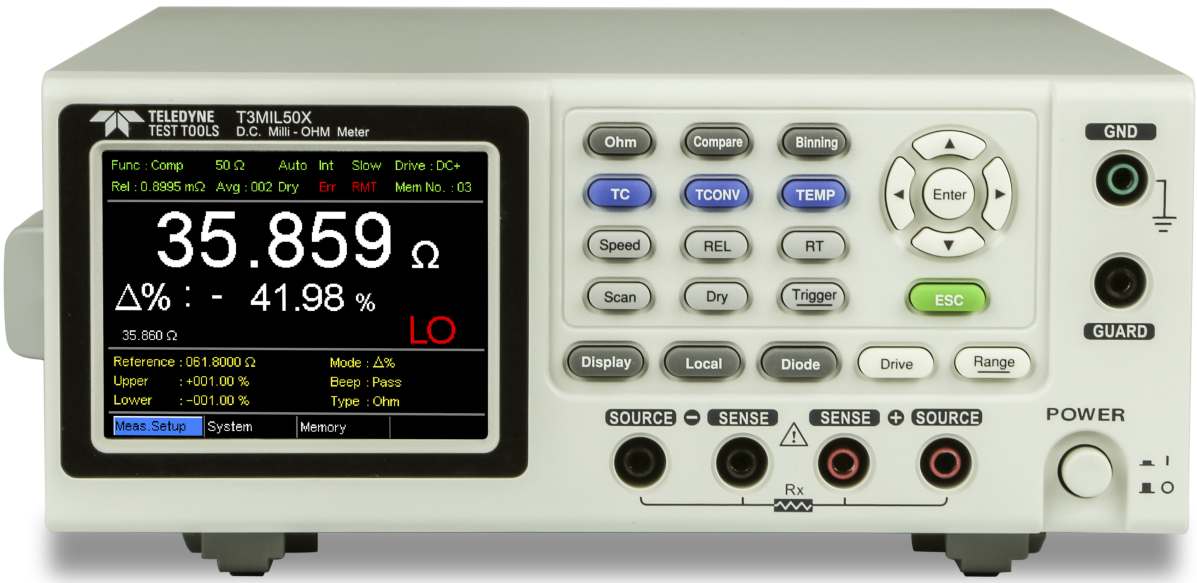
T3MIL50 & T3MIL50X

D.C. Milli-Ohm Meters

User Manual



The information in this manual was correct at the time of printing. However, Teledyne LeCroy continues to improve products and reserves the right to change specifications, equipment, and maintenance procedures at any time without notice.

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SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow when operating the T3MIL50/50X or when keeping it in storage. Read the following before any operation to ensure your safety and to keep the T3MIL50/50X in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the T3MIL50/50X.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the instrument or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal
	Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline ⚠ CAUTION	• Do not place any heavy objects on the instrument. • Avoid severe impact or rough handling that leads to damaging the instrument. • Do not discharge static electricity to the instrument. • Use only mating connectors, not bare wires, for the terminals. • Do not disassemble the instrument unless you are qualified as service personnel.
	(Note) EN 61010-1:2010 specifies the measurement categories and their requirements as follows. The T3MIL50/50X doesn't fall under category II, III or IV. • Measurement category IV is for measurements performed at the source of low-voltage installation. • Measurement category III is for measurements performed in the building installation. • Measurement category II is for measurements performed on the circuits directly connected to the low voltage installation.
Power Supply ⚠ WARNING	• AC Input voltage: 100 - 240 V AC, 50 - 60Hz, 25VA • The power supply voltage should not fluctuate more than 10%. • Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.
Cleaning the T3MIL50/50X	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the instrument. • Do not use chemicals or cleaners containing harsh material such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Temperature Range: 0~35°C, Relative Humidity: <80%RH; >35°C, Relative Humidity: <70%RH • Altitude: < 2000m • Operating Environment: 0°C to 40°C (operation) • Pollution Degree 2

	(Note) EN 61010-1:2010 specifies the pollution degrees and their requirements as follows. The T3MIL50/50X falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage Environment	• Location: Indoor • Storage Conditions: −10°C to 70°C • Temperature Range: 0~35°C, Relative Humidity: <90%RH; >35°C, Relative Humidity: < 80%RH
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the instrument in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead / appliance must only be wired by competent persons

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow: Earth

Blue: Neutral

Brown: Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

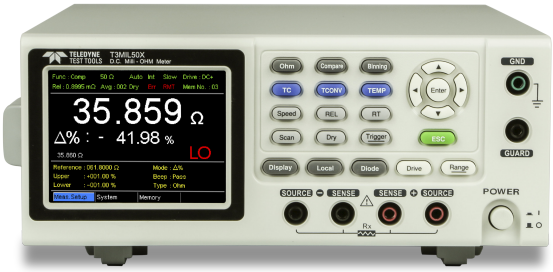
This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

This chapter describes the T3MIL50/50X, including its main features as well as its front and rear panels. After going through the panel overview, follow the Power-up sequence before attempting to use the instrument.

Please note the information in this manual was correct at the time of printing. However as Teledyne LeCroy continues to improve its products, changes can occur at any time without notice. Please see the Teledyne LeCroy website for the latest information and content.



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T3MIL50/50X Characteristics

T3MIL50 and T3MIL50X are modern high precision programmable DC Milli-ohm meters suitable for low resistance measurements of switches, relays, connectors, PCB tracks and a variety of other devices. The meters feature a color TFT-LCD screen with easy-to-read measurement results. With the easy-to-use features, superior performance and automatic test interfaces, these meters are dependable instruments for resistance measurements.

Easy to Use Features	Each test function on the T3MIL50/50X can be easily activated by pressing a single front panel key. All the settings and measurement results are displayed and set on the TFT-LCD panel at the same time making each function naturally intuitive to use. Each primary and secondary measurement result is displayed prominently on the display along with any corresponding settings. Sequential measurement results, such as those from the scan or binning function, are tabulated in an intuitive and easy-to-read format. In addition, the meters can recall previously used settings upon startup, allowing the meter to be ready the next time it is used in a matter of moments. The meters can also save or recall up to 20 sets of function settings.
Performance	The T3MIL50/50X has nine selectable measurement ranges from 5mΩ to 5MΩ, a constant current source of 1uA to 1A, an accuracy of up to 0.05%, a 0.1uΩ resolution and performs measurements using four wire Kelvin connections for accurate, consistent measurements. The ability to choose between high accuracy measurements at 10 samples/sec (full scale at 50000 counts) or high speed measurements at 60 samples/sec (full scale at 50000 counts), allows the T3MIL50/50X the flexibility to fulfill a number of different measurement roles.

Advanced Temperature Measurements	The T3MIL50/50X has a number of advanced temperature functions that can be used with the optional temperature probe, PT-100. The temperature compensation function can extrapolate what the resistance of a DUT will be at a desired temperature, if the temperature coefficient of the DUT and the resistance of the DUT at ambient temperature are known. The temperature conversion function can be used to extrapolate what the temperature rise of a DUT will be at specified resistance if the initial resistance, initial temperature and the constant for the DUT are known.
Drive Signals	The T3MIL50X can select a number of different drive signals to suit a number of different measurement scenarios, for example the Pulse setting can be used to cancel the effects of thermoelectric EMF on the measurement results.
Dry Circuit Testing	Dry circuit testing allows the T3MIL50X to measure the contact resistance of switches and connectors according to the DIN IEC 512 and ASTM B539 standards. The open circuit voltage will not exceed 20mV in this mode to prevent the oxidization layer on metal switches and connector points from breakdown.
Automatic Testing	The T3MIL50/50X has a handler interface designed for automatic testing. The handler interface outputs the status of PASS, FAIL, HI, LO, READY and EOT signals and inputs a trigger control signal. Automatic testing is used with the binning, compare and scan functions.
Applications	• Production testing for contact resistance of switches, relays, connectors, cables and printed circuit boards and other low resistance devices. • Component testing of resistors, motors, fuses and heating elements. • Incoming inspection and quality assurance testing. • Conductivity evaluation for product design.

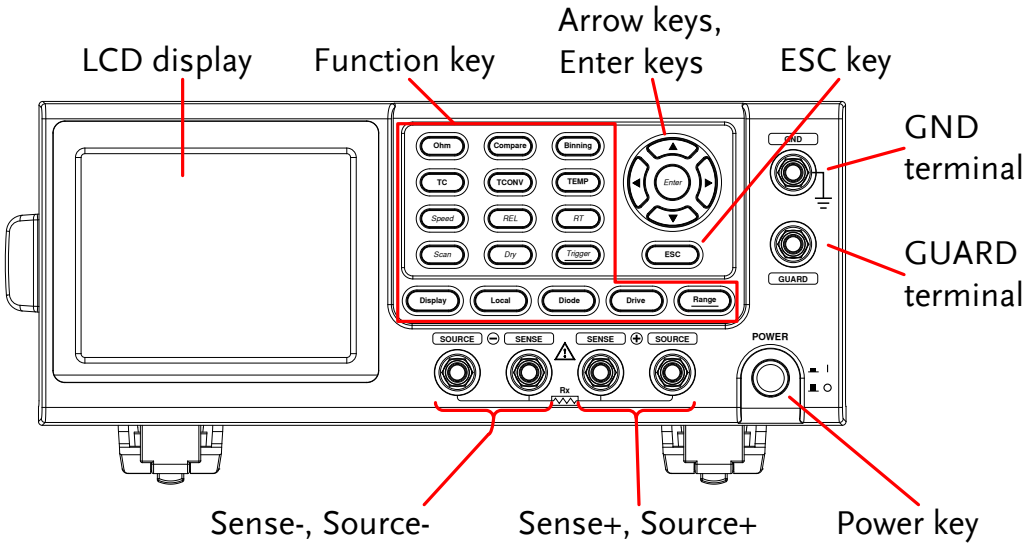
Key Features

- 50,000 counts
- Measurement Range: 5mΩ~5MΩ
- Accuracy of up to 0.05%
- Compare function
- Binning function
- Manual or Auto-ranging
- Continuous or Triggered measurement modes
- Temperature measurement, temperature compensation and temperature conversion
- Four-wire Kelvin measurement method
- Selectable power-on settings
- Diode test
- Alarm settings for function-specific PASS/FAIL test results
- Sampling rate: 10 or 60 sampling/sec
- Standard interfaces: USB/RS232/Scan/Handler
- Save/Recall settings: 20 memory sets
- External I/O logic function

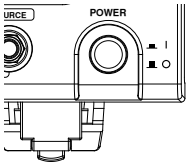
Model Lineup

Feature / Model	T3MIL50	T3MIL50X
Ohm Measurement	✔	✔
Compare Function	✔	✔
Diode Measurement	✔	✔
Temp. Compensation	✔	✔
Temp. Conversion	✔	✔
Temp Measurement	✔	✔
Scan Function	✔	✔
Dry Circuit	✘	✔
Drive Selection	✘	✔
Binning Function	✘	✔
Interface		
RS-232 Interface	✔	✔
USB Device Interface	✔	✔
Handler/EXT IO/Scan Interface	✔	✔
Temperature Sensor Interface	✔	✔

Front Panel Overview



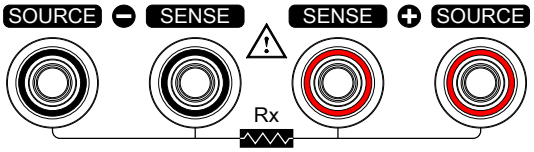
Power Switch



Turns On or Off the main power. For details about the power up sequence, see page 23.

Measurement Terminals

Source, Sense Terminals



Sense + and Sense - terminals.

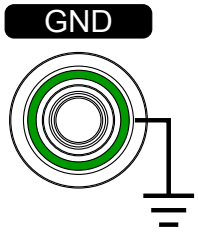
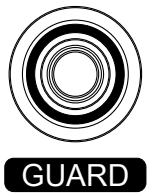
Current source terminals: Source + and Source -.

CAUTION

When measuring components with polarity, connect Source+ to the positive potential and connect Source- to the negative potential of the component.

WARNING

Discharge any DUT before measurement to avoid damaging the T3MIL50/50X.

GND Terminal		Connect the GND (ground) terminal to the earth ground.
GUARD Terminal		The GUARD terminal has the same potential as earth, but cannot be substituted for it. Connect the GUARD terminal to the cable shield layer of the test leads to help reduce noise.
Function Keys	Ohm	The Ohm key activates the resistance measurement function.
	Compare	The Compare key activates the comparator function.
	Binning	The Binning key activates the binning function to grade the DUTs into eight bins according to the tolerance settings. T3MIL50X only.
	TC	The TC key activates the TC (temperature compensation) function which calculates the resistance of a DUT at a specified temperature given the resistance of the DUT at the ambient temperature and the temperature coefficient of the DUT is known.
	TCONV	The TCONV (Temperature Conversion) function calculates the temperature of a DUT given an initial temperature, initial resistance, measured resistance and a constant (inferred zero resistance temperature) for the DUT.
	TEMP	The TEMP key activates the temperature measurement function.

Speed — The Speed key toggles between 10 samples per second and 60 samples per second (Slow rate and Fast rate).

REL — The REL key is used to perform a zero adjustment to the test leads or a DUT.

RT — The RT key is used to display the real-time (not averaged) measured resistance value.

Scan — The Scan key is used to turn on the Scan function.

Dry — The Dry key is used to turn on the dry circuit measurement mode which allows the T3MIL50X to measure the contact resistance of switches and connectors according to DIN IEC 512 and ASTM B539 standards. T3MIL50X only.

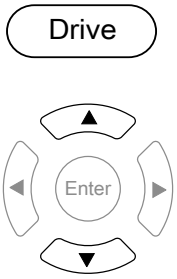
Trigger — When in the internal trigger mode, pressing the Trigger key will turn on the external trigger mode. When in the external trigger mode, pressing the Trigger key will perform a manual trigger.

A long press of the Trigger key when in external trigger mode will reset the trigger mode back to the internal trigger mode.

Display — The Display key toggles between the standard display mode and the simplified display mode (sans menus and display icons).

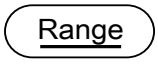
Local — The Local key will switch the milliohm meter between local and remote mode.

Diode — The Diode key is used to turn on the Diode measurement function.

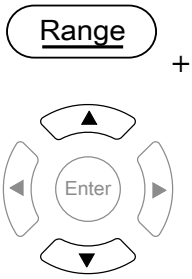


The Drive key in conjunction with the up/down arrow keys is used to select the measuring signal: DC+, DC-, Pulse, PWM, Zero and Standby. In particular, the Zero setting can be used as a +/-10mV DC voltmeter to measure the EMF of passive components. The Standby, on the other hand, is used to break off Relay of Force+/- without outputting test current, and none of measurements will be executed.

See page 32 for details. T3MIL50X only. The drive signal is fixed to DC+ and Standby on the T3MIL50.



Long pressing the Range key will activate the auto ranging mode.

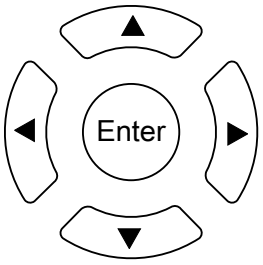


The Range key in conjunction with the up/down arrow keys is used to select the resistance measurement range.

When in auto ranging mode, pressing the Range key will activate the manual ranging mode.

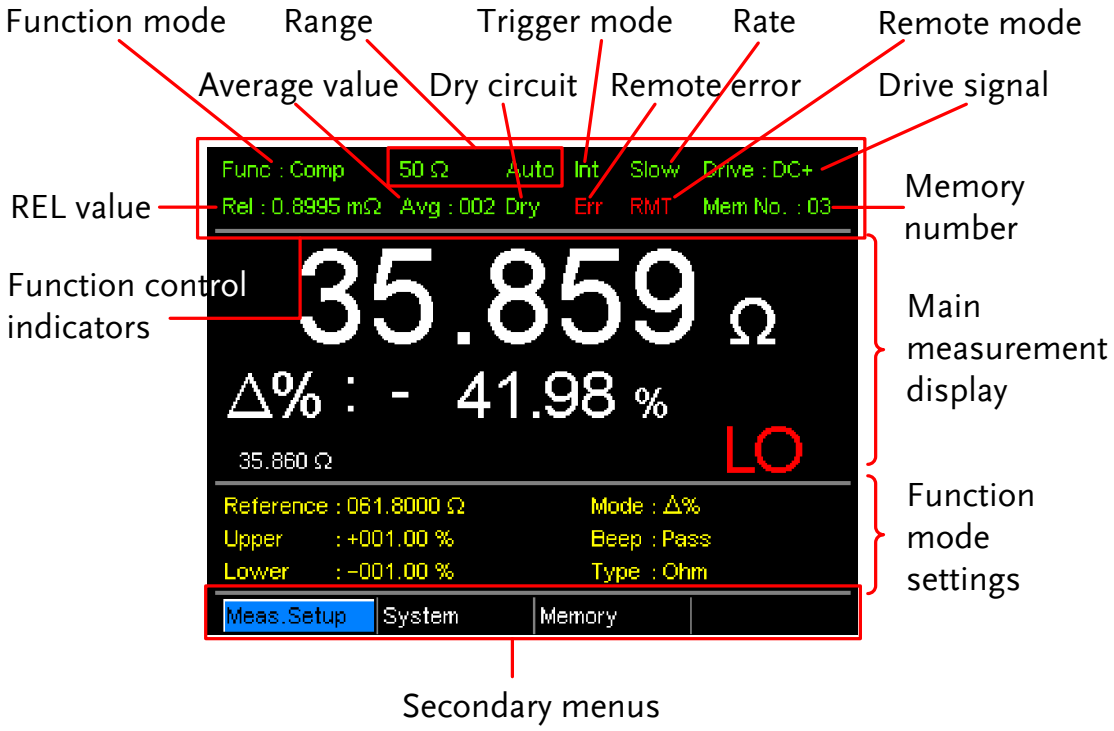
The ESC key cancels the current setting and returns the cursor to its default location or returns to the previous menu, depending on the circumstances.

Arrow Keys, Enter Key



The arrow keys and Enter key are used to edit parameters, to navigate the menu system and to select parameter ranges.

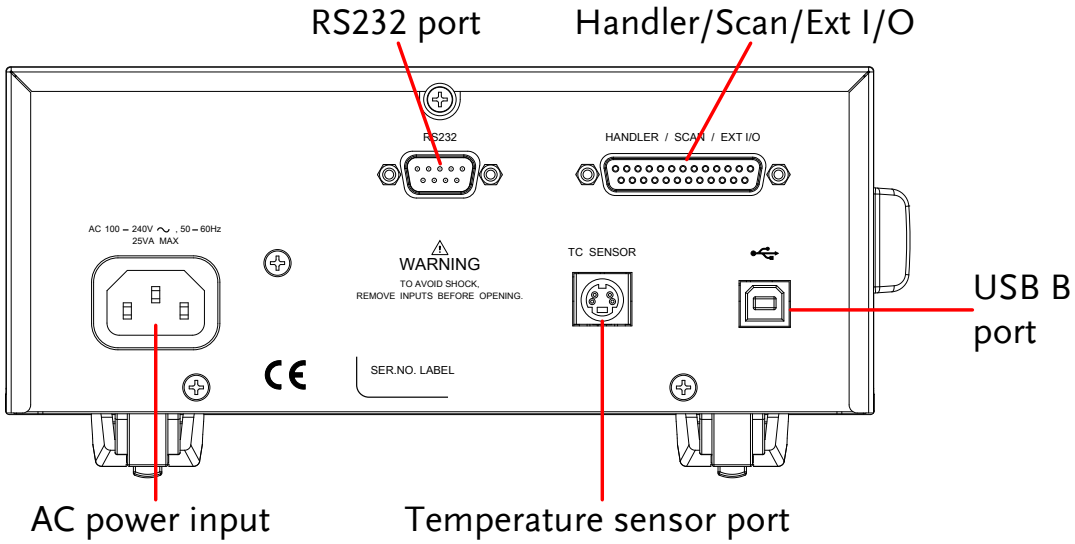
TFT-LCD Overview

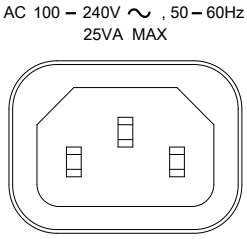
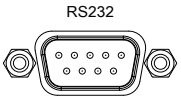
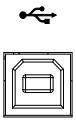
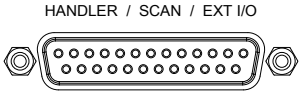


Function Control Indicators	The function control indicators show all the currently active settings for the selected function mode:
Func	Currently selected function mode
Range	The measurement range. Auto indicates that auto ranging is active
Trigger mode	Int/Ext
Rate	Slow/Fast
Drive:	DC+, DC-, Pulse, PWM, Zero, Standby
Rel	Shows the relative (nominal) reference value
Avg	Number of samples used for the Average function.
Dry	Indicates that the dry circuit function is active

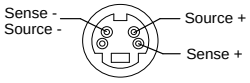
	Err	Indicates a remote command error
	RMT	Indicates that the unit is in remote control mode
	Mem No.	Indicates which memory setting has been recalled
Main Measurement Display	Shows all measurement results for the selected function mode.	
Function Mode Settings	Shows any function mode-specific settings.	
Secondary Menus	The secondary menus show global menus (Meas. Setup, System, Memory) as well as function-specific secondary menus.	
	Meas. Setup	Goes to the global Measurement Setup menu.
	System	Goes to the global System menu
	Memory	Allows you to save, recall and clear memory settings.
	View	Shows the results for all the channels when a scan has finished.
	Clear	Clears the measurement results in the Binning function when the display mode is set to Count.

Rear Panel Overview



AC Input		Accepts the power cord. AC 100 - 240Vac; 50 - 60Hz. For the power up sequence, see page 23.
RS-232 Port		Accepts an RS-232C cable for remote control; DB-9 male connector. For remote control details, see page 85.
USB Device Port		USB device port for remote control. See page 84 for details.
Handler / Scan / EXT I/O Port		The Handler / Scan / EXT I/O port is used to output pass/fail/high/low comparison results. This port is also used for the user-programmable EXT I/O pins.
Temperature Sensor Port		The temperature sensor input is for a PT-100 temperature probe.

Note



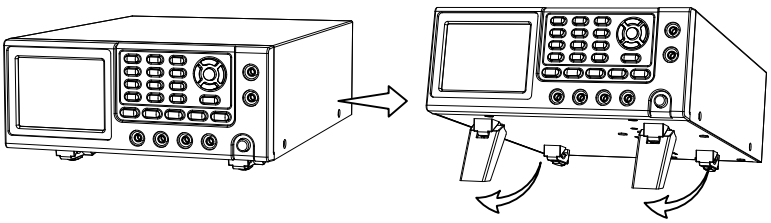
The pin definition of Temperature Sensor Port.

Set Up

Tilt Stand

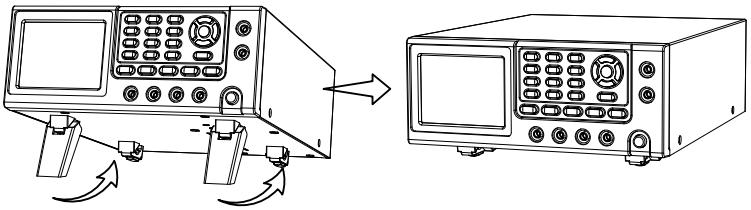
Tilt

To tilt, pull the legs forward, as shown below.



Stand Upright

To stand the unit upright, push the legs back under the casing as shown below.

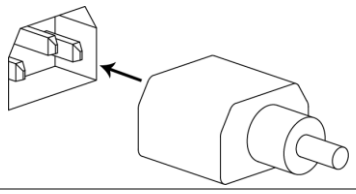


Power Up

1. Connection

Ensure that the input AC power voltage is within the range of 100~240 V.

Connect the power cord to the AC Voltage input.

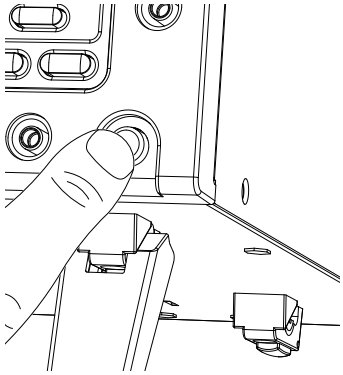


⚠CAUTION

Ensure the ground connector of the power cord is connected to a safety ground. This will affect the measurement accuracy.

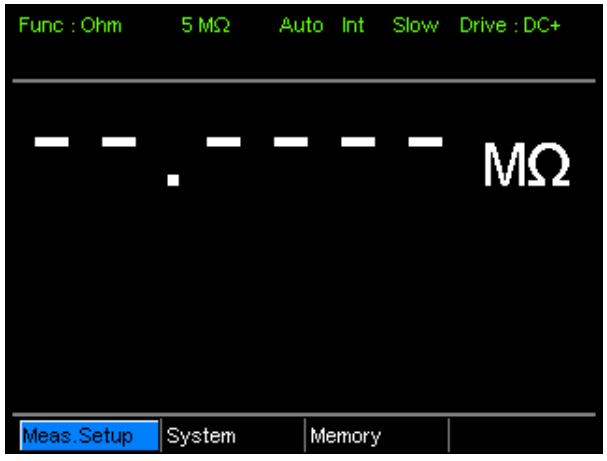
1. Power up

Press the main power switch on the front panel.

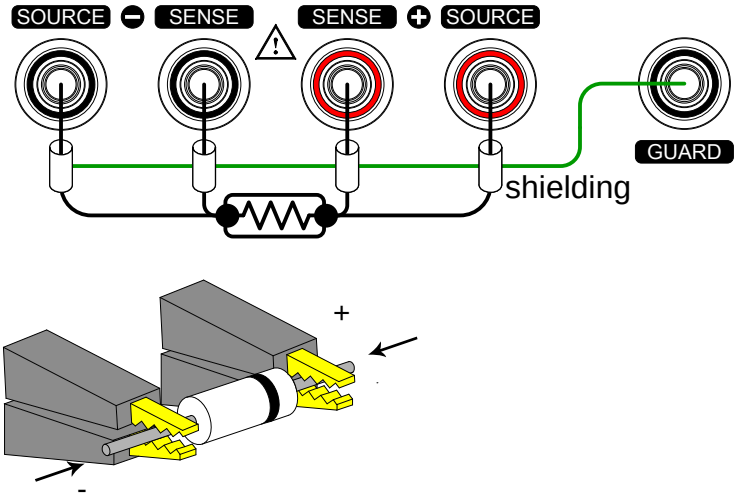


The display will light up and show the last setting used before the last shut down.

Example: Resistance measurement mode

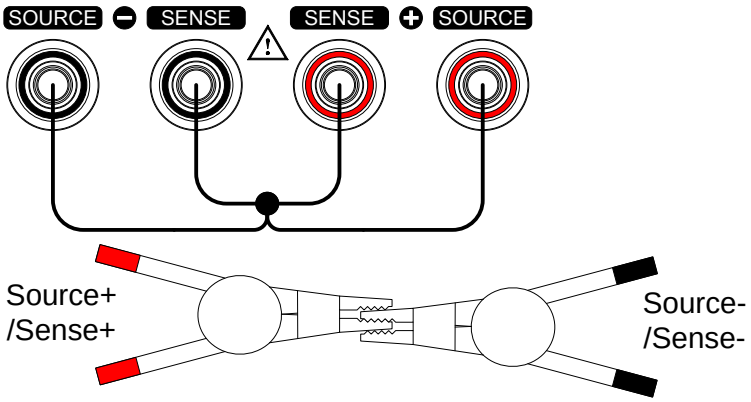


4 Wire Kelvin Connection

Background	The T3MIL50/50X uses 4 wire Kelvin connections for accurate measurements.	
Connection Diagram		
Description	Source +	The Source + terminal carries the measuring current source. It is connected to the + side of the DUT.
	Source -	The Source - terminal accepts the signal return current and connects to the – side of the DUT.
	Sense +	Monitors the positive (+) potential.
	Sense -	Monitors the negative (-) potential.
	Guard	Grounds the shielding layer of the test lead cables to reduce noise.
	GND	Provides a reference ground for the T3MIL50/50X.

Zeroing (Relative Function)

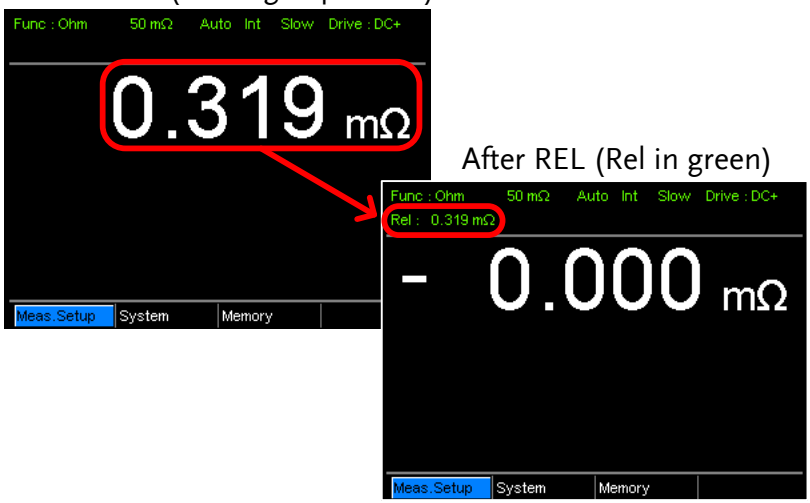
Background	The Relative function is used to perform a zero adjustment on the test leads. After the Relative value is pre-set, each measurement that is displayed is equal to the actual value minus the relative preset value.
⚠ Note	The Relative function cannot be used with the Scan or Diode functions.
1. Short the cables	Short the test cables together as shown in the diagram below:



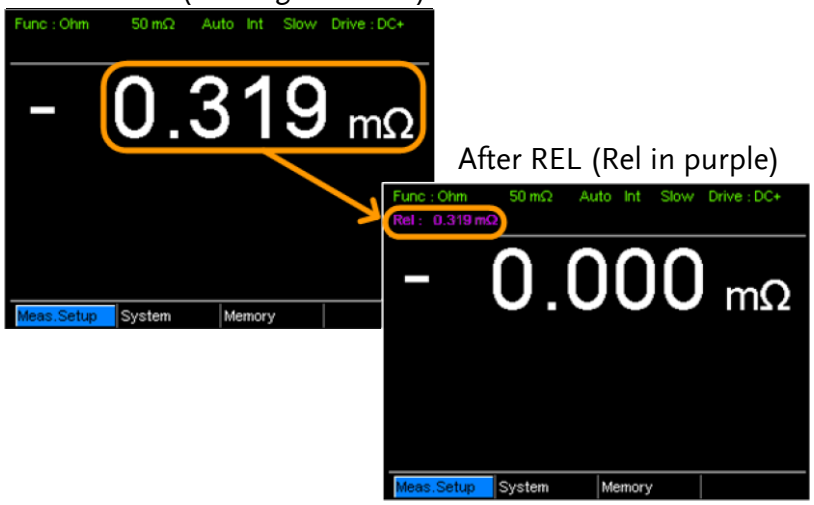
2. Set the Reference value	Press the REL key.

3. Relative mode display appears

Before REL (reading in positive)



Before REL (reading in minus)



Rel:	Indicates the Relative function is active

MEASUREMENT

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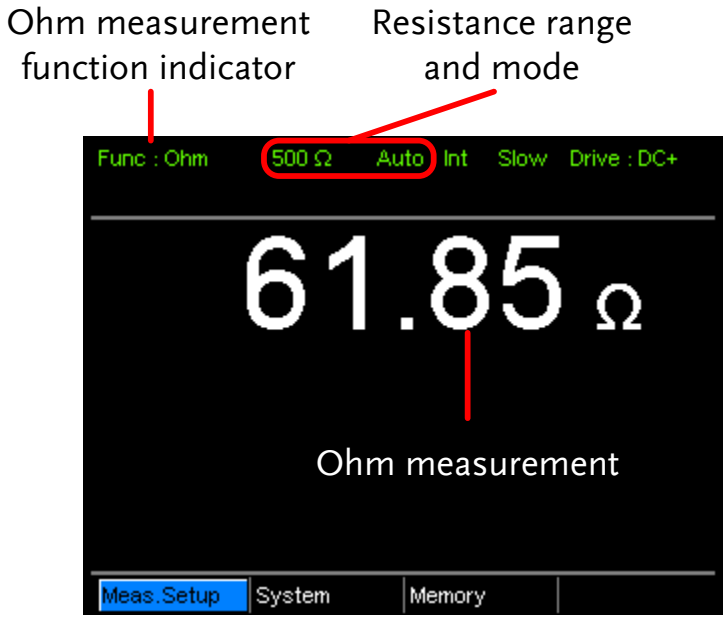
Resistance Measurement

1. Select the Resistance function.

Press Ohm to access the Resistance measurement mode.

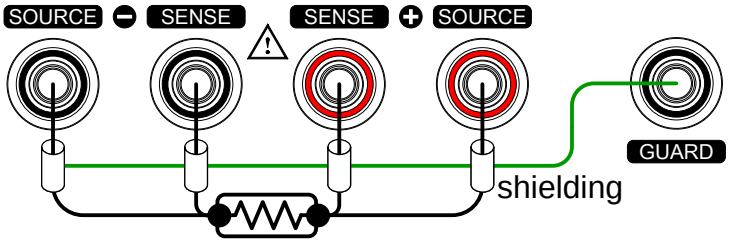
2. Resistance mode display appears.



3. Connect the test lead and measure

4-wire resistance:

Use the SOURCE + and the SOURCE - terminal for measurement, and the SENSE +, and SENSE - terminal for sensing.

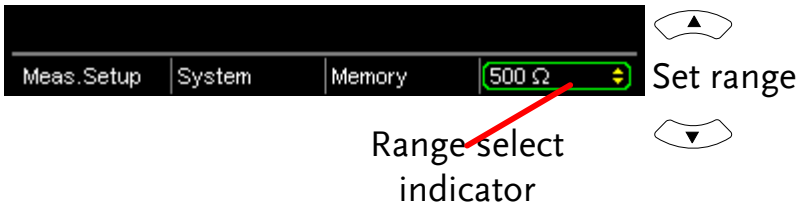


Note

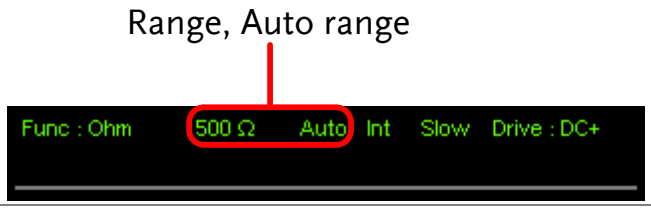
When switching between measurement ranges, please allow a moment for the circuits to settle before measuring.

Select the Resistance Range

Background	The resistance range can be used with normal resistance measurement as well as the temperature compensation function.
Manual	Press the Range key and use the up and down arrow keys to manually select the resistance range.



Auto Range	Long press the Range key to turn on automatic ranging.



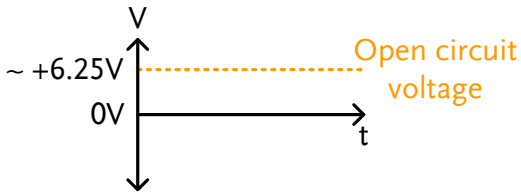
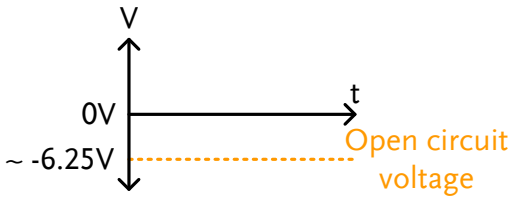
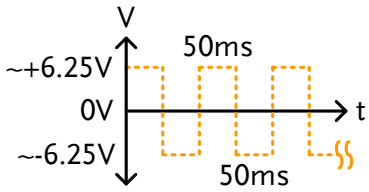
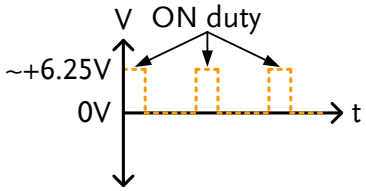
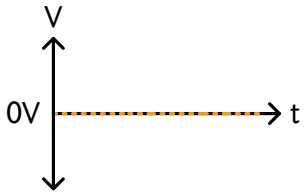
Selection List

Range	Resolution
5mΩ	0.1uΩ
50mΩ	1uΩ
500mΩ	10uΩ
5Ω	100uΩ
50Ω	1mΩ
500Ω	10mΩ
5kΩ	100mΩ
50kΩ	1Ω
500kΩ	10Ω
5MΩ	100Ω

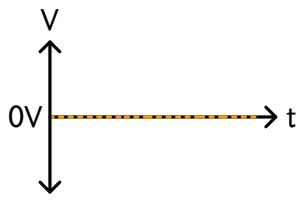
Note

For detailed specifications, please see the specifications on page 145.

Measuring Signal (Drive) Overview

Background	Resistance measurement has 6 different measuring signals that can be applied to obtain a resistance measurement: DC+, DC-, Pulse, PWM, Zero and Standby. These 6 signals are described in below.
Note	The Drive function is only applicable to the T3MIL50X and the open circuit voltage is a maximum of no greater than 20mV when Drive function is activated. The Drive signal for the T3MIL50 is fixed to DC+ and Standby.
DC+	 Default drive signal.
DC-	 Negative drive signal.
Pulse	 This mode can be used to eliminate the thermoelectric EMF formed on the contact between a test lead and a DUT.
PWM	 This mode can be used to avoid heating up the DUT and thus avoid having the measurement accuracy compromised on temperature-sensitive DUTs.
Standby	 The Standby is used to break off Relay of Force+/- without outputting test current, and none of measurements will be executed.

Note	Standby mode only applies to hardware with the latest PCB board. Refer to page 63 for details.

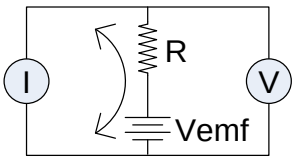
Zero		In this mode, T3MIL50X outputs no measuring signal on the Source loop; therefore, the Sense loop can be used as a voltage meter which can measure up to +/-10mV for thermoelectric EMF measurement. This function is useful for measuring the Vemf of thermocouple wires.

A note about Thermoelectric EMF

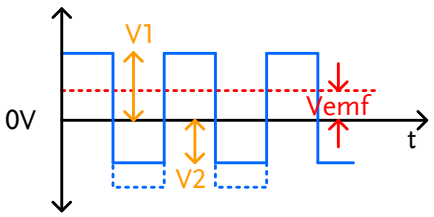
When making low resistance measurements, thermoelectric electromotive force (Vemf) can affect measurement accuracy. Vemf is created at the junction of two dissimilar metals, such as the contact point of a test lead and the pin of a DUT. Vemf adds a small but measurable voltage to the measurement.

There are primarily two different methods to compensate for Vemf in low resistance measurements: Offset Compensation and Vemf Cancelling. The T3MIL50X uses Vemf Cancelling with the pulse drive signal setting (see page 32).

The Pulse drive mode supplies a positive and a negative measurement current source.



This produces a positive and negative measurement voltage across the DUT, which also includes the Vemf (V1+Vemf & V2+Vemf).

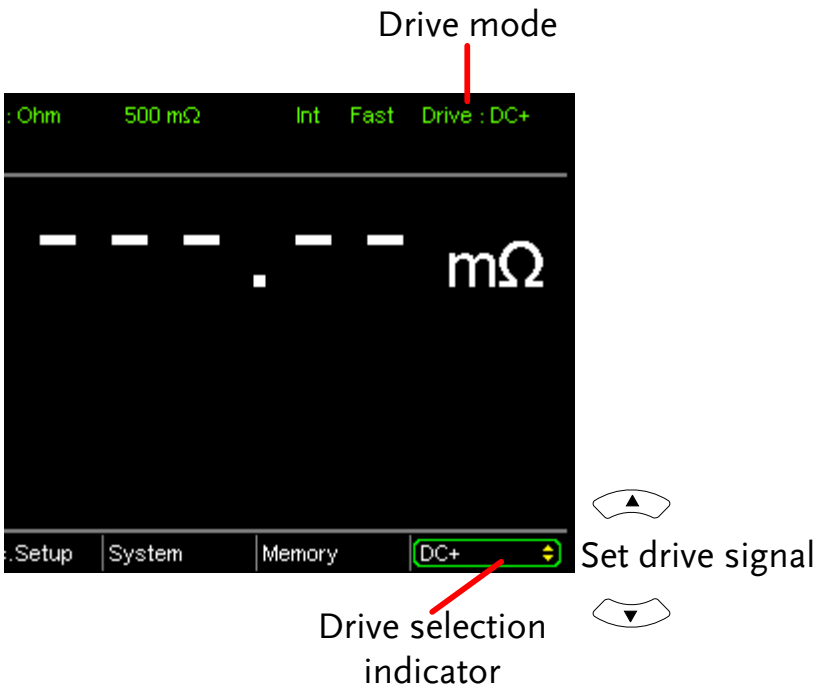


To cancel the Vemf, V2 is deducted from V1 and divided by 2 to get the average measurement, as shown in the formula below:

$$Vx = \frac{(V1 + Vemf) - (V2 + Vemf)}{2}$$ Where Vx = measured voltage sans Vemf.

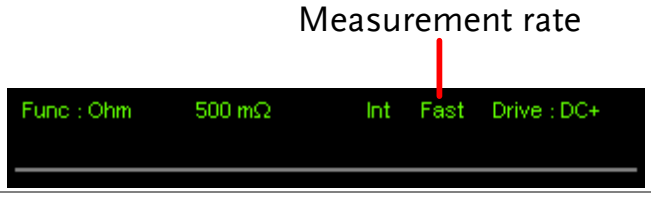
Select Measuring Signal (Drive)

Background	Resistance measurement has 6 different measuring signals that can be applied to obtain a resistance measurement: DC+, DC-, Pulse, PWM, Zero and Standby.
Note	The Drive function is only applicable to the T3MIL50X. The drive signal for the T3MIL50 is fixed to DC+ and Standby. The Drive function cannot be used with the Scan or Diode functions. In addition, the "Zero" drive setting is only available with the Ohm measurement function.
1. Select Drive	Press the Drive key and use the up and down arrow keys to select a drive signal.



Drive Range	DC+, DC-, Pulse, PWM, Zero, Standby

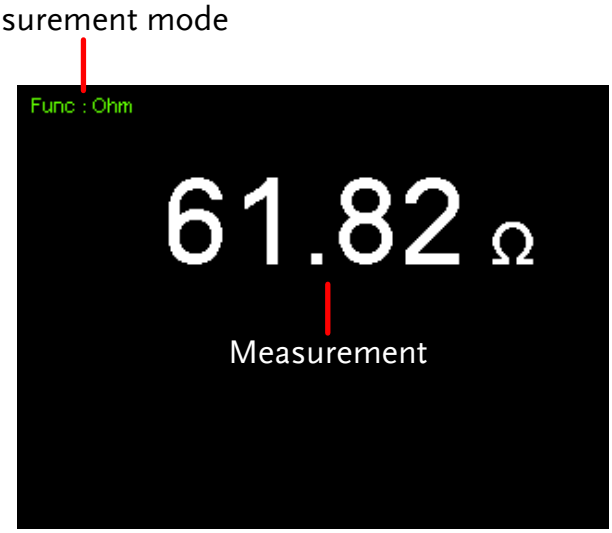
Select Measurement Rate

Background	The resistance measurement speed has 2 ranges: slow and fast. Slow speed is the most accurate with 10 measurements/second. Fast speed has 60 measurements/second. Both have the same measurement resolution. The rate selection function is not applicable in Diode measurement mode. When the PWM drive signal is used or when the Scan function is activated, the only available rate setting is fast.
1. Select Rate	Press the Speed key to toggle between the Slow and Fast rates. 

Display Mode

Background	The Display key can be used to toggle between the normal and the simplified display mode. The simplified display mode clears all text, menus and function indicators from the screen except for the measurement and measurement mode indicators.
1. Toggle Display mode	Press the Display key to toggle the display between normal and simplified. The display will change accordingly.

Simplified Display Mode Example



View Real-Time Measurement

Background

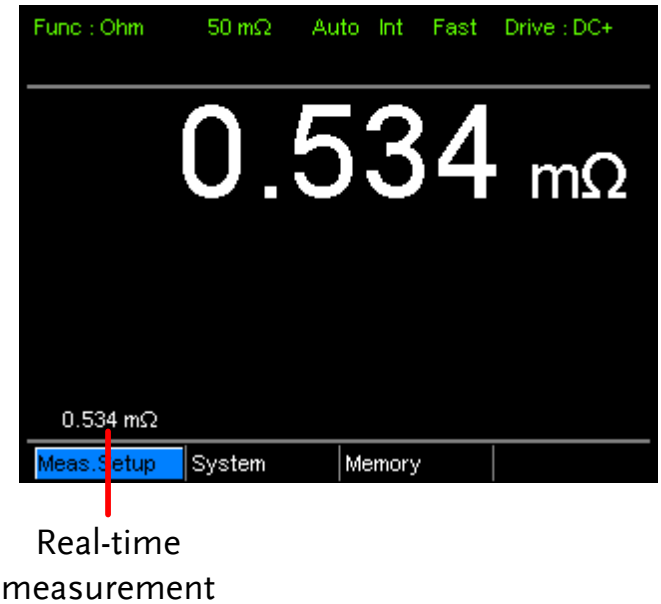
When measurements are smoothed using the averaging function, the RT key can be used to view the real-time results in addition to the averaged results.

See page 56 for Average configuration.

1. Toggle Real-Time display

Press the RT key to toggle the real-time display on or off.

The real-time measurement will appear in the bottom left-hand corner.



Dry-Circuit Measurement

Background

The Dry Circuit measurement function is used where the maximum open-circuit voltage must be kept to a minimum for applications such as measuring the contact resistance of switches, relays and connectors. The T3MIL50X provides a maximum of up to 20mV in this mode.

Note

Dry circuit testing is for switch and connector contact resistance. Switch and connector contact resistance measurement is in accordance with DIN IEC 512 and ASTM B539 which requires that the open circuit voltage of the measuring device should not exceed 20mV DC. Voltage at such low levels avoids the breakdown of any oxides that may be present on the contacts. In this mode the open circuit measuring voltage is limited <20mV, while modes like DC+ or pulse mode can have an open circuit measuring voltage as high as 6.25V.

The Dry Circuit function cannot be used with the Scan or Diode functions. In addition, when the Dry Circuit function is turned on, only 3 drive settings are available: DC+, DC- and Pulse.

Dry Limitations

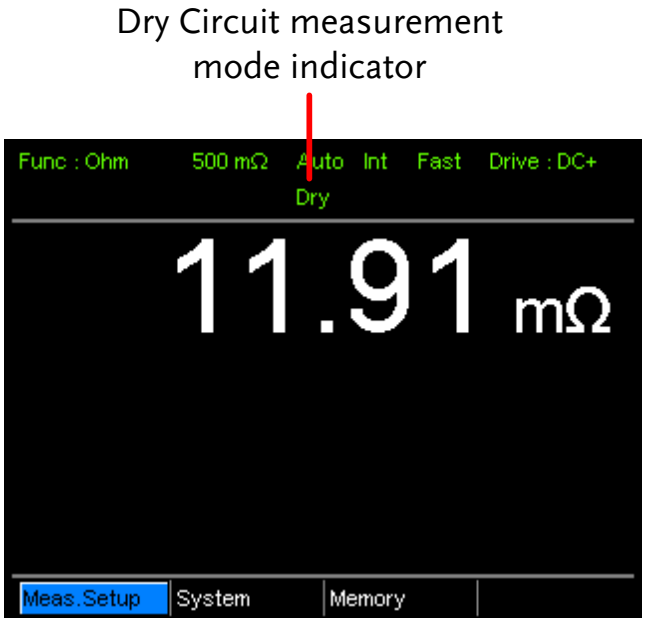
When the Dry Circuit measurement function is turned on, the measurement range is reduced. See the specifications for more details.

Range	Dry Mode	Rate
5mΩ	✘	
50mΩ	✘	
500mΩ	✔	Slow/Fast
5Ω	✔	Slow/Fast
50Ω	✔	Slow/Fast
500Ω	✘	
5kΩ	✘	
50kΩ	✘	
500kΩ	✘	
5MΩ	✘	

1. Toggle Dry mode on or off

Press the Dry key to toggle the dry circuit measurement mode on or off.

The DRY function indicator will appear in the middle of the display when active.



Using the Trigger Function

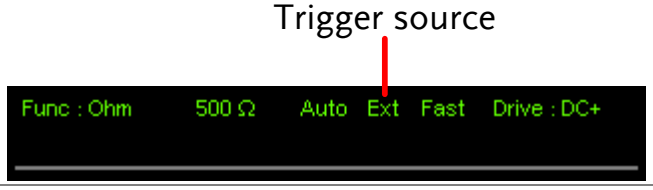
Background

The T3MIL50/50X can use internal or manual triggering for the Resistance, Temperature, Temperature Compensation, Temperature Conversion, Binning, Handler and Scan modes.
By default the T3MIL50/50X is set to internal triggering mode.

1. Select Manual Trigger

Short press Trigger to switch to manual triggering mode.

The Ext indicator will be shown on the display when the manual trigger is active.



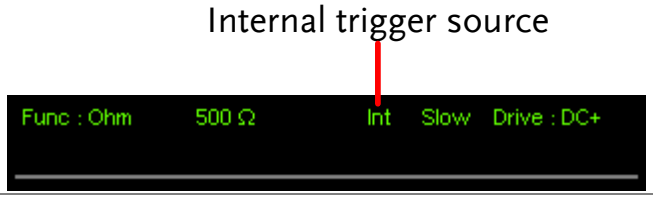
2. Manually Triggering Measurements

Short press the Trigger key each time you want to start a single measurement (when in the manual mode).

3. Internal Triggering

Long press Trigger to return the triggering mode back to internal mode.

The Int indicator will be shown on the display.



Diode Function

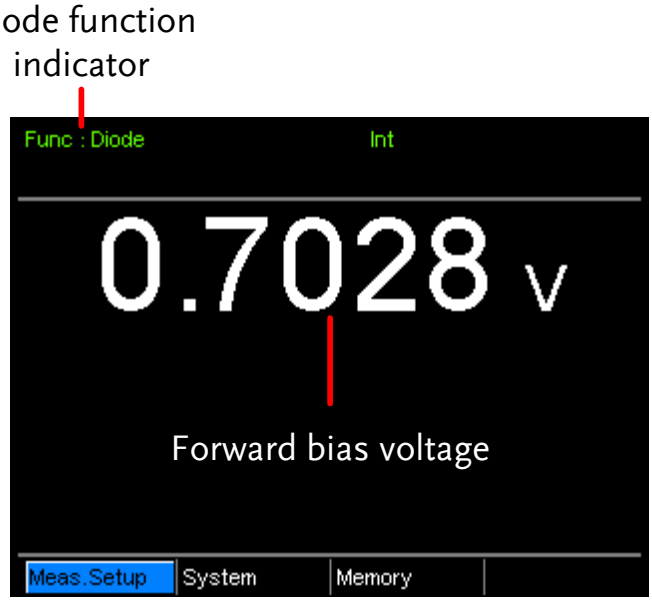
Background

The Diode function can be used to measure the forward bias voltage of a diode under test.

1. Select the Diode function.

Press Diode to access the Diode measurement mode.

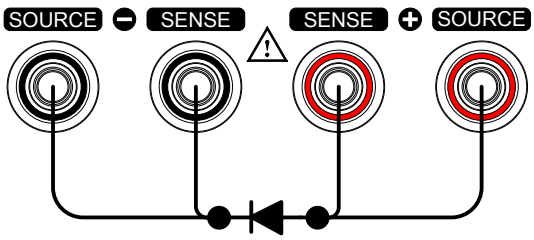
2. Diode mode appears.



3. Connect the test lead and measure

Connect the Sense+, Source+ to the anode.

Connect the Sense-, Source- to the cathode.



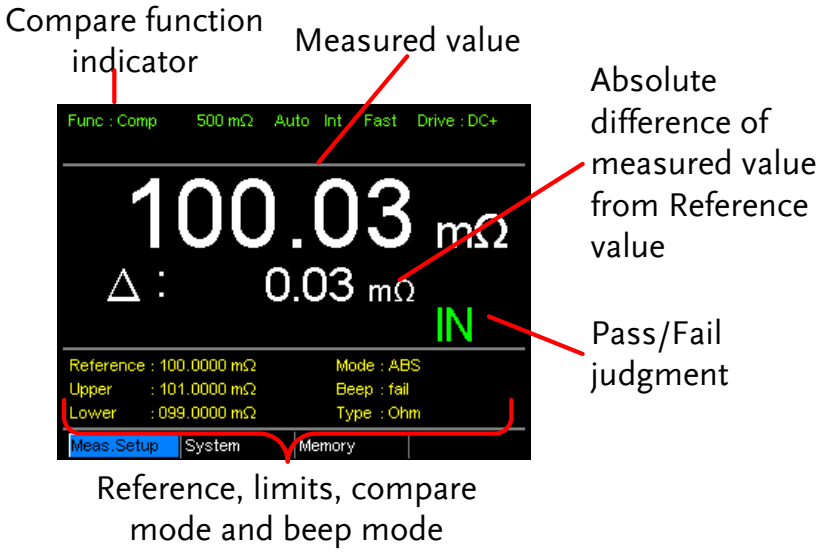
Compare Function

Background

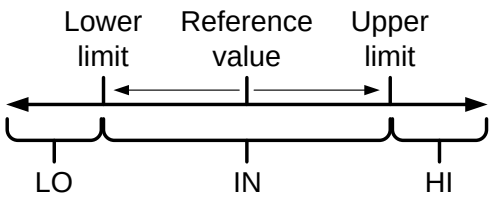
The compare function compares a measured value to a "Reference" value that has an upper (HI) and lower (LO) limit. If the measured value is within the upper and lower limit, then the measured value is judged as IN.

There are three compare modes that can be used to make a judgment: ABS, △% and % modes.

The ABS mode displays the absolute difference between the measured and the reference value (shown as △) and compares the measured value to the upper (HI) and lower (LO) limit. The upper and lower limits are set as absolute resistance values.

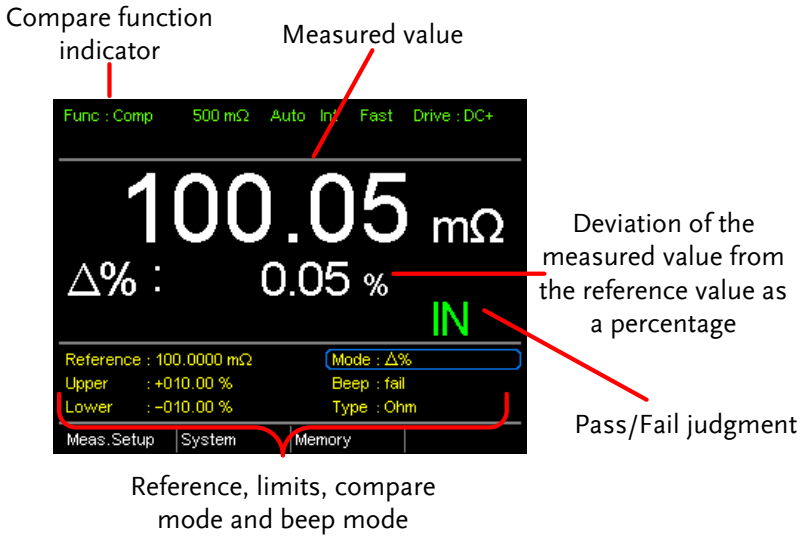


A measured value that falls within the upper and lower limits is considered IN (pass), a value that falls below the lower limits is considered LO, and a value that falls over the upper limit is a HI.



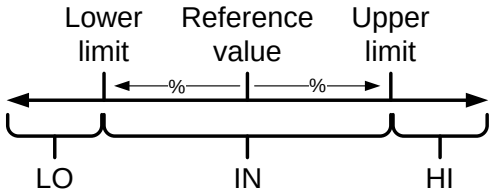
[Note that the reference value in the ABS mode is only for reference purposes and is not used to make a judgment.]

The △% compare function displays the deviation of the measured value from the reference value as a percentage. {[(Measured Value-Reference)/Reference]%}.



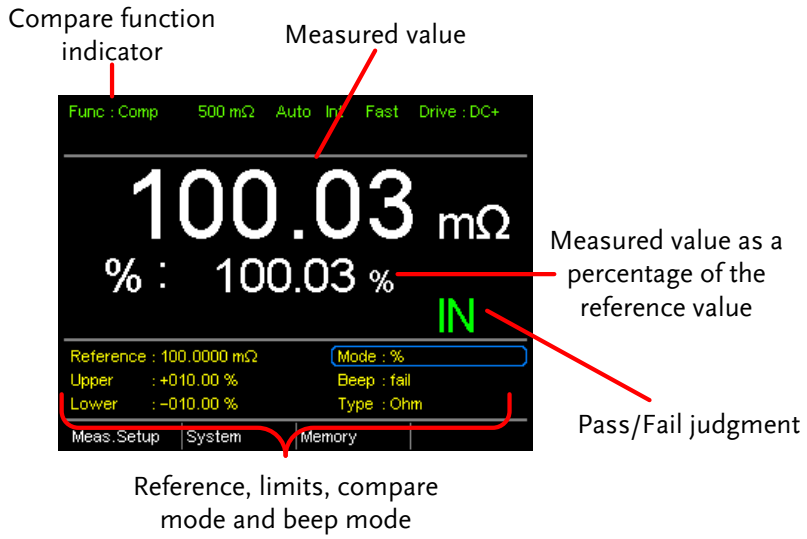
The upper (HI) and lower (LO) limits are set as a percentage *from* the reference value. (Identical to the % compare mode)

A measured value that falls within the upper and lower limits is considered IN (pass), a value that falls below the lower limits is considered LO, and a value that falls over the upper limit is a HI.

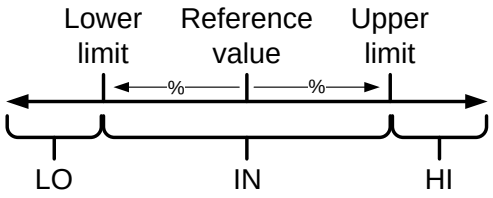


The % compare mode displays the measured value as a percentage of the reference value [(Measured Value/Reference Value)%].

The upper (HI) and lower (LO) limits are set as a percentage *from* the reference value. (Identical to the △% compare mode)

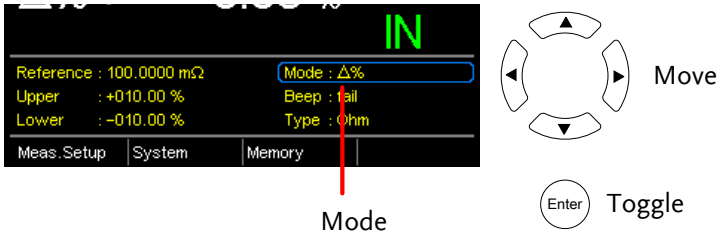


A measured value that falls within the upper and lower limits is considered IN (pass), a value that falls below the lower limits is considered LO, and a value that falls over the upper limit is a HI.



For all the compare modes, IN, HI or LO will be shown on the display for each judgment.

1. Select the compare function	Press Compare to access the compare mode, as shown above.
2. Select the compare mode	Use the arrow keys to navigate to the Mode setting. Press the Enter key to toggle the compare mode.

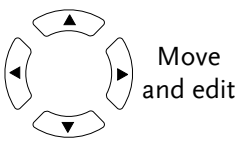


Range	Abs, △%, %

3. Reference value setting

Use the arrow keys to navigate to the Reference setting and press Enter.

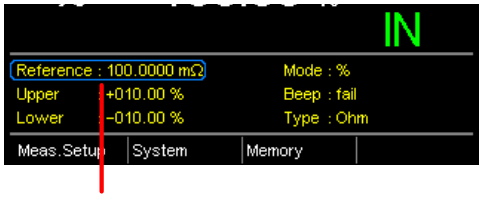
Use the left and right arrow keys to select a digit. Use the up and down arrow keys to edit the value of the selected digit and the unit. Press Enter to confirm the setting.



Move and edit

Enter

Select and confirm



Reference

Range: 000.0001~ 999.9999 (mΩ/Ω/kΩ/MΩ)

Note

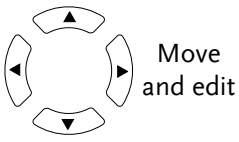
After setting the Reference value, the displayed △, % or △% values will be changed to reflect the new Reference value setting.

4. Upper & lower limit setting

Use the arrow keys to navigate to the Upper or Lower limit setting and press Enter.

Use the left and right arrow keys to select a digit. Use the up and down arrow keys to edit the value of the selected digit. Press Enter to confirm the setting.

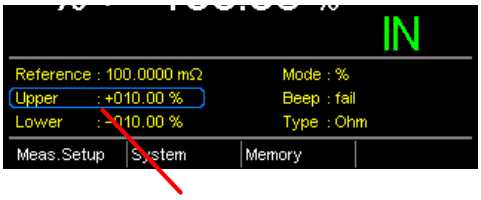
Repeat for the other limit (Upper or Lower).



Move and edit

Enter

Select and confirm



Upper, Lower reference

Setting Range: ABS mode: 000.0000~999.9999 (mΩ/Ω/kΩ/MΩ)
△% and % mode:
-999.99 ~ +999.99

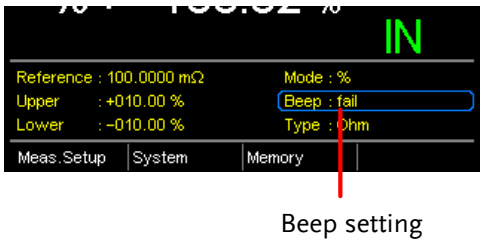
Note

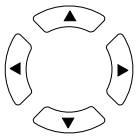
The upper limit must be higher than the lower limit. Not setting the upper limit higher than the lower limit is not allowed. Likewise the lower limit cannot be set higher than the upper limit.

5. Beep setting

Use the arrow keys to navigate to the Beep setting.

Press Enter to toggle the beep setting.





Beep Setting: Off, Pass, Fail

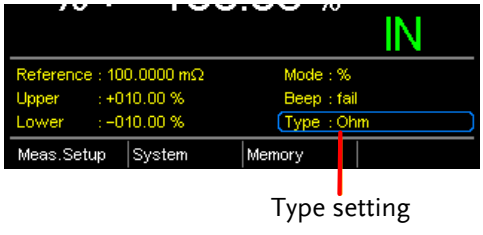
Note

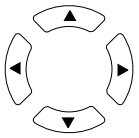
The Beep setting can also be set from the System>Utility>Beep>Compare menu.

6. Type setting

Use the arrow keys to navigate to the Type setting.

Press Enter to toggle the type setting.





Type Setting: Ohm, TC

Note

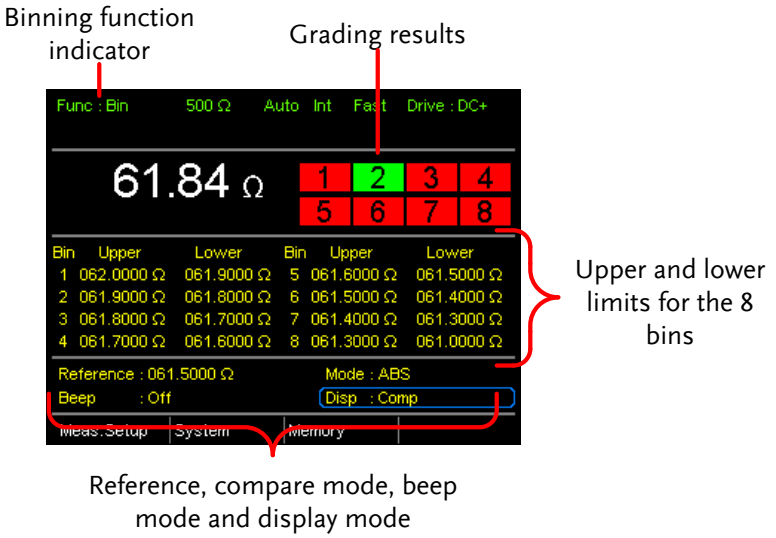
The measured value is displayed according to Type setting is selected.

For TC function comparison, please make sure the relative TC setting is done. See page 49 respectively for details.

Binning Function

Background

The Binning function is used to grade DUTs into eight different bins according to 8 sets of upper and lower limits. Two compare modes can be used in this function, ABS and △% modes.



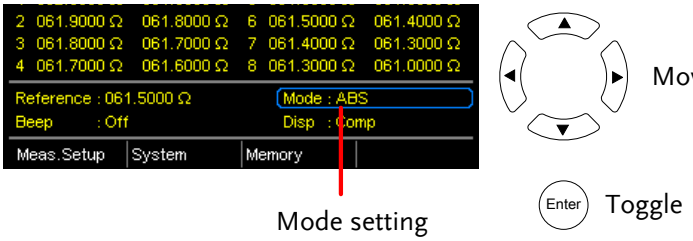
1. Select the Binning function

Press the Binning key to access this function.

2. Select the compare mode

Use the arrow keys to go to the Mode setting.

Press Enter to toggle between ABS or △% compare modes.



ABS Mode	The ABS mode allows you to set the upper and lower limits of each bin as absolute resistance values.
△%	The Delta % mode allows you to set the upper and lower limits of each bin as percentage value from the reference value.

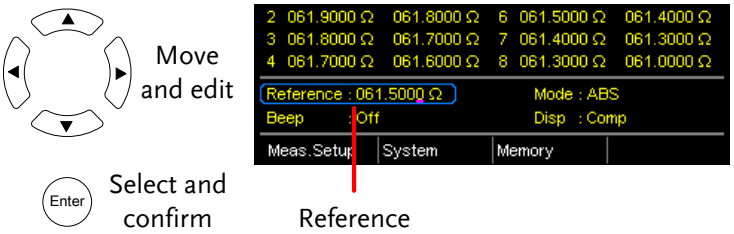
Note	For further details on the ABS or △% compare modes, see the description in the Compare section, page 38.

3. Reference value setting

Although the 8 bins have their own upper and lower limits, they still share a common reference value.

Use the arrow keys to go to the Reference setting and press Enter.

Use the left and right arrow keys to select a digit. Use the up and down arrow keys to edit the value of the selected digit and the unit. Press Enter to confirm the setting.



Range	000.0001~ 999.9999(mΩ/Ω/kΩ/MΩ)

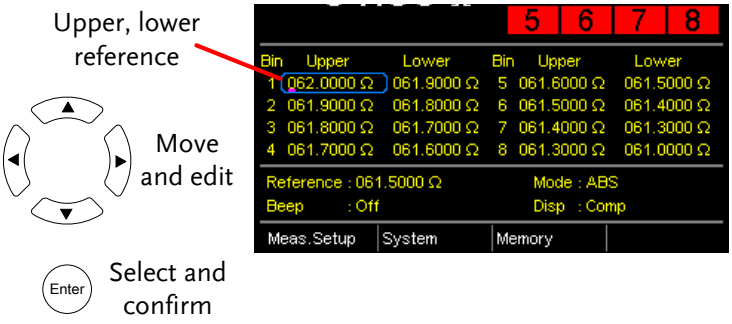
4. Upper & lower limit settings

Use the arrow keys to go to the upper limit of the first bin and press Enter.

Use the Left and Right arrow keys to select a digit. Use the Up and Down arrow keys to edit the value of the selected digit and unit. Press the Enter key to confirm the setting.

Repeat for the lower setting.

Repeat for the remaining bins.



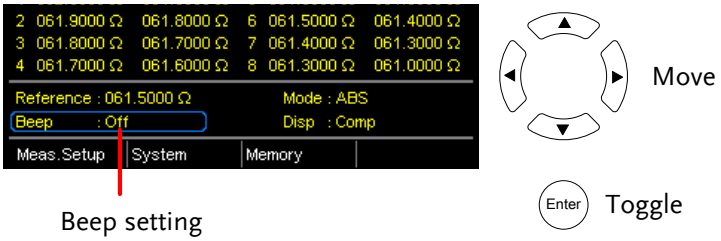
Setting range	ABS mode: 000.0000~999.9999 (mΩ/Ω/kΩ/MΩ) △% mode: -999.99 ~ +999.99

Note	The upper limit must be higher than the lower limit. Not setting the upper limit higher than the lower limit is not allowed. Likewise the lower limit cannot be set higher than the upper limit.

5. Beep setting

Use the arrow keys to navigate to the Beep setting.

Press Enter to toggle the beep setting.



Beep Setting: Off, Pass, Fail

Note	The Beep setting can also be set from the System>Utility>Beep>Binning menu.

6. To start binning

The binning function starts automatically if you are in internal trigger mode.

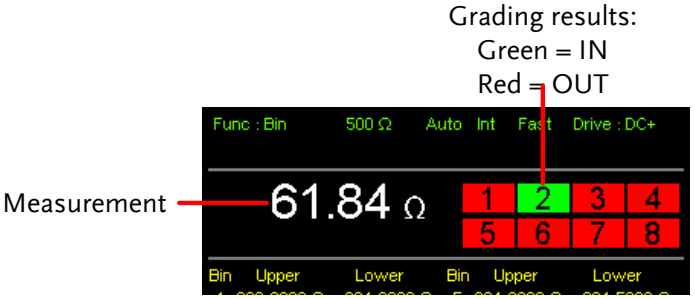
If you are using the manual triggering mode, press the Trigger button or apply a pulse on the trigger pin of the Handler interface to start binning.

See page 36 to set the triggering modes.

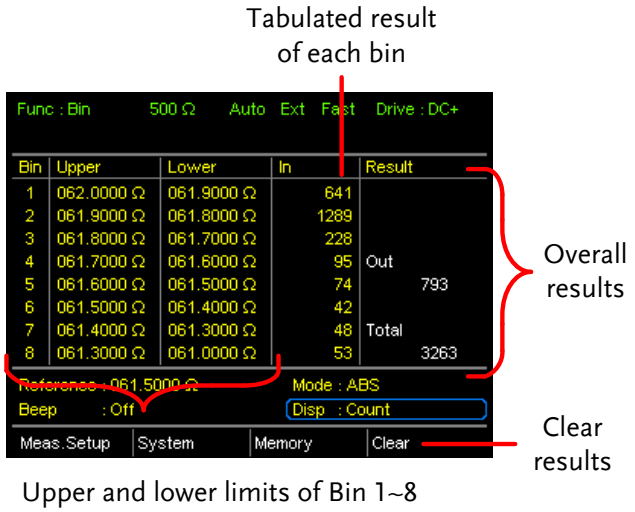
7. Display the binning results

There are two different display modes to view results.

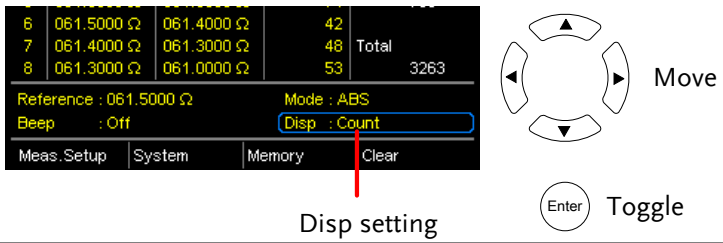
The Comp (Compare) display mode is the default display mode. This mode will display the currently measured value and displays which of the bins (if any) the measured value is graded as.



The Count display mode tabulates the results on the right-hand side of the display and shows the bin settings on the left.

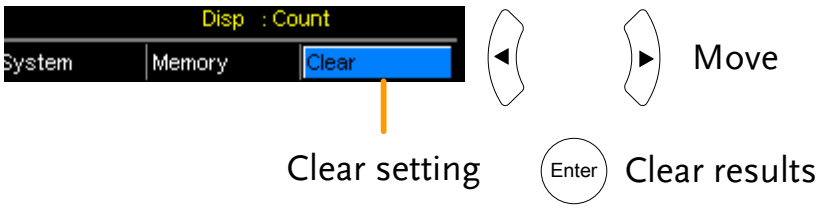


To toggle the display mode, go to the Disp setting and press Enter.



8. How to clear the result count

When in the Count display mode, press the ESC key. Go to the Clear setting and press Enter. The accumulated results will be cleared from the display.



Temperature Measurement

Background

The temperature measurement function uses a PT-100 temperature probe. The measured temperature is displayed on the display. For more information on the PT-100 sensor, see the appendix on page 141.

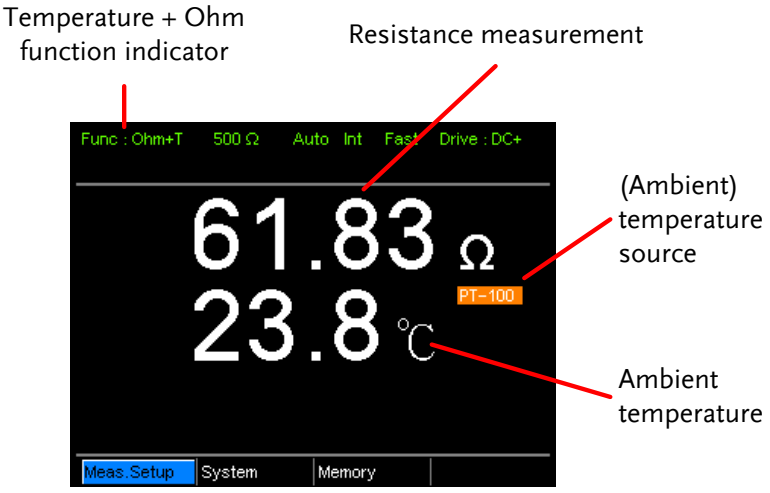
There is only one range for the temperature function. However the resistance measurement range can still be changed when in the temperature function.

Note

The temperature measurement function is used in conjunction with the Ohm measurement function. The two measurements share the same display, so the Ohm readings stay on the display even after the temperature measurement function is activated. Thus when the Temperature function is selected, "Ohm+T" is shown as the selected function.

1. Select the Temperature function

Press TEMP to enter the temperature measurement function.

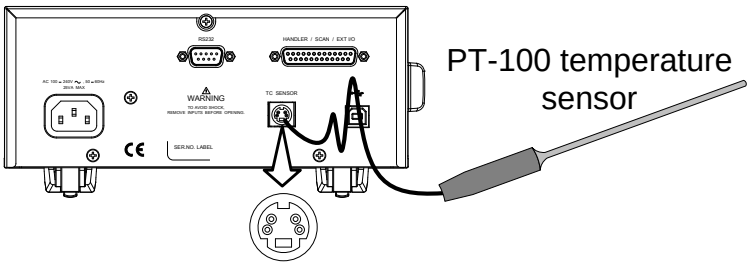


The temperature is displayed on the Ohm display.

2. Select the temperature units

From the bottom menu, go to Meas. Setup>Temperature Unit and select °C or °F.

See page 60 for setting details.

3. Ambient Temperature	The Ambient temperature setting should be turned off when using the temperature function. From the bottom menu go to Meas. Setup > Ambient Temperature and turn the Ambient Temperature setting off. See page 60 for setting details.
4. Temperature mode connection	The temperature sensor uses the rear panel TC Sensor port for input. 

Temperature Compensation

Background

If the resistance of a DUT at a particular temperature is needed, the compensation function can be used. This function can simulate the resistance of a DUT at a desired temperature. If the ambient temperature and the temperature coefficient of the DUT are known, it is possible to determine the resistance of a DUT at any temperature.

The Temperature Compensation works on the following formula:

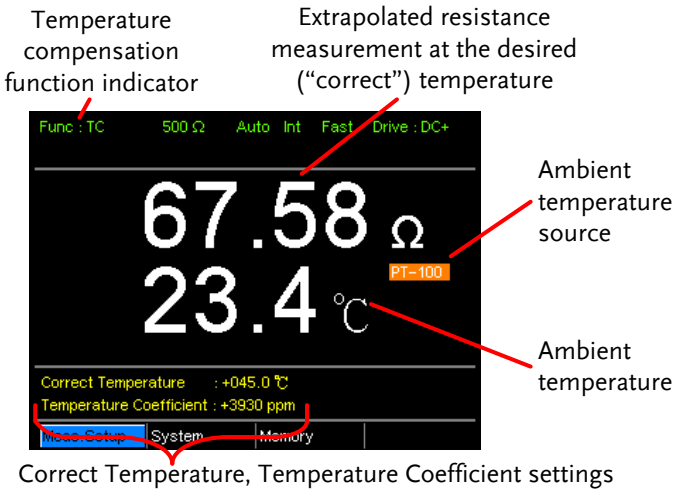
$$R_{t0} = \frac{R_t}{1 + \alpha_{t0}(t - t_0)}$$

Where:
R_t = Measured resistance value (Ω)
R_{t0} = Corrected resistance value (Ω)
T_0 = Inferred absolute temperature
t_0 = Corrected temperature (°C)
t = Current ambient temperature (°C)
a_{to} = Temperature coefficient of resistance at the correct temperature. $a_{to} = \frac{1}{|T_0| + t_0}$.

1. Select the Temperature Compensation mode

Press TC to access the Temperature Compensation function.

The temperature-compensated resistance measurement will appear on the display.



2. Ambient Temperature

The ambient temperature can be either measured with the PT-100 sensor or be set manually.

If using the PT-100 sensor the Ambient temperature setting should be turned off. If the PT-100 probe is not used, then the ambient temperature needs to be manually set.

From the bottom menu, go to Meas. Setup > Ambient Temperature and set the ambient temperature.

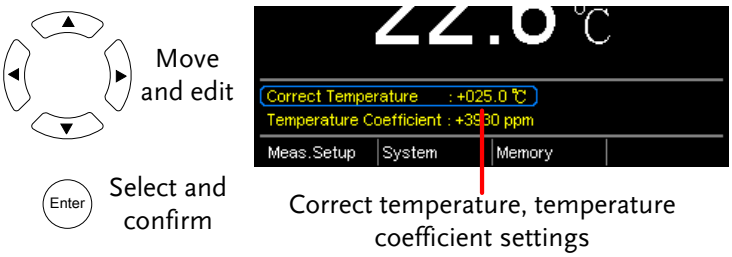
See page 60 for setting details.

Range	Off, -50.0 °C ~ 399.9°C

3. Temperature compensation

Use arrow keys to go to Correct Temperature or to Temperature Coefficient and press Enter to select the setting.

To edit the setting values use the left and right arrow keys to select a digit and use the up and down arrow keys to edit the digit. Press Enter to confirm the setting.



Desired Temperature range -50.0 ~ +399.9 ˚C

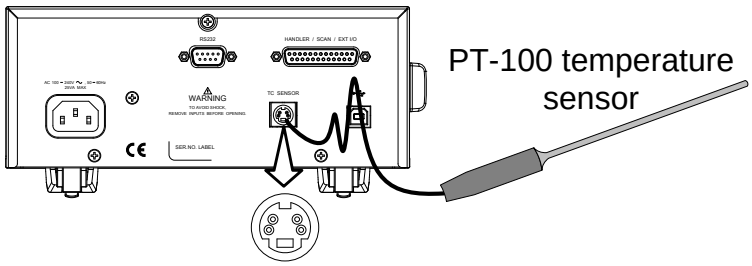
Temperature Coefficient range -9999 ~ +9999 ppm

Below are the inferred zero resistance temperatures of some common conductors:

Material	Inferred Absolute Temperatures
Silver	-243
Copper	-234.5
Gold	-274
Aluminum	-236
Tungsten	-204
Nickel	-147
Iron	-162

4. Temperature compensation connection

Sensor Connection:

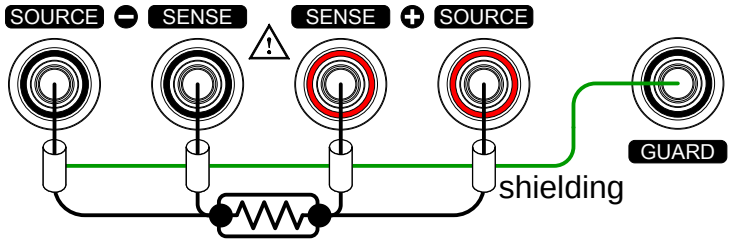


Note

If the sensor is not connected, then the Ambient temperature needs to be manually set.

DUT connection:

4 wire Kelvin:



Temperature Conversion

Background

The Temperature Conversion function allows you to determine the temperature change of a DUT at any given resistance, if the initial temperature, the inferred zero resistance temperature for the DUT and the initial resistance of the DUT are known. The displayed result can also be the extrapolated to calculate the final temperature (T) or the extrapolated temperature difference (△T)*.

Temperature Conversion function works on the following formula:

$$\frac{R_2}{R_1} = \frac{t_0 + t_2}{t_0 + t_1}$$

Where:
R_2 = resistance @ temperature t_2
R_1 = resistance @ temperature t_1
t_0 = inferred zero resistance temperature in °C**
t_1 = temperature at R_1
t_2 =temperature at R_2

The temperature conversion function is used to determine the temperature of transformer windings, electric motors, or other materials where it may not be practical to embed a temperature sensor.

*(T) Final temperature = t_2 = △T +T_A

(T_A) Ambient temperature = Ambient temperature when R_2 is measured. T_A can either be manually measured with the PT-100 sensor or it can be manually set.

(△T) Extrapolated temperature difference = T - T_A

**"Constant" setting on the panel display is equivalent to the absolute value of the inferred zero resistance temperature.

Common inferred zero resistance temperatures

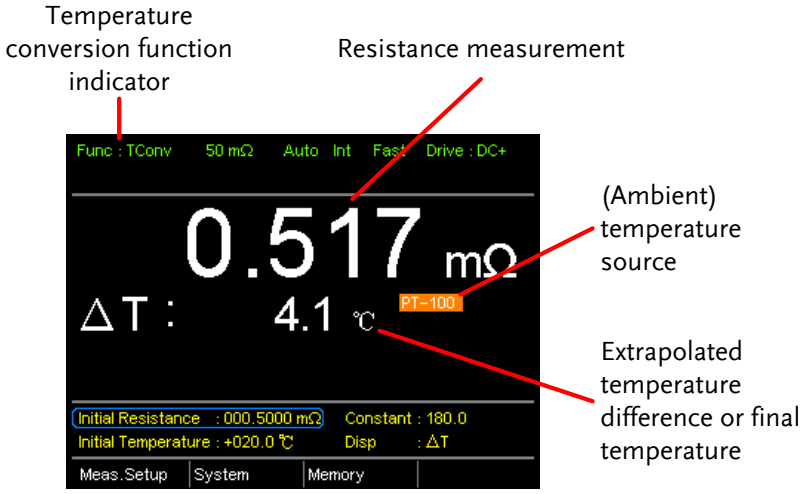
Metallic conductors show increased resistivity when temperature is increased, and likewise show reduced resistivity when temperature is reduced. Inferred zero resistance temperature is simply the inferred temperature at which the material will have no resistance. This value is derived from the temperature coefficient of the material. Note: the inferred zero resistance temperature is an ideal value, and not a real-world value.

Material	Inferred zero resistance temp. in °C
Silver	-243
Copper	-234.5
Gold	-274
Aluminum	-236
Tungsten	-204
Nickel	-147
Iron	-162

1. Select the Temperature compensation mode.

Press TCONV to access the temperature compensation function.

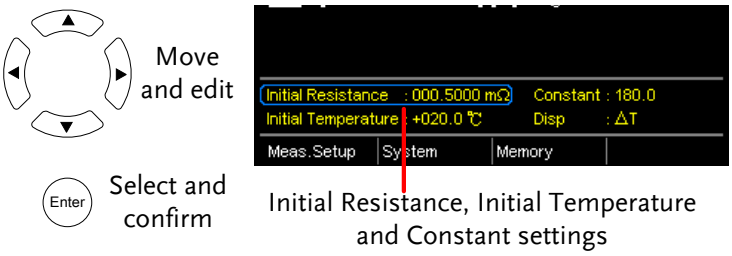
The temperature-converted measurement will appear on the display.



2. Initial Resistance, Initial Temperature and Constant settings

Use the arrows keys to go to Initial Resistance, Initial Temperature or Constant (inferred initial resistance temperature) and press Enter.

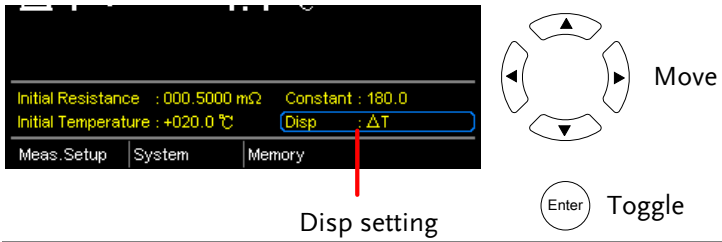
Use the left and right arrow keys to select a digit and use the up and down arrow keys to edit the digit. Press Enter to confirm the edit.



Initial Resistance	000.0001~999.9999 mΩ, Ω, kΩ, MΩ
Initial Temperature	-50.0 ~ +399.9 ℃
Constant	000.0~999.9

3. Display mode

Use the arrow keys to go to Disp. Press Enter to toggle between the T and △T modes.

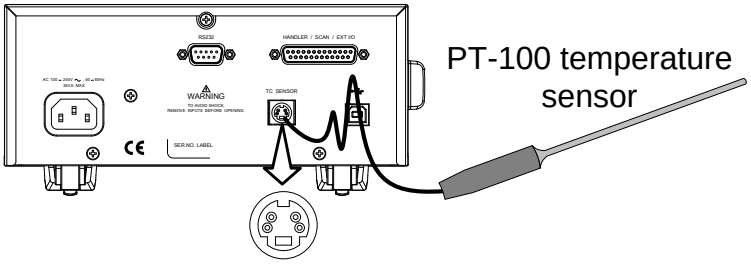


T displays the extrapolated temperature at the measured resistance of the DUT.

△T displays the difference from the extrapolated temperature at the measured resistance of the DUT and the ambient temperature. Please refer to page 52 for further details.

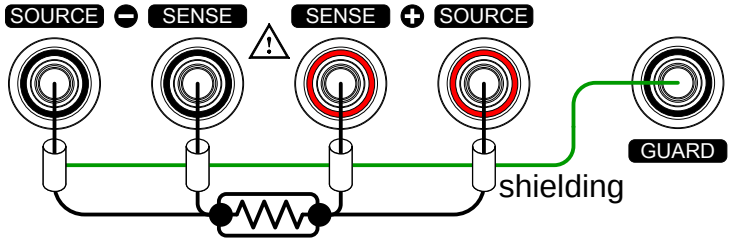
4. Temperature compensation connection.

Sensor Connection:



DUT connection

4 wire Kelvin:

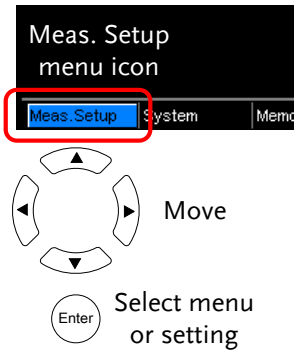


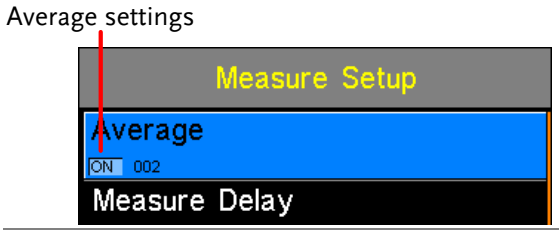
Measurement Settings

Background	The following measurement settings are used to configure the various measurement modes.

Average Function

Background	The average function smooths measurements using a moving average. The average function sets the number of samples used for the moving average; a higher number results in smoother measurement results. The average function is turned off by default.
1. Select Average setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to Meas. Setup and press Enter. Go to Average and press Enter.
2. Average setting appears	Use the arrow keys to turn Average on and set the average number. Press Enter to confirm the setting.





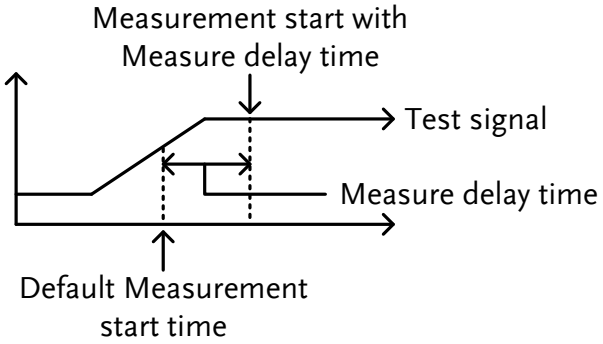
Average	OFF, ON: 2~100

Note	Pressing ESC before pressing ENTER will exit the Average function settings.

Measure Delay

Background

The Measure Delay setting inserts a delay time between each measurement. Measure delay is turned off by default.



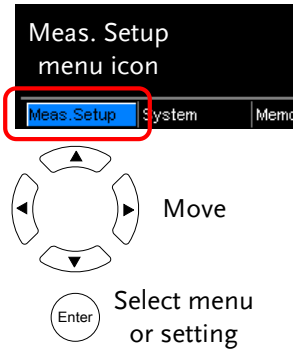
The measure delay setting is useful for measuring components that need some time to charge if the default measurement start time is not adequate. An adequate delay time allows the meter to avoid the effects of transient disturbances that are usually seen when measuring reactive DUTs with a current source.

1. Select Measure Delay setting

From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

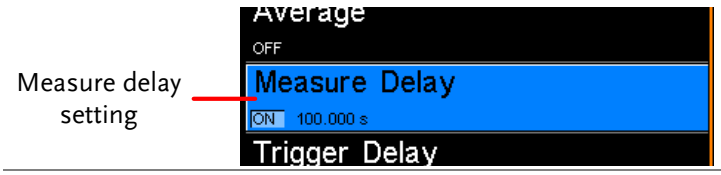
Go to Meas. Setup and press Enter.

Go to Measure Delay and press Enter.



2. Measure Delay setting appears

Use the arrow keys to turn Measure Delay on and set the delay time. Press Enter to confirm the setting.



Measure Delay* OFF, ON: 000.000 ~ 100.000s

* When the set value is > 0.1s, the resolution is 0.1s. When the set value is < 0.1S, the resolution is 1mS.

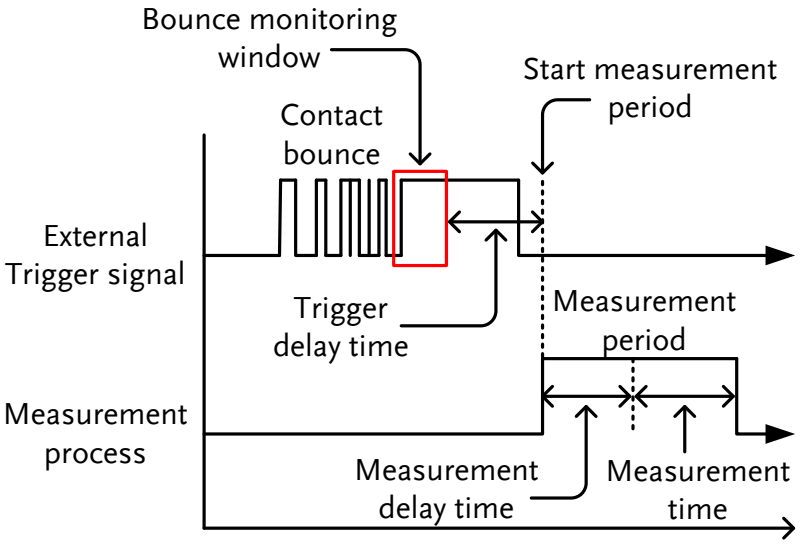
Note

Pressing ESC before pressing ENTER will exit the Measure Delay settings.

Trigger Delay

Background

The Trigger Delay setting adds a delay when an external trigger signal is recognized. Normally the external trigger is recognized when there is no contact bounce in the signal for a fixed length of time, this time is known as the bounce monitoring window. This ensures that the external trigger signal is stable before it is recognized. The Trigger Delay time starts right after the bounce monitoring window ends.



The Trigger Delay setting is turned off by default.

Note

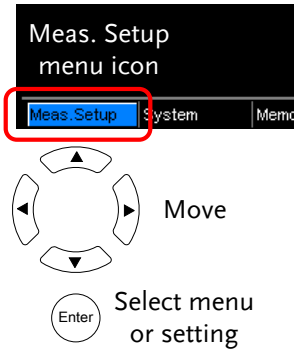
Pin 2 of the Handler/Scan/Ext I/O interface is used for external triggering, See page 70 for pinout details.

1. Select Trigger Delay setting

From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

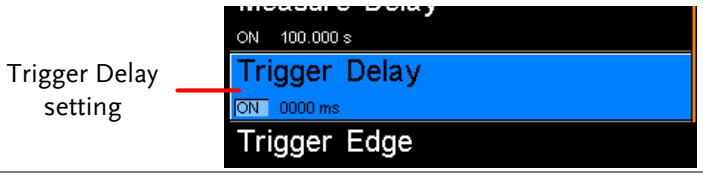
Go to Meas. Setup and press Enter.

Go to Trigger Delay and press Enter.



2. Trigger Delay setting appears

Use the arrow keys to turn Trigger Delay on and set the delay time. Press Enter to confirm the settings.



Trigger Delay	OFF, ON: 0 ~ 1000ms

Note

Pressing ESC before pressing ENTER will exit the Trigger Delay settings.

Trigger Edge

Background

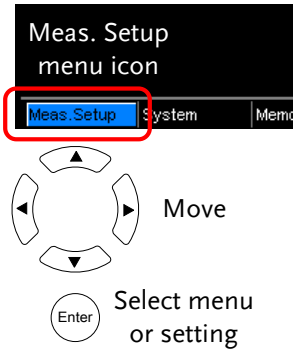
The Trigger Edge setting sets the external trigger edge as rising or falling. By default the trigger edge is set to rising.

1. Select Trigger Edge setting

From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

Go to Meas. Setup and press Enter.

Go to Trigger Edge and press Enter.



2. Trigger Edge setting appears

Use the arrow keys to set the Trigger Edge. Press Enter to confirm the setting.

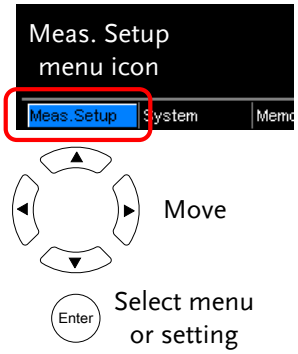
Trigger Edge	Rising, Falling

Note

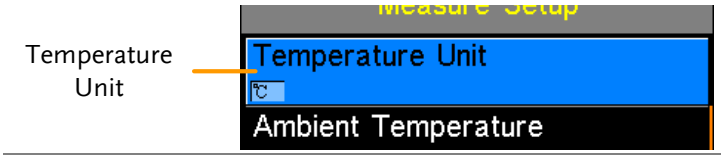
Pressing ESC before pressing ENTER will exit the Trigger Edge settings.

Temperature Unit

Background	Temperature units can be set to Fahrenheit or Celsius for all temperature measurements.
1. Select Temperature Unit setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to Meas. Setup and press Enter. Go to Temperature Unit and press Enter.



2.Temperature Unit setting appears	Use the arrow keys to set the Temperature Unit. Press Enter to confirm the setting.

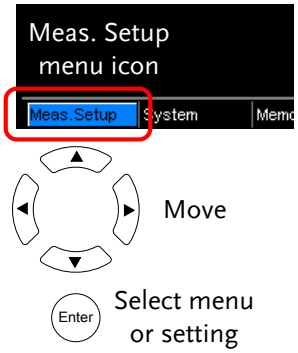


Temperature Unit Fahrenheit, Celsius

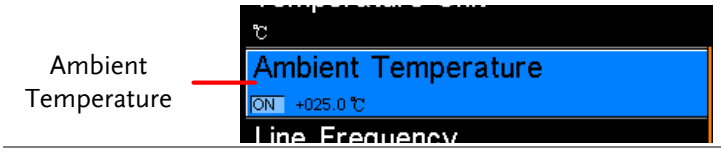
Note	Pressing ESC before pressing ENTER will exit the Temperature Unit setting.

Ambient Temperature

Background	The Ambient Temperature setting is used to set the ambient (room temperature) for the Temperature Compensation or Temperature Conversion function in the absence of the PT-100 temperature sensor. See page 49 and 52 respectively for details.
1. Select Ambient Temperature setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to Meas. Setup and press Enter. Go to Ambient Temperature and press Enter.



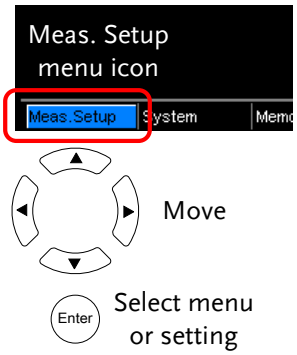
2.Ambient Temperature setting appears	Use the arrow keys to set the Ambient Temperature. Press Enter to confirm the setting.



Ambient Temperature	Off, On: -50°C ~ 399.9°C
Note	Pressing ESC before pressing ENTER will exit the Ambient Temperature setting.

Line Frequency

Background	The Line Frequency setting selects the appropriate line filter to reduce the influence of the AC line frequency on the milliohm measurements. This setting is set to AUTO by default.
1. Select Line Frequency setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to Meas. Setup and press Enter. Go to Line Frequency and press Enter.



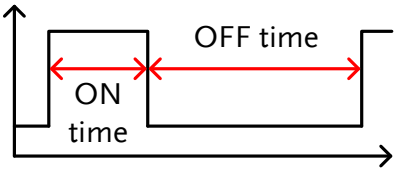
2.Line Frequency setting appears	Use the arrow keys to set the Line Frequency. Press Enter to confirm the setting.

Line Frequency	Auto, 50Hz, 60Hz
Note	Pressing ESC before pressing ENTER will exit the Line Frequency setting.

PWM Setting

Background

The PWM setting will set the duty of the PWM Drive setting. The duty is set with ON and OFF times for the waveform.



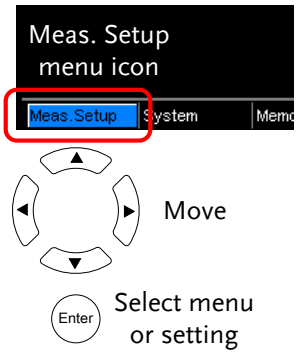
See page 30 for Drive setting details.

1. Select PWM setting

From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

Go to Meas. Setup and press Enter.

Go to PWM and press Enter.



2.PWM setting appears

Use the arrow keys to set the ON and OFF time for the duty. Press Enter to confirm the setting.

ON	03 ~ 99 time units*
OFF	0100 ~ 9999 ms

*The ON time setting is set in "time units", not milliseconds. The amount of time in a time unit depends on the line frequency settings (see page 61).

Line frequency	1 Time Unit
60Hz	16.6mS
50Hz	20mS

Note

Pressing ESC before pressing ENTER will exit the PWM setting.

System Settings

Background

The System settings are used to view the system information, set the power on state, the remote interface, screen brightness, external interface and beep settings as well as access the calibration menu.

System Information

Background

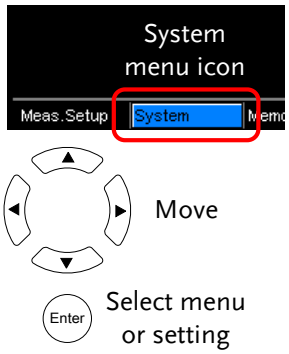
The System Information will show the manufacturer, model, software version and serial number of the unit. The system information is the equivalent of the return string from the *idn? query (page 127).

1. View System Information

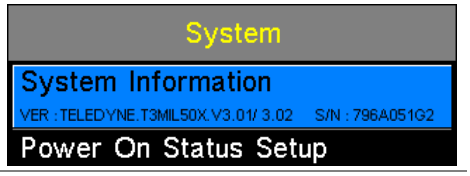
From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

Go to System and press Enter.

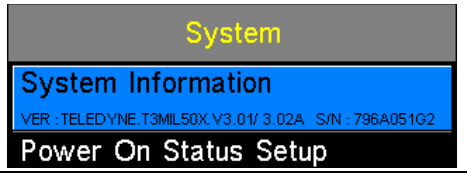
System information will be displayed at the top of the System menu.



System Information of hardware with the old PCB board



System Information of hardware with the latest PCB board



Note

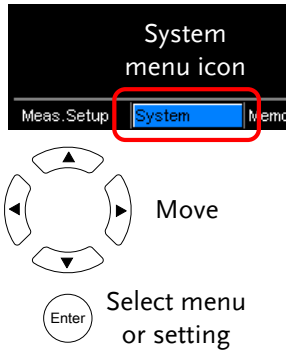
From the screenshot above where "A" from the 3.01A indicates it is equipped with the latest PCB board, which empowers the features of HVP and Standby mode. Refer to page 70 for details of HVP and page 30 for details of Standby mode.

Note

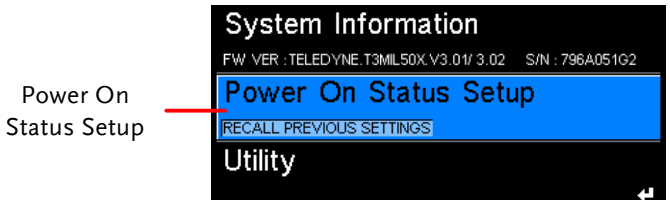
Pressing ESC will exit from the System menu.

Power On Status Setup

Background	The Power On Status Setup allows you to either load the previous settings or the default settings on startup.
1. Select Power On Status setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Power On Status Setup and press Enter.



2. Power On Status Setup appears	Use the arrow keys to set Power ON Status Setup. Press Enter to confirm the setting.

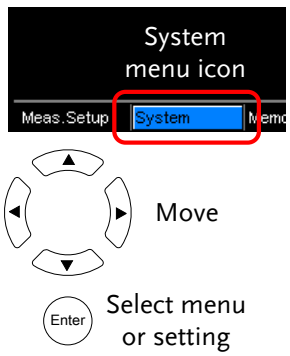


Power On Status	Recall Previous Settings, Load Default

Note Pressing ESC before pressing ENTER will exit the Power On Status Setup.

Interface

Background	The remote interface can be set to RS232 or USB.
1. Select Interface setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Utility and press Enter. Go to Interface and press Enter.



2. Interface setting appears	Use the arrow keys to choose an interface and to set the baud rate (RS232). The EOL (end of line) character can also be set. Press Enter to confirm the settings.

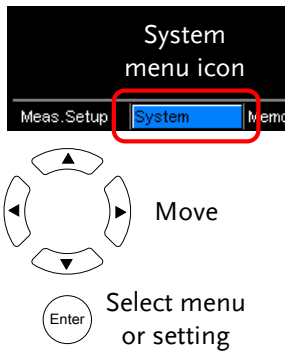
Interface	RS232, Baud Rate (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
	USB
DATA OUT	ON, OFF
EOL	LF, CR, CR+LF, LF+CR (default = LF) See page 94 for further details.

Note

- Pressing ESC before pressing ENTER will exit from the Interface settings.
- After DATA OUT is turned on, the measured value will be automatically sent back, via communicating interface, to the connected PC.
- The DATA OUT function is only available when Trigger Mode is selected in EXT.

Brightness

Background	The Brightness setting sets the backlight brightness of the TFT-LCD panel.
1. Select Brightness setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Utility and press Enter. Go to Brightness and press Enter.



2. Brightness setting appears	Use the arrow keys to set the brightness level. Press Enter to confirm the setting.

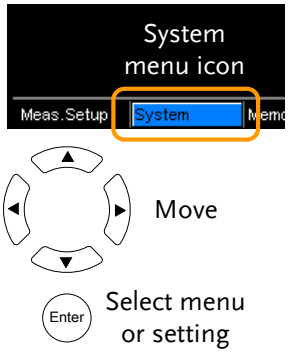
Brightness

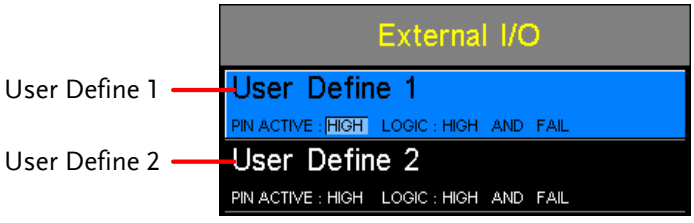
Brightness	01 (dim) ~ 05 (bright)

Note	Pressing ESC before pressing ENTER will exit from the Brightness settings.

User Define Pins

Background	The External I/O User Define Pin settings set the logic and the active level for the Define 1 and Define 2 pins on the Handler/Scan/EXT I/O port on the rear panel. The External I/O pins are used with the compare or bin functions. The logic settings can be based on the pass, fail, high, low or bin grade results of the selected function.
1. Select External I/O Setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Utility and press Enter. Go to External I/O and press Enter.
2. External I/O Menu Appears	Use the arrow keys to choose either User Define 1 or User Define 2 and press Enter. Use the arrow keys to set the active level of the pin when the logic conditions are true and to set the logic settings. Press Enter to confirm the settings.





User Define 1

User Define 2

User Define 1/2: Pin Active: High, Low

Logic:

	Operand1	Operator	Operand2
	Fail	Logical OR, Logical AND, OFF*	Fail
	Pass		Pass
	Low		Low
	High		High
	Bin O**		Bin O**
	Bin 1 ~ 8		Bin 1 ~ 8

*The OFF operator sets the Logic as true when Operand1 is true.

** Bin O is defined as outside bin 1~ 8.

Note

The Bin logic settings are not available for the T3MIL50.

Pressing ESC before pressing ENTER will exit from the selected External I/O setting.

Handler Mode

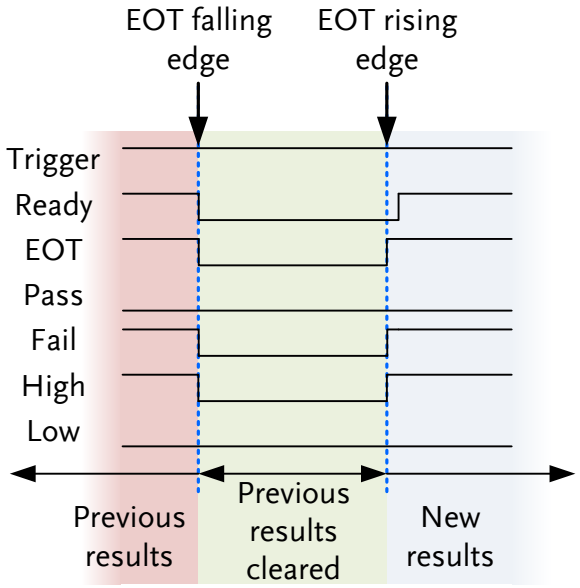
Background

The Handler Mode setting determines the behavior of the result signals from the handler interface. There are two settings, Clear and Hold. The Clear setting will clear the results of the previous test before starting the succeeding one and the Hold setting will keep the test result of the previous test until the succeeding test has completed.

The timing diagrams below are used as examples. All the result signals in the examples are active high.

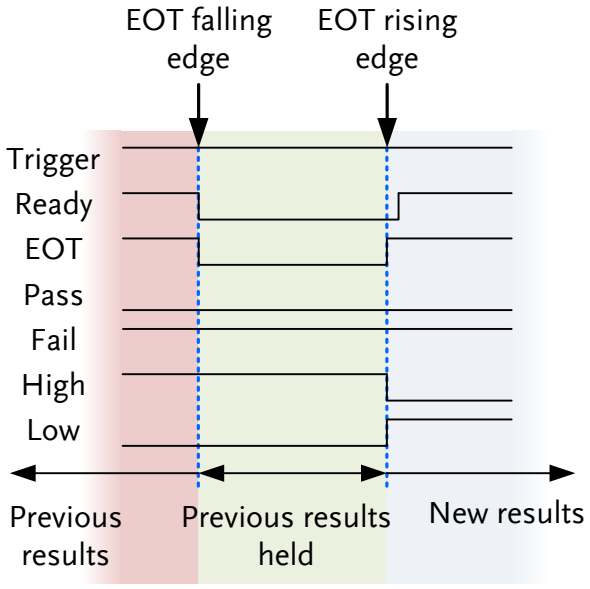
Clear example

Clear: All result signals (PASS, Fail, High and Low) are cleared at the falling edge of EOT and the results from the current test are output at the rising edge of the EOT signal.

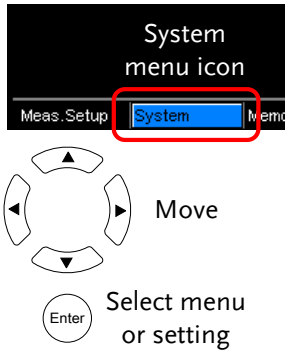


Hold example

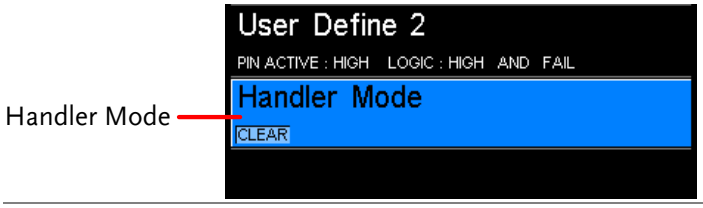
Hold: The results of the previous tests are held until the current test has completed.



1. Select External I/O setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Utility and press Enter. Go to External I/O and press Enter.



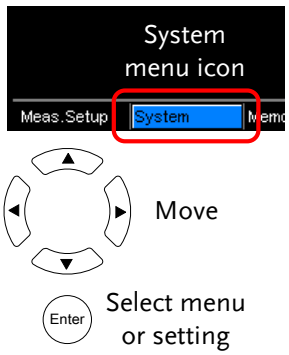
2. External I/O menu appears	Use the arrow keys to choose Handler Mode and press Enter. Use the arrow keys to set the handler mode. Press Enter to confirm the setting.



Handler Mode	HOLD, CLEAR
Note	Pressing ESC before pressing ENTER will exit from the Handler Mode setting.

Beep

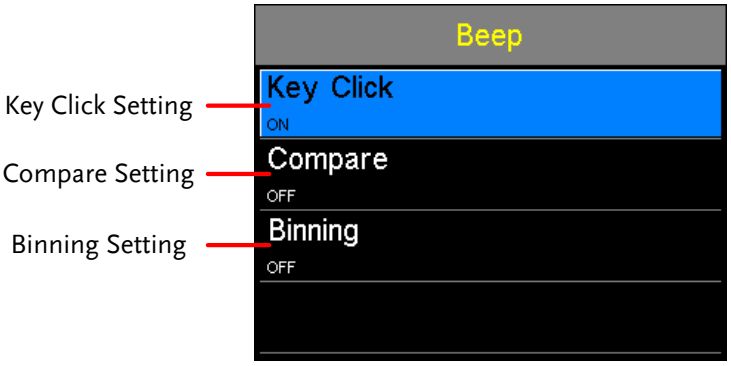
Background	The Beep setting will configure the beeper sound for the key presses, the Compare function and the Binning function. For the Compare and Binning function the beep can be configured to beep on a pass or fail judgment.
1. Select Beep setting	From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus. Go to System and press Enter. Go to Utility and press Enter. Go to Beep and press Enter.



2. Beep menu appears

Use the arrow keys to choose a beep setting and press Enter.

Use the arrow keys to set the selected setting and press Enter to confirm.



Beep Settings:	Key Click	On, Off
	Compare	Off. Pass, Fail
	Binning	Off. Pass, Fail

Note

Pressing ESC before pressing ENTER will exit from the selected Beep setting.

High Voltage Protect

Background

This page is to enable or disable the function of HVP (High Voltage Protect), which promptly interrupts output to DUT with warning note present when high voltage is carried by the DUT. If, on the other hand, HVP is tuned Off, output test will keep going without interruption in any case.

Note

The HVP function is enabled by default and can be deactivated manually by the user. When HVP is disabled, the user should pay attention if any high voltage occurs from the connected DUT, which may cause damage to the T3MIL50/50X.

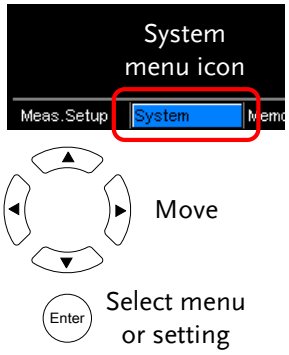
1. Select High Voltage Protect setting

From one of the main screens, press the ESC key so that the menu system at the bottom of the display has focus.

Go to System and press Enter.

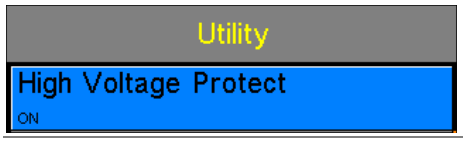
Go to Utility and press Enter.

Go to High Voltage Protect and press Enter.



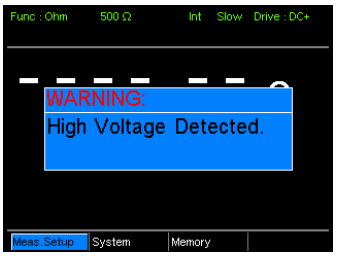
2. High Voltage Protect menu appears

Use the up and down arrow keys to change the High Voltage Protect setting followed by pressing the Enter button to confirm and take effect.



High Voltage Protect Setting:	On, Off

When high voltage is detected from DUT, the warning message will prompt as the screenshot shown and will disappear only after the high voltage withdraws.



Note

- HVP is turned ON by default and reboot will restore the unit back to the factory default setting.
- Pressing ESC before pressing ENTER will exit from the High Voltage Protect setting.

HANDLER/SCAN INTERFACE

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Handler Interface for Binning and Compare Functions 75
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Pin Definitions for the SCAN Interface 78
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Configure USB Interface 84
Install USB Driver 84
Configure RS-232 Interface 85
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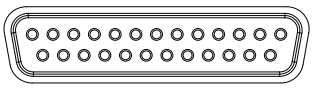
Using Realterm to Establish a Remote Connection 87

Handler Overview

Background	The Handler interface is used to help grade components based on the Compare or Binning function test results. The appropriate pins on the handler interface are active when the Compare or Binning function is used. There are 17 TTL outputs and 1 TTL inputs. The Handler interface is only applicable with the Binning function or Compare measurement modes.	
⚠ Note	Please see following pages for related functions and settings: Compare function: 38 Binning function: 42 Ext I/O settings: 66 Handler mode settings 67	
Interface and pin assignment	25-Pin D-SUB (Female)	HANDLER / SCAN / EXT I/O 
Pin assignment	TRIGGER	Starts the trigger for a single measurement.
	READY	High when the measurement has finished. The instrument is ready for the next trigger.
	EOT	High when the AD conversion has completed. The DUT is ready to be changed.
	BIN 1~8	High when the sorting result is in one of the eight bin grades. Bin1~8 (pass).
	BIN OUT	High when the sorting result is out of all the eight bin grades (Bin1~8). The status of this pin reflects either a HI or LO result (fail).
	LOW	High when the compare result is deemed LO.
	HIGH	High when the compare result is deemed HI.

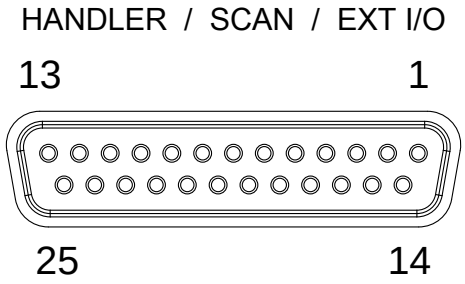
FAIL	High when the compare result is either HI or LO (fail).
PASS	High when the compare result is IN (pass).

For the full pin definition, please refer to the table listed below.

Note	The output current from all the pins and the VINT(+5V) pin cannot exceed 60mA.

Pin Definitions for the Handler Interface

As this interface is used for the handler and scan functions, the interface pinout depends on the function mode. The following pinout is only applicable when using the Binning or Compare function.

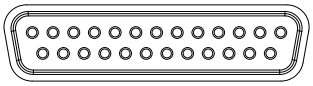


Handler Interface for Binning and Compare Functions

Pin	Name	Description	Active modes	In/ Out
1, 17		Reserved		
2	Trigger	Trigger for a single measurement.	All	In
3, 14, 18	GND	Ground.		
4	Fail	High when the compare result is either HI or LO (fail).	Compare	Out
5	High	High when the compare result is deemed HI.	Compare	Out
6	Pass	High when the compare result is IN (pass).	Compare	Out
7	EOT	High when the AD conversion has completed. The DUT is ready to be changed.	Ext trigger mode	Out
8	VINT	Internal DC Voltage +5V.		Out
9	Bin1	High when the binning sorting result is within the bin1 setting range.	Binning	Out
10	Bin2	High when the binning sorting result is within the bin2 setting range.	Binning	Out
11	Bin3	High when the binning sorting result is within the bin3 setting range.	Binning	Out
12	Bin4	High when the binning sorting result is within the bin4 setting range.	Binning	Out
13	Bin5	High when the binning sorting result is within the bin5 setting range.	Binning	Out

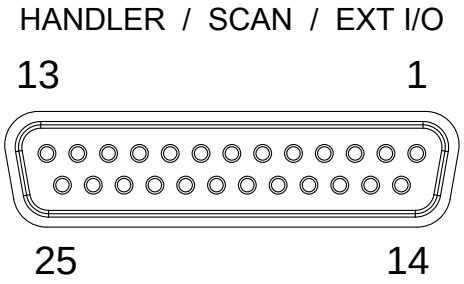
15	Userdefine2	High or low when the user define2 logic conditions are met.	Compare, Binning	Out
16	Userdefine1	High or low when the user define1 logic conditions are met.	Compare, Binning	Out
19	VEXT	External DC Voltage, acceptable range is +5V.		In
20	Ready	High when the measurement has finished. The instrument is ready for the next trigger.	Ext trigger mode	Out
21	Bin6	High when the binning sorting result is within the bin6 setting range.	Binning	Out
22	Low	High when the compare result is deemed LO.	Compare	Out
23	Bin7	High when the binning sorting result is within the bin7 setting range.	Binning	Out
24	Bin8	High when the binning sorting result is within the bin8 setting range.	Binning	Out
25	Bin Out	High when the binning sorting result is out of all the bin setting ranges.	Binning	Out

Scan Overview

Background	The Scan function is used to automatically bin groups of up to 100 components. The associated pins in the handler interface are active when the Scan function is activated. There are a total of 6 outputs, 3 inputs as well as a GND and power (+5V) pin.	
Interface and pin assignment	25Pin D-SHELL (Female)	HANDLER / SCAN / EXT I/O 
Pin Assignment	Relay	Controls the relay output.
	Pass	Pass signal. Indicates the compare result is IN(pass).
	Low	Low signal. Indicates a LO compare result.
	High	High signal. Indicates a HI compare result.
	Clock	The clock signal will pulse high when each group of output signals (Relay, Pass, Low, High) are ready. There are up to 100 groups of output signals
	STRB	After all (100) output groups are ready, the STRB signal will pulse high.

Pin Definitions for the SCAN Interface

As this interface is used for the handler and scan functions, the interface pinout depends on the function mode. The following pinout is only applicable when using the Scan function.



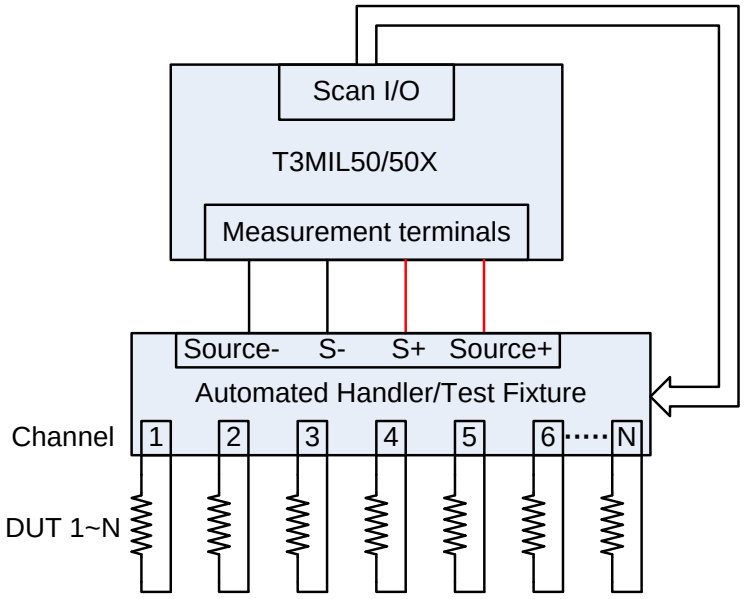
Scan Interface

Pin	Name	Description	In/Out
1,9-13,15-17,21,23-25		Reserved	
2	Trigger	Start for Scan measurement.	In
3,14,18	GND	Ground.	
4	High	High signal. Indicates a HI compare result.	Out
5	Clock	The clock signal will pulse high when each group of output signals (Relay, Pass, Low, High) are ready. There are up to 100 groups of output signals.	Out
6	Low	Low signal. Indicates a LO compare result.	Out
7	Pass	Pass signal. Indicates an IN compare result (pass).	Out
8	VINT	Internal DC Voltage +5V.	Out
19	VEXT	External DC Voltage, acceptable range is +5V.	In
20	Relay	Controls the relay output.	Out
22	STRB	After all (up to 100) output groups are ready, the STRB signal will pulse high.	Out

Scan Setup

Background

The Scan function sequentially scans up to 100 channels and grades the resistance of the DUT on each channel to a reference value. An automated handler or test fixture is required to interface the DUTs to the measurement terminals and the scan interface that controls the timing of each scan.



Note: The automated handler/test fixture is user-supplied. Please see your distributor for support and technical details.

Grading of each DUT is essentially the same as the compare function (page 38), the difference being the Scan function will compare up to 100 DUTs sequentially, whereas the Compare function will compare only one DUT at a time.

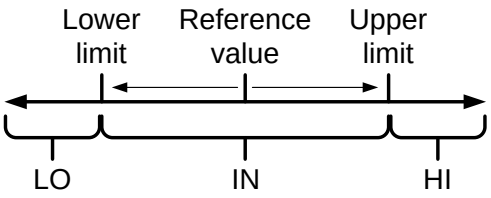
The scan function compares a measured value to a "Reference" value that has an upper (HI) and lower (LO) limit. If the measured value is within the upper and lower limit, then the measured value is judged as IN.

There are two modes that can be used to make a judgment: ABS and △% modes.

The ABS mode compares the measured value to the upper (HI) and lower (LO) limits. The upper and lower limits are set as absolute resistance values.

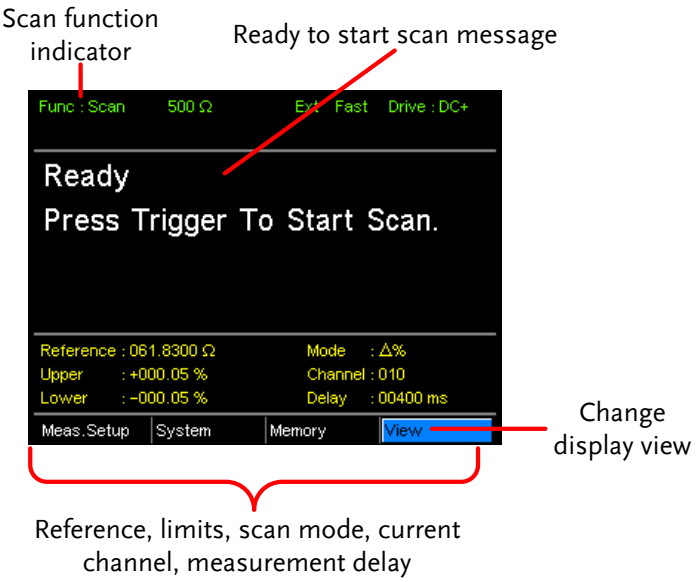
The △% compare function compares the deviation of the measured value from the reference value as a percentage.
{ [(Measured Value-Reference)/Reference]%}.

A measured value that falls within the upper and lower limits is considered IN (pass), a value that falls below the lower limits is considered LO, and a value that falls over the upper limit is a HI.



For both scan modes, the IN, HI or LO will be shown on the display for each judgment (if the time between each judgment is not too fast).

Display Overview

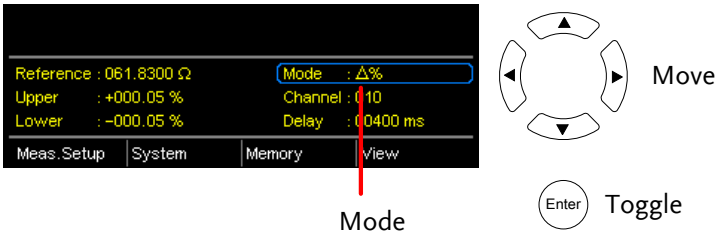


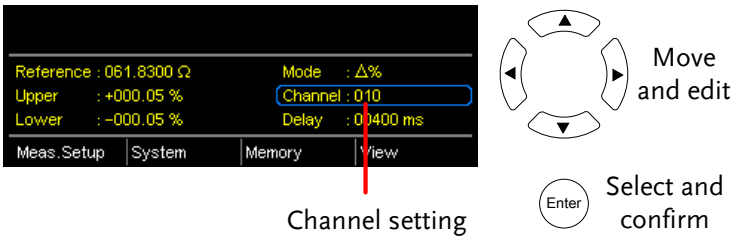
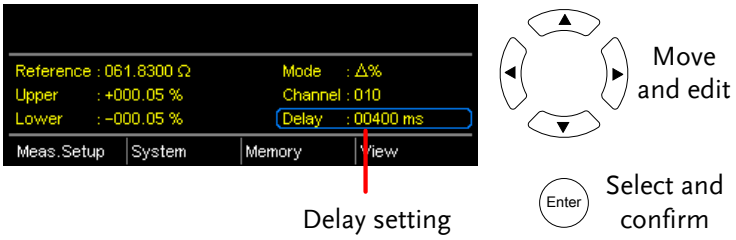
1. Select the Scan function

Press Scan Scan to access the scan mode, as shown above.

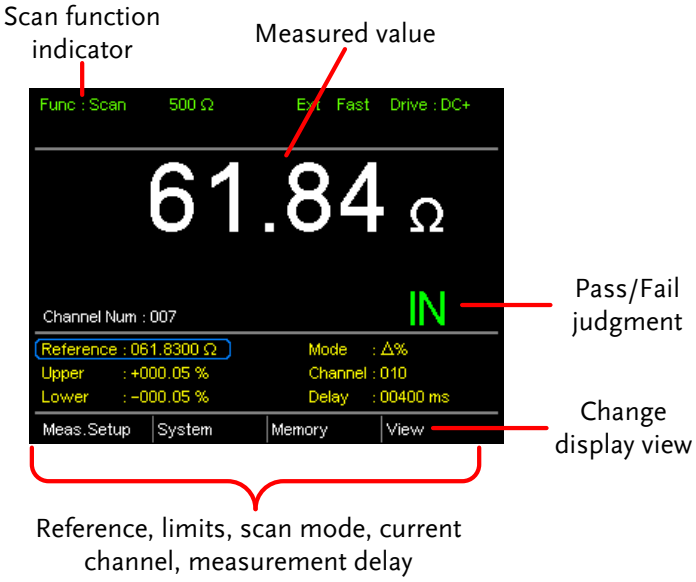
2. Select the compare mode

Use the arrow keys to navigate to the Mode setting. Press the Enter key to toggle the compare mode.



	Range Abs, △%
3. Channel setting	The Channel setting sets the number of DUT channels that are used. Use the arrow keys to navigate to the Channel setting and press Enter. Use the left and right arrow keys to select a digit. Use the up and down arrow keys to edit the value of the selected digit. Press Enter to confirm the setting. 
	Channel Range: 01 ~100
4. Delay setting	The Delay setting adds a pause between each channel measurement. The Use the arrow keys to navigate to the Delay setting and press Enter. Use the left and right arrow keys to select a digit. Use the up and down arrow keys to edit the value of the selected digit. Press Enter to confirm the setting. 
	Delay Range: 400ms ~ 30000ms
5. Start the scan.	Press the Trigger key or input a pulse signal on the Trigger pin of the SCAN interface port to start a scan test.
Note	See page 59 to set the external trigger edge as a rising or falling leading edge.

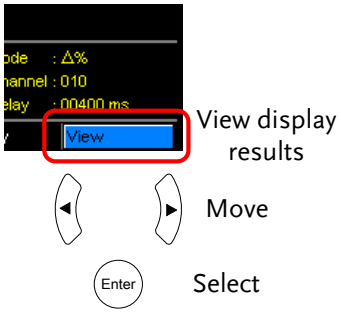
The results will be displayed on the screen as each test is performed. The results will also be output through the scan port until the scan has finished.



6. View Results

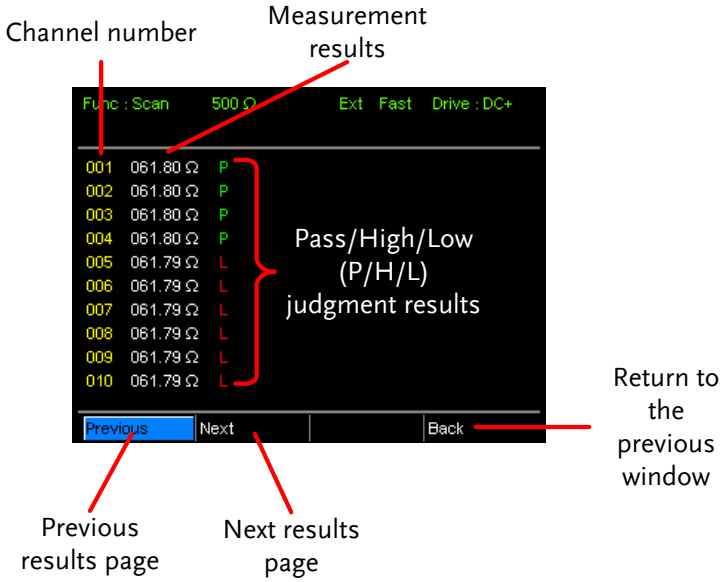
After the last SCAN test has finished, press the ESC key so that the menu system at the bottom of the display has focus.

Go to View and press Enter to view the results of each channel.



Use the Previous and Next soft-keys to view each page.

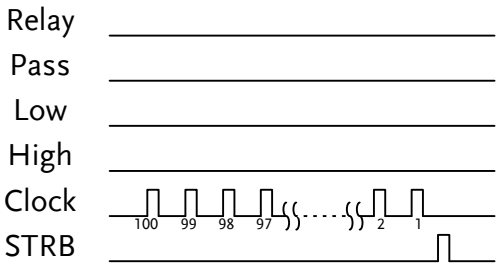
Use the Back soft-key to return to the previous window.



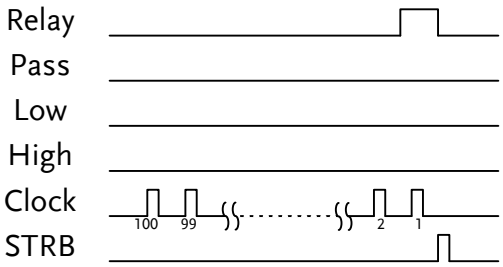
Scan Output

Background — The timing diagrams for the scan output under different conditions are shown below.

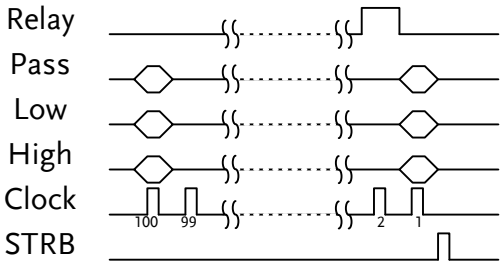
Ready message displayed…



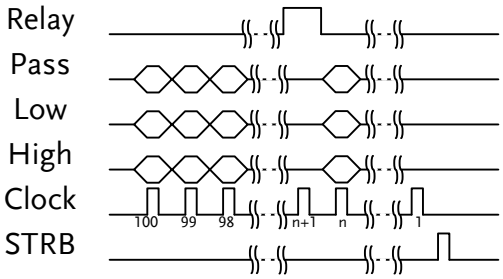
After the manual trigger key is pressed….



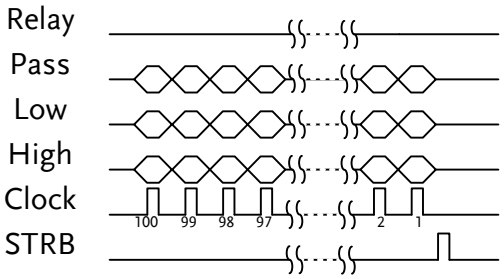
Scan channel 1. Delay time has elapsed.



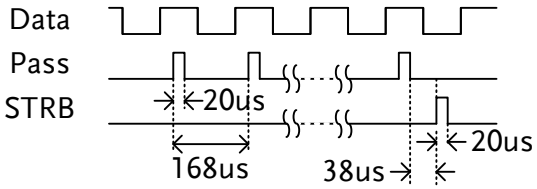
Scan channel n. Delay time has elapsed.



Scan Channel 100. Delay time has elapsed.



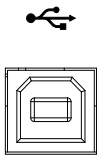
Scan output signal timing.



Configure Interface

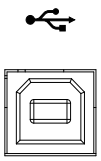
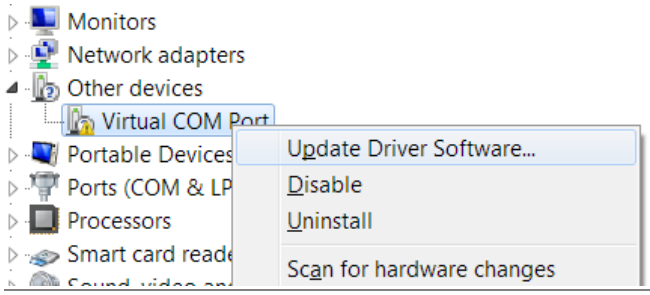
Overview	The RS-232 and USB interfaces are standard for both models. The remote control interfaces allow the T3MIL50/50X to be programmed for automatic testing. For more information on remote control programming, please see the Command Overview chapter on page 92.	
Interface	USB	USB Device
	RS-232	DB-9 male port

Configure USB Interface

Background	The Type B USB port on the rear panel is used for remote control. This interface creates a virtual COM port when connected to a PC.	
⚠ Note	The USB interface requires the USB driver to be installed. See page 84 to install the USB driver.	
1. Connect and configure to USB.	Configure the interface to USB in System>Utility>Interface menu.	Page 64
	Connect the Type A-B USB cable to the rear panel USB B port on the T3MIL50/50X. Connect the other end to the Type A port on the PC.	

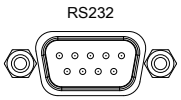
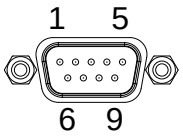
Install USB Driver

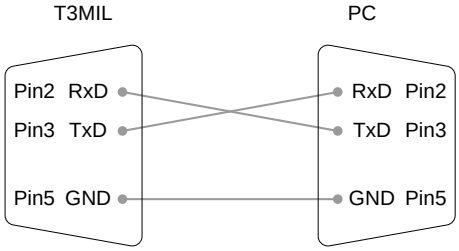
Background	The USB driver needs to be installed when using the USB port for remote control. The USB interface creates a virtual COM port when connected to a PC.	
1. Select the USB driver.	Configure the interface to USB in System>Utility>Interface menu.	Page 64

	Connect the Type A-B USB cable to the rear panel USB B port on the T3MIL50/50X. Connect the other end to the Type A port on the PC. 
	Go to the Windows Device Manager. For Windows 7 go to: Start Menu > Control Panel > Hardware and Sound > Device Manager
	The T3MIL50/50X will appear as an unknown Virtual Com Port under "Other Devices".
	
	Right-click Other Devices and select "Update Driver Software".
	Select "Browse my computer for driver software" and select the driver previously downloaded from the Teledyne LeCroy website.
	The T3MIL50X and the COM port that it is assigned to will now appear in under the Ports (COM & LPT) node.

Configure RS-232 Interface

Background	The T3MIL50/50X can also use an RS-232C connection for remote control. When connecting to a PC ensure the correct baud rate, parity, data bits, stop bit and data control settings are used.	
Settings	Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
	Parity	None
	Data bits	8
	Stop bit	1
	Data flow control	None

1. Select the RS-232 baud rate	Configure the interface to RS232 and set the baud rate in System>Utility>Interface menu.	Page 64
	Connect the RS-232C cable to the rear panel RS232 port.	
RS-232 pin assignment	Pin 2: RxD Pin 3: TxD Pin 5: GND Pin 1, 4, 6 ~ 9: No Connection	
PC – T3MIL RS-232C connection	The RS232C connection uses a Null-modem connection, in which transmit (TxD) and receive (RxD) lines are cross-linked.	



RS232/USB Function Check

Operation	Invoke a terminal application such as Realterm. For RS-232, set the COM port, baud rate, stop bit, data bit and parity accordingly. To check the COM settings in Windows, see the Device Manager. For example, in WinXP go to the Control panel → System → Hardware tab. Run this query from the terminal. *idn? This should return the Manufacturer, Model number, Serial number, and Firmware version. Teledyne, T3MIL50X, TXXXXXXXX, V1.00
⚠ Note	If you are not familiar with using a terminal application to send/receive remote commands from the serial port or via a USB connection, please page 87 (Using Realterm to Establish a Remote Connection) for more information.

Using Realterm to Establish a Remote Connection

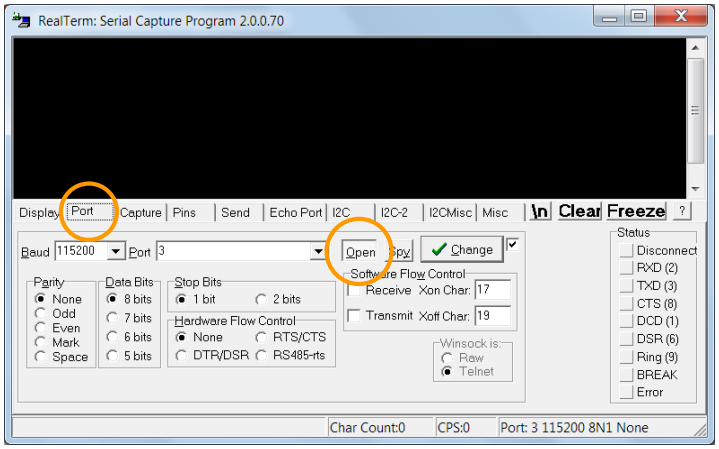
Background	Realterm is a terminal program that can be used to communicate with a device attached to the serial port of a PC or via an emulated serial port via USB. The following instructions apply to version 2.0.0.70. Even though Realterm is used as an example to establish a remote connection, any terminal program can be used that has similar functionality.
Note	Realterm can be downloaded on Sourceforge.net free of charge. For more information please see http://realterm.sourceforge.net/
1. Install Realterm	Download Realterm and install according to the instructions on the Realterm website.
2. Configure connection	Connect the T3MIL50/50X via USB (page 84) or via RS232 (page 85). If using RS232, make note of the configured baud rate. Go to the Windows device manager and find the COM port number for the connection. For example in Windows 7, go to the Start menu > Control Panel > Hardware and Sound > Device Manager Double click the Ports icon to reveal the connected serial port devices and the COM port for each connected device. If using USB, the baud rate, stop bit and parity settings can be viewed by right-clicking connected device and selecting the Properties option.
3. Run Realterm	Start Realterm on the PC as an administrator. Click: Start menu>All Programs>RealTerm>realterm Tip: to run as an administrator, you can right click the Realterm icon in the Windows Start menu and select the Run as Administrator option.

After Realterm has started, click on the Port tab.

Enter the Baud, Parity, Data bits, Stop bits and Port number configuration for the connection.

The Hardware Flow Control and Software Flow Control options can be left at the default settings.

Press Open to connect to the T3MIL50/50X.



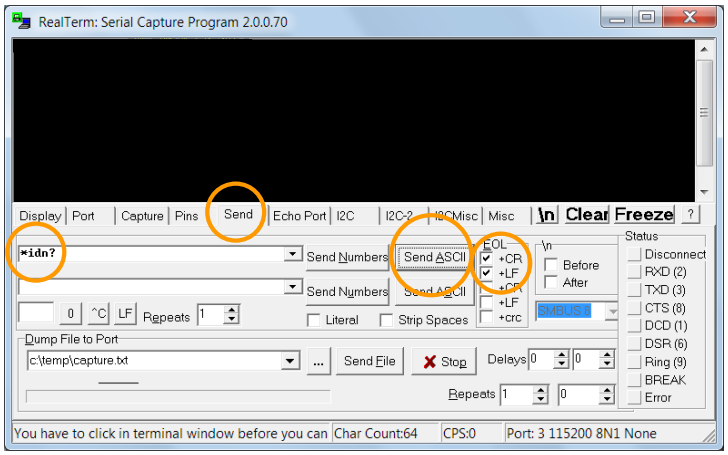
4. Test remote command

Click on the Send tab.

In the EOL configuration, check on the +CR and +LF check boxes.

Enter the query:
*idn?

Click on Send ASCII.



The terminal display will return the following:

Teledyne,T3MIL50X,TXXXXXXXX,V1.00

(manufacturer, model, serial number, version)

5. Errors or Problems

If Realterm fails to connect to the T3MIL50/50X, please check all the cables and settings and try again.

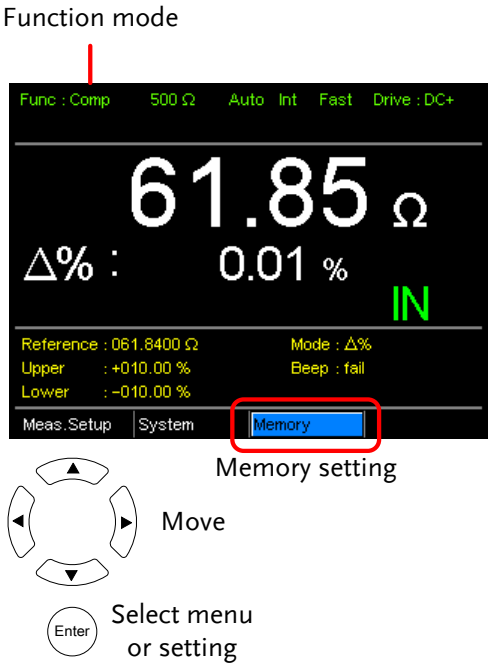
SAVE/RECALL

The settings for all the major functions can be saved and recalled from 20 memory slots.

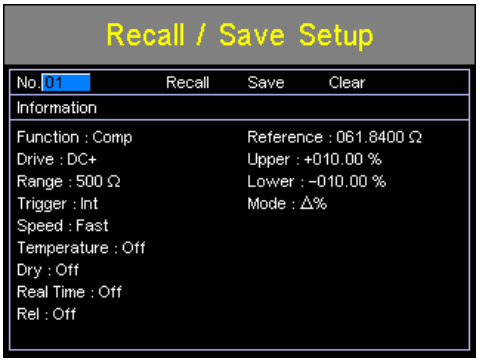
Settings can saved/recalled for the following functions:
Ohm, Compare, Binning, TC, TCONV, TEMP, Scan, Diode.

Save/Recall Settings

Background	The save function saves the current function as well the settings related to that function. There are 20 memory slots that can be used to save and recall settings on the T3MIL50/50X.
1. Enter the Memory menu	When you are in the desired function mode, press the ESC key (if necessary) to so that the menu system at the bottom of the display has focus. Use the arrow keys to navigate to the Memory setting and press Enter.

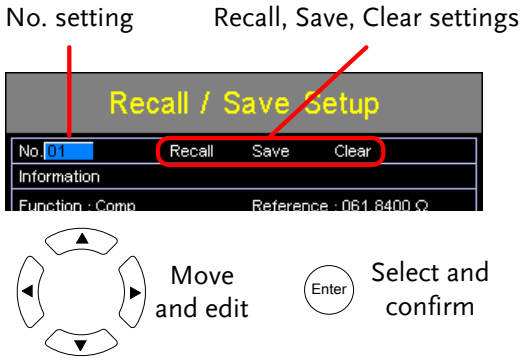


The Recall/Save Setup menu will appear.



2. Save/ Recall/Clear Memory

The No. setting should be already highlighted when entering the Recall/Save Setup menu. If not, use the Left/Right arrow keys to highlight the No. setting.



Use the up and down arrow keys to select a memory space.

Range	01~20

*If a memory space has been used before, the settings for that memory slot will also be shown on the display.

To Save:
Use the arrow keys to go to Save and press Enter.

To Recall:
Use the arrow keys to go to Recall and press Enter.

To Clear:
Use the arrow keys to go to Clear and press Enter.

Press Enter again when asked to confirm the selected operation.

After saving the settings, press ESC to return to the current function mode.

After recalling settings, the unit will automatically go to the recalled setting function.

Note Pressing ESC before pressing Enter will exit the Save/Recall/Clear operation.

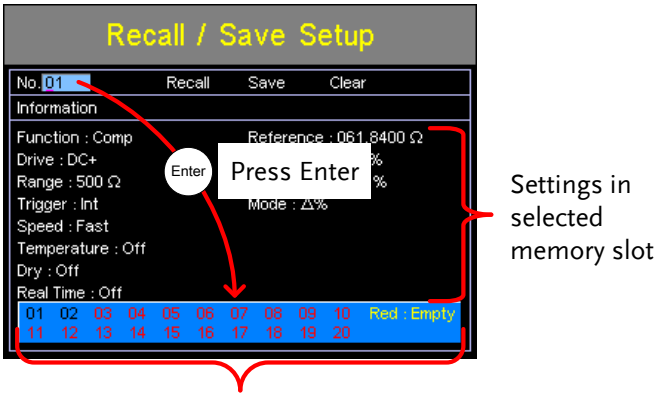
View memory slot availability

Press the Enter key when the No. setting is highlighted to see which memory slots are empty.

The status of memory slots 01 ~ 20 are shown at the bottom of the display.

Memory slots in red are empty slots while those in black have already been used.

Press Enter again to exit from this view.



Note The memory number can also be selected when in the above view using the arrow keys.

COMMAND OVERVIEW

The Command overview chapter lists all the programming commands in alphabetical order. The command syntax section shows you the basic syntax rules you have to apply when using commands.

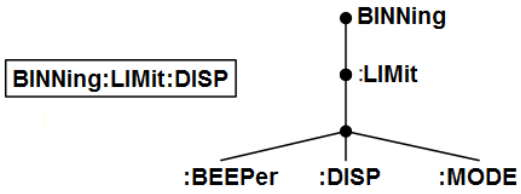
Command Syntax

Compatible Standard	IEEE488.2	Partial compatibility
	SCPI, 1994	Partial compatibility

Command Structure

SCPI (Standard Commands for Programmable Instruments) commands follow a tree-like structure, organized into nodes. Each level of the command tree is a node. Each keyword in an SCPI command represents each node in the command tree. Each keyword (node) of an SCPI command is separated by a colon (:).

For example, the diagram below shows an SCPI sub-structure and a command example.



Command Types

There are a number of different instrument commands and queries. A command sends instructions or data to the unit and a query receives data or status information from the unit.

Command Types	
Simple	A single command with/without a parameter
Example	SENSe:FUNCtion OHM

	Query	A query is a simple or compound command followed by a question mark (?). A parameter (data) is returned.
	Example	SENSe:RANGe?

Command Forms

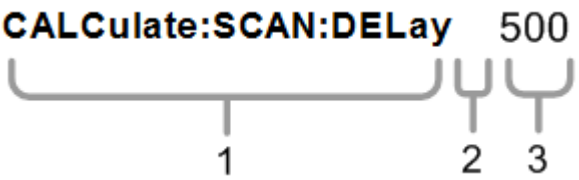
Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.

The commands can be written either in capitals or lower-case, just so long as the short or long forms are complete. An incomplete command will not be recognized.

Below are examples of correctly written commands.

Long form	CALCulate:COMPare:BEEPer CACLULATE:COMPARE:BEEPER calculate:compare:beeper
Short form	CALC:COMP:BEEP calc:comp:beep

Command Format



1. Command header
2. Space
3. Parameter

Common Input Parameters

Type	Description	Example
<Boolean>	boolean logic	0,1
<NR1>	integers	0,1,2,3
<NR2>	decimal numbers	0.1,3.14,8.5
<NR3>	floating point with exponent	4.5e-1,8.25e+1

	<NRf>	Any of NR1,2,3	1,1.5,4.5e-1
	<string>	ASCII text string	TEST_NAME
Message Terminator (EOL)	Marks the end of a command line. The following messages are in accordance with IEEE488.2 standard.		
	Remote Command	LF, CR, CR+LF, LF+CR	The most common EOL character is CR+LF
	Return Message	LF	User configurable See page 64.
Message Separator	EOL or ;	Command separator.	

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READ 101

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General Commands

SENSe:FUNCtion

Set → Query

Description	Sets or returns the function mode.	
Syntax	SENSe:FUNCtion {OHM|COMP|BIN|TC|TCONV|SCAN|DIODE}	
Query Syntax	SENSe:FUNCtion?	
Parameter/ Return parameter	OHM	OHM MODE
	COMP	COMP MODE
	BIN	BIN MODE
	TC	TC MODE
	TCONV	TCONV MODE
	OHM+T*	TEMP MODE*
	SCAN	SCAN MODE
	DIODE	DIODE MODE
Example	SENS:FUNC OHM Sets ohm mode on.	
Note *	For set to TEMP (OHM+T) function, please use command at Temperature commands section.	

SENSe:AUTo

Set → Query

Description	Sets or returns the auto-range state.	
Syntax Query Syntax	SENSe:AUTo <NR1> | {OFF|ON} SENSe:AUTo?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Auto-Range is off.
	ON	Auto-Range is on.
Example	SENS:AUT ON Sets auto-range mode on.	

SENSe:RANGe

Set → / → Query

Description	Sets or returns the range of the present function.	
Syntax Query Syntax	SENSe:RANGe <NRf> SENSe:RANGe?	
Parameter	<NRf>	5E-3~ 5E+6
Return parameter	<NR3>	5E-3 ~ 5E+6
Example	SENS:RANG 0.005 Sets range to 5mΩ. SENS:RANG? >5.0000E-3 Returns the range as 5mΩ.	

SENSe:SPEed

Set → / → Query

Description	Sets or returns the measurement speed.	
Syntax Query Syntax	SENSe:SPEed {SLOW|FAST} SENSe:SPEed?	
Parameter/ Return parameter	SLOW	Measurement speed is slow.
	FAST	Measurement speed is fast.
Example	SENS:SPE FAST Sets measurement speed to the fast rate.	

SENSe:REL:STATe

Set → / → Query

Description	Sets or returns the relative function state.	
Syntax Query Syntax	SENSe:REL:STATe <NR1> | {OFF|ON} SENSe:REL:STATe?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Turn the relative function off.
	ON	Turn the relative function on.
Example	SENS:REL:STAT OFF Sets the relative function off.	

Note	The SENS:REL:STAT can only be turned ON when measured value is displayed.

SENSe:REL:DATa

Set → Query

Description	Sets or returns the relative value for the relative function.	
Syntax Query Syntax	SENSe:REL:DATa <NRf> SENSe:REL:DATa?	
Parameter	<NRf>	0.0000~500.00 The unit will be auto set by the present range.
Return parameter	<NR3>	±0.0000~5.1000E±X
Example	SENS:REL:DAT 490.32 Sets the relative function value to 490.32Ω. SENS:REL:DAT? >4.9032E+2 Returns the relative value (490.32Ω).	

Note	The SENS:REL:DAT can only be set when measured value is displayed.

SENSe:REALtime:STATe

Set → Query

Description	Sets or returns the real time function state.	
Syntax Query Syntax	SENSe:REALtime:STATe <NR1> | {OFF|ON} SENSe:REALtime:STATe?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Turn the real time function off.
	ON	Turn the real time function on.
Example	SENS:REAL:STAT ON Turns the real time function on.	

SENSe:DISPlay

Set → / → Query

Description	Sets or returns the display mode. There are two display modes, normal and simple.	
Syntax Query Syntax	SENSe:DISPlay <NR1> | {OFF|ON} SENSe:DISPlay?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Display mode is normal.
	ON	Display mode is simple.
Example	SENS:DISP OFF Sets the display mode to normal.	

TRIGger:SOURce

Set → / → Query

Description	Sets or returns current trigger source.	
Syntax Query Syntax	TRIGger:SOURce {INT|EXT} TRIGger:SOURce?	
Parameter/ Return parameter	INT	Internal trigger mode.
	EXT	External trigger mode.
Example	TRIG:SOUR EXT Sets the current trigger source to external trigger.	

READ

→ Query

Description	Returns the measurement value.	
Query Syntax	READ?	
Return parameter	<NR3>	±0.0000~5.1000E±X
Example	READ? >+2.2012E+0 Returns the measurement.	
⚠ Note	+9.0000E+9: it indicates measure value is OverRange. +9.9999E+9: it indicates the HVP is detected.	

Compare Commands

CALCulate:COMPare:TYPE

Set → Query

Description	Sets or returns the compared function.	
Syntax Query Syntax	CALCulate:COMPare:TYPE {OHM|TC} CALCulate:COMPare:TYPE?	
Parameter/ Return parameter	OHM	OHM function.
	TC	TC function.
Example	CALC:COMP:TYPE TC Sets the compare to TC function.	

CALCulate:COMPare:LIMit:REFerence

Set → Query

Description	Sets or returns the limit reference value for the compare function.	
Syntax Query Syntax	CALCulate:COMPare:LIMit:REFerence {<NRf>[,<String>]} CALCulate:COMPare:LIMit:REFerence?	
Parameter	<NRf>	000.0001~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0001~999.9999E±X
Example	CALC:COMP:LIM:REF 10.00,mohm Sets the limit reference value to 10.00mΩ. CALC:COMP:LIM:REF? >10.0000E-3 Returns the limit as 10.00mΩ.	

CALCulate:COMPare:LIMit:MODE

Set → Query

Description	Sets or returns the compare mode for the compare function.

Syntax Query Syntax	CALCulate:COMPare:LIMit:MODE {ABS|DPER|PER} CALCulate:COMPare:LIMit:MODE?	
Parameter/ Return parameter	ABS	The test results are judged from absolute values.
	DPER	The test results are judged from a reference value ± a percentage offset. (delta percentage)
	PER	The test results are displayed as a percentage of the reference value.
Example	CALC:COMP:LIM:MODE ABS Sets test results as absolute values for the compare function.	

CALCulate:COMPare:LIMit:LOWer

Set → Query

Description	Sets or returns the lower limit value for the compare function.	
Syntax Query Syntax	CALCulate:COMPare:LIMit:LOWer {<NRf>[,<String>]} CALCulate:COMPare:LIMit:LOWer?	
Parameter	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If the unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0000~999.9999E±X
Example	CALC:COMP:LIM:LOW 0.95,kohm Sets the lower limit value to 0.95kΩ. CALC:COMP:LIM:LOW? >0.9500E+3 Returns the lower limit as 0.95kΩ.	
Note	This command is only applicable when compare mode is set to ABS for compare function.	

CALCulate:COMPare:LIMit:UPPer

Set → Query

Description	Sets or returns the upper limit value for the compare function.

Syntax Query Syntax	CALCulate:COMPare:LIMit:UPPer {<NRf>[,<String>]} CALCulate:COMPare:LIMit:UPPer?	
Parameter	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0000~999.9999E±X
Example	CALC:COMP:LIM:UPP 0.123,maohm Sets the upper limit value to 0.123MΩ. CALC:COMP:LIM:UPP? >0.1230E+6 Returns the upper limit as 0.123MΩ.	
Note	This command is only applicable when compare mode is set to ABS for compare function.	

CALCulate:COMPare:PERCent:LOWer

Set → Query

Description	Sets or returns the lower limit percent value for the compare function.	
Syntax Query Syntax	CALCulate:COMPare:PERCent:LOWer <NRf> CALCulate:COMPare:PERCent:LOWer?	
Parameter	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99
Example	CALC:COMP:PERC:LOW 10.00 Sets the lower limit percent value to -10.00%. CALC:COMP:PERC:LOW? >10.00 Returns the lower limit as -10.00%.	
Note	This command is only applicable when compare mode is set to DPER or PER for compare function.	

CALCulate:COMPare:PERCent:UPPer

Set → Query

Description	Sets or returns the upper limit percent value for the compare function.
Syntax Query Syntax	CALCulate:COMPare:PERCent:UPPer <NRf> CALCulate:COMPare:PERCent:UPPer?

Parameter	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99
Example	CALC:COMP:PERC:UPP 90.00 Sets the upper limit percent value to +90.00%. CALC:COMP:PERC:UPP? >90.00 Returns the upper limit as +90.00%.	
Note	This command is only applicable when compare mode is set to DPER or PER for compare function.	

CALCulate:COMPare:BEEPer

Set → / → Query

Description	Sets or returns the compare function beeper mode.	
Syntax Query Syntax	CALCulate:COMPare:BEEPer {OFF|PASS|FAIL} CALCulate:COMPare:BEEPer?	
Parameter/ Return parameter	OFF	Turns the beeper off.
	PASS	The beeper will sound on a pass test result.
	FAIL	The beeper will sound on a fail test result.
Example	CALC:COMP:BEEP FAIL Sets the beeper on when the test result is a fail.	

CALCulate:COMPare:MATH:DATa

→ Query

Description	Returns the deviation value for the compare function.	
Query Syntax	CALCulate:COMPare:MATH:DATa?	
Return parameter	<NR3>	±0.0000~9.9999E±X.
Example	CALC:COMP:MATH:DAT? >+0.3658E+2 Returns the deviation as 36.58%.	

CALCulate:COMPare:LIMit:RESult

→ Query

Description	Returns the compare function test result.
Query Syntax	CALCulate:COMPare:LIMit:RESult?

Return parameter	<NR1>	0: LO 1: IN 2: HI
Example	CALC:COMP:LIM:RES? >2 Indicates that the test result is HI.	

Binning Commands

Binning commands are only applicable to T3MIL50X.

BINNing:COUNt:CLEar

Set →

Description	Clear all bin sorting function test result counts.
Syntax	BINNing:COUNt:CLEar
Parameter	<None>

BINNing:COUNt:TOTal

→ Query

Description	Returns the total number (count total) of test bin results.	
Query Syntax	BINNing:COUNt:TOTal?	
Return parameter	<NR1>	0~999999999
Example	BINN:COUN:TOT? >150 Indicates that the total number (count total) of test results (pass and fail) is 150.	

BINNing:COUNt:OUT

→ Query

Description	Returns the number of failed (judged OUT) test results for the bin sorting function test.	
Query Syntax	BINNing:COUNt:OUT?	
Return parameter	<NR1>	0~99999999
Example	BINN:COUN:OUT? >50 Indicates that the number of failed test results is 50.	

BINNing<X>:COUNt:RESult

→ Query

Description	Returns the number of passed (judged IN) test results for the selected bin.

Query Syntax	BINNing<X>:COUNt:RESult?	
Parameter	<X>	1~8
Return parameter	<NR1>	0~99999999
Example	BINN1:COUN:RES? >100 Indicates that bin1 has a pass count of 100.	

BINNing<X>:LIMit:LOWer

Set → Query

Description	Sets or returns the lower limit value (absolute value) for the selected bin.	
Syntax Query Syntax	BINNing<X>:LIMit:LOWer {<NRf>[,<String>]} BINNing<X>:LIMit:LOWer?	
Parameter	<X>	1~8
	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If the unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0000~999.9999E±X
Example	BINN1:LIM:LOW 23.8,kohm Sets the bin1 lower limit value to 23.8kΩ. BINN1:LIM:LOW? >23.8000E+3 Returns the lower limit as 23.8kΩ.	

BINNing<X>:LIMit:UPPer

Set → Query

Description	Sets or returns the upper limit value (absolute value) for the selected bin.	
Syntax Query Syntax	BINNing<X>:LIMit:UPPer {<NRf>[,<String>]} BINNing<X>:LIMit:UPPer?	
Parameter	<X>	1~8
	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm, unit If the unit is not set, the unit will be automatically set by the present range.

Return parameter	<NR3>	000.0000~999.9999E±X
Example	BINN1:LIM:UPP 0.95,maohm Sets bin1 upper limit value to 0.95MΩ. BINN1:LIM:UPP? >0.9500E+6 Returns the upper limit as 0.95MΩ.	

BINNing<X>:PERCent:LOWer

Set → Query

Description	Sets or returns the lower value percentage value for the selected bin. The value is a percentage offset from the reference value.	
Syntax Query Syntax	BINNing<X>:PERCent:LOWer <NRf> BINNing<X>:PERCent:LOWer?	
Parameter	<X>	1~8
	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99
Example	BINN1:PERC:LOW 10.15 Sets the bin1 lower limit percent value to -10.15%. BINN1:PERC:LOW? >10.15 Returns the lower limit percentage value as -10.15%.	

BINNing<X>:PERCent:UPPer

Set → Query

Description	Sets or returns the upper value percentage value for the selected bin. The value is a percentage offset from the reference value.	
Syntax Query Syntax	BINNing<X>:PERCent:UPPer <NRf> BINNing<X>:PERCent:UPPer?	
Parameter	<X>	1~8
	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99

Example	BINN1:PERC:UPP 150.95 Sets the bin1 upper limit percent value to +150.95%. BINN1:PERC:UPP? >150.95 Returns the upper limit percentage value as +150.95%.

BINNing:LIMit:BEEPer

Set → Query

Description	Sets or returns beeper mode for the bin sorting function.	
Syntax Query Syntax	BINNing:LIMit:BEEPer {OFF|PASS|FAIL} BINNing:LIMit:BEEPer?	
Parameter/ Return parameter	OFF	Turns the beeper off.
	PASS	The beeper will sound on a pass test result.
	FAIL	The beeper will sound on a fail test result.
Example	BINN:LIM:BEEP OFF Turns the beeper off.	

BINNing:LIMit:DISP

Set → Query

Description	Sets or returns the bin sorting function display mode.	
Syntax Query Syntax	BINNing:LIMit:DISP {COMP|COUNT} BINNing:LIMit:DISP?	
Parameter/ Return parameter	COMP	The display is set to compare mode.
	COUNT	The display is set to count mode.
Example	BINN:LIM:DISP COMP Sets the bin sorting function display mode to compare.	

BINNing:LIMit:MODE

Set → Query

Description	Sets or returns the setting mode for upper and lower limits (absolute or Δ%).
Syntax Query Syntax	BINNing:LIMit:MODE {ABS|DPER} BINNing:LIMit:MODE?

Parameter/ Return parameter	ABS	The test results are judged from absolute values.
	DPER	The test results are judged from a reference value ± a percentage offset. (delta percent)
Example	BINN:LIM:MODE DPER Sets the mode to Δ%.	

BINNing:LIMit:REFerence

Set → / → Query

Description	Sets or returns the limit reference value for the bin sorting function.	
Syntax Query Syntax	BINNing:LIMit:REFerence {<NRf>[,<String>]} BINNing:LIMit:REFerence?	
Parameter	<NRf>	000.0001~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If the unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0001~999.9999E±X
Example	BINN:LIM:REF 100 Sets the limit reference value to 100Ω. BINN:LIM:REF? >100.0000E+0 Returns the reference as 100Ω.	

BINNing:LIMit:RESult

→ Query

Description	Returns the bin sorting function test result.	
Query Syntax	BINNing:LIMit:RESult?	
Return parameter	<NR1>	1~8: Bin1~Bin8 9: Bin Out
Example	BINN:LIM:RES? >1 Indicates a pass for bin1.	

Temperature Compensate Commands

TEMPerature:COMPensate:CORRect

Set → Query

Description	Sets or returns the reference temperature for the temperature compensation function.	
Syntax Query Syntax	TEMPerature:COMPensate:CORRect <NRf> TEMPerature:COMPensate:CORRect?	
Parameter	<NRf>	-50.0~399.9 (Unit: °C)
Return parameter	<NR2>	-50.0~399.9 (Unit: °C)
Example	TEMP:COMP:CORR 25.5 Sets the reference temperature to 25.5°C.	

TEMPerature:COMPensate:COEFficient

Set → Query

Description	Sets or returns the temperature coefficient for temperature compensation function.	
Syntax Query Syntax	TEMPerature:COMPensate:COEFficient <NR1> TEMPerature:COMPensate:COEFficient?	
Parameter/ Return parameter	<NR1>	-9999~+9999
Example	TEMP:COMP:COEF 3930 Sets the temperature coefficient to 3930ppm.	

Temperature Conversion Commands

TEMPerature:CONVersion:RESistance

Set → Query

Description	Sets or returns the initial resistance for the temperature conversion function.	
Syntax Query Syntax	TEMPerature:CONVersion:RESistance {<NRf>[,<String>]} TEMPerature:CONVersion:RESistance?	
Parameter	<NRf>	000.0001~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If the unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0001~999.9999E±X
Example	TEMP:CONV:RES 10.00,maohm Sets initial resistance value to 10.00MΩ. TEMP:CONV:RES? >10.0000E+6 Returns the initial resistance as 10.00MΩ.	

TEMPerature:CONVersion:TEMPerature

Set → Query

Description	Sets or returns the initial temperature for the temperature conversion function.	
Syntax Query Syntax	TEMPerature:CONVersion:TEMPerature <NRf> TEMPerature:CONVersion:TEMPerature?	
Parameter	<NRf>	-50.0~399.9 (Unit: °C)
Return parameter	<NR2>	-50.0~399.9 (Unit: °C)
Example	TEMP:CONV:TEMP 25.6 Sets the initial temperature to +25.6°C.	

TEMPerature:CONVersion:CONStant

Set → Query

Description	Sets or returns the temperature constant for the temperature conversion function.

Syntax Query Syntax	TEMPerature:CONVersion:CONStant <NRf> TEMPerature:CONVersion:CONStant?	
Parameter	<NRf>	0.0~999.9
Return parameter	<NR2>	0.0~999.9
Example	TEMP:CONV:CONS 235 Sets the temperature constant to 235.	

TEMPerature:CONVersion:DISPlay

Set → Query

Description	Sets or returns the temperature display mode for the temperature conversion function.	
Syntax Query Syntax	TEMPerature:CONVersion:DISPlay <NR1> TEMPerature:CONVersion:DISPlay?	
Parameter/ Return parameter	<NR1>	1: ΔT 2:T
Example	TEMP:CONV:DISP 1 Sets the temperature display mode for the temperature conversion function to ΔT.	

TEMPerature:CONVersion:MATH:DATa

→ Query

Description	Returns conversion function deviation value.	
Query Syntax	TEMPerature:CONVersion:MATH:DATa?	
Return parameter	<NR3>	±0.000~9.999E±X
Example	TEMP:CONV:MATH:DAT? Returns 1.250E+2.	

Temperature Commands

TEMPerature:STATe

Set → / → Query

Description	Sets or returns the temperature function state.	
Syntax Query Syntax	TEMPerature:STATe {<NR1>|OFF|ON} TEMPerature:STATe?	
Parameter/ Return parameter	<NR1>	0:OFF 1:ON
	OFF	Turn the temp function off.
	ON	Turn the temp function on.
Example	TEMP:STAT ON Sets the TEMP (Ohm+T) function on.	

TEMPerature:DATa

→ Query

Description	Returns the PT-100 sensor temperature measurement in degrees Celsius.	
Query Syntax	TEMPerature:DATa?	
Return parameter	<NR3>	-50.0~399.9
Example	TEMP:DAT? >0.250E+2 Returns the temperature as 25°C.	

Scan Commands

CALCulate:SCAN:CHANnel

Set → Query

Description	Sets or returns the channel for the scan function.	
Syntax Query Syntax	CALCulate:SCAN:CHANnel <NR1> CALCulate:SCAN:CHANnel?	
Parameter/ Return parameter	<NR1>	1~100
Example	CALC:SCAN:CHAN 5 Sets the channel to 5.	

CALCulate:SCAN:DELay

Set → Query

Description	Sets or returns the interval delay for the scan function.	
Syntax Query Syntax	CALCulate:SCAN:DELay <NR1> CALCulate:SCAN:DELay?	
Parameter/ Return parameter	<NR1>	400~30000 Unit:ms
Example	CALC:SCAN:DEL 500 Sets interval delay of the scan to 500ms.	

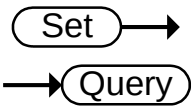
CALCulate:SCAN:LIMit:REFerence

Set → Query

Description	Sets or returns the reference limit for the scan function.	
Syntax Query Syntax	CALCulate:SCAN:LIMit:REFerence {<NRf>[,<String>]} CALCulate:SCAN:LIMit:REFerence?	
Parameter	<NRf>	000.0001~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0001~999.9999E±X

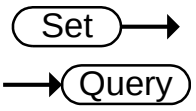
Example	CALC:SCAN:LIM:REF 10.00,mohm Sets the reference limit to 10.00mΩ. CALC:SCAN:LIM:REF? >10.0000E-3 Returns the reference limit as 10.00mΩ.

CALCulate:SCAN:LIMit:MODE



Description	Sets or returns the scan function compare mode.	
Syntax Query Syntax	CALCulate:SCAN:LIMit:MODE {ABS|DPER} CALCulate:SCAN:LIMit:MODE?	
Parameter/ Return parameter	ABS	The test results are judged from absolute values.
	DPER	The test results are judged from a reference value ± a percentage offset. (delta percent)
Example	CALC:SCAN:LIM:MODE ABS Sets compare mode to absolute values.	

CALCulate:SCAN:LIMit:LOWer



Description	Sets or returns the lower limit value for the scan function.	
Syntax Query Syntax	CALCulate:SCAN:LIMit:LOWer {<NRf>[,<String>]} CALCulate:SCAN:LIMit:LOWer?	
Parameter	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0000~999.9999E±X
Example	CALC:SCAN:LIM:LOW 1.37,kohm Sets the lower limit value to 1.37kΩ. CALC:SCAN:LIM:LOW? >1.3700E+3 Returns the lower limit as 1.37kΩ.	

CALCulate:SCAN:LIMit:UPPer

Set → Query

Description	Sets or returns upper limit of the scan function.	
Syntax Query Syntax	CALCulate:SCAN:LIMit:UPPer {<NRf>[,<String>]} CALCulate:SCAN:LIMit:UPPer?	
Parameter	<NRf>	000.0000~999.9999
	<String>	mohm/ohm/kohm/maohm,unit If unit is not set, the unit will be automatically set by the present range.
Return parameter	<NR3>	000.0000~999.9999E±X
Example	CALC:SCAN:LIM:UPP 0.123,maohm Sets the upper limit to 0.123MΩ. CALC:SCAN:LIM:UPP? >0.1230E+6 Returns the upper limit as 0.123MΩ.	

CALCulate:SCAN:PERCent:LOWer

Set → Query

Description	Sets or returns lower limit percent value for the scan function.	
Syntax Query Syntax	CALCulate:SCAN:PERCent:LOWer <NRf> CALCulate:SCAN:PERCent:LOWer?	
Parameter	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99
Example	CALC:SCAN:PERC:LOW 10.00 Sets the lower limit percent value to -10.00%. CALC:SCAN:PERC:LOW? >10.00 Returns the lower limit as -10.00%.	

CALCulate:SCAN:PERCent:UPPer

Set → Query

Description	Sets or returns the upper limit percent value for the scan function.

Syntax Query Syntax	CALCulate:SCAN:PERCent:UPPer <NRf> CALCulate:SCAN:PERCent:UPPer?	
Parameter	<NRf>	000.00~999.99
Return parameter	<NR2>	000.00~999.99
Example	CALC:SCAN:PERC:UPP 90.00 Sets the upper limit percent value to +90.00%. CALC:SCAN:PERC:UPP? >90.00 Returns the upper limit as +90.00%.	

MEASure<X>

→ Query

Description	Returns the results of the selected channel in the scan mode, including HI/LO/IN and value.	
Query Syntax	MEASure<X>?	
Parameter	<X>	Channel 1~100
Return parameter	0|1|2,<NR3>	0:LO 1:IN 2:HI <NR3>: Measurement result.
Example	MEAS1? >1,+0.9978E+1 Returns channel 1 is IN as 9.978Ω.	

SHOW

→ Query

Description	Returns the judgments of all (up to 100) channels in the scan mode.	
Query Syntax	SHOW?	
Return parameter	<String>	100 characters 0:LO 1:IN 2:HI _:Channel not active

Example	SHOW? Returns 1111111111_____ _____ _____.

Source Commands

Source commands are only applicable to T3MIL50X.

SOURce:DRY

Set →
→ Query

Description	Sets or returns the dry circuit test mode.	
Syntax Query Syntax	SOURce:DRY {<NR1> | {OFF|ON} SOURce:DRY?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Turn dry circuit test mode off.
	ON	Turn dry circuit test mode on.
Example	SOUR:DRY On Turns the dry circuit test mode on.	

SOURce:DRIVe

Set →
→ Query

Description	Sets or returns the drive mode.	
Syntax Query Syntax	SOURce:DRIVe <NR1> SOURce:DRIVe?	
Parameter/ Return parameter	<NR1>	1: the DC+ mode. 2: the DC- mode. 3: the PULSE mode. 4: the PWM mode. 5: the ZERO mode. 6: the STANDBY mode
Example	SOUR:DRIV 3 Sets the drive mode to pulse.	

Meas. Setup Commands

SYSTem:AVERage:STATe

Set
Query

Description	Sets or returns the average function state.	
Syntax Query Syntax	SYSTem:AVERage:STATe <NR1> | {OFF|ON} SYSTem:AVERage:STATe?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Turn the average function off.
	ON	Turn the average function on.
Example	SYST:AVER:STAT OFF Turns the average function off.	

SYSTem:AVERage:DATa

Set
Query

Description	Sets or returns the number of measurements used for the average function.	
Syntax Query Syntax	SYSTem:AVERage:DATa <NR1> SYSTem:AVERage:DATa?	
Parameter/ Return parameter	<NR1>	2~100
Example	SYST:AVER:DAT 5 5 measurements are used to perform the average function.	

SYSTem:MDELay:STATe

Set
Query

Description	Sets or returns the measurement delay function state.	
Syntax Query Syntax	SYSTem:MDELay:STATe <NR1> | {OFF|ON} SYSTem:MDELay:STATe?	
Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.

	OFF	Turn the measurement delay off.
	ON	Turn the measurement delay on.

Example
SYST:MDEL:STAT OFF
Turns the measurement delay function off.

SYSTem:MDELay:DATa

Set → / → Query

Description	Sets or returns the measurement delay time.	
Syntax Query Syntax	SYSTem:MDELay:DATa <NRf> SYSTem:MDELay:DATa?	
Parameter/ Return parameter	<NRf>	0.000~100.000 Unit: ms For values under 1s, the unit resolution is 1ms. For values above 1s, the unit resolution is 0.1s.

Example
SYST:MDEL:DAT 1.105
Sets the delay time of measure is 1.1s.
SYST:MDEL:DAT?
>001.100
Returns the measurement delay as 1.1s.

TRIGger:DELay:STATe

Set → / → Query

Description	Sets or returns the trigger delay function state.	
Syntax Query Syntax	TRIGger:DELay:STATe <NR1> | {OFF|ON} TRIGger:DELay:STATe?	
Parameter/ Return parameter	<NR1>	0:ON 1:OFF
	OFF	Turn the trigger delay function off.
	ON	Turn the trigger delay function on.

TRIGger:DELay:DATa

Set → / → Query

Description	Sets or returns the trigger delay time.

Syntax Query Syntax	TRIGger:DELay:DATa <NR1> TRIGger:DELay:DATa?	
Parameter/ Return parameter	<NR1>	0~1000 Unit:ms
Example	TRIG:DEL:DAT 100 Sets the trigger delay time to 100ms.	

TRIGger:EDGE

Set →
→ Query

Description	Sets or returns the trigger edge (falling or rising edge).	
Syntax Query Syntax	TRIGger:EDGE {RISING|FALLING} TRIGger:EDGE?	
Parameter/ Return parameter	RISING	Select rising trigger.
	FALLING	Select falling trigger.
Example	TRIG:EDGE FALLING Sets the trigger to falling edge.	

TEMPerature:UNIT

Set →
→ Query

Description	Sets or returns the temperature unit. (Only used for the display readback.)	
Syntax Query Syntax	TEMPerature:UNIT {DEGC|DEGF} TEMPerature:UNIT?	
Parameter/ Return parameter	DEGC	°C
	DEGF	°F
Example	TEMP:UNIT DEGF Sets temperature unit to °F (Fahrenheit).	

TEMPerature:AMBient:STATe

Set →
→ Query

Description	Sets or returns the state of the user-set ambient temperature.
Syntax Query Syntax	TEMPerature:AMBient:STATe <NR1> | {OFF|ON} TEMPerature:AMBient:STATe?

Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Disables the user-set ambient temperature.
	ON	Enables the user-set ambient temperature.
Example	TEMP:AMB:STAT OFF Disables the user-set ambient temperature.	

TEMPerature:AMBient:DATa

Set → Query

Description	Sets or returns the user-set ambient temperature value for the temperature compensation and the temperature conversion function.	
Syntax Query Syntax	TEMPerature:AMBient:DATa <NRf> TEMPerature:AMBient:DATa?	
Parameter	<NRf>	-50.0~399.9 (Unit: °C)
Return parameter	<NR2>	-50.0~399.9 (Unit: °C)
Example	TEMP:AMB:DAT 25.6 Sets the user ambient temperature value to +25.6°C. TEMP:AMB:DAT? >25.6 Returns the set ambient temperature as 25.6°C.	

SYSTem:LFRequency

Set → Query

Description	Sets or returns the frequency setting for the line filter.	
Syntax Query Syntax	SYSTem:LFRequency {AUTO | 50 | 60} SYSTem:LFRequency?	
Parameter/ Return parameter	AUTO	The frequency setting for the line filter is automatically detected.
	50	The frequency is 50Hz.
	60	The frequency is 60Hz.

Example	SYST:LFR 60 Sets the line frequency to 60Hz. SYST:LFR? >60Hz Returns the line frequency as 60Hz.

SYSTem:PWM:ON

Set → Query

Description	Sets or returns the duty ON period for the PWM drive mode.
⚠ Note	PWM drive mode is only available for the T3MIL50X.
Syntax Query Syntax	SYSTem:PWM:ON <NR1> SYSTem:PWM:ON?

Parameter/ Return parameter	<NR1>	3~99 Unit: time units. For 60Hz LF, each unit is equal 16.6ms. For 50Hz LF, each unit is equal to 20.0ms.

Example	SYST:PWM:ON 5 Sets the duty ON time to 5 adc units.

SYSTem:PWM:OFF

Set → Query

Description	Sets or returns the duty OFF period for the PWM drive mode.
Syntax Query Syntax	SYSTem:PWM:OFF <NR1> SYSTem:PWM:OFF?

Parameter/ Return parameter	<NR1>	100~9999 Unit:ms

Example	SYST:PWM:OFF 200 Sets the duty OFF period to 200 ms.

System Commands

*IDN

→ Query

Description	Returns the manufacturer, model No., serial number and system version number.	
Query Syntax	*IDN?	
Return parameter	<String>	31 characters
Example	*IDN? >Teledyne,T3MIL50X,TXXXXXXXX,V1.00.	

SYSTem:SERial

→ Query

Description	Returns the serial number.	
Query Syntax	SYSTem:SERial?	
Return parameter	<String>	9 characters
Example	SYST:SER? > TXXXXXXXX	

SYSTem:BRIGhtness

Set →
→ Query

Description	Sets or returns the brightness level.	
Syntax Query Syntax	SYSTem:BRIGhtness <NR1> SYSTem:BRIGhtness?	
Parameter/ Return parameter	<NR1>	1(dim)~5(bright)
Example	SYST:BRIG 4 Turns the brightness level to 4.	

USERdefine<X>:ACTive

Set →
→ Query

Description	Sets or returns the active output state of the selected user define pin.

Syntax Query Syntax	USERdefine<X>:ACTive <NR1> USERdefine<X>:ACTive?	
Parameter/ Return parameter	<X>	Userdefine pin 1~2
	<NR1>	1:active low state 2:active high state
Example	USER1:ACT 1 Sets the userdefine1 pin IO to active low state.	

USERdefine<X>:FIRStdata

Set → Query

Description	Sets or returns the first operand for the selected user define pin.	
Syntax Query Syntax	USERdefine<X>:FIRStdata <NR1> USERdefine<X>:FIRStdata?	
Parameter/ Return parameter	<X>	Userdefine pin 1~2
	<NR1>	1~8:bin1~bin8 state 9:bin out state 10:hi state 11:low state 12:pass state 13:fail state
Example	USER1:FIRS 12 Sets first operand of userdefine1 as pass state.	

USERdefine<X>:LOGic

Set → Query

Description	Sets or returns operator for the selected user define pin.	
Syntax Query Syntax	USERdefine<X>:LOGic <NR1> USERdefine<X>:LOGic?	
Parameter/ Return parameter	<X>	Userdefine pin 1~2
	<NR1>	1:off(only judge first data) 2:logical and. 3:logical or.
Example	USER1:LOG 1 Sets the operator of userdefine1 to off. (I.e., only the first operand determines the output of userdefine1.)	

USERdefine<X>:SEConddata

Set → Query

Description	Sets or returns the second operand for the selected user define pin.	
Syntax Query Syntax	USERdefine<X>:SECondata <NR1> USERdefine<X>:SECondata?	
Parameter/ Return parameter	<X>	1~2
	<NR1>	1~8:bin1~bin8 state 9:bin out state 10:hi state 11:low state 12:pass state 13:fail state
Example	USER1:SEC 3 Sets the last operand of userdefine1 as the state of the bin3 result.	

SYSTem:HANDler

Set → Query

Description	Sets or returns the handler state.	
Syntax Query Syntax	SYSTem:HANDler {CLEAR | HOLD} SYSTem:HANDler?	
Parameter/ Return parameter	Clear	It clears the last result before executing measurement.
	HOLD	It holds the test result and changes when a different result appears.
Example	SYST:HAND HOLD Sets the test result to the hold state.	

SYSTem:KEYClick:BEEPer

Set → Query

Description	Sets or returns the keyclick beeper state.
Syntax Query Syntax	SYSTem:KEYClick:BEEPer <NR1> | {OFF | ON} SYSTem:KEYClick:BEEPer?

Parameter/ Return parameter	<NR1>	0:OFF. 1:ON.
	OFF	Turn the keyclick beeper off.
	ON	Turn the keyclick beeper on.
Example	SYST:KEYC:BEEP OFF Sets the keyclick beeper off.	

SYSTem:VOLTage:PROTect

Set → / → Query

Description	Sets or returns the HVP function state.	
Syntax Query Syntax	SYSTem:VOLTage:PROTect <NR1> | {OFF | ON} SYSTem:VOLTage:PROTect?	
Parameter/ Return parameter	<NR1>	0: OFF. 1: ON.
	OFF	Turn the HVP function off.
	ON	Turn the HVP function on.
Example	SYST:VOLT:PROT OFF Sets the HVP function off.	

SYSTem:ERRor

→ Query

Description	Returns the current system error, if any.	
Query Syntax	SYSTem:ERRor?	
Return parameter	<String>	Error number,"Error message"
Example	SYST:ERR? >0,"No error". Indicates that there is no error message.	
Error Message List	0,"No error" 1,"Command error" 4,"Data out of range"	

SYSTem:LOCal

Set →

Description	Enables local control (front panel control) and disables remote control.

Syntax	SYSTem:LOCal
Parameter	<None>

SYSTem:VERSion → Query

Description	Returns the SCPI version of the device.
Query Syntax	SYSTem:VERSion?
Return parameter	<String> 10 characters
Example	SYST:VERS? >SCPI1994.0. SCPI version: 1994

Memory Commands

MEMory:SAVe

Set →

Description	Saves the settings to the selected memory slot.	
Syntax	MEMory:SAVe <NR1>	
Parameter	<NR1>	1~20
Example	MEM:SAV 1 Saves the settings to memory slot 1.	

MEMory:RECall

Set →

Description	Recalls the settings from the selected memory slot.	
Syntax	MEMory:RECall <NR1>	
Parameter	<NR1>	1~20
Example	MEM:REC 1 Recall the settings from memory slot 1.	

MEMory:CLEar

Set →

Description	Clears the data from the selected memory slot.	
Syntax	MEMory:CLEar <NR1>	
Parameter	<NR1>	1~20
Example	MEM:CLE 1 Clear data from memory slot 1.	

MEMory:STATe

→ Query

Description	Returns the status of all the memory slots.	
Query Syntax	MEMory:STATe?	
Return parameter	<String>	23 Characters composed of "N" or "F", where "N" indicates "Not used" and "F" indicates "Full".

Example	MEM:STAT? > NFFNN-NNNNN-NNNNN-NNNNN Indicates that memory slots 2 and 3 have data and that all other memory slots are empty.

Status Commands

STATus:PRESet

Set →

Description	Sets the QUESTionable enable register to zero.
Syntax	STATus:PRESet <NONE>
Parameter	<None>

STATus:QUEStionable:ENABle

Set →
→ Query

Description	Sets or returns the Questionable Data Enable register.	
Syntax Query Syntax	STATus:QUEStionable:ENABle <NR1> STATus:QUEStionable:ENABle?	
Parameter/ Return parameter	<NR1>	0~32767.
Example	STAT:QUES:ENAB 2560 Sets the Questionable Data Enable register to 000101000000000.	

STATus:QUEStionable:EVENt

→ Query

Description	Returns the contents of the Questionable Data Event register.	
Query Syntax	STATus:QUEStionable:EVENt?	
Return parameter	<NR1>	0~32767
Example	STAT:QUES:EVEN? >512 512 indicates that the Questionable Data Event register=0000001000000000.	

IEEE 488.2 Common Commands

*CLS

Set →

Description	Clears the Event Status register (Output Queue, Operation Event Status, Questionable Event Status, Standard Event Status).
Syntax	*CLS
Parameter	<None>

*ESE

Set →
→ Query

Description	Sets or returns the ESER (Event Status Enable Register) contents.	
Syntax Query Syntax	*ESE <NR1> *ESE?	
Parameter/ Return parameter	<NR1>	0~255
Example	*ESE 65 Sets the ESER to 01000001 *ESE? >130 ESER=10000010	

*ESR

→ Query

Description	Returns SESR (Standard Event Status Register) contents.	
Syntax Query Syntax	*ESR?	
Return parameter	<NR1>	0~255
Example	*ESR? >198 SESR=11000110	

*OPC

Set → / → Query

Description	Sets or returns the operation complete bit (bit0) in SERS (Standard Event Status Register) when all pending operations are completed.	
Syntax Query Syntax	*OPC *OPC?	
Parameter	<None>	
Return parameter	<NR1>	0:operation not complete 1:operation complete
Example	*OPC? Returns 1.	

*RST

Set →

Description	Recalls default panel setup.	
Syntax	*RST	
Parameter	<None>	

*SRE

Set → / → Query

Description	Sets or returns the SRER (Service Request Enable Register) contents.	
Syntax Query Syntax	*SRE <NR1> *SRE?	
Parameter/ Return parameter	<NR1>	0~255
Example	*SRE 7 Sets the SRER to 00000111 *SRE? >3 SRER=00000011	

*STB

→ Query

Description	Returns the SBR (Status Byte Register) contents.
Query Syntax	*STB?
Return parameter	<NR1> 0~255
Example	*STB? >81 SESR=01010001

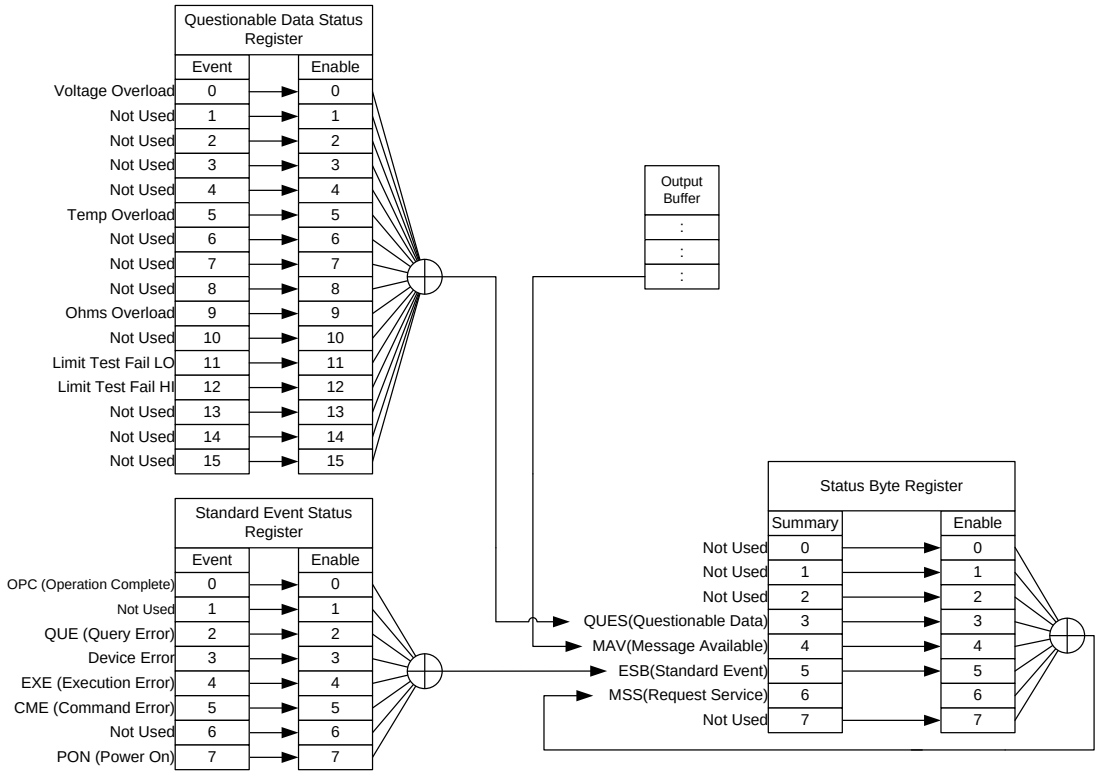
*TRG

Set →

Description	Manually triggers the instrument.
Syntax	*TRG
Parameter	<None>

Status system

The diagram below is a description of the status system.



For the following command sets, please refer to the diagram above:

STAT: QUES: EVEN?

STAT: QUES: ENAB

STAT: QUES: ENAB?

*ESR?

*ESE

*ESE?

*STB?

*SRE

*SRE?

FAQ

- What are the different measurement speeds?
- The T3MIL50/50X performance does not match the specifications.

What are the different measurement speeds?

There are two measurement speeds for both resistance and temperature measurement. At the slow measurement rate, the measurement speed is 10 samples/s and at the fast measurement rate the measurement speed is at 60 samples/s.

The T3MIL50/50X performance does not match the specifications.

Make sure the device is powered on for at least 30 minutes, is operated at the slow measurement rate and is within +18°C~+28°C with a humidity not exceeding 80%. This is necessary to stabilize the unit to match the specifications.

APPENDIX

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Function Selection Combinations

Function Combination Table

Overview: The following table shows which functions can be used with the Relative, Drive and Dry Circuit functions.

Function	Rel	Dry(*1)	Drive(*2)
Ohm	✔	✔	✔
Comp	✔	✔	✔
Bin	✔	✔	✔
TC	✔	✔	✔
Tconv	✔	✔	✔
Temp	✔	✔	✔
Scan	✘	✘	✘
Diode	✘	✘	✘

*1. When the Dry Circuit measurement function is turned on, only the DC+, DC- and Pulse signals can be selected. Please refer to page 35 for limitations on the range selection when using the Dry Circuit measurement function.

*2. The “Zero” drive setting is only available for the Ohm measurement function.

Temperature Measurement

Reference Temperature Table

Overview Background

The International Temperature Scale (ITS) is based on the following table. The table has 17 fixed calibration points as of 1990.

Element		Type	Temperature	
			˚K	˚C
(H_2)	Hydrogen	Triple point	13.8033	-259.3467
(Ne)	Neon	Triple point	24.5561	-248.5939
(O_2)	Oxygen	Triple point	54.3584	-218.7916
(Ar)	Argon	Triple point	83.8058	-189.3442
(Hg)	Mercury	Triple point	234.325	-38.8344
(H_2O)	Water	Triple point	273.16	+0.01
(Ga)	Gallium	Melting point	302.9146	29.7646
(In)	Indium	Freezing point	429.7485	156.5985
(Sn)	Tin	Freezing point	505.078	31.928
(Zn)	Zinc	Freezing point	692.677	419.527
(Al)	Aluminum	Freezing point	933.473	660.323
(Ag)	Silver	Freezing point	1234.93	961.78
(Au)	Gold	Freezing point	1337.33	1064.18

RTD Sensors

Overview

Resistive Thermal Devices (RTDs) are commonly used as temperature sensors. RTDs change resistance linearly over a specific range of temperature. The table below shows some of the inherent features of RTDs compared to thermocouples.

Feature	Description
Accuracy	Higher accuracy
Resolution	0.1~1.0˚C, higher resolution
Speed of response	Slower
Self-heating	Yes
Long term stability	Good
Output characteristics	Approx. 0.4ohm/˚C, near linear

Optional Platinum Sensor

Introduction

The platinum sensor is a PT-100 sensor. The PT-100 sensor meets the German DIN43760: 1968 3 wire measurement specification.

These sensors are one of the most common temperature sensors used in industry. These sensors have a nominal resistance of 100Ω at 0˚C.

The relationship between temperature and resistance for the PT-100 sensor can be described with the Gallendarvan Dusen equation shown below:

$$R_{RTD}=R_0[1+AT+BT^2+CT^3(T-100)]$$

Where: R_{RTD} is the calculated resistance of the RTD.

R_0 is the known RTD resistance at 0˚C.

T is the temperature in˚C

A=alpha [I+(delta/100)]

B=-I(alpha)(delta)(Ie-4)

C=-I(alpha)(beta)(Ie-8)

The Alpha (A), Beta (B), Delta (D) values for the PT-100 sensor are listed below:

Type	Standard	Alpha	Beta	Delta	Ω@0˚C
PT-100	ITS90	0.003850	0.10863	1.49990	100Ω

Temperature Calculation Example

Example—Calculating the resistance of a PT-100 RTD at 100˚C (T). The following R_0 (Ωat 0˚C), alpha, beta, and delta values are used for the PT-100 RTD:

T=100˚C

R_0 (Ω at 0˚C) = 100Ω

Alpha=0.003850

Beta=0.10863

Delta=1.49990

A, B, and C are calculated according to equations listed above:

A=0.00391

B=5.77e-7

C=4.18e-12

The resistance of the RTD at 100˚C (R_{100}) is then calculated as follows:

R_{100}: $=R_0[1+AT+BT^2+CT^3(T-100)]$

$=100\{1+[(0.00391)(100)]+[(-5.77e-7)(100^2)]+[(-4.18E-12)(100^3)(100-100)]\}$

$=138.5\Omega$

Specifications

Conditions Background

The specifications are applicable under the following conditions:

- A 1-year calibration cycle.
- An operating temperature of 18 to 28 ˚C (64.4 to 82.4˚F).
- Relative humidity not exceeding 80%.
- Accuracy is expressed as ± (percentage of reading + percentage of range).
- The instrument requires 30 minutes warm-up time and must be operated at the slow measurement rate to achieve rated accuracy.
- The power cord protective grounding conductor must be connected to ground.

Resistance Measurement

50000 counts

Range	Resolution	Measuring Current	Accuracy	Open-Terminal Voltage
5mΩ	0.1μΩ	1A	±(0.1%+0.2%)	~6.25V
50mΩ	1 μΩ	1A	±(0.1%+0.02%)	~6.25V
500mΩ	10 μΩ	100mA	±(0.05%+0.02%)	~6.25V
5Ω	100 μΩ	100mA	±(0.05%+0.02%)	~6.25V
50Ω	1mΩ	10mA	±(0.05%+0.02%)	~6.25V
500Ω	10mΩ	1mA	±(0.05%+0.008%)	~6.25V
5kΩ	100mΩ	100μA	±(0.05%+0.008%)	~6.25V
50kΩ	1Ω	100μA	±(0.05%+0.008%)	~6.25V
500kΩ	10Ω	10μA	±(0.05%+0.008%)	~6.25V
T3MIL50X Only				
5MΩ	100Ω	1μA	±(0.5%+0.008%)	~6.25V
T3MIL50 Only				
5MΩ	100Ω	1μA	±(0.2%+0.008%)	~6.25V

*When use 5mΩ range, in order to obtain a stable value, it is recommended to use 10 times average and fixed connection method such as lock.
*When the instrument is set to 5mΩ or 50mΩ or 500mΩ ranges, the resistance value will be changed while connecting or disconnecting the test

lead to the panel due to the different temperature between internal and external parts of the instrument. Therefore, please wait 1 minute in order to obtain an accurate value after the test leads have been connected or disconnected.
* When Kelvin clips are used to resume testing after a long period of time, please wait for a short time to stabilize the measurement.
*Fast and Slow measurement rates have the same specifications. However, the Slow rate is more accurate as it will correct for any errors associated with temperature drift that occurs from the difference between the measurement temperature and the calibration temperature.

Measurement	Four-terminal method.
Auto-ranging	Provided.
Over input range	"------" indicates over range
Maximum Applied voltage*	5m~5Ω range: 30VpDC Other range: 100VpDC
Comparator	20 sets of comparator status can be selected.
Buzzer mode switchable	OFF, PASS, FAIL

*Only when HVP (High Voltage Protect) function is enabled, can Maximum Applied voltage be available. Refer to page 71 for details.

Dry Resistance Measurement

Range	Measuring Current	Accuracy
500mΩ	100mA	±(0.3%+0.05%)
5Ω	10mA	±(0.3%+0.05%)
50Ω	1mA	±(0.3%+0.05%)

Temperature Measurement

Temperature sensor	Platinum resistor. Lead length: 1.5m approx.
-10˚C ~40˚C	0.3%±0.5˚C
Other	0.3%±1.0˚C

Temperature Correction Function

Reference temperature range	-50.0˚C~399.9˚C
Thermal coefficient range	±9999 ppm
Temperature range	Accuracy of temperature compensation for 3930 ppm/Cu wire.*
-10˚C~40.0˚C	0.3%+resistance measurement accuracy.
Other	0.6%+resistance measurement accuracy.

*The temperature coefficient for the other settings must be calculated individually according to different conditions.
*If the temperature coefficient or the difference between the environmental temperature and the required temperature exceeds normal operation, after calculating the compensation, the variation to the reading value will be significant.
*When using the PT-100 temperature sensor for temperature measurements, the accuracy of the sensor (typical accuracy of <±0.5°C) should also be taken into account and calculated for.

Interface

Handler interface*	Signal: Trigger: TTL input Signal: LOW, HIGH, FAIL, PASS, EOT, READY, BIN 1~8, BIN OUT: total 15 TTL outputs.
Scan*	Signal: RELAY, PASS, LOW, HIGH, CLOCK, STRB total 6 TTL outputs.
Communication Interfaces	T3MIL50: USB/RS-232 T3MIL50X: USB/RS-232/GPIB *The Scan and Handler interface use the same connector.

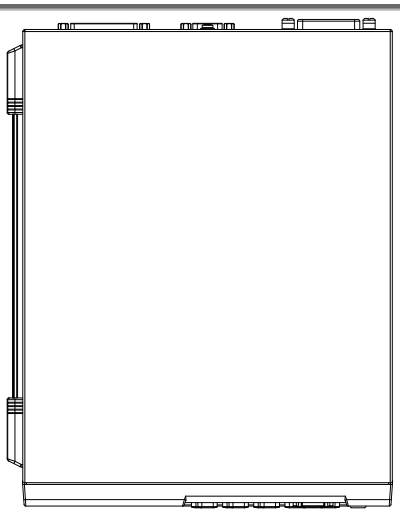
Environmental

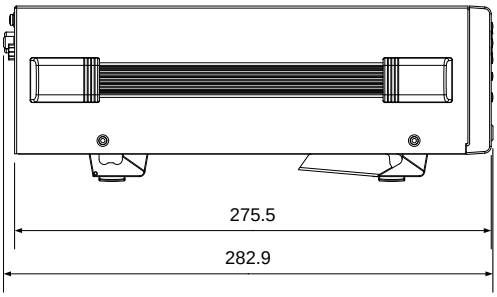
Operation Environment	Indoor use, altitude up to 2000m. Operation Environment: 0˚C to 40˚C. Temperature Range: 0 ~ 35˚C, Relative Humidity: <80%RH; >35˚C, Relative Humidity: <70%RH. Pollution Degree 2
Storage Conditions	-10˚C to 70˚C. Temperature Range: 0 ~ 35˚C, Relative Humidity: <90%RH; >35˚C, Relative Humidity: <80%RH

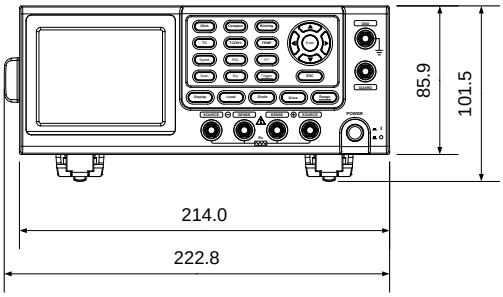
General

Power source	AC 100-240V±10%, 50-60Hz, 25VA
Accessories	Power cord x 3 Test Lead: T3TL4K-150 x 1
Dimension	223(W)×102(H)×283(D) mm
Weight	Approx. 3 kg

Dimensions







CERTIFICATIONS

Teledyne LeCroy certifies compliance to the following standards as of the time of publication. Please see the EC Declaration of Conformity document shipped with your product for current certifications.

EMC Compliance

EC DECLARATION OF CONFORMITY - EMC

The instrument meets intent of EC Directive 2014/30/EU for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications listed in the Official Journal of the European Communities:

EN 61326-1:2013, EN 61326-2-1:2013 EMC requirements for electrical equipment for measurement, control, and laboratory use.[1]

Electromagnetic Emissions:

EN 55011:2016+A1:2017, Radiated and Conducted Emissions Group 1, Class A [2 3]

EN 61000-3-2:2014 Harmonic Current Emissions, Class A

EN 61000-3-3:2013 Voltage Fluctuations and Flickers, Pst = 1

Electromagnetic Immunity:

EN 61000-4-2:2009 Electrostatic Discharge, 4 kV contact, 8 kV air, 4 kV vertical/horizontal coupling planes[4]

EN 61000-4-3:2006+ A2:2010 RF Radiated Electromagnetic Field,

3 V/m, 80-1000 MHz; 3 V/m, 1400 MHz - 2 GHz; 1 V/m, 2 GHz - 2.7 GHz

EN 61000-4-4:2012 Electrical Fast Transient/Burst, 1 kV on power supply lines, 0.5 kV on I/O signal data and control lines[4]

EN 61000-4-5:2014+A1:2017 Power Line Surge, 1 kV AC Mains, L-N, L-PE, N-PE[4]

EN 61000-4-6:2014 RF Conducted Electromagnetic Field, 3 Vrms, 0.15 MHz - 80 MHz

EN 61000-4-11:2004+A1:2017 Mains Dips and Interruptions, 0%/1 cycle, 70%/25 cycles, 0%/250 cycles [4] [5]

[1] To ensure compliance with all applicable EMC standards, use high- quality shielded interface cables.

[2] Emissions which exceed the levels required by this standard may occur when the instrument is connected to a test object.

[3] This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.

[4] Meets Performance Criteria "B" limits of the respective standard: during the disturbance, product undergoes a temporary degradation or loss of function or performance which is self-recoverable.

[5] Performance Criteria "C" applied for 70%/25 cycle voltage dips and for 0%/250 cycle voltage interruption test levels per EN61000-4-11.

European Contact:*

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AUSTRALIA & NEW ZEALAND DECLARATION OF CONFORMITY – EMC

The instrument complies with the EMC provision of the Radio Communications Act per the following standards, in accordance with requirements imposed by Australian Communication and Media Authority (ACMA):

AS/NZS CISPR 11:2015 Radiated and Conducted Emissions, Group 1, Class A.

Australia / New Zealand Contacts:*

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Kent Town, South Australia 5067

RS Components Ltd.

Units 30 & 31 Warehouse World

761 Great South Road

Penrose, Auckland, New Zealand

* Visit teledynelecroy.com/support/contact for the latest contact information.

Safety Compliance

EC DECLARATION OF CONFORMITY – LOW VOLTAGE

The instrument meets intent of EC Directive 2014/35/EU for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use –

Part 1: General requirements

EN 61010-2:030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use –

Part 2-030: Particular requirements for testing and measuring circuits

The design of the instrument has been verified to conform to the following limits put forth by these standards:

- Mains Supply Connector: Overvoltage Category II, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).
- Measuring Circuit Terminals: No rated measurement category. Terminals not intended to be connected directly to the mains supply.
- Unit: Pollution Degree 2, operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

Environmental Compliance

END-OF-LIFE HANDLING

The instrument is marked with this symbol to indicate that it complies with the applicable European Union requirements of Directives 2012/19/EU and 2006/66/EC on Waste Electrical and Electronic Equipment (WEEE) and Batteries.

The instrument is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your Teledyne LeCroy product, please visit teledynelecroy.com/recycle.

RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

EC DECLARATION OF CONFORMITY – RoHS

Unless otherwise specified, all the materials and processes are compliant with RoHS Directive 2011/65/EU in its entirety, inclusive of any further amendments or modifications of said Directive.

CHINA RoHS 2

Unless otherwise specified, all the materials and processes are compliant with the latest requirements of China RoHS 2. The hazardous substances contained in the instrument are disclosed in accordance with the standards SJ/T 11364-2014 (Marking for the restricted use of hazardous substances in electronic and electrical products) and GB/T 26572-2011 (Requirements on concentration limits for certain restricted substances in electrical and electronic products). The instrument is marked with an appropriate Environmental Friendly Use Period (EFUP) symbol. The packaging materials include the appropriate recycling labels. The below substance disclosure tables (in Chinese and English languages) provide the required compliance information.

部件名称	有毒有害物质和元素					
	铅	汞	镉	六价铬	多溴联苯	多溴二苯醚
	(Pb)	(Hg)	(Cd)	(Cr6+)	(PBB)	(PBDE)
PCBAs	X	0	0	0	0	0
机械硬件	0	0	0	0	0	0
金属片	0	0	0	0	0	0
塑料部件	0	0	0	0	0	0
电缆组件	X	0	0	0	0	0
显示器	0	0	0	0	0	0
电源	0	0	0	0	0	0
风扇	0	0	0	0	0	0
电池	0	0	0	0	0	0
电源线	0	0	0	0	0	0
外部电源(如有)	X	0	0	0	0	0
探头(如有)	X	0	0	0	0	0
熔丝(如有)	0	0	0	0	0	0
产品外壳(如有)	0	0	0	0	0	0
适配器/模块(如有)	0	0	0	0	0	0
鼠标(如有)	0	0	0	0	0	0
0: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11364-2014 标准规定的限量要求之下。						
X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11364-2014 标准规定的限量要求。						

EFUP (对环境友好的使用时间): 30 年。

使用条件：参阅用户手册“环境条件”部分的规定。

探头 EFUP: 10 年。

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr6+)	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	O	O	O	O
Mechanical Hardware	O	O	O	O	O	O
Sheet Metal	O	O	O	O	O	O
Plastic Parts	O	O	O	O	O	O
Cable Assemblies	X	O	O	O	O	O
Display	O	O	O	O	O	O
Power Supply	O	O	O	O	O	O
Fans	O	O	O	O	O	O
Batteries	O	O	O	O	O	O
Power Cord	O	O	O	O	O	O
Ext Power Supply (if present)	X	O	O	O	O	O
Probes (if present)	X	O	O	O	O	O
Fuse (if present)	O	O	O	O	O	O
Product Case (if present)	O	O	O	O	O	O
Adapters/ Modules (if present)	O	O	O	O	O	O
Mouse (if present)	O	O	O	O	O	O
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11364-2014.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11364-2014.						

EFUP (Environmental Friendly Use Period): 30 years.

Use Conditions: Refer to the environmental conditions stated in the User Manual.

EFUP for Probes: 10 years.

ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
Everywhereyoulook™

Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

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T3 stands for Teledyne Test Tools.