/fail indication
- Remote operation via serial, USB, and optional Ethernet interfaces
- Data output and programmable control for automated systems
- Available rear-panel locking connectors for secure connections

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Instrument Identification

Valhalla Scientific instruments are identified by a two-part serial number located on the Serial Tag, found on the rear or bottom of the device.

The serial number is formatted as **72-XXXXXX**,

where:
The first two digits (the serial number prefix) indicate the model and change only when modifications are made to the instrument.

The last six digits (the serial number suffix) are unique to each individual unit.

Be sure to include the entire serial number—both prefix and suffix—in any correspondence regarding your instrument.

Operating Considerations

Protective Ground

The instrument must be operated using a three-conductor power cable with a protective earth ground. If an extension cord is used, the ground connection must be maintained.

Cooling and Ventilation

The 4300E utilizes forced-air cooling. Ensure that all intake and exhaust vents remain unobstructed during operation. Restricted airflow may result in overheating and degraded performance.

Unpacking and Installation

Inspection

Inspect the shipping container for visible damage before unpacking. If damage is present, request that the carrier's representative be present during unpacking.

After unpacking, inspect the instrument for any signs of physical damage. If damage is observed, or if the instrument does not operate as expected, notify the carrier and your nearest Valhalla Scientific representative.

Retain all shipping materials for carrier inspection. Do not return the instrument to Valhalla Scientific, Inc. without first obtaining a Return Material Authorization (RMA).

Line Voltage Configuration

The instrument is factory-configured for the specified line voltage at the time of shipment.

If the line voltage setting must be changed, perform the following steps:

1. Disconnect the power cord from the instrument.
2. Using a small flat-head screwdriver, set the **Line Voltage Selector** to the appropriate position.
3. Verify that the correct fuse is installed for the selected voltage (see Fuse Selection below).

Fuse Selection

The line fuse must match the selected operating voltage:

- **105–125 VAC** — 3 A, slow-blow
- **210–250 VAC** — 1.5 A, slow-blow

The fuse holder is located on the rear panel.

To replace the fuse:

1. Disconnect the power cord.
2. Insert the fuse into the fuse cap.
3. Install the fuse cap into the holder.
4. Press inward and rotate clockwise to secure.

Replace fuses only with the specified type and rating.

Rack Mounting (Optional)

The 4300E may be installed in a standard 19-inch equipment rack using the optional **RX-3 Rack Mount Kit**, which includes two mounting brackets and four flat-head screws.

Install the brackets on the front of each side rail as shown in the applicable figure.

Because of the instrument's size and weight, it must be supported along its full length using rack slides or a support tray. If the unit is transported while rack-mounted, additional support should be provided to prevent vertical movement.

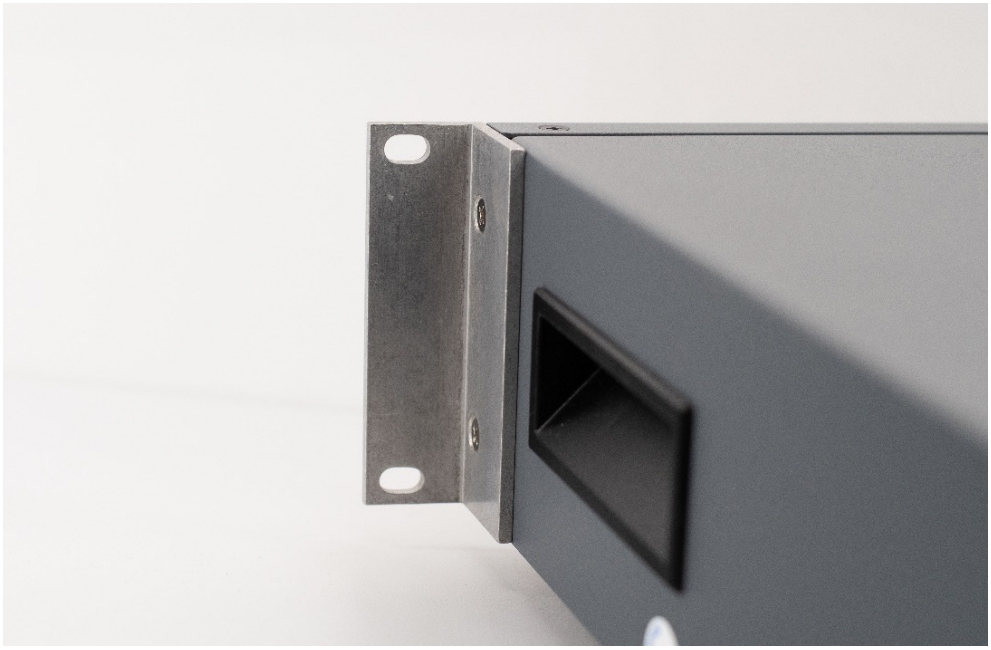

Figure 1 - Rack Mount Adaptor RX-3

Cooling and Ventilation

The instrument uses forced-air cooling and requires unobstructed airflow.

- Do not block intake or exhaust vents
- Allow adequate spacing between adjacent rack-mounted equipment
- It is recommended to install at least **1.75 inches (1U)** of open space or vented panel between units

Maximum allowable ambient temperature:

- **Operating:** 50 °C
- **Non-operating:** 70 °C

Restricted airflow or excessive temperature may result in overheating and degraded performance.

Specifications

This section defines the accuracy and operating characteristics of the Model 4300E.

Unless otherwise specified, accuracy is valid for one year following calibration, after a 30-minute warm-up, and within an ambient temperature range of 22 °C to 28 °C.

Outside this temperature range, the specified temperature coefficient applies.

Standard Measurement Mode

#	Range	Test Voltage	Full Scale	Resolution	Test Current[1]	Accuracy[2] (±% Reading ±Ω)	Temperature Coefficient[3]
1	2mΩ	20mV	2.0000mΩ	100nΩ	10A	±0.06% ± 0.0006mΩ	±50 ppm/°C
2	20mΩ	20mV	20.000mΩ	1µΩ	1A	±0.04% ± 0.006mΩ	±50 ppm/°C
3	200mΩ	20mV	200.00mΩ	10µΩ	0.1A	±0.04% ± 0.06mΩ	±50 ppm/°C
4	2Ω	20mV	2.0000Ω	100µΩ	10mA	±0.04% ± 0.0006Ω	±50 ppm/°C
5	20Ω	20mV	20.000Ω	1mΩ	1mA	±0.04% ± 0.006Ω	±50 ppm/°C
6	200Ω	20mV	200.00Ω	10mΩ	0.1mA	±0.04% ± 0.06Ω	±50 ppm/°C
7	20mΩ	200mV	20.000mΩ	1µΩ	10A	±0.06% ± 0.003mΩ	±50 ppm/°C
8	200mΩ	200mV	200.00mΩ	10µΩ	1A	±0.04% ± 0.03mΩ	±50 ppm/°C
9	2Ω	200mV	2.0000Ω	100µΩ	0.1A	±0.04% ± 0.0003Ω	±50 ppm/°C
10	20Ω	200mV	20.000Ω	1mΩ	10mA	±0.04% ± 0.003Ω	±50 ppm/°C
11	200Ω	200mV	200.00Ω	10mΩ	1mA	±0.04% ± 0.03Ω	±50 ppm/°C
12	2kΩ	200mV	2.0000kΩ	100mΩ	0.1mA	±0.04% ± 0.0003kΩ	±50 ppm/°C
13	200mΩ	2V	200.00mΩ	10µΩ	10A	±0.06% ± 0.03mΩ	±50 ppm/°C
14	2Ω	2V	2.0000Ω	100µΩ	1A	±0.04% ± 0.0003Ω	±50 ppm/°C
15	20Ω	2V	20.000Ω	1mΩ	0.1A	±0.04% ± 0.003Ω	±50 ppm/°C
16	200Ω	2V	200.00Ω	10mΩ	10mA	±0.04% ± 0.03Ω	±50 ppm/°C
17	2kΩ	2V	2.0000kΩ	100mΩ	1mA	±0.04% ± 0.0003kΩ	±50 ppm/°C
18	20kΩ	2V	20.000kΩ	1Ω	0.1mA	±0.04% ± 0.003kΩ	±50 ppm/°C

Table 1 - Range Parameters and Accuracies

[1] Test current source accuracy is ±1% (absolute).

[2] Accuracy specifications apply after a 30-minute warm-up and include the effects of line voltage variations within the specified operating range.

[3] Applies for ambient temperatures from 5 °C to 21 °C and 29 °C to 50 °C.

Temperature Compensator Mode Specifications

#	Range	Test Voltage	Test Current	Accuracy[4] (±% Reading ±Ω)
1	2mΩ	20mV	10A	±0.11% ± 0.0006mΩ
2	20mΩ	20mV	1A	±0.09% ± 0.006mΩ
3	200mΩ	20mV	0.1A	±0.09% ± 0.06mΩ
4	2Ω	20mV	10mA	±0.09% ± 0.0006Ω
5	20Ω	20mV	1mA	±0.09% ± 0.006Ω
6	200Ω	20mV	0.1mA	±0.09% ± 0.06Ω
7	20mΩ	200mV	10A	±0.11% ± 0.003mΩ
8	200mΩ	200mV	1A	±0.09% ± 0.03mΩ
9	2Ω	200mV	0.1A	±0.09% ± 0.0003Ω
10	20Ω	200mV	10mA	±0.09% ± 0.003Ω
11	200Ω	200mV	1mA	±0.09% ± 0.03Ω
12	2kΩ	200mV	0.1mA	±0.09% ± 0.0003kΩ
13	200mΩ	2V	10A	±0.11% ± 0.03mΩ
14	2Ω	2V	1A	±0.09% ± 0.0003Ω
15	20Ω	2V	0.1A	±0.09% ± 0.003Ω
16	200Ω	2V	10mA	±0.09% ± 0.03Ω
17	2kΩ	2V	1mA	±0.09% ± 0.0003kΩ
18	20kΩ	2V	0.1mA	±0.09% ± 0.003kΩ

[4] Accuracy specifications apply after a 30-minute warm-up and include the effects of line voltage variations within the specified operating range.

General Specifications

Electrical & Measurement

- **Display:** High-contrast OLED display with automatic dimming
- **Overload Indication:** Overload condition displayed on screen with status indication
- **Terminal Configuration:** Four-wire Kelvin
- **ADC Conversion Rate:** 10 readings per second
- **Display Update Time:** 100msec
- **Maximum Kickback Protection:** 500 A peak induced current
- **Compliance Voltage (Normal Mode):** 7.5 VDC nominal at 10 A (resistive load)
- **Compliance Voltage (Charging Inductor Mode):** > 20 VDC (when active)
- **Open Circuit Voltage (Test Current Off):** < 20 mV between IHI and ILO terminals

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Environmental

- **Operating Temperature:** 0 °C to 50 °C
- **Humidity:** 70% RH at 40 °C, non-condensing
- **Storage Temperature:** −30 °C to 70 °C

Power Requirements

- **Input Voltage:** 105–125 VAC or 210–250 VAC
- **Frequency:** 50–60 Hz
- **Power Consumption:** 200 VA maximum

Physical

- **Dimensions:** 17 in (43 cm) W × 14.5 in (36.8 cm) D × 4 in (10 cm) H
- **Weight:**
    - Net: 9.1 kg (20 lb)
    - Shipping: 11.8 kg (26 lb)

Getting Started

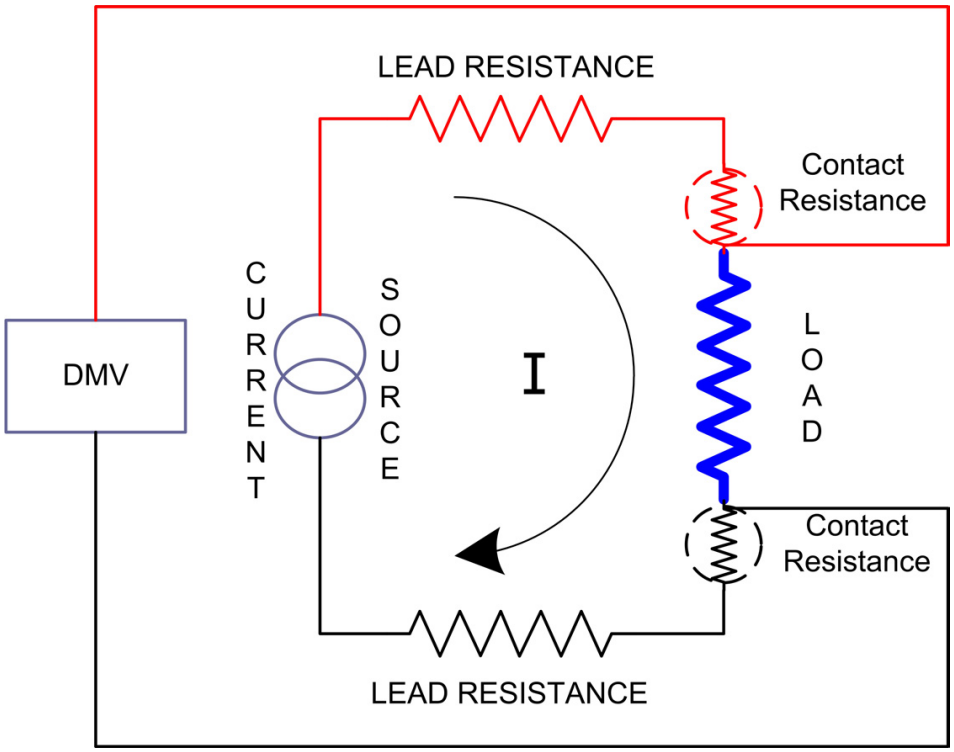
This section introduces the basic operation of the Model 4300E, including connection methods, front and rear panel features, and display behavior. It is intended to help you quickly begin making accurate resistance measurements.

4-Wire (Kelvin) Measurement

The 4300E uses a **4-wire (Kelvin) measurement technique** to eliminate errors caused by lead, wire, and contact resistance.

In this configuration:

- A controlled current is applied to the device under test through the **current leads (IHI / ILO)**
- The resulting voltage drop is measured across the device using separate **sense leads (VHI / VLO)**



Because the voltage measurement is performed using a high-impedance input, negligible current flows through the sense leads. This minimizes the effect of lead and contact resistance on the measurement.

The internal current source automatically compensates for series resistance (within compliance voltage limits), ensuring accurate and stable readings.

Overview of Operation

The following sections describe:

- Front panel controls and indicators
- Rear panel connections
- Making proper Kelvin connections
- Display layout and status messages

Understanding these elements will allow you to configure the instrument correctly and obtain accurate, repeatable measurements.

Front Panel Overview

The front panel of the Model 4300E is organized into functional sections as shown in **Figure 2**.

Each control and indicator is described in the following sections.

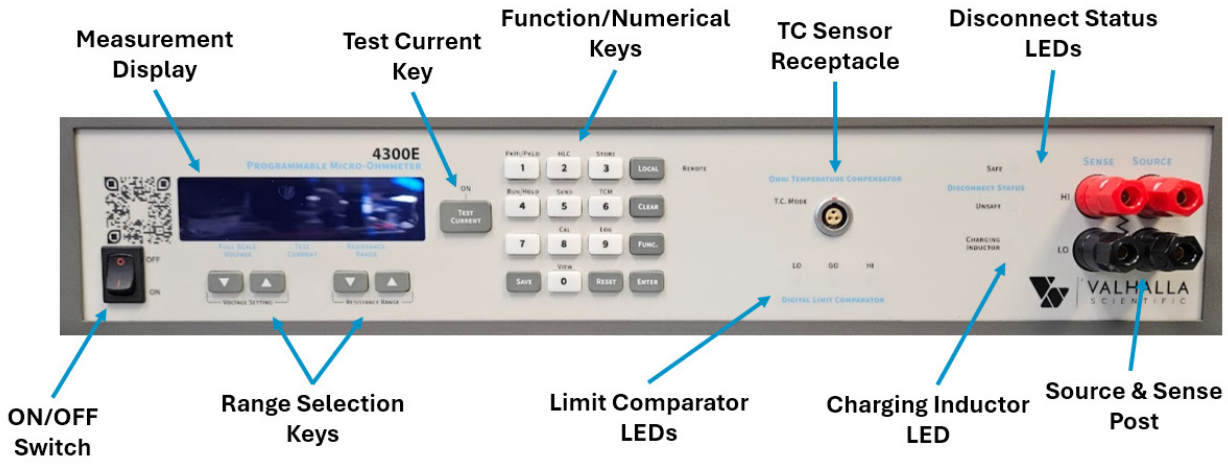


Figure 2 - Front Panel Sections

Power Switch

The **Power** switch controls AC input power to the instrument.

- **ON** — Applies power and enables instrument operation
- **OFF** — Removes power from the internal circuitry

Allow the instrument to complete its startup sequence before making measurements.

Display

The 4300E features a high-contrast OLED display that provides real-time measurement data, status information, and user prompts.

During operation, the display is divided into **four sections**, as shown in Figure 3:

- **Measurement** — Displays the current resistance reading
- **Hold** — Indicates when the measurement hold function is active
- **Temp.** — Displays the measured ambient temperature when Temperature Compensation Mode (TCM) is enabled
- **Range** — Displays the active test configuration, including voltage setting, current range, and resistance range

The display is also used to present alerts and system messages, including conditions such as overload, invalid settings, or connection issues.

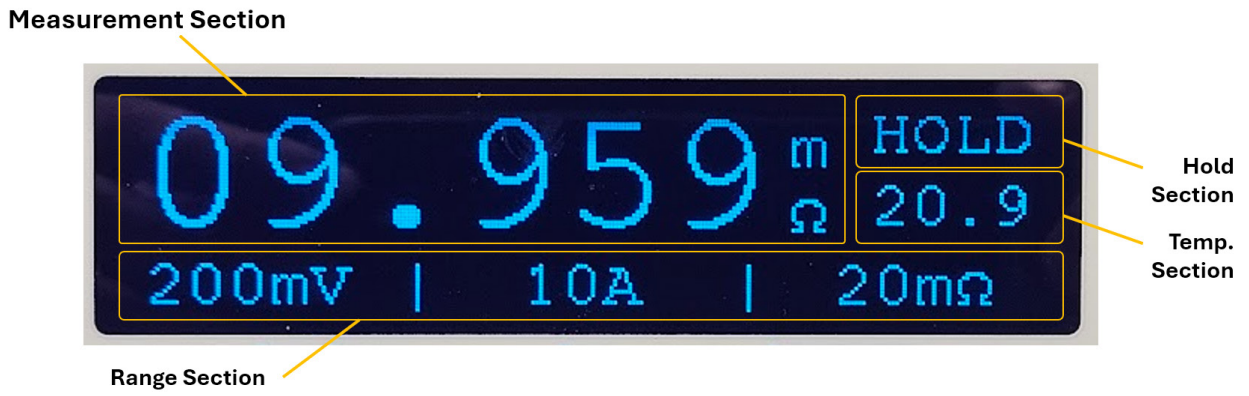


Figure 3 - Display Sections

Range Selection and Test Current

The 4300E provides flexible control of measurement range through independent selection of **test voltage** and **test current**. These combine to define the active resistance measurement range.

Range Selection

The instrument provides:

- **3 voltage settings:** 20 mV, 200 mV, 2 V
- **6 current ranges:** 10 A to 100 µA

These combinations result in **18 available resistance ranges**, as shown below.

Current	20 mV	200 mV	2 V
10 A	2 mΩ	20 mΩ	200 mΩ
1 A	20 mΩ	200 mΩ	2 Ω
100 mA	200 mΩ	2 Ω	20 Ω
10 mA	2 Ω	20 Ω	200 Ω
1 mA	20 Ω	200 Ω	2 kΩ
100 µA	200 Ω	2 kΩ	20 kΩ

Voltage Selection

The **F.S. Voltage** keys are used to select the test voltage:

- **▲ (UP)** — Increase voltage setting
- **▼ (Down)** — Decrease voltage setting

Resistance Range Selection

Within each voltage setting, six resistance ranges are available.

The **Ω Range** keys are used to change the active range:

- **▲(UP)** — Increase resistance range
- **▼(DOWN)** — Decrease resistance range

As the resistance range increases, the test current decreases, and vice versa.

Test Current Control

The **Test Current** key enables or disables the current source.

- When **ON**, test current is applied to the device under test
- When **OFF**, no current is applied

A red LED above the key indicates the current source status.

Test current may also be controlled through:

- Remote interface commands
- Optional foot switch (Option “RS”)

When the **Test Current Timer** function is enabled in *Timed* mode, the Test Current key operates as a trigger. Pressing the key will apply current for the programmed duration, after which the current automatically turns OFF.

Function / Numerical Keys

There are sixteen Function/Numerical keys used to trigger the standard and/or optional ohmmeter functions and for data entry. Table 2 lists a brief description of each key and its uses. The Function/Numerical keys will be further described throughout this manual.

Key	Num. Value	Idle State	Function Menu	View Menu
FUNC.	-	Enter Function Menu	-	-
PKHI/PKLO	1	Toggle Peak Hi/Lo	-	-
HLC	2	Toggle HLC (disables relays)	Enter HLC Configuration	View HLC settings
STORE	3	Enter Store Power-Up Data Confirm state	-	-
RUN/HOLD	4	Toggles Run/Hold	-	-
SEND	5	Send current reading (format depends on config)	Enter Send/Print Format Selection	View Send/Print settings
TCM	6	Toggle TCM (disables auto-range)	Enter TCM Calibration (guided steps)	View TCM settings
TIMER	7	-	Enter Test Current Timer Setup	View Test Current Setting
CAL	8	-	Enter Internal Calibration (guided steps)	-
LOG	9	Toggle logging	Enter Log Format Selection	View Log settings
VIEW	0	Enter View Menu	Enter Brightness Configuration	-
RESET	-	Soft reset device	Enter Factory Reset Confirmation	-
LOCAL	-	Exits Remote Mode	Enter UART Port Selection	View Ethernet/IP info
CLEAR	-	-	Return to Idle	Return to Idle
ENTER	-	-	-	-
SAVE	-	-	-	-

Table 2 - Key Summary Table

Remote / Local Operation

The **Remote** LED indicates the current control mode:

- **LED ON** — Remote mode (instrument controlled via interface)
- **LED OFF** — Local mode (front panel control active)

In Remote mode, front panel keys are disabled except where explicitly supported.

Temperature Compensation (TCM)

Temperature Compensation Controls

This section of the front panel is used when performing **temperature-compensated measurements (TCM)**.

The **TCM key** enables or disables Temperature Compensation Mode. When enabled, the instrument calculates and displays a temperature-corrected resistance value based on the measured ambient temperature and user-defined parameters (described in the following section).

- **TCM LED (green):** Indicates that TCM mode is active
- **Display "FAULT" message:** Indicates that the temperature sensor is missing or not properly connected

Because TCM alters the displayed resistance value, it is important to verify whether TCM mode is enabled when interpreting measurements.

Temperature Sensor Receptacle

Accurate temperature compensation requires a stable and reliable connection between the instrument and the temperature sensor.

The front panel receptacle is designed for use with the **Valhalla Scientific Omni Compensator**[5] temperature sensor. The connector is keyed to ensure proper orientation.

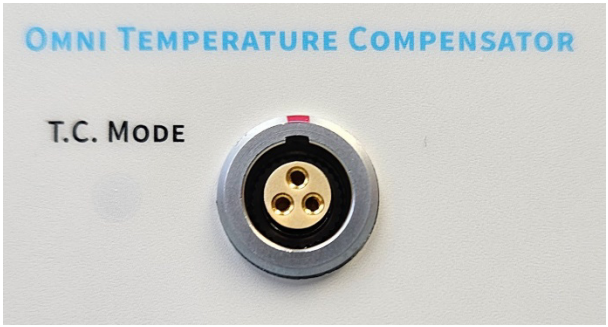


Figure 4 - Temp Comp Sensor Receptacle

- Align the **red dot** on the sensor connector with the **red marking** on the receptacle
- Insert the connector fully to ensure proper operation

Improper or missing connection will result in a fault condition and disable TCM functionality.

Hi/Lo Comparator (HLC) Indicators

This part of the front panel provides a visual indication of the Hi-Lo Comparator (HLC) results. HLC mode is explained in detail in the **Measurement Modes and Functions** section of this manual. The HLC LEDs are only active when the HLC mode is enabled.

[5] The Omni Compensator is an optional accessory to the 4300E. See Measurement Modes and Functions for more detail.

- The **green LED**, labeled **“GO”**, illuminates if the measured resistance falls within the user-defined limits.
- The **red LED**, labeled **“LO”**, lights up if the measurement is below the lower limit.
- The **red LED**, labeled **“HI”**, activates if the measurement exceeds the upper limit.

Figure 5 - Front Panel HLC Area

Cable Disconnect Status Indicators

The **SAFE** and **UNSAFE** indicators provide guidance on when it is safe to disconnect test leads from the device under test.

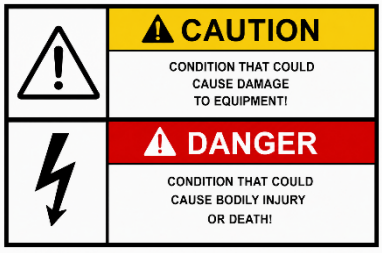
When measuring inductive loads, removing test current can generate a high back electromotive force (back-EMF). The instrument includes an internal discharge path and monitors this condition.

- **SAFE (LED ON):** Back-EMF is below 5 V — safe to disconnect
- **UNSAFE:** Voltage remains above safe levels — do not disconnect

Always wait for the SAFE indication before removing connections when testing inductive loads.

The **UNSAFE** indicator is also illuminated whenever a test current of **100 mA (0.1 A) or greater** is selected, and the **Test Current** is ON.

This condition is independent of the connected load.



Although the 4300E is protected against up to 500 Amps of inductive kickback, it is not advisable to remove test leads with the Test Current On, or with the UNSAFE LED lit. In some extreme applications if leads are removed or pull loose before the SAFE LED is lit, damage may occur to the 4300E and/or injury to the operator!

Charging Inductor Mode

The **Charging Inductor Mode LED** indicates that the instrument has exceeded the normal current source compliance voltage.

- **Normal Mode:** ~7 V compliance
- **Charging Inductor Mode:** > 20 V boost applied

This mode is automatically activated when measuring highly inductive loads to reduce settling time.

Important:
When the Charging Inductor Mode LED is illuminated, displayed readings may not be valid. Measurements should be interpreted only after the LED is no longer active.

Source and Sense Terminals

Connections to the 4300E are made using four front-panel binding posts configured for **4-wire (Kelvin) measurement**.

- **Right terminals (red/black):** Current source (IHI / ILO)
- **Left terminals (red/black):** Voltage sense (VHI / VLO)

The terminals accept:

- Standard banana plugs
- Wires up to 12 AWG
- Spade lugs

All contacts are gold-plated to ensure low-resistance, stable connections.

Kelvin Connection Guidelines

For accurate measurements:

- Connect the **current leads** to carry the test current
- Connect the **sense leads** directly across the device under test
- Ensure all connections are secure and free of contamination

When using Valhalla test leads:

- The **tabbed side** of each banana connector is connected to the **current terminals**
- This ensures current flows through the larger conductor while the voltage sense leads remain shielded

Measurement Accuracy (4-Wire Principle)

The 4-wire (Kelvin) configuration eliminates errors caused by lead, wire, and contact resistance.

In many applications, contact resistance may exceed the resistance of the device under test. By separating current sourcing and voltage sensing, the 4300E measures only the voltage drop across the load itself.

This results in fast, stable, and highly accurate resistance measurements, independent of the resistance of the current-carrying leads.

Rear Panel Overview

The rear panel provides power input, protection, and interface connections for the 4300E.

Figure 6 shows a fully configured rear panel. Available connectors and features may vary depending on the installed options.

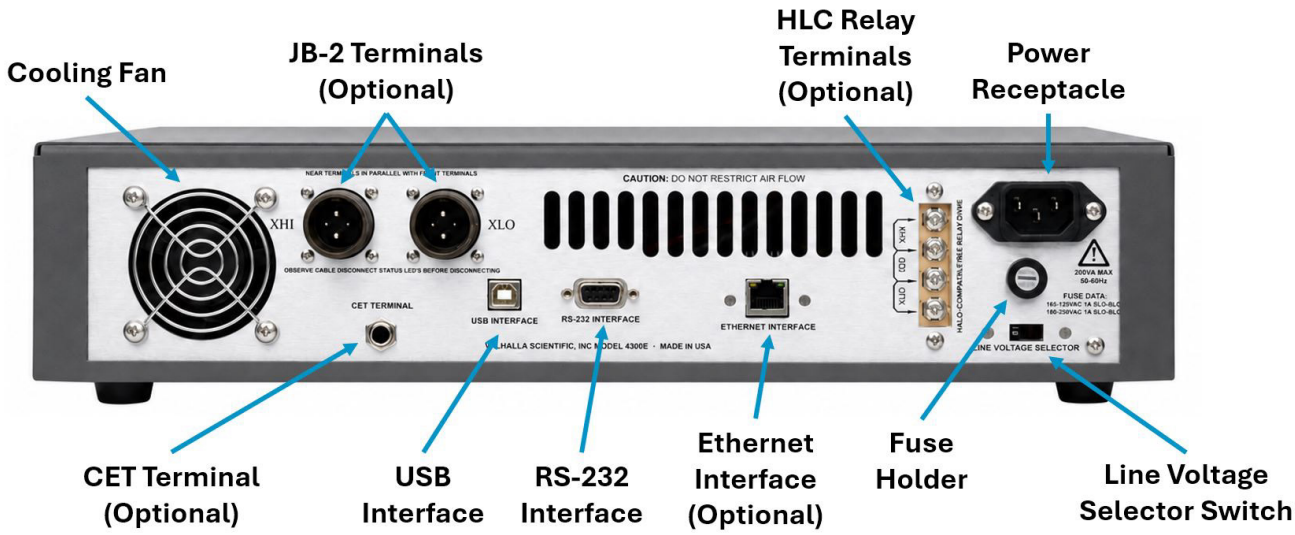
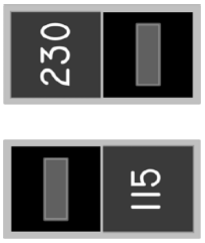


Figure 6 - Rear Panel Sections

Line Voltage Selector



The **Line Voltage Selector** configures the instrument for the local AC power source.

- **115 V setting** — For 115 VAC ±10% operation
- **230 V setting** — For 230 VAC ±10% operation

Verify the correct setting before applying power.

Selecting the incorrect line voltage setting may cause damage to the instrument!

Fuse Holder

The line fuse must match the selected operating voltage:

- **105–125 VAC** — 3 A, slow-blow
- **210–250 VAC** — 1.5 A, slow-blow

The fuse holder is located on the rear panel.

To replace the fuse:

1. Disconnect the power cord from the instrument
2. Insert the fuse into the fuse cap
3. Install the fuse cap into the holder
4. Press inward and rotate clockwise to secure

Replace fuses only with the specified type and rating.

Power Connector

The 3-prong power connector on the rear panel is used to supply AC power to the instrument. The included power cord mates with this connector. For details on available voltages and safety precautions, refer to **Chapter 1**.

RS-232 Connector

The RS-232 serial interface is accessible via the 9-pin female D-Sub connector located on the rear panel. For certain applications, understanding the specific pin functions may be necessary; refer to **Remote Interface Chapter** for detailed pin assignments.

USB Interface

This interface allows for easy data transfer, configuration, and control of the instrument via standard USB connections.

The USB port supports plug-and-play functionality and is compatible with most modern operating systems. For proper operation, use a standard USB Type B cable to connect the instrument to your computer’s USB port.

Refer to **Remote Interface Chapter** for detailed instructions on establishing a connection and configuring communication settings.

Ethernet Port (Optional)

The 4300E may be equipped with an optional Ethernet port located on the rear panel to enable network connectivity. This port allows the instrument to be integrated into local networks for remote monitoring, data logging, or control via standard Ethernet protocols.

The Ethernet port supports standard RJ45 connectors and complies with typical network configurations. To establish a connection, use an appropriate Ethernet cable to connect the instrument to your local area network (LAN).

For detailed setup instructions, including IP address configuration, network settings, and communication protocols, refer to **Remote Interface Chapter** or the network configuration guide provided with your instrument. Proper setup ensures reliable communication and seamless integration into your existing network infrastructure.

Current Enable Terminal (CET) (Optional)

If the CET option is installed, the rear panel includes a ¼-inch jack used to externally enable or disable the test current.

The CET operates as an interlock:

- **Closed (shorted):** Test current may be enabled
- **Open:** Test current is disabled

If the CET is open, the instrument will not allow the test current to turn on.

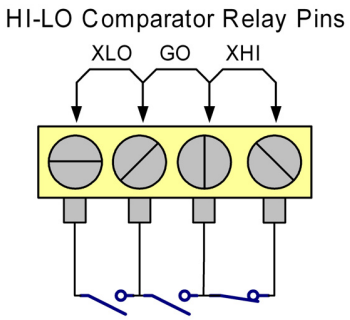
If the test current is already on and the CET becomes open, the instrument will immediately disable the current output.

This feature is commonly used with external switches, foot pedals or safety interlocks to control when current can be applied to the device under test.

The instrument is supplied with:

- A **wiring plug**, allowing the user to connect an external switch or interlock for their application
- A **bypass plug**, which keeps the CET closed for normal operation when no external control is required

HLC Relay Terminal (Optional)



The HLC (High-Low Comparator) relay terminal is internally connected to three relays, which are active only when the HLC mode is enabled. Based on the measurement comparison:

- One relay's contacts will close if the measured load value (Ω) falls within the set limits.
- The other two relays will remain open.

This relay contact closure capability facilitates automated sorting or control processes at an economical cost. The screw-type terminals are designed for connections to wires or spade lugs.

Electrical Ratings:

- **Voltage:** 100 V
- **Current:** 100 mA

HLC State and Result Truth Table:

HLC State	HLC Result	XLO	GO	XHI
ON	LL ≤ Ω ≤ UL	OPEN	CLOSED	OPEN
ON	Ω < LL	CLOSED	OPEN	OPEN
ON	Ω > UL	OPEN	OPEN	CLOSED
OFF	LL ≤ Ω ≤ UL	OPEN	OPEN	OPEN
OFF	Ω < LL	OPEN	OPEN	OPEN
OFF	Ω > UL	OPEN	OPEN	OPEN

(Note: "Ω" represents the load measurement; UL and LL are the user-set upper and lower limits.)

Rear Bendix Connectors (JB-2) (Optional)

Option **JB-2** provides a set of **rear-mounted, locking Bendix-style connectors** for source and sense connections.

These connectors offer a secure, positive-mating interface that helps prevent accidental disconnection during operation, making them well suited for production or high-reliability test environments.

The mating cable set is available as **Option KC**.

Applying Power

To turn on the ohmmeter, set the front panel power switch to the **ON** position. If the device does not power up, verify that it is properly connected to the power line. If power connection is confirmed but the instrument still does not start, check the line power fuse and ensure that the line voltage selection switch is set correctly for your local voltage.

Power-On Settings

When the ohmmeter is powered on, it initializes with the following factory default settings:

Function	Default Setting
Test Current Range	1µA
Voltage Setting	2V
Resistance Range	20kΩ
Temperature Compensation Mode (TCM)	OFF
Hi-Lo Comparator Mode (HLC)	OFF
Peak/HiLo Mode (PkHiLo)	OFF
Test Current Mode	Continuous

Changing the Power-On Settings

These defaults are set at the factory and are automatically applied at power-up. However, you can customize and store your preferred settings at any time using the **Store** function, which saves the current configuration for future power cycles.

Reset to Factory Defaults:

To revert the instrument back to its original factory power-on settings, press the **Func.** button, then the **Reset** button. This will restore all settings to their default values.

Connecting a Load to the 4300E

The first step in using the ohmmeter is to connect it to the load or device under test. Valhalla Scientific, Inc. offers a variety of test leads compatible with the Model 4300E and other Valhalla ohmmeters. Refer to **Optional Features and Accessories** section of this manual for a list of available test leads.

All ohmmeter test leads consist of a pair of conductors terminated with multi-stacking dual banana plugs. It is essential to observe the position of the ground marker on each plug to ensure proper connection. The marked side of each banana jack should be connected to the respective **Source** terminals.

Connecting the Leads:

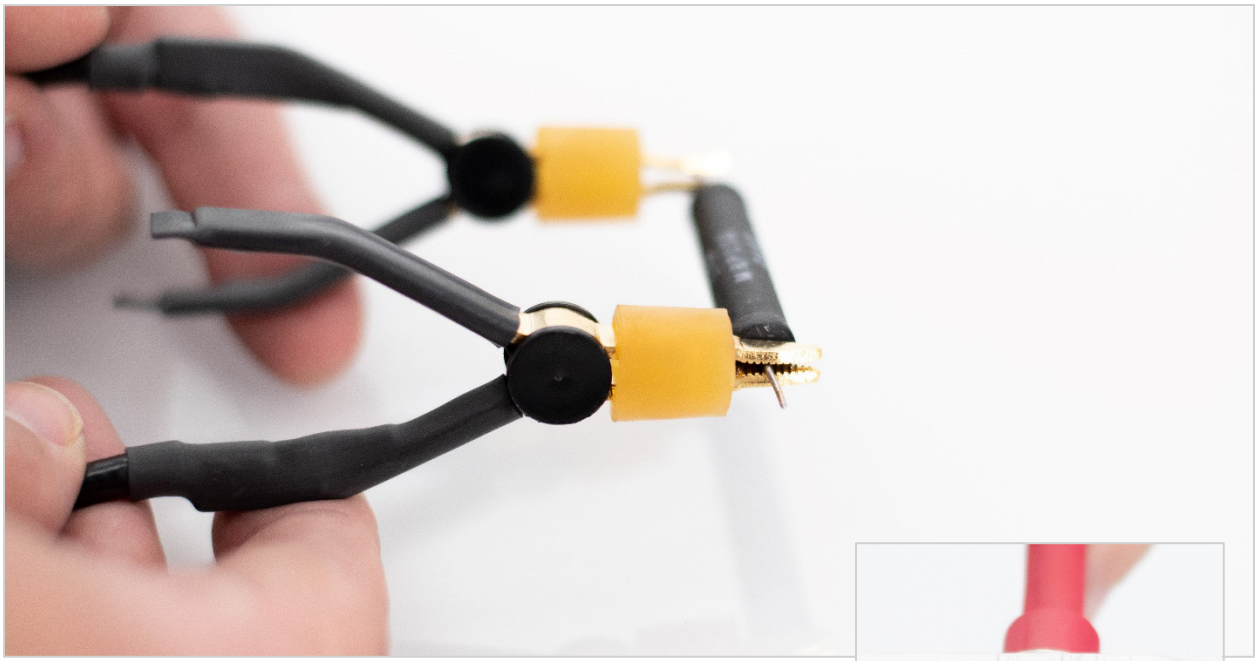
- **Lead 1:** Connect between **SENSE HI** and **SOURCE HI**, with the ground marker on the source side.
- **Lead 2:** Connect between **SENSE LO** and **SOURCE LO**, with the ground marker on the source side.

This configuration ensures that the current source is carried through the largest conductor in the cable, and the sense input remains shielded from interference.

The opposite ends of the leads may have different types of terminations. On the following page, a description of the three most common termination styles will be provided.

Common Termination Styles for Test Leads

The most common termination is alligator clip connectors. If you choose this type of lead, simply attach one clip to one side of your load and the other clip to the opposite side.



Surface Probes

For measurements on flat surfaces, Valhalla Scientific offers two types of spring-loaded surface probes. To use these:

- Press one probe firmly against one side of the surface of your load, ensuring full contact between the probe surface and the load surface.
- Press the second probe against the opposite side of the load, again ensuring full contact.

Needle Probes

For hard-to-reach surfaces, Valhalla Scientific provides two sets of spring-loaded dual needle probes. These differ in overall size and the distance between the needles. To use them:

- Press both needles of one probe against one end of the load's surface.
- Press both needles of the second probe against the opposite end of the load's surface.

Note: For a complete list of available lead sets and accessories for the 4300E, see the **Optional Features and Accessories** section.

Taking Standard Measurements

To perform a resistance measurement:

1. Connect the device under test using a proper **4-wire (Kelvin) configuration**
2. Select the appropriate measurement range
3. Enable the **Test Current**
4. Observe and record the measurement
5. Disable the Test Current before disconnecting the load or leads

Setting the Measurement Range

The 4300E provides:

- **3 voltage settings:** 20 mV, 200 mV, 2 V
- **6 current ranges:** 10 A to 100 µA

These combine to create **18 available resistance ranges**.

Current	20 mV	200 mV	2 V
10 A	2 mΩ	20 mΩ	200 mΩ
1 A	20 mΩ	200 mΩ	2 Ω
100 mA	200 mΩ	2 Ω	20 Ω
10 mA	2 Ω	20 Ω	200 Ω
1 mA	20 Ω	200 Ω	2 kΩ
100 µA	200 Ω	2 kΩ	20 kΩ

Selecting Voltage Setting

Use the **Full Scale Voltage** keys to select the test voltage:

- ▲ **(Up)** — Increase voltage setting
- ▼ **(Down)** — Decrease voltage setting

Selecting Resistance Range

Use the **Resistance Range** keys to select the desired resistance range:

- **UP** — Increase resistance range (Decrease Test Current)
- **DOWN** — Decrease resistance range (Increase Test Current)

As the resistance range increases, the test current decreases, and vice versa.

Test Current Control

Press the **Test Current** key to enable or disable the current source.

- **LED ON (red):** Test current is active
- **LED OFF:** Test current is disabled

Test current may also be controlled via:

- Remote interface commands
- Optional foot switch (Option “RS”)

When the **Test Current Timer** function is enabled in *Timed* mode, the Test Current key operates as a trigger. Pressing the key applies current for the programmed duration, after which the current automatically turns OFF and the final reading is captured.

CAUTION
When measuring inductive loads, allow the instrument to fully settle before disconnecting the device under test.
Do not remove test leads while the **Test Current** is ON or while the **UNSAFE** indicator is illuminated.
Always wait for the **SAFE** indication before disconnecting.

During measurements of inductive loads, the instrument may enter **Charging Inductor Mode** and generate elevated compliance voltage to reduce settling time. Readings may be unstable during this condition and should be considered valid only after the instrument has settled and the indicator is no longer active.

Overload

If the load value exceeds the selected range limit, the instrument enters an **Overload** state. During overload, the display will flash the **“O. L.”**. In this case, you should select a higher range.

If the load exceeds the highest available range, promptly turn off the test current and disconnect the load from the instrument to prevent damage.

Important Note:
If no load is connected to the 4300E, the display may also read **“O.L.”**. This is normal and does not indicate a fault with the device. It simply means that there is no load present.

Measurement Modes and Functions

The primary feature of the 4300E is its capability to perform **4-wire resistance measurements**. In addition to standard measurements, the 4300E offers **Temperature Compensation Mode (TCM)** and **Hi-Lo Comparator Mode (HLC)**. These advanced features can significantly reduce measurement time and cost, especially in temperature-sensitive or automated applications.

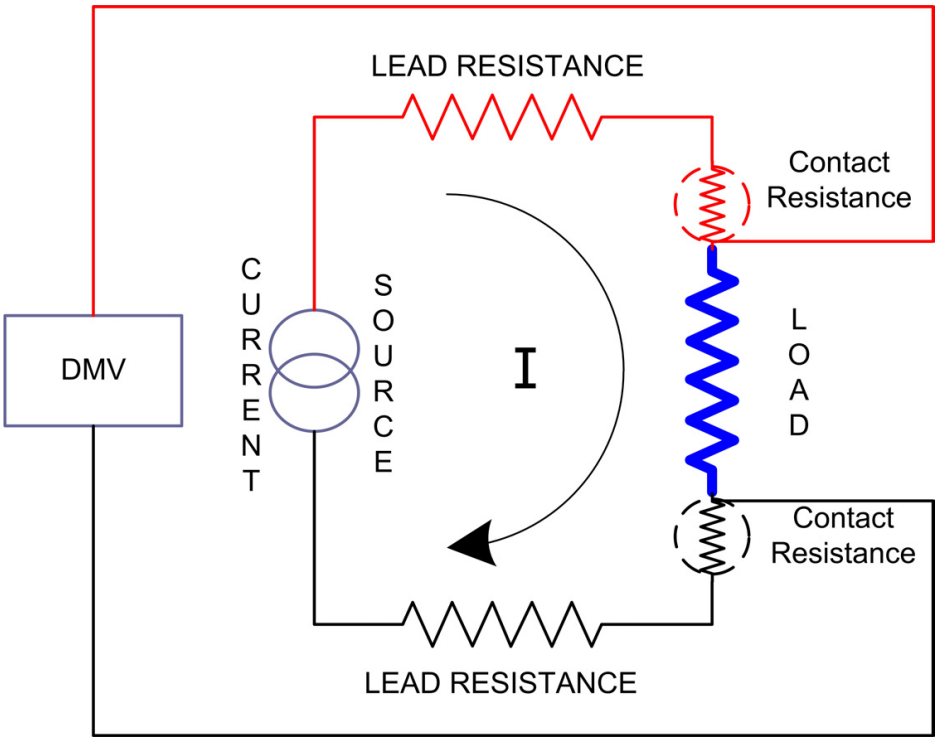
Standard Measurement Mode

The 4300E powers on in **Standard Measurement Mode**[6], which measures the load value using a 4-wire configuration. This setup effectively eliminates errors caused by test lead and contact resistance, which in many applications can be several orders of magnitude greater than the load resistance.

The 4-wire measurement technique involves:

- **Two terminals** dedicated to a **constant current source** (positive and negative).
- **Two additional terminals** for **high-impedance voltage sensing**.

This configuration ensures that the measurement is unaffected by lead, wire, or contact resistances, providing a fast and highly accurate resistance reading.



The illustration above (not shown here) demonstrates how the 4-wire method minimizes errors from lead, wire, and contact resistances. The internal current source delivers a precise, constant current that overcomes series resistance within compliance voltage limits. The high-impedance voltage measurement input of the digital voltmeter (DVM) senses the voltage drop across the load, with negligible error introduced by contact or lead resistance due to its high input impedance.

[6] Default power-up configure can be changed. See “Changing the Power-On Settings” section of this manual.

Test Current Timer (Timed Current)

The 4300E includes a **Test Current Timer** function that allows the user to control how long the test current remains active.

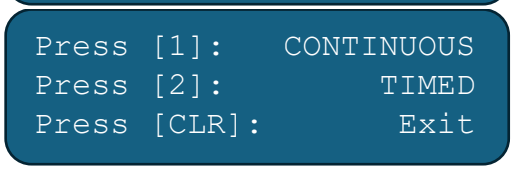
This feature supports both continuous operation and timed measurements, and is useful for repeatable testing, automation, and safety control.

Selecting Timer Mode

To access the Test Current Timer:

Start by pressing **Func.** key.

Press (**Timer**)



Press **1** for Continuous Mode
Press 2 for Timed Mode

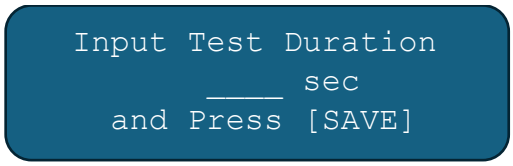
Continuous Mode

In **Continuous** mode, the Test Current operates in the standard manner:

- Press **Test Current** → current turns ON
- Press again → current turns OFF

Timed Mode

In **Timed** mode, the user defines how long the test current remains active.



Enter the desired test duration in seconds (0-1800) and press SAVE.

Press CLR to cancel.

Once configured:

- Pressing the **Test Current** button acts as a **trigger**
- The current turns ON and remains active for the programmed time
- After the time expires, the current automatically turns OFF
- The final resistance reading is captured and transmitted through the active interface.

This ensures consistent and repeatable measurement timing for automated or remote data collection.

"TCM" — Temperature Compensated Measurement Mode

Valhalla engineers are pioneers in the technology of accurate measuring devices using recognized formulas that compensate for measurement inaccuracies because of environmental changes. The TCM feature simulates a constant ambient temperature chamber for materials which are normally subject to varying ambient temperatures. When in the TCM mode, the temperature sensor, the Omni-TC\, senses the ambient temperature and automatically compensates the reading to indicate what the actual resistance value should be in a controlled environment (usually 20° C). The compensated value is calculated with the following equation:

$$\frac{\Delta R}{R_0} = \alpha \Delta T$$

The variation of resistance (ΔR) divided by the initial resistance (R_0), is equal to the temperature coefficient of the material (α) multiplied by the variation of temperature (ΔT).

Expressed in terms of the resistance:

$$\frac{R - R_0}{R_0} = \alpha(T - T_0) \;\; OR \;\; R = R_0[1 + \alpha(T - T_0)]$$

To better understand our uses of the equation, we will now express it in terms of our application.

$$R_M = R_C[1 + \alpha(T_A - T_R)]$$

Where R_C is the compensated value, R_M is the measured resistance, T_A is the ambient temperature and T_R is the temperature reference.

The compensated resistance is therefore calculated as follows:

$$R_C = \frac{R_M}{1 + \alpha(T_A - T_R)}$$

The user can select from a list of temperature coefficients and temperature references. The list is based on the most used values. The user can also customize these settings with unique values.

Once the temperature coefficient and the temperature reference are set, the instrument's task is to measure the load resistance and the ambient temperature. After all the variables are determined, the 4300E automatically calculates the compensated resistance value.

Here is an example of the equation. Let us assume that we are measuring a copper wire, and we wish to know the resistance value at a temperature of 20°C. The temperature coefficient of copper is 0.003931Ω/°C.

If the load measures 1.0000Ω and the ambient temperature is 22.5°C:

$$R_C = \frac{1}{1 + 0.003931(22.5 - 20)} = 0.9903\Omega$$

The value of the load at 20°C would be 0.9903Ω.

Omni Compensator

The **4300E** measures ambient temperature using an external sensor called the **Omni-TC**. This sensor is **not included** with the standard package and must be purchased separately. If the 4300E and Omni-TC are purchased at the same time, they are calibrated together for optimal accuracy.

Each instrument should have its **own dedicated Omni-TC sensor**. Sensors are **not interchangeable** between different ohmmeters without prior calibration. Additionally, calibration is required if the sensor is purchased separately. The calibration routine for TCM is described later in this chapter.

Enabling TCM Mode

To activate **Temperature Compensated Measurement (TCM)** mode:

- Press the **TCM** (6)
- The **green TCM LED** on the front panel will illuminate to indicate that TCM is active.

Display "FAULT" message: Indicates that the temperature sensor is faulty, missing or not properly connected. In this case, check that the Omni-TC sensor is properly connected to the front panel.

To deactivate TCM mode, press the **TCM** key again.

Temperature Compensator Setup

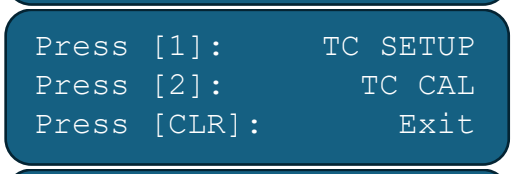
As described earlier, the 4300E requires a **temperature coefficient** and a **reference temperature** to calculate the compensated resistance value. The instrument's memory stores **six predefined configurations** that can be selected based on the material or application. Each configuration corresponds to specific coefficient and temperature reference values. Below is a table illustrating the typical values associated with each configuration, allowing the user to quickly select the appropriate setup for accurate temperature compensation.

Material	Configuration	Temperature Coefficient	Temperature Reference
Copper	CU20	3931 ppmΩ/°C	20°C
	CU25		25°C
Aluminum	AL20	4030 ppmΩ/°C	20°C
	AL25		25°C
Gold	AU20	3000 ppmΩ/°C	20°C
	AU25		25°C

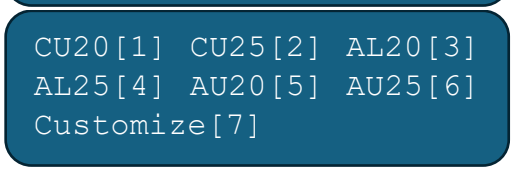
The following procedure demonstrates how to select one of the predefined configurations or how to set up a customized configuration. This process only needs to be performed once; the selected or entered custom values will be saved and set as the default for future use whenever the TCM mode is activated.

Start by pressing **Func.** key.

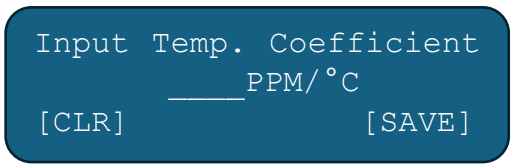
Press (**TCM**) to start TCM Setup



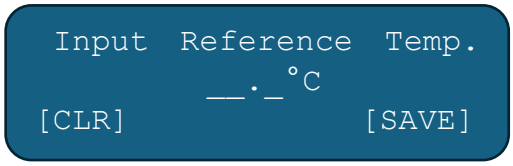
Press **1** to start TC Setup (TCS)



Press the number **1-6** associated with the desired configurations or press **7** to input custom values.



Using the numeric keys, enter the desired Temp. Coefficient. All 4 digits need to be entered. Value is in PPM/°C
Press **Save** to store as the new Temp. Coeff.
CLR clears the value in case of a mistake.



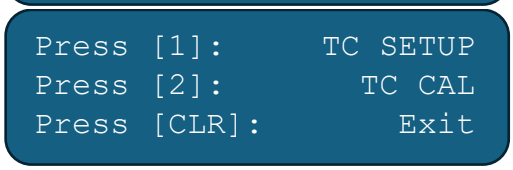
Using the numeric keys, enter the desired Reference Temp. All 3 digits need to be entered. Value is in °C
Press **Save** to store as the new Ref. Temp.
CLR clears the value in case of a mistake.

Temperature Compensator Calibration

This procedure is used to match a 4300E with its Omni Compensator. Before beginning, verify that the instrument is located in a temperature-controlled environment to ensure accurate calibration and measurement.

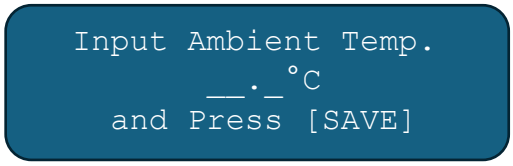
Start by pressing **Func.** key.

Press (**TCM**) to start TCM Setup

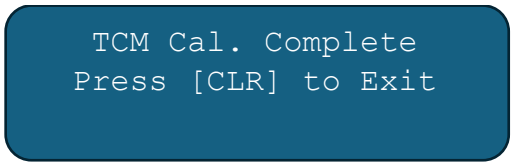


Press **2** to start TC Calibration (TCC)

As per the prompt, connect an Omni-TC to the front panel receptacle. It is recommended to wait a few minutes to allow the sensor time to settle to the current ambient temperature before continuing by pressing **Enter**.



Enter the current ambient temperature after checking with a thermometer. Temp. will be enter using 3 digits. No decimal point needs to be entered.
Press **SAVE** to continue.
CLR clears the value is they make a mistake.



This concluded TCM calibration.

Once the calibration values are stored, press "**TCM**" and verify that the temperature displayed matches the ambient temperature. If the values do not match, repeat the procedure.

“HLC” – Hi-Lo Comparator Mode

The 4300E features a **Dual Limit Comparator (HLC)** that helps eliminate operator interpretation of readings, greatly reducing errors and fatigue while increasing testing efficiency. This mode is especially useful for applications such as receiving inspection of precision resistors by operators with minimal training, it streamlines quality control by providing immediate visual and automated feedback, reducing the need for manual interpretation.

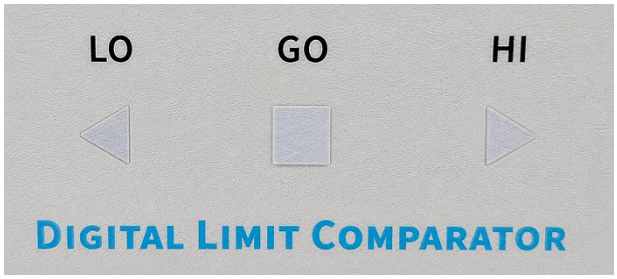
Functionality:
The **Hi/Lo Comparator (HLC)** compares the measured value against user-defined limits. These limits can be set as either:

- **Min/Max** limits, or
- **Nominal ± percentage** limits.

Based on the comparison, the system controls the **Buzzer**, **HLC LEDs**, and **HLC Relays** to indicate whether the load value is within or outside the specified limits.

This feature is **range-dependent**, meaning each measurement range can have its own specific limit setup. This allows for precise control and automation tailored to different measurement scales.

Example Application: Suppose you are inspecting 1 kΩ resistors with a tolerance of ±0.1%. You would set the 4300E to the **2 kΩ range**, with the upper limit at **1.0010 kΩ** and the lower limit at **0.9990 kΩ**.



- If the measured resistance falls within these limits, the **green indicator** remains illuminated, indicating a within-tolerance condition.
- If either the **red indicator** (LO or HI) illuminates, the resistor exceeds the set limits and should be rejected.

To activate the Hi-Lo Comparator mode:

1. Select the appropriate measurement range for your load.
2. Press the **“HLC”** button.

the instrument will perform a **LED check sequence**: all three HLC LEDs will illuminate briefly. After the check, **only one** of the three LEDs will remain lit, indicating the current comparison status.

It is good practice to verify that the limits for the active range meet your specifications:

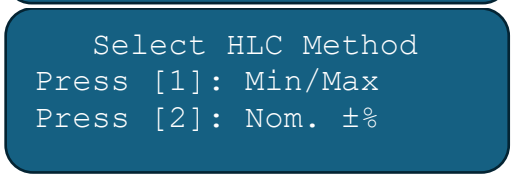
- Press **“VIEW + HLC”**.

The display will then show the **upper and lower limits** currently set for that range, allowing you to confirm or adjust as needed.

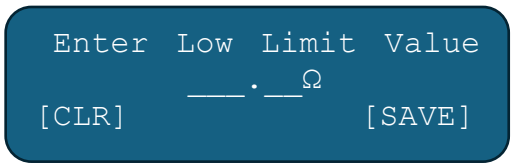
Min/Max HLC Setup

Start by pressing the **Func.** key.

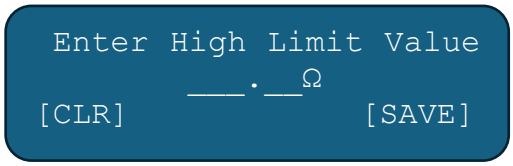
Press (**HLC**) to start HLC Setup.



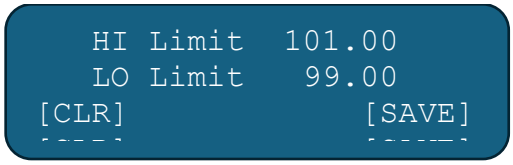
Press **1** for Min/Max



Using the numeric keys, enter the desired low limit. All 5 digits need to be entered. Leading zeros if needed.
Press Save to store the value.
CLR clears the value in case of a mistake.



Using the numeric keys, enter the desired high limit. All 5 digits need to be entered. Leading zeros if needed.
Press [**Save**] to store the value.
CLR clears the value in case of a mistake.



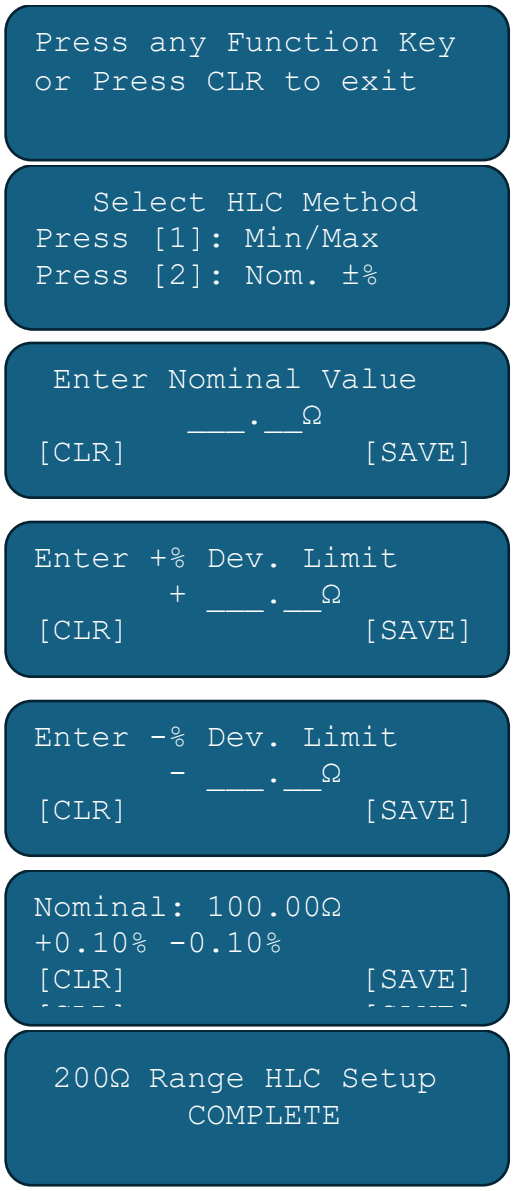
The display will show the limits entered so that they can be reviewed. [**Save**] to confirm. [CLR] to start over.

Choose the buzzer setting.
[1] Beeps if the reading is HI or LO
[2] Beeps if the reading is within limits
[3] Beeps if the reading is HI
[4] Beeps if the readings are LO
[5] No HLC Beep

Set up complete.

Nominal ±% HLC Setup

Start by pressing the **Func.** key.



Press (**HLC**) to start HLC Setup

Press **2** for Nominal ±%
Press CLR to Exit

Using the numeric keys, enter the desired Nominal Value. All 5 digits need to be entered. Leading zeros if needed.
Press Save to store the value.
CLR clears the value in case of a mistake.
Using the numeric keys, enter the + deviation value. All 5 digits need to be entered. Leading zeros if needed.
Press Save to store the value.
CLR clears the value in case of a mistake.
Using the numeric keys, enter the - deviation value. All 5 digits need to be entered. Leading zeros if needed.
Press Save to store the value.
CLR clears the value in case of a mistake.
The display will show the limits entered so that they can be reviewed. [**Save**] to confirm. [CLR] to start over.

Set up complete.

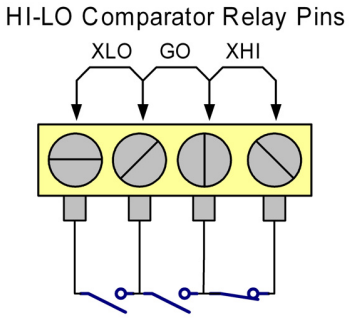
HLC Default Settings and Limits

Factory default values for all ranges.

HLC Mode	Beep Mode	Low Limit	High Limit
Nom ± %	OFF	-0.10%	+0.10%

HLC Relay Terminal (Optional)

The 4300E provides relay closure outputs that can be used to automate batch sorting, operate counters, sound alarms, or shut off processes. This is applicable for tolerancing items such as resistors, transformers, strain gauges, thermocouples, and thermistors.



The **HLC relay terminal** is wired internally to **three relays**, which activate only when the HLC mode is engaged. Based on the comparison result, one relay will have its contacts **closed**, while the other two relays will have their contacts **open.**

This **"relay contact closure"** feature allows for economical setup of automated sorting systems.

Connection Details:

- The HLC rear panel terminals are screw-type, suitable for connection to wires or spade lugs.
- The relays are rated at **100V, 100mA**.

HLC Truth Table

HLC State	HLC Result	XLO	GO	XHI
ON	LL ≤ Ω ≤ UL	OPEN	CLOSED	OPEN
ON	Ω < LL	CLOSED	OPEN	OPEN
ON	Ω > UL	OPEN	OPEN	CLOSED
OFF	LL ≤ Ω ≤ UL	OPEN	OPEN	OPEN
OFF	Ω < LL	OPEN	OPEN	OPEN
OFF	Ω > UL	OPEN	OPEN	OPEN

(Note: Ω is the measured load value; UL is the upper limit, LL is the lower limit set by the user.)

Display Brightness and Screen Saver Mode

The 4300E allows the user to customize the display brightness and activate a screen saver to extend the life of the display.

After **60 seconds** of no user interaction following a keypress, the instrument will automatically enter **screen saver mode**. During this mode, the display will **dim** or **turn off completely** until the next user input.

Brightness Settings:
The display brightness can be set to the following levels:

- **100%** (no dimming)
- **75%** (default setting)
- **50%**
- **25%**
- **0%** (screen turns off)

To set the brightness level press **Func.** then press the **View** key. Follow the prompts on the screen to select your preferred brightness level.

Other brightness percentages can also be configured via **serial interface commands** for advanced customization.

Run / Hold Feature

The **Run/Hold** key toggles the measurement display between **updating** continuously and **holding** the current reading.

- When in **Run mode**, the display updates automatically with new measurements.
- When **Hold mode** is activated, the current reading is **frozen** and will not update until the key is pressed again.

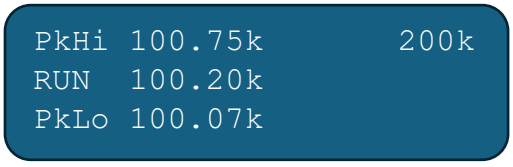
This feature allows the user to capture and record a specific measurement without it changing.

PeakHi/PeakLo Function

The PeakHi/PeakLo function allows the user to see the current reading alongside the maximum and minimum readings recorded while the function is on. This feature helps monitor how the resistance values change over time.

To activate or deactivate the Peak function, press the **PkHi/PkLo** button on the front panel.

When the Peak function is active, an indicator will show the display of the Peak Hi and Peak Lo values with the current measurement.



Additionally, a beeper will sound each time a new Peak Hi or Peak Lo is measured, providing an audible indication of the new peak values. These functions are also available while in Temperature Compensation Mode.

Note that enabling the Peak Hi and Peak Lo functions disables the auto range feature, ensuring stable and consistent measurement settings during use.

Send Function

The **Send** function allows the user to transmit a single measurement directly through one of the instrument's serial interfaces—**RS-232**, **USB**, or **Ethernet**—by simply pressing the **Send** key on the front panel.

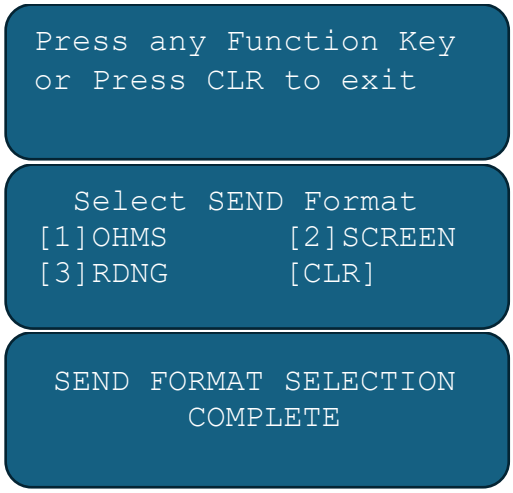
Configuration Options:
The data can be sent in **three different formats**:

1. **Ohms:**
   The measurement is formatted in ohms with the appropriate multiplier (e.g., 1.23kΩ).
2. **Screen:**
   The value is formatted in ohms **without** any multiplier, as displayed on the screen.
3. **RDNG:**
   The value is presented in **reduced engineering notation**, making it easier to interpret very large or small values.

The factory default setup is **OHMS**.

Send Function Setup

Start by pressing the **Func.** key.



Press (**SEND**) to start SEND Setup

Press 1 for OHMS?
Press 2 for SCREEN?
Press 3 for RDNG?
Press CLR to Exit

Setup complete.

LOG Function

The **LOG** function enables continuous transmission of measurement data via one of the serial interfaces—**RS-232**, **USB**, or **Ethernet**. When activated, the instrument will **send ongoing measurement data** until the user presses the **Log** key again to stop.

To start or stop logging:

- Press the **Log** key on the front panel.

This feature is ideal for real-time data recording, remote monitoring, or trend analysis over extended periods.

Configuration Options:

1. **Ohms:**
   The measurement value formatted in ohms with the appropriate multiplier (e.g., 1.23kΩ).
2. **Screen:**
   The measurement value in ohms, displayed exactly as shown on the screen, without any multiplier.
3. **RDNG:**
   The measurement in reduced engineering notation, making it easier to interpret very large or very small values.
4. **RDNG + RANGE:**
   The measurement in reduced engineering notation combined with the currently selected range, providing additional context for the value.

The factory default setup is **OHMS**.

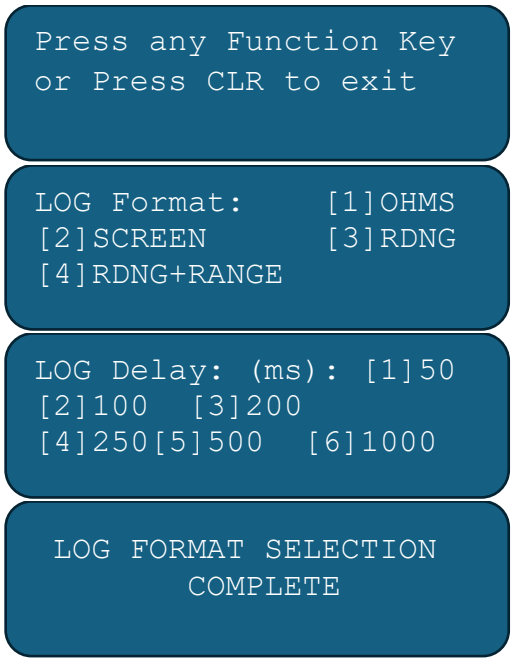
Log Delay Options:
The user can set the interval between data transmissions to control the data rate:

Option	Interval
1	50 milliseconds
2	100 milliseconds
3	200 milliseconds
4	250 milliseconds
5	500 milliseconds
6	1000 milliseconds (1 second)

LOG Function Setup

The following steps allow the user to configure the Log function type and delay.

Start by pressing the **Func.** key.



Press (LOG) to start LOG Setup

Press the number associated with the desired format.

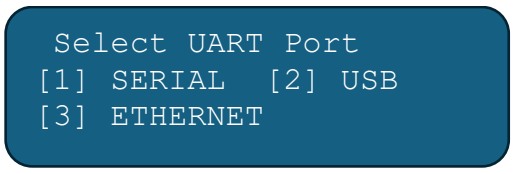
Press the number associated with the desired delay.

Setup complete.

Log/Send Interface Port Selection Function

The 4300E can have up to three interfaces. It is important to set the interface you wish to use for the front-panel Log and Send functions.

To select the desired interface, press Function, then Local.



Press the number associated with the desired port.

Note that the 4300E will revert to the interface that most recently received a command or query.

View Function

The **VIEW** function allows the user to check the current settings of various functions on the instrument.

To access the settings:

1. Press the **View** key.
2. Then press the specific function key related to the setting you want to review.

Available options include:

- **HLC:**
  View the current **Hi/Lo Limit** settings.

- **TCM:**
  View the **Temperature Coefficient** and **Temperature Reference** values.

- **LOG:**
  View the **Data Format** and **Interval** settings for logging.

- **TIMER:**
  View the Current Timer settings.

- **SEND:**
  View the **Data Format** setting for the Send function.

- **LOCAL:**
  View **Ethernet/IP** information and network settings.

- **CLR:**
  Return the display to the **Idle** state, exiting the VIEW mode.

This feature provides quick access to important configuration parameters, ensuring proper setup.

Optional Features and Accessories

The 4300E Micro-Ohmmeter are shipped with a detachable power cord as standard equipment. This section lists several items that may be desirable for special applications.

Options

Ethernet Interface

The 4300E may be equipped with an optional Ethernet port located on the rear panel to enable network connectivity. This port allows the instrument to be integrated into local networks for remote monitoring, data logging, or control via standard Ethernet protocols. Details are available in the Remote Interface Chapter of this Manual.

HLC Relay Terminal

The HLC (High-Low Comparator) relay terminal is internally connected to three relays, which are active only when the HLC mode is enabled. The terminal can be used to implement an automated batch sorting system for components or products, operate counters, sound alarms, or shut off a process. For details see HLC Section of this manual.

Current Enable Terminals (CET)

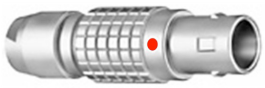
Optional CET provides an external interlock for controlling the test current. When the CET connection is closed (shorted), the instrument allows the test current to be enabled; when open, the current output is disabled. The instrument will not allow test current to turn on if the CET is open, and will immediately disable the current if the connection opens during operation. This feature is commonly used with external switches, foot pedals, or safety interlocks to control when current can be applied to the device under test. The CET option includes a user-wirable plug for external integration, as well as a bypass plug for normal operation when no external control is required.

Rear Bendix Connector (JB-2)

Option **JB-2** provides a set of rear-mounted, locking Bendix-style connectors for source and sense connections, offering a secure, positive-mating interface that prevents accidental disconnection during operation. This option is well suited for production or automated test environments and allows all connections to be made from the rear of the instrument while maintaining full 4-wire (Kelvin) measurement capability. The mating cable set is available as **Option KC**.

Accessories

Omni TC



To be able to use the TCM feature of the 4300E, the user will need an Omni-TC temperature sensor. This item allows the ohmmeter to compensate for temperature variations when testing any material.

Option RX-3: Rack Mount Adapter

The 4300E Micro-Ohmmeter may be mounted in a standard 19" equipment rack using a set of optional rack ears. Option RX-3 comes with all the necessary hardware for installation and mounting.

Test Leads

This section details the different test lead sets and connectors available for use with the 4300E Micro-Ohmmeter. All cables and test leads are manufactured by Valhalla Scientific Inc. and tested before shipping.

Alligator Clip Type Leads

K: Kelvin Lead Set

"K" is a shielded, 4-wire Kelvin cable set, 48 inches in length terminated in gold plated alligator clips *(KCS)*.
Option "K" is the recommended general purpose lead set for most applications. *Figure 7.*

Figure 7 - Kelvin 4-Wire Lead Set

KCS: Gold-Plated Clips

"KCS" are gold-plated alligator clips used on the "K" lead set for 4-wire measurements of smaller components and leads. Clips open to 1/2 inch and accommodate test currents of up to 10A.

C: Banana-to-Clip Cable

"C" is a 48" general purpose shielded lead set terminated on one end in dual banana plugs and on the other end in red and black alligator clips.

KK: Heavy-Duty Lead Set

"KK" is a 4-wire Kelvin cable set, 48-inches in length terminated in heavy-duty gold-plated clamps. *Figure 8*.

Figure 8 - Heavy Duty Kelvin 4-Wire Lead Set

JAWS: Gold-Plated Clamps

"JAWS" are gold-plated heavy-duty clamps. Clamps open 2 inches for connection to large motors, bushings, etc.

KC: Bendix Cable Set

“KC” is a heavy-duty 4-wire Bendix-style cable set designed for use with Option JB-2 rear connectors. It provides secure, reliable source and sense connections while maintaining full Kelvin measurement capability, making it well suited for production and automated test environments.

Needle Type Probes

MP-1: Kelvin Micro-Probes

"MP-1" is a 48-inch shielded 4-wire Kelvin cable set with a 1A test current capacity employing a set of Kelvin Micro-Probes. The probes are equipped with spring-loaded stainless-steel tips with 0.05" spacing.

MP-2: Kelvin Mini-Probes

"MP-2" is a 48-inch shielded 4-wire Kelvin cable set with a 10A test current capacity employing a set of Kelvin Mini-Probes. The probes are equipped with spring-loaded stainless-steel tips with 0.18" spacing.

MP-S: Single Pointed Probe Set

"MP-S" is a 48-inch shielded cable set with a 10A test current capacity employing a set of single pointed handheld pencil type probes. (2 wires to each point).

Surface Probes

MP-4: Surface Probes

These probes permit rapid, repeatable bonding testing on a variety of screened or flat surfaces. Test current is evenly distributed through the probe base while sensing is accomplished via a spring-loaded center contact. The target area is 1-inch in diameter. *Fig. 9*

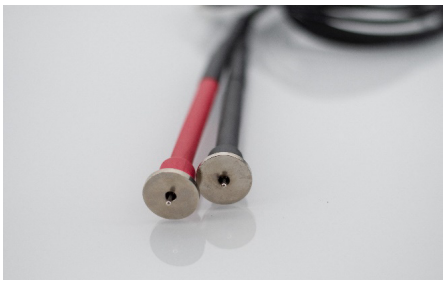
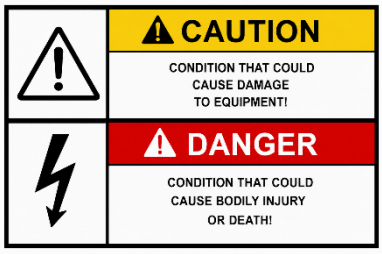


Figure 9 - MP-4 Surface Probe

MP-5: Surface Probes

These probes permit rapid, repeatable bonding testing on a variety of screened or flat surfaces. Test current is evenly distributed through the probe base while sensing is accomplished via a spring-loaded center contact. The target area is 1/2 inch in diameter.



Use caution when operating the Needle Type and Surface Type Probes with the Model 4300E in the 10A range. Always turn OFF test current before connecting or disconnecting the probes from the load.

Other Lead Sets

BBL: Banana-to-Banana Cable

"BBL" is a 48" shielded cable terminated on both ends in dual stacking banana plugs. This cable may be used for voltage and current connections to the ohmmeter.

SL-48: Low Thermal Leads

"SL-48" is a 48" shielded lead set terminated in gold-plated spade lugs. This lead set is designed to eliminate problems caused by thermal EMF's and is rated for the maximum output current of 1A.

Remote Interface

This chapter describes how to operate the 4300E remotely via its serial interfaces, including RS-232, USB, and Ethernet. Remote operation enables integration with external systems for automated control, data logging, and monitoring.

RS-232 Interface

Capabilities

The RS-232 interface provides a point-to-point connection between the 4300E and an external device such as a computer. Once configured, you can control the instrument and retrieve data through this interface.

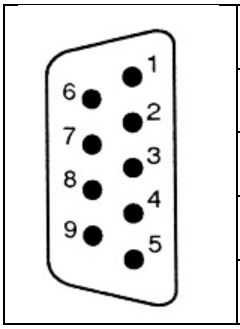
Communication Parameters

Set the RS-232 parameters on both the 4300E and the external device to ensure proper communication:

- **Baud rate:** 115200 baud
- **Parity:** None
- **Data bits:** 8 bits
- **Stop bits:** 1 stop bit
- **Flow control:** None

Notes for Installation

- The 4300E uses a **9-pin D-type female connector** on the rear panel (see Table 3 below for pin assignments).
- Many devices require a constant high signal (e.g., RTS or DTR) on certain input pins.
- Connect the **signal ground** of the external device to the 4300E's signal ground.
- Connect the **chassis ground** of both devices.
- Use cables no longer than **15 meters** to prevent signal degradation.
- Ensure that the baud rate and other parameters match between the device and the PC.



Pin #	Pin Function
1, 4, 6, 7, 8, 9	Not Connected
2	Receive Data (RxD) (input)
3	Transmit Data (TxD) (output)
5	Signal Ground (GND)

Table 3 - RS-232 Connector Pin Configuration

Connecting to a Computer

1. Connect one end of an RS-232 cable to the computer's serial port.
2. Connect the other end to the 4300E's RS-232 port.
3. Power on the 4300E.
4. Power on the computer.

Input and Output Queues
The RS-232 interface uses:

- **Input queue:** 64 bytes
- **Output queue:** 128 bytes

USB Interface

The 4300E is equipped with a standard USB Type B receptacle located on the rear panel. This interface allows for easy connection to a computer for control and data transfer.
Compatibility and Commands

The USB interface supports the same command set as the RS-232 interface. All commands, query formats, and syntax are identical, making the transition between interfaces seamless.

Connection and Setup

1. Connect a USB Type B cable from the 4300E to the computer's USB port.
2. Power on the 4300E; the device will be recognized as a COM port by most operating systems.
3. Use your terminal or control software to communicate with the instrument via the assigned COM port.

Software Drivers
Ensure that the appropriate drivers are installed if required. The command set remains the same as outlined for RS-232, simplifying software development and integration.

Ethernet Interface (Optional)

The 4300E can be optionally equipped with an **Ethernet** interface, enabling remote control and data transfer over a local network or the internet. This provides greater flexibility for automation, remote monitoring, and integration into larger systems.

Overview

The Ethernet interface supports standard TCP/IP communication protocols and is configured via the instrument's network settings. Once connected, the 4300E can be controlled using the same command set as the RS-232 and USB interfaces, ensuring seamless integration.

Hardware Connection

1. Connect an Ethernet cable from the 4300E's Ethernet port (RJ45 connector) to your network switch, router, or PC directly (using a crossover cable if required).
2. Power on the 4300E.

Default Configuration

By default, the Ethernet interface is configured for **Static IP operation** with the following settings:

- **IP Address:** 192.168.1.50
- **Mode:** Static IP

Changing Network Configuration

All Ethernet configuration changes are performed via the **serial or USB interface**.

Set Configuration Mode

- Enable DHCP:
  eth dhcp

- Set Static IP mode:
  eth stat

Set IP Address (Static Mode Only)

eth stat <ip_address>

Example: eth stat 192.168.1.100

Set Subnet Mask

eth mask <subnet_mask>

Example: eth mask 255.255.255.0

Set Gateway

eth gw <gateway>

Example: eth gw 192.168.1.1

Obtaining the IP Address

To view the IP address and Port setting on the 4300E, Press **View** followed by the **Local** Key.
The screen will display the following:

Communication and Command Set

The Ethernet interface supports the same command set and syntax as the RS-232 and USB interfaces. Commands are sent as plain text over TCP/IP, terminated with CR/LF, and responses follow the same format.

Establishing a Connection

1. Use a TCP/IP socket connection to connect to the instrument's IP address and port (default port is typically 4300 but verify your device settings).
2. Once connected, the instrument will accept commands in the same format as RS-232/USB.

Note: The command syntax, data formats, and responses are identical to those used in the RS-232 and USB interfaces, simplifying software development and remote operation.

Commands

As previously stated, the following list of commands are valid across all 3 interface formats (RS-232, USB and Ethernet).

Commands and Syntax

- Commands may be terminated with **LF**, **CR**, or **CR/LF**.
- After executing a command, the instrument appends a **CR/LF** to responses.

Entering Commands

- Commands are not case-sensitive.
- One (and only one) space must separate command headers from parameters.

Verifying Connection

To test the connection, send an identification query:

*idn?

The 4300E should respond with: **VALHALLA SCIENTIFIC 4300E, 4.01A** (depending on firmware revision)

If no response is received, resend the command. If no response is received, verify power and cable connections.

Details of Command Reference

Each command described in this section will include a detailed explanation, example syntax, and the expected response or query result.

Remote mode is activated when the instrument receives a **valid printable character** via the communication interface. To exit remote mode, use the **LOCAL** front panel key or send the **LOCAL** command.

Alphabetical Commands & Queries Summary Table

Comm/ Query	Type	Syntax	Returns	Notes	Detail on page
*IDN	Q	*IDN?	ID string: Manufacturer, Model, Firmware	Alternate syntax: IDN?, *IDN, IDN	56
Bright	C	Bright <0–15>	<crlf>	Sets display brightness (0=OFF … 15=100%)	
Bright?	Q	Bright?	Brightness value (0–15)	Returns brightness percentage	
CET?	Q	CET?	"0" (CET CLOSED) / "1" (CET OPEN)	Query CET Status	
CHARGING?	Q	Charging?	"0" (Charging Inductor OFF) / "1" (Charging Inductor ON)	Query Charging Inductor	
CStat?	Q	CStat?	"0" (No Fault) / "1" (Fault)	TCM sensor status	
Eth?	Q	Eth?	Ethernet IP (x.x.x.x)	Returns 0.0.0.0 if no Ethernet	
HLC	C	HLC <ON/OFF>	<crlf>	Enable/disable Hi-Lo Comparator	
HLC?	Q	HLC?	"ON" or "OFF"	Returns state	
HLCHI	C	HLCHI <value>	<crlf> or “Invalid Value”	Sets comparator High limit (range dependent)	
HLCHI?	Q	HLCHI?	Current High limit	Returns numeric value	
HLCLO	C	HLCLO <value>	<crlf> or “Invalid Value”	Sets comparator Low limit (range dependent)	
HLCLO?	Q	HLCLO?	Current Low limit	Returns numeric value	
HLCS?	Q	HLCS?	"HI" / "LO" / "GO" / "OFF"	Comparator status	
IRANGE	C	Irange <1–6>	<crlf>	Selects Current range; Default=6	
IRANGE?	Q	Irange?	Current Range(1 – 6)	Returns selected voltage setting	
LOCAL	C	LOCAL	<crlf>	Sets device to Local mode; keypad active	56
LOGOFF	C	LOGOFF	<crlf>	Stops continuous logging	
LOGON	C	LOGON <0–5>	Depends on mode	Starts continuous logging; response depends on value	
LogSpeed	C	LogSpeed <1–6>	<crlf>	Sets log interval (1=50ms … 6=1000ms)	
LogSpeed?	Q	LogSpeed?	Current log speed (1–6)	Returns timing code	
OHMS?	Q	OHMS?	Resistance in ohms with multiplier	Range formatted; no leading zeros	
Port	C	Port <xx>	<crlf>	Sets Ethernet port (default=4300E)	
Port?	Q	Port?	Current port	Default = 4300E	
RANGE	C	Range <1–18>	<crlf>	Selects measurement range; Default=18	57
RANGE?	Q	Range?	Current range (1 – 18)	Returns selected range	
RDNG?	Q	RDNG?	Engineering notation value	e.g., 4.998e-3, 1.0000e+1	
RESET	C	RESET	Display shows “RESETTING”	Soft reset, restores defaults	**57**
RSTDFLT	C	RSTDFLT	<crlf>	Resets stored setup to factory defaults	
SAFE?	Q	Safe?	"S" (Safe to Disconnect) / "U" (Unsafe to Disconnect)	Query Safe/Unsafe to Disconnect Status	
SCREEN?	Q	SCREEN?	Display data without multipliers	Raw front panel string	
Serial?	Q	Serial?	Serial number string	e.g., "70-241001"	56
Store	C	Store	<crlf>	Saves current setup for power-up	
Stored?	Q	Stored?	Encoded 5-digit string	Encodes Range, Auto, TCM, HLC, PkHiLo	
Temp?	Q	Temp?	Temperature in °C	Valid only if TCM=ON	

Comm/ Query	Type	Syntax	Returns	Notes	Detail on page
TCoeff	C	TCoeff <1–9999>	<crlf> or error	Sets temperature coefficient (ppm/°C)	
TCoeff?	Q	TCoeff?	Current coefficient	Returns numeric value	
TCURRENT	C	TCURRENT <ON/OFF>	<crlf>	Turns Test Current ON/OFF Alternate syntax: tstc, tcnt	
TCURRENT?	Q	TCURRENT?	"ON" or "OFF"	Returns state	
TCM	C	TCM <ON/OFF>	<crlf>	Enable/disable Temperature Compensation	
TCM?	Q	TCM?	"ON" or "OFF"	Returns state	
TCS	C	TCS <0–6>	<crlf>	Selects preset configuration (CU20, AL25, etc.)	
TCS?	Q	TCS?	Config number (0–6)	0=Custom, use TCoeff? / TRef?	
TIMER	C	Timer <1-1800>	<crlf>	Sets Test Current ON time for Timed Mode.	
TIMER?	Q	Timer?	(1–1800)	Returns numeric value in seconds	
TRef	C	TRef <0–50.0>	<crlf>	Sets reference temperature (°C)	
TRef?	Q	TRef?	Current reference temperature	Returns numeric value	
TRIGGER	C	Trigger	<crlf> Resistance in ohms with multiplier	Returns Resistance value after set Timer	
UCOhms?	Q	UCOhms?	Uncompensated resistance	Valid only if TCM=ON	
VRANGE	C	Vrange <1–3>	<crlf>	Selects voltage setting; Default=3	
VRANGE?	Q	Vrange?	Voltage setting (1 – 3)	Returns selected voltage setting	

Table 4 - Command & Query Summary Table

System Commands and Queries

***IDN** **QUERY**

Returns serial identification string from non-volatile.

Syntax: idn?<crlf>

Returns: ID string "VALHALLA SCIENTIFIC 4300E,4.01A"

Example: *Idn?<crlf>
"VALHALLA SCIENTIFIC 4300E,4.01A"<crlf>

ID_STRING : "VALHALLA SCIENTIFIC"

MODEL : "4300E"

FIRMWARE VERSION : "4.01A"

Note Alternate Syntax: IDN, IDN?

Serial? **QUERY**

Returns the Serial Number of the device.

Syntax: Serial?<crlf>

Returns: Serial Number string

Example: Serial?<crlf>

Returns: "70-241001"

LOCAL **COMMAND**

Returns meter to local mode, remote LED off, Keypad functions.

Syntax: LOCAL<crlf>

Returns: <crlf>

Power-on default = LOCAL mode

Remote mode is activated when the meter receives a valid character or command (anything other than <crlf>). In remote mode, all keypad keys are disabled, so no key beeps occur, except for the LOCAL key. Pressing the LOCAL key in remote mode will turn off the REMOTE LED and switch the device back to local mode, enabling keypad operation.

RESET **COMMAND**

Executes a soft reset of the device.

Syntax: RESET<crlf>

Returns: Front panel display shows soft reset initiation. "RESETTING" is displayed flashing while all system configurations are returned to power up default.

RANGE **COMMAND**

Selects a measurement range.

Syntax: Range <range number><crlf>

Range number = 1 – 18

1 = RNG1 2.0000mΩ (I1+V1)	2 = RNG2 20.000mΩ (I1+V2)
3 = RNG3 200.00mΩ (I1+V3)	4 = RNG4 20.000mΩ (I2+V1)
5 = RNG5 200.00mΩ (I2+V2)	6 = RNG6 2.0000Ω (I2+V3)
7 = RNG7 200.00mΩ (I3+V1)	8 = RNG8 2.0000Ω (I3+V2)
9 = RNG9 20.000Ω (I3+V3)	10 = RNG10 2.0000Ω (I4+V1)
11 = RNG11 20.000Ω (I4+V2)	12 = RNG12 200.00Ω (I4+V3)
13 = RNG13 20.000Ω (I5+V1)	14 = RNG14 200.00Ω (I5+V2)
15 = RNG15 2.0000kΩ (I5+V3)	16 = RNG16 200.00Ω (I6+V1)
17 = RNG17 2.0000kΩ (I6+V2)	18 = RNG18 20.000kΩ (I6+V3)

RANGE **QUERY**

Returns the selected range.

Syntax: RANGE?<crlf>

Returns: Range number = 1 – 18

1 = RNG1 2.0000mΩ (I1+V1)	2 = RNG2 20.000mΩ (I1+V2)
3 = RNG3 200.00mΩ (I1+V3)	4 = RNG4 20.000mΩ (I2+V1)
5 = RNG5 200.00mΩ (I2+V2)	6 = RNG6 2.0000Ω (I2+V3)
7 = RNG7 200.00mΩ (I3+V1)	8 = RNG8 2.0000Ω (I3+V2)
9 = RNG9 20.000Ω (I3+V3)	10 = RNG10 2.0000Ω (I4+V1)
11 = RNG11 20.000Ω (I4+V2)	12 = RNG12 200.00Ω (I4+V3)
13 = RNG13 20.000Ω (I5+V1)	14 = RNG14 200.00Ω (I5+V2)
15 = RNG15 2.0000kΩ (I5+V3)	16 = RNG16 200.00Ω (I6+V1)
17 = RNG17 2.0000kΩ (I6+V2)	18 = RNG18 20.000kΩ (I6+V3)

VOLTAGE RANGE **COMMAND**

Selects a Voltage Setting.

Syntax: VRange <range number><crlf>

Range number = 1 – 3

VOLTAGE RANGE **QUERY**

Returns the selected Voltage Setting.

Syntax: VRange?<crlf>

Returns: Range number = 1 – 3.

1 = 20mV
2 = 200mV
3 = 2V

CURRENT RANGE **COMMAND**

Selects a measurement range.

Syntax: IRange <range number><crlf>

Range number = 1 – 6

1 = 10A
2 = 1A
3 = 100mA
4 = 10m
5 = 1mA
6 = 100µA

CURRENT RANGE **QUERY**

Selects a measurement range.

Syntax: IRange? <crlf>

Range number = 1 – 6

TEST CURRENT **COMMAND**

Selects Test Current on or off.

Syntax: TCURRENT <ON or OFF><crlf>

Note Alternate Syntax: TCNT?, TSTC?

TEST CURRENT **QUERY**

Responds with Test Current on or off.

Syntax: TCURRENT? <crlf>

Response: <"ON or "OFF">

Note Alternate Syntax: TCNT, TSTC

TIMER **COMMAND**

Sets Timed Test Current mode Timer in seconds.

Syntax: TIMER <0-1800><crlf>

TIMER? **QUERY**

Responds with Timed Test Current mode Timer setting.

Syntax: Timer? <crlf>

Response: <0-1800>

TRIGGER **COMMAND**

Turns on the Test Current, Returns Display data in Ohms after Timer delay, Turns off Test Current.

Syntax: Trigger<crlf>

<Display data in Ohms with multiplier><crlf>

CET **QUERY**

Returns CET status.

Syntax: CET? <crlf>

0 – CET CLOSED (NORMAL OPERATIONS)

1 – CET OPEN (CURRENT DISABLED)

DISCONNECT STATUS **QUERY**

Returns SAFE UNSAFE status.

Syntax: SAFE? <crlf>

S = SAFE

U = UNSAFE

CHARGING INDUCTOR STATUS **QUERY**

Returns Charging Inductor status.

Syntax: CHARGING? <crlf>

0 – OFF

1 – ON

STORE SETUP **COMMAND**

Allows the user to store range, TCM ON/OFF, HLC ON/OFF, PkHiLo On/Off settings. At power up the unit will turn on as range and functions as stored.

Syntax: Store<crlf>

Returns: <crlf>

Default values are:

Range: 20k
Auto: ON
TCM: OFF
HLC: OFF
PkHiLo: OFF

STORED SETUP QUERY

Returns stored power up setting as a string.

Syntax: Stored?<crlf>

Returns: xxxxx

String digits represent:

1. Range: Value can be 0-7
2. AUTO: Value is 0 for off and 1 for on
3. TCM: Value is 0 for off and 1 for on
4. HLC: Value is 0 for off and 1 for on
5. PkHiLo: Value is 0 for off and 1 for on

Example: Stored?<crlf>

Returns: "60100"

The device is set to power up in the 2k range. Auto range is off, TCM is on, HLC is off and PkHiLo is off.

RESET SETUP COMMAND

Allows the user to reset store range, TCM ON/OFF, HLC ON/OFF, PkHiLo On/Off settings to the factory defaults.

Syntax: RSTDFLT<crlf>

Returns: <crlf>

Default values are:

Range: 20k
Auto: ON
TCM: OFF
HLC: OFF
PkHiLo: OFF

DISPLAY BRIGHTNESS COMMAND

Sets the resting display brightness.

Syntax: Bright <xx><crlf>

Brightness number = 0 – 15

0 = OFF	4 ~ 27%	8 ~ 53%	12~ 80%
1 ~ 7%	5 ~ 33%	9 ~ 60%	13~ 87%
2 ~ 13%	6 ~ 40%	10~ 67%	14~ 93%
3 ~ 20%	7 ~ 47%	11~ 73%	15~ 100%

DISPLAY BRIGHTNESS QUERY

Returns the selected resting display brightness.

Syntax: Bright?<crlf>

Returns: Range number = 0 – 15

0 = OFF	4 ~ 27%	8 ~ 53%	12~ 80%
1 ~ 7%	5 ~ 33%	9 ~ 60%	13~ 87%
2 ~ 13%	6 ~ 40%	10~ 67%	14~ 93%
3 ~ 20%	7 ~ 47%	11~ 73%	15~ 100%

ETHERNET IP QUERY

Returns Ethernet IP address.

Syntax: Eth?<crlf>

Returns: x.x.x.x

Note: If the Ethernet option is not installed, or the device is not connected to a network, the query will return 0.0.0.0

ETHERNET PORT COMMAND

This command allows the user to change the ethernet port setting.

Syntax: port <xx><crlf>

Returns: <crlf>

Default value is 4300E.

ETHERNET PORT QUERY

Returns Ethernet Port setting.

Syntax: Port?<crlf>

Returns: 4300E

Default value is 4300E.

OHMS? **QUERY**

Responds with the front panel reading formatted in ohms with multiplier. No leading zeros.

Syntax: OHMS?<crlf>

Returns: <Display data in Ohms with multiplier><crlf>

Example for a 1.1m ohm reading on:

```
20mΩ Range:       1.100m
200mΩ Range:      1.10m
2Ω Range:         0.0011
```

Example for a 1.1 ohm reading on:

```
2Ω Range:         1.1000
20Ω Range:        1.100
200Ω Range:       1.10
2kΩ Range:        0.0011k
```

SCREEN? **QUERY**

Responds with reading from the front panel display. The Ohms omega (Ω), milli (mΩ) and kilo (kΩ) characters are removed during this formatting.

Syntax: SCREEN?<crlf>

Returns: <Display data without multiplier><crlf>

Example for a 1.1m ohm reading on:

```
20mΩ Range:       01.100
200mΩ Range:      001.10
2Ω Range:         0.0011
```

Example for a 1.1 ohm reading on:

```
2Ω Range:         1.1000
20Ω Range:        01.100
200Ω Range:       001.10
2kΩ Range:        0.0011
```

READING? **QUERY**

Responds with reading from the device in engineering notation. Response format is not set by the range, but by the value.

Syntax: RDNG?<crlf>

Returns: <value in reduced engineering notation><crlf>

A few examples of engineering notation:

Value	Response
4.998mΩ	4.998e-3
9.998mΩ	9.998e-3
0.04999Ω	4.999e-2
0.10000Ω	1.0000e-1
0.4999Ω	4.999e-1
1.0000Ω	1.0000e-0
4.999Ω	4.999e+0
10.000Ω	1.0000e+1
49.99Ω	4.999e+1
100.00Ω	1.0000e+2
0.4999kΩ	4.999e+2
0.999kΩ	9.99e+2
1.0000kΩ	1.0000e+3
10.000kΩ	1.0000e+4

LOG ON/OFF **COMMAND**

Turns on continuous reading mode synonymous. Note: If the device is already Logging, the LogOn command will return "Invalid Command".

Syntax: LOGON <Value><crlf>

Returns: "Depends on Log Value. See Table"

Responses as if the following queries sent

==========

0 – OHMS? 1 – SCREEN? 2 – RDNG?

3 – RDNG?,RANGE? 4 – OHMS?,Temp? *(only valid if TCM on)*

5 – UCOhms?,Temp? *(only valid if TCM on)*

==========

LOGOFF turns off logging.

Syntax: LOGOFF<crlf>

Returns: <crlf>

LOG SPEED COMMAND

Sets the speed of the LOG Functions.

Syntax: LogSpeed <speed number><crlf>

Range number = 1 – 6

1 = 50msec
2 = 100msec
3 = 200msec
4 = 250msec
5 = 500msec
6 = 1000msec

LOG SPEED QUERY

Returns the selected Log Speed.

Syntax: LogSpeed?<crlf>

Returns: Range number = 1 – 6

1 = 50msec
2 = 100msec
3 = 200msec
4 = 250msec
5 = 500msec
6 = 1000msec

HLC Commands and Queries

HLC **COMMAND**

Selects HLC mode on or off

Syntax: HLC <ON or OFF><crlf>

HLC **QUERY**

Responds with HLC mode on or off

Syntax: HLC?<crlf>

Returns: <"ON" or "OFF">

HLC STATUS **QUERY**

Responds with status of the comparison. HI, LO, or GO

Syntax: HLCS?<crlf>

Returns: <"HI" or "LO" or "GO" or "OFF">

HLCHI **COMMAND**

Sets the Hi-Lo Comparator High Limit for current range.

Syntax: HLCHI <value><crlf>

Value is only valid if entered properly. See acceptable values/range

Range	Min	Max
R20mOHM	00.001	19.999
R200mOHM	000.01	299.99
R2_OHM	0.0001	2.9999
R20_OHM	00.001	29.999
R200_OHM	000.01	299.99
R2K_OHM	0.0001	2.9999
R20K_OHM	00.001	29.999

Returns “Invalid Value” if outside specified values.

Note: Command not valid while in Auto Range. Return “Invalid Command”

HLCHI? **QUERY**

Returns the Hi-Lo Comparator high value for the selected range.

Syntax: HLCHI?<crlf>

Returns: <Selected Range HLC HI Value>

Example: HLCHI?<crlf>

Returns: <1.3456>

HLCLO **COMMAND**

Sets the Hi-Lo Comparator Low Limit for current range.

Syntax: HLCLO <value><crlf>

Value is only valid if entered properly. See acceptable values per range.

Range	Min	Max
R20mOHM	00.000	19.998
R200mOHM	000.00	299.98
R2_OHM	0.0000	2.9998
R20_OHM	00.000	29.998
R200_OHM	000.00	299.98
R2K_OHM	0.0000	2.9998
R20K_OHM	00.000	29.998

Return "Invalid Value" if outside specified values.

Note: Command not valid while in Auto Range. Return "Invalid Command"

HLCLO? **QUERY**

Returns the Hi-Lo Comparator Low value for the selected range.

Syntax: HLCLO?<crlf>

Returns: <Selected Range HLC LO Value>

Example: HLCLO?<crlf>

Returns: <1.3456>

TCM Commands and Queries

TCM **COMMAND**

Selects TCM mode on or off

Syntax: TCM <ON or OFF><crlf>

TCM **QUERY**

Responds with TCM mode on or off

Syntax: TCM?<crlf>

Example: TCM?<crlf>

Returns: <"ON" or "OFF">

TCS **COMMAND**

Selects Temperature Compensation Configuration Setting.

Syntax: TCS <Value><crlf>

Returns: <crlf>

Example: TCS 1<crlf>

TCS Preset Configurations
==========
1 = CU20
2 = CU25
3 = AL20
4 = AL25
5 = AU20
6 = AU25

TCS QUERY

Returns the selected range.

Syntax: TCS?<crlf>

Returns: Configuration number = 0 – 6

1 = CU20
2 = CU25
3 = AL20
4 = AL25
5 = AU20
6 = AU25
0 = Custom Values

Note: If the Query returns "0", use TCoeff?, and TRef?, to find Temperature coefficient and reference.

TEMP. COEFFICIENT COMMAND

Sets the Temperature Coefficient used during TCM. Value must be entered in PPM/°C.

Syntax: TCoeff <value><crlf>

Returns: <crlf>

Value is only valid if entered properly.

Acceptable values

1 9999

Return "Invalid Value" if outside specified values.

TEMP. COEFFICIENT QUERY

Returns the Temperature Coefficient used during TCM.

Syntax: TCoeff?<crlf>

Returns: <Selected Temp. Coeff.>

Example: TCoeff?<crlf>

Returns: <3456>

TEMP. REFERENCE COMMAND

Sets the Temperature Reference used during TCM. Value must be entered in °C.

Syntax: TRef <value><crlf>

Returns: <crlf>

Value is only valid if entered properly.

Acceptable values

Min	Max
0	50.0

Return "Invalid Value" if outside specified values.

TEMP. REFERENCE QUERY

Returns the Temperature Coefficient used during TCM.

Syntax: TRef?<crlf>

Returns: <Selected Temp. Reference>

Example: TRef?<crlf>

Returns: <20.0>

SENSOR STATUS QUERY

Responds with TCM Sensor Status. Fault or No Fault.

Syntax: CStat?<crlf>

Example: CStat?<crlf>

Returns: <"0" or "1">

0 = No Fault
1 = Fault

Temp? **QUERY**

Returns the temperature reading formatted in °C. This command is only valid while in TCM. If TCM is off, returns "Invalid Command".

Syntax: Temp?<crlf>

Returns: <Temp value in °C><crlf>

Example: Temp?<crlf>

Returns: 21.3<crlf>

UNCOMPENSATED OHMS **QUERY**

Responds with uncompensated (measured) resistance value reading formatted in ohms with multiplier. No leading zeros.

Syntax: UCOhms?<crlf>

Returns: <Uncomp. resistance in Ohms with multiplier><crlf>

This command is only valid while in TCM. If TCM is off, returns "Invalid Command".

Keypad Commands

KEY **COMMAND**

Presses a key from the interface, use for macros when the command you desire is not listed here.

The remote key macro command was developed so our customers can literally perform any action from the remote available to the key press enthusiast.

We will note the following to the user: This capability is not without restrictions. Illegal key sequences may get the machine in a menu you do not expect or cause the meter to not process properly the keys you send. Key presses are human interface and therefore not buffered. Because of this key delays may be necessary as sending keys too quickly may lose keys.

Syntax: KEY <key number>

Returns: <crlf> (only after the key has been processed)

Key number = 0 - 23

0 = No_Key

1 = Key_VRange_DN (▽)

2 = Key_VRange_UP (△)

3 = Key_IRange_DN (▽)

4 = Key_IRange_UP (△)

5 = Key_TCurrent

6 = No_Key

7 = No_Key

8 = Key_#1_PkHiLo

9 = Key_#2_HLC

10 = Key_#3_Store

11 = Key_#4_Run/Hold

12 = Key_#5_Send

13 = Key_#6_TCM

14 = Key_#7_Timer

15 = Key_#8_Cal

16 = Key_#9_Log

17 = Key_#0_View

18 = Key_Local

19 = Key_Clear

20 = Key_Function

21 = Key_Save

22 = Key_Reset

23 = Key_Enter

General Maintenance and Calibration

General

This chapter provides information on general maintenance and the procedure for calibrating the Model 4300E µ-Ohmmeter.

To ensure continued accuracy, your model 4300E should be calibrated on a routine basis. A **12-month interval** is recommended.

Before performing the calibration procedure, the ohmmeter must be allowed to **warm up for at least 30 minutes** at a stable ambient temperature with all covers in place.

Required Test Equipment
The following equipment is required to perform calibration of the Model 4300E:

1. **Precision Resistors** (±0.005% tolerance)
    - 0.01 Ω
    - 0.1 Ω
    - 1 Ω
    - 10 Ω
    - 100 Ω
    - 1 kΩ
    - 10 kΩ
2. **DC Voltage Standard**
    - Capable of providing outputs of 0, 5mV, 10mV, 19mV, 50mV, 100mV, 190mV, 500mV, 1V and 1.9mV
    - Additionally, if calibrating the temperature compensation circuit: 200mV and 300mV
3. **Four-Wire Test Lead Set**
4. **Precision Digital Voltmeter (DVM)**

Pre-Calibration Procedure
Calibration adjustments are accessed by removing the **top cover** of the instrument.

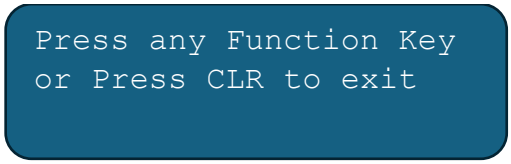
- Leave the cover in place as much as possible.
- After each adjustment, replace the cover and allow the instrument to **stabilize** before proceeding.

Selecting the incorrect line voltage setting may cause damage to the instrument!

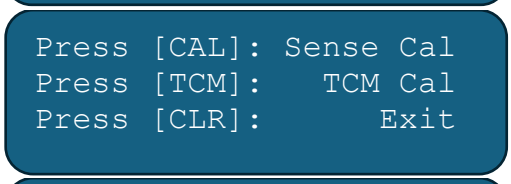
Calibration Procedure

The standard calibration consists of 2 parts: sense calibration, and source calibration. The sense calibration is cover-on and automated; the instrument will prompt the user throughout the steps. The source calibration is performed by adjusting potentiometers located on the 4300E main board. Both calibrations must be performed for a complete calibration of the 4300E.

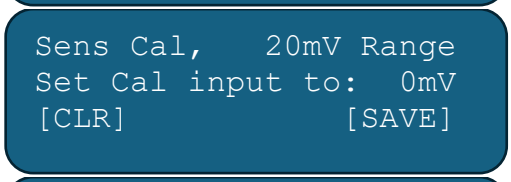
Sense Calibration



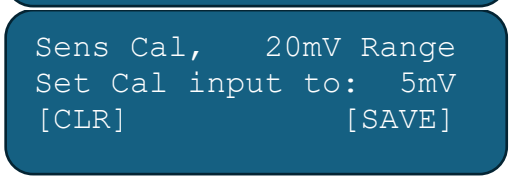
Press [CAL] to select calibration type.



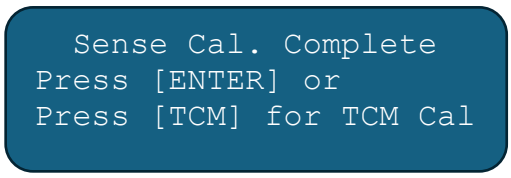
Press [CAL] to start Sense Calibration.
Pressing [CLR] at any point during calibration, will exit the routine.



Connect the voltage source to the Sense terminals of the 4300E. Place a jumper from Sense LO to Source LO terminals.
Apply 0mV and press [SAVE]



When prompted, apply 5mV and press [SAVE]
Repeat this step as prompted applying:
10mV, 19mV, 0V, 50mV, 100mV, 190mV, 0V, 500mV, 1V and 1.9V.



Disconnect the voltage source from the Sense Terminals.
Press [ENTER] to skip TCM calibration, or Press [TCM] to continue calibrating the temperature compensation ADC.
TCM Calibration is only required if a temperature sensor (Omni-TC) is used. You will note be able to perform the following steps without a sensor.

Source Calibration

This procedure calibrates the current source of the 4300E. The current source is calibrated against the instrument's internal voltmeter; therefore, sense (voltage) calibration must be completed prior to this procedure.

Reference Adjustment (If Required)

This adjustment is required only if components in the reference circuit have been replaced. It is not part of routine calibration.
Equipment Required:

- DC voltmeter with accuracy of ±0.03% or better

Procedure:

1. Connect the voltmeter low lead to 0 V (front of R117)
2. Connect the voltmeter high lead to IC101, Pin 5
3. Adjust RV101 for a reading of 1.0000 V
4. Remove the voltmeter connections

Current Range Adjustments

For all steps below:

- Use 4-wire (Kelvin) connections
- Allow adequate settling time, especially at higher current ranges
- Keep the instrument cover in place as much as possible to maintain proper thermal conditions

10 A Range

- Connect a 0.1 Ω standard resistor
- Select 2 V / 10 A range
- Adjust RV102 for a reading of 100.00 mΩ

1 A Range

- Connect a 1 Ω standard resistor
- Select 2 V / 1 A range
- Adjust RV103 for a reading of 1.0000 Ω

100 mA Range

- Connect a 10 Ω standard resistor
- Select 2 V / 100 mA range
- Adjust RV104 for a reading of 10.000 Ω

10 mA Range

- Connect a 100 Ω standard resistor
- Select 2 V / 10 mA range
- Adjust RV105 for a reading of 100.00 Ω

1 mA Range

- Connect a 1 kΩ standard resistor
- Select 2 V / 1 mA range
- Adjust RV106 for a reading of 1.0000 kΩ

100 µA Range

- Connect a 10 kΩ standard resistor
- Select 2 V / 100 µA range
- Adjust RV107 for a reading of 10.000 kΩ

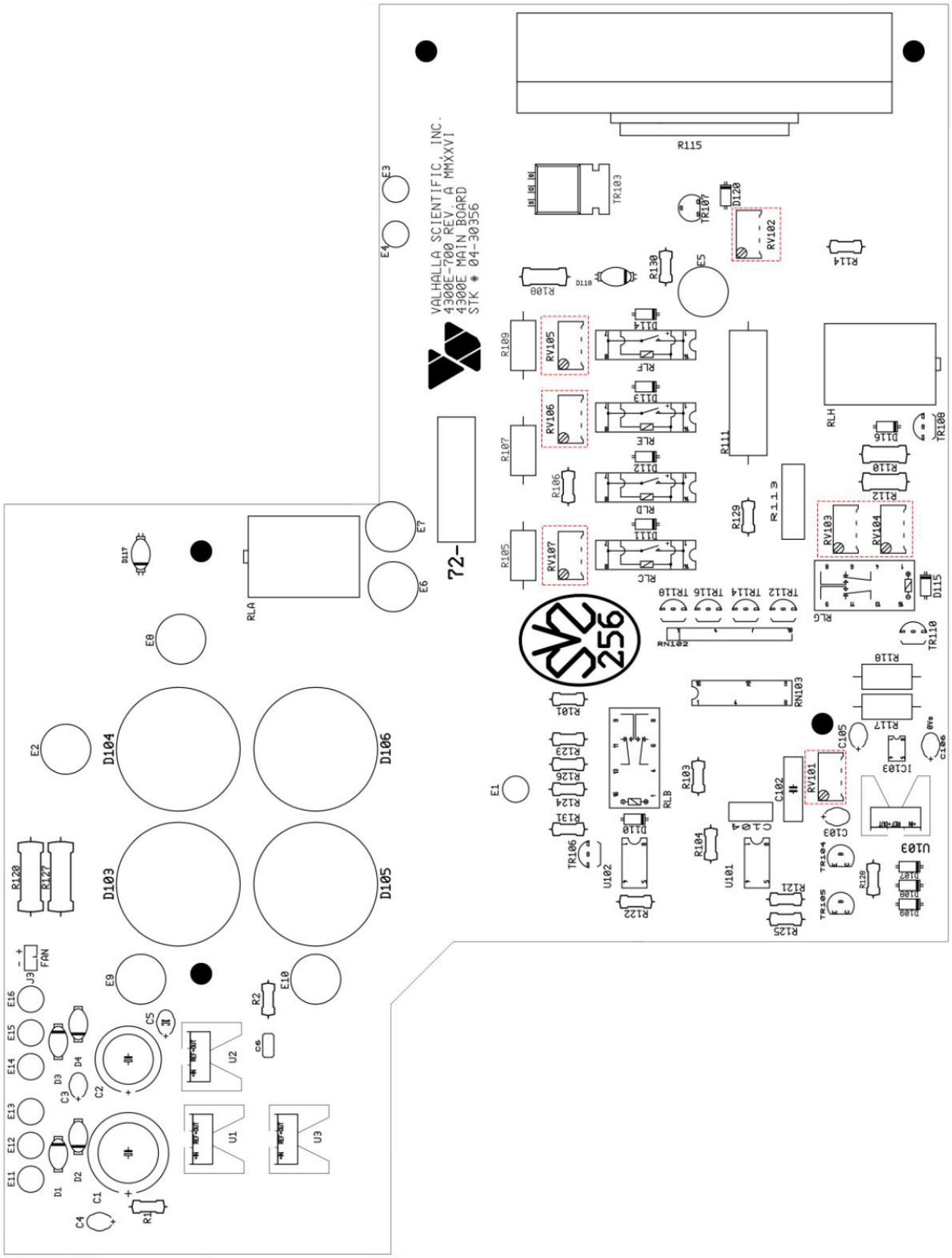
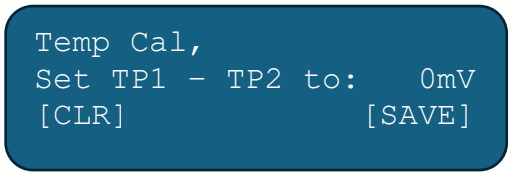
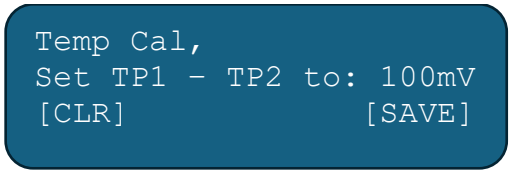


Figure 9 - Drawing # 4300E-700

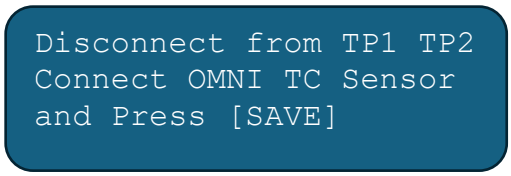
Optional TCM Sense Calibration



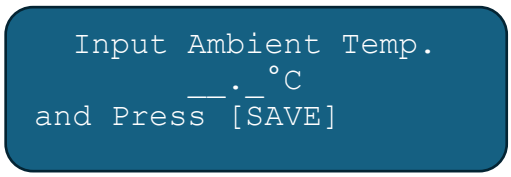
Connect the voltage source to TP1(+) and TP2(-) located on the Controller board (near input terminals).
Short Sense HI, Sense LO and Source Hi Terminals.
If connected, remove the Omni TC from the 4300E.
Apply 0mV and Press [SAVE]



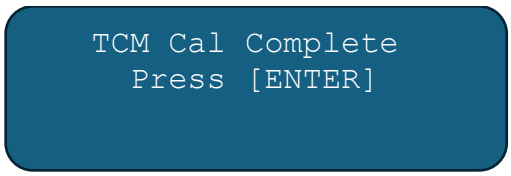
When prompted, apply 100mV and press [SAVE].
Repeat this step as prompted applying 200mV and 300mV.



When prompted, disconnect the voltage source from TP1-TP2. Connect the Omni TC Sensor to the front panel receptacle.
Allow **5 minutes** for the sensor to reach ambient temperature and press [SAVE]



Verify the current ambient temperature.
Enter the value in °C and press [SAVE]



Calibration is complete. Press [ENTER] to return to measurement mode.

Special Procedures

Inductive Loads — General

Inductive loads require special consideration when making resistance measurements. These include devices such as:

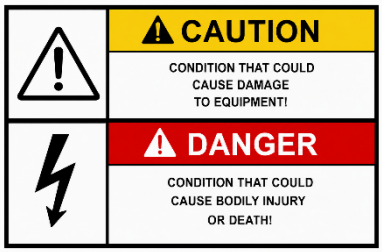
- Transformers
- Coils
- Ballasts
- Wire-wound resistors
- Magnets
- Motors

These devices store energy and can generate high voltages during measurement and when current is removed.

Connections

When connecting test leads to an inductive load:

- Ensure the **Test Current is OFF** before making or breaking connections
- Secure all connections firmly before applying current
- Avoid making contact under load to prevent arcing



Connecting or disconnecting leads while test current is applied may result in arcing, equipment damage, or personal injury.

Settling Time

When measuring highly inductive loads, settling time is determined by the compliance voltage of the current source.

In **Charging Inductor Mode**, the 4300E provides an elevated compliance voltage (typically > 20 V) to reduce settling time. However, large inductances can still require significant time to stabilize.

During this period:

- The instrument may indicate **OVERLOAD**
- The **Charging Inductor Mode** indicator may be active
- Displayed readings may be unstable

Measurements should be considered valid only after the instrument has settled and the indicator is no longer active.

Settling Time Calculation

Settling time can be approximated using:

$$T = \frac{L \times I}{V}$$

Where:

T — Settling time (seconds)

L — Inductance (Henries)

I — Test current (Amps)

V — Compliance voltage (typically 20 V in Charging Inductor Mode)

Practical Considerations

- Higher test currents result in longer settling times
- Large inductive loads may require extended measurement periods
- For very high inductance values, allow sufficient time before recording measurements

Noisy Readings

When measuring very low resistances on highly inductive loads, the measurement may be affected by **60 Hz noise pickup**.

This occurs because inductive loads exhibit high impedance at AC frequencies:

$$Z = 377 \times L$$

Where:

- **Z** — Impedance (ohms)
- **L** — Inductance (Henries)

For example, a 1000 H inductor presents an impedance of approximately **377 kΩ at 60 Hz**, allowing small induced voltages to appear as noise in the measurement.

Reducing Noise

Measurement noise can be minimized by:

- Using **shielded test leads** (e.g., Valhalla Option “K”)
- Minimizing cable movement during measurement
- Reducing electrical interference from nearby equipment
- Shorting unused windings of the device under test (when possible)

Shorting unused windings:

- Reduces effective inductance
- Improves settling time
- Prevents unwanted induced voltages

Thermal EMF Effects

When using the **20 mV range**, measurements may be affected by **thermal EMFs**, which appear as noise or drift.

To reduce this effect:

- Use **low-thermal lead sets** (e.g., Valhalla Option SL-48)
- Ensure stable and consistent connections

Disconnecting Test Leads

Extreme care must be taken when disconnecting test leads from inductive loads.

Inductive devices store energy and can generate high-voltage **back-EMF** when current is interrupted. This can result in:

- Equipment damage
- Hazardous voltages
- Potentially lethal conditions

WARNING

Do not disconnect test leads while energy is stored in an inductive load. Always ensure the load has been safely discharged before disconnecting.

Method 1 — Internal Discharge (Flyback Protection)

The 4300E includes an internal discharge path that safely dissipates stored energy.

To discharge the load:

1. Turn **Test Current OFF**
2. Reduce the current range to a low value (≤ 10 mA)
3. Allow the instrument to discharge the load internally
4. Wait until the **SAFE** indicator is illuminated

During discharge:

- The display may indicate **OVERLOAD**
- The reading will return toward zero when discharge is complete

Discharge Time

$$T = \frac{L \times I}{V}$$

Where:

- **T** — Time (seconds)
- **L** — Inductance (Henries)
- **I** — Test current (Amps)
- **V** — Internal discharge voltage (~6 V)

Large inductors may require significant time to discharge.

Method 2 — External Shorting

An external shorting method may also be used to discharge the inductor.

In this method, stored energy is discharged through the test leads and an external shorting switch.

Discharge time depends on:

- Inductance (**L**)
- Total resistance of the circuit (**R**)

For high inductance and low resistance, discharge time can be extremely long.

Example:

- L = 1000 H
- R ≈ 1 mΩ
- 10 A test current

Discharge time may exceed **weeks**.

The instrument may be disconnected only if a secure short circuit is maintained across the load.

For repair and calibration services, call 800-548-9806 or visit valhallascientific.com.
Email support available at support@valhallascientific.com