Time Electronics
Calibration, Test and Measurement

User Manual

5025 Series 2
Multifunction Calibrator

Revision 2506-1

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This manual provides operating and safety instructions for the Time Electronics product. To ensure correct operation and safety, please follow the instructions in this manual.

Time Electronics reserves the right to change the contents, specifications and other information contained in this manual without notice.

Contents

1 Introduction

1.1 Overview

The 5025 calibration system is a multifunction high accuracy calibration source. The calibrator is supplied with a test lead set, RS-232 to USB adaptor and system USB drive.

Standard Features

- 0 to 1050 V DC Voltage
- 2 mV to 1050 V AC Voltage
- 10 MHz Digital Frequency
- 0 to 22 A DC Current
- 10 µA to 22 A AC Current
- Variable Resistance
- Pt100 Simulation
- Thermocouple Simulation
- Capacitance
- Inductance (5025C only)
- Power Calibration
- RS-232, USB, GPIB Interfaces

Internal Factory Fitted Options

- Oscilloscope Calibration

External Options

- Clamp Meter Adaptor (1 and 50 turn coil)
- Optical Tacho Adaptor
- Power Amplifier (60 V AC, 90 V DC 100 mA)
- 19” Rack Mount Kit
- Premium Test Lead Set
- Soft Carry Case
- Transit Case

1.2 Important Information

Warning: The 5025 is a heavy instrument and care should be taken when lifting to prevent injury. Use both handles to carry.

Warning: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. This instrument must be connected to a grounded outlet.

High Voltage

The 5025 is capable of producing **1050 V** and users should be aware of the dangers involving serious electrical shock.

High Current

The 5025 is capable of producing **22 Amps** and users should be aware of the power levels involved. Equipment connected to the 5025 should be capable of withstanding the currents involved without damage. High current outputs, greater than 10 A, should not be left on for periods longer than 20 minutes.

This instrument is to be serviced by trained personnel only.

Disconnect mains supply before removing cover or replacing fuses.

For operations involving removal of the 5025's cover, users should be aware that certain sections of the circuitry carry high voltages, which are hazardous. Very high currents causing burns can also be generated if certain terminals are inadvertently shorted.

Static Awareness

Although the 5025 has been designed to withstand electrostatic discharge it is always good practice to observe anti-static precautions.

1.3 Installation

1.3.1 Positioning the Instrument

Benchtop Use

The 5025 should always be positioned on a flat, firm surface. The instrument base is fitted with four feet. The front feet have tilt legs to angle the instrument upwards for ergonomic front panel operation.

- A 10 cm area of free space is recommended at the rear of the instrument.
- Do not obstruct the fan inlet on the rear of the instrument.
- Do not obstruct any exhaust outlets on the bottom of the instrument.
- Do not place objects or materials under the instrument.

Rack Mounting

A 19” rack mount option is also available. In this configuration mounting brackets replace the carry handles.

Cleaning

When cleaning the 5025 use an alcohol-free wipe such as a ‘durable screenclean 50’.

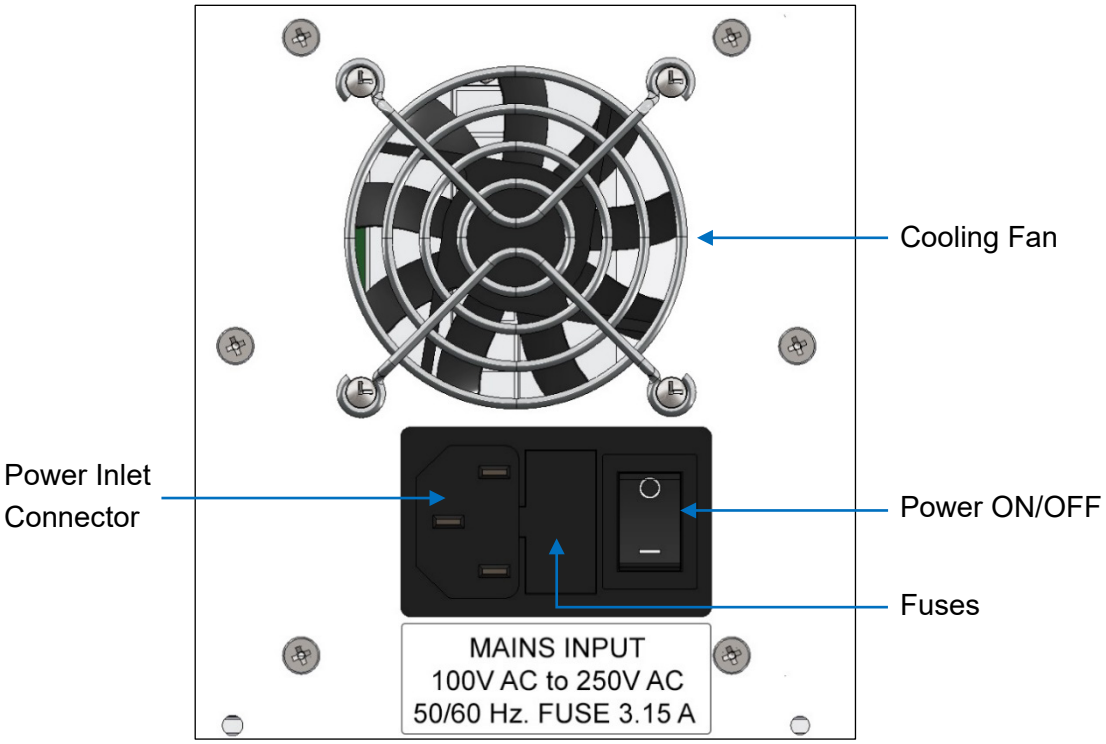
Packaging

The 5025 is supplied in a carton with protective inserts. Retain the shipping box and internal packaging for future use. If the unit is returned to Time Electronics for calibration, please use this original packaging to avoid possible damage in transit.

1.3.2 Mains (Line) Power Supply

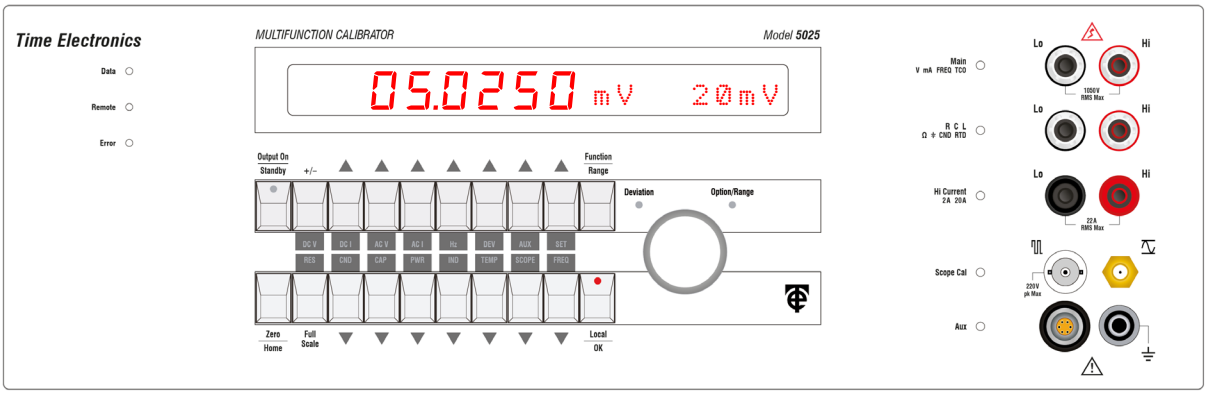
The supply power is connected via a standard IEC Euro connector on the rear panel. The standard voltage supply is 100 to 230 V 50/60 Hz. There are two protection fuses mounted in the IEC connector assemble, both are T3.15 A slow blow.

Mains Power Unit - Rear Panel

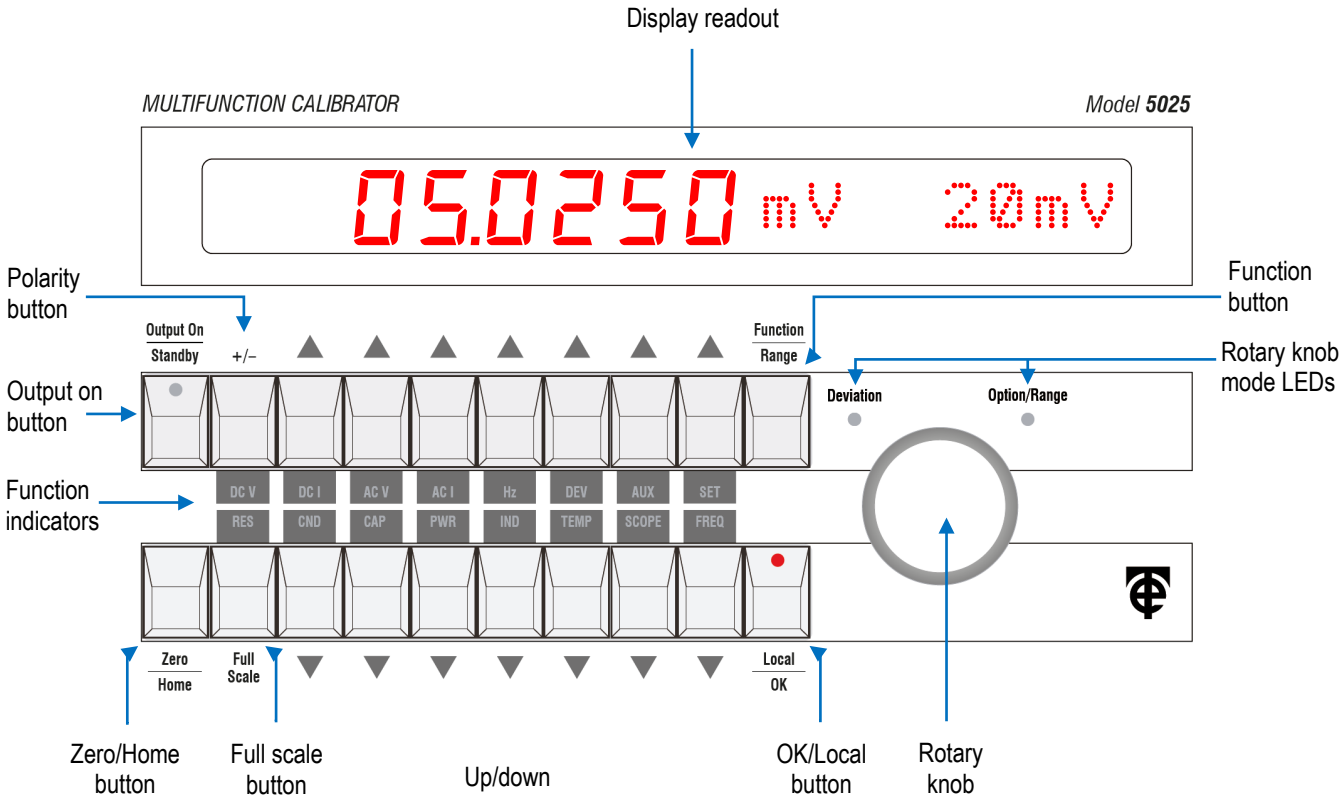


For information on PC communication and settings see the *Remote Operation Section*.

2 Front Panel Controls



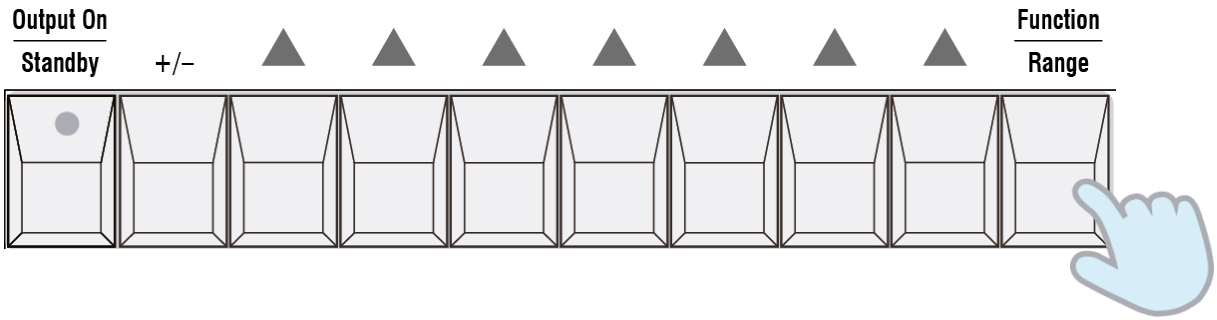
2.1 Keypad and Display



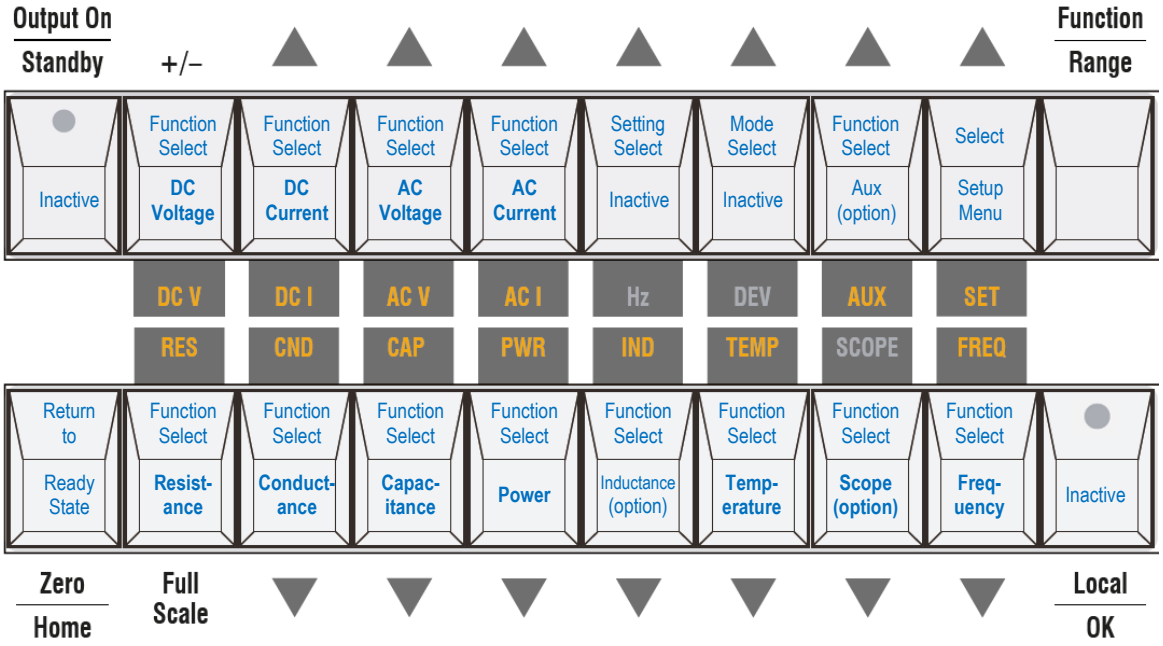
2.2 Keypad Buttons

2.2.1 Function Selection Buttons

Function selection is initiated by pressing the "**Function/Range**" button.



The function indicators flash to prompt a selection. This informs the user that the buttons adjoining the indicators are now function selectors:



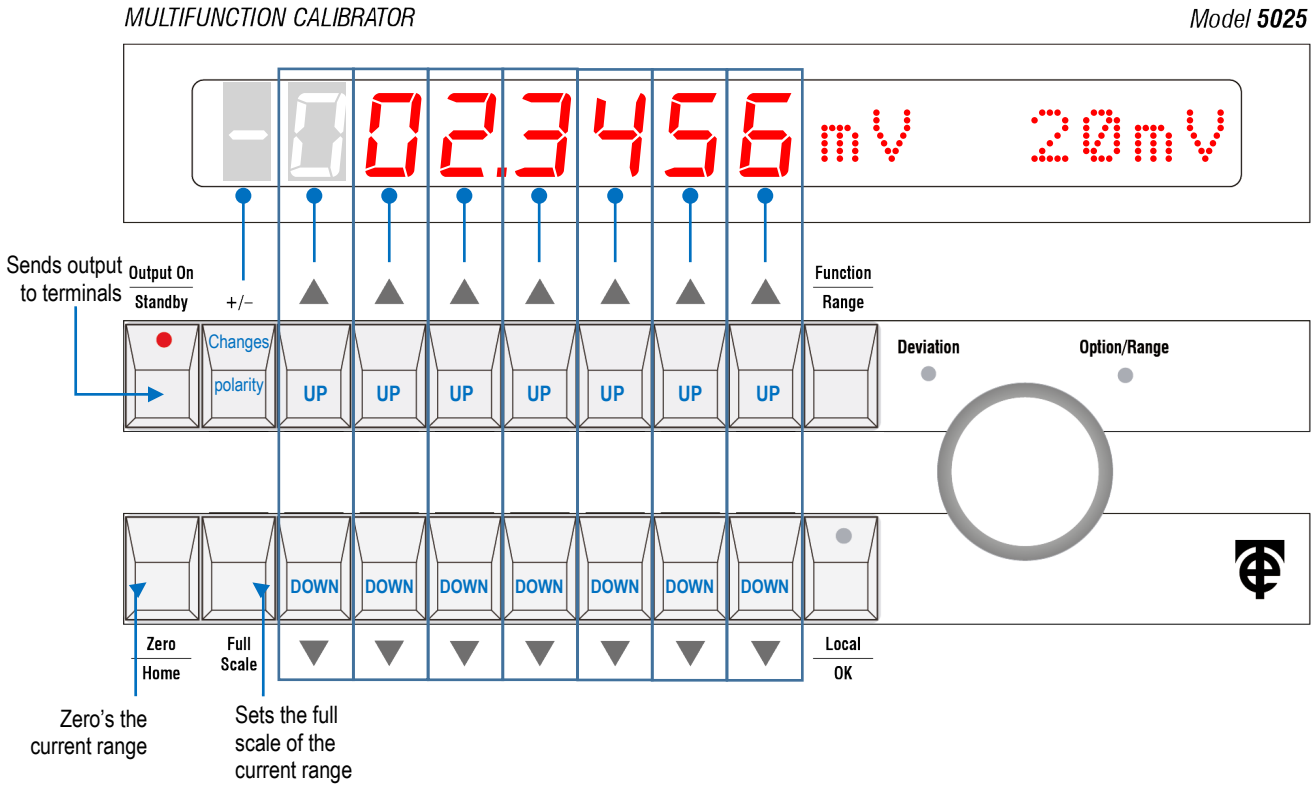
The **Function/Range** button can also be pressed after a function has been selected and is in use. The function indicators will flash show they are selectable. Any modes or setting buttons available for use will also flash. The user can choose to:

- Select a new function.
- Select a new range or setting for the present function, by pressing the same function.
- DEV: Deviation mode if available on the present function.
- SET: Settings menu.
- Hz: Adjust the frequency setting (AC V and ACI).

2.2.2 Output Value Setting Buttons

Setting an output value is performed by using the up/down buttons for the following functions: DC Voltage, DC Current, AC Voltage, AC Current, Resistance, Power, Frequency, Scope.

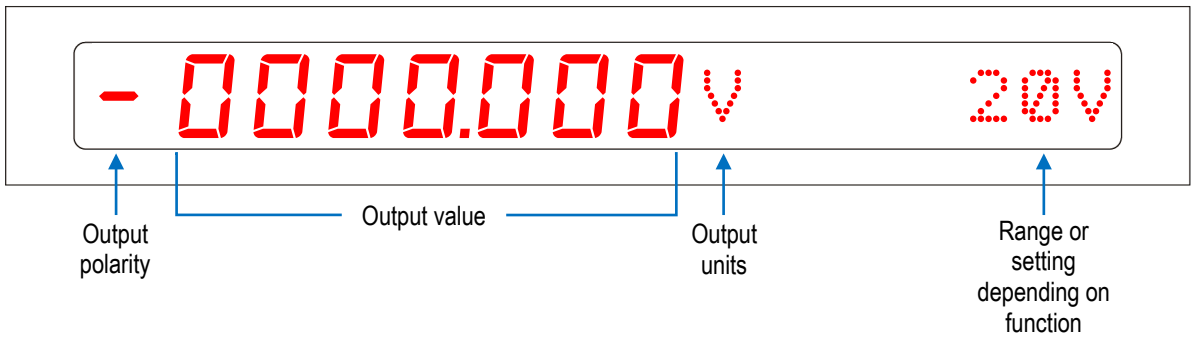
The buttons are in-line with the numerical readout to the as shown below:



2.3 Display Readout

An alphanumeric display. During calibrator output operation shows the following:

- Output value.
- Output unit of measure (mV, V, mA, A, Hz, Ω, °C etc).
- Function range or setting depending on the function.



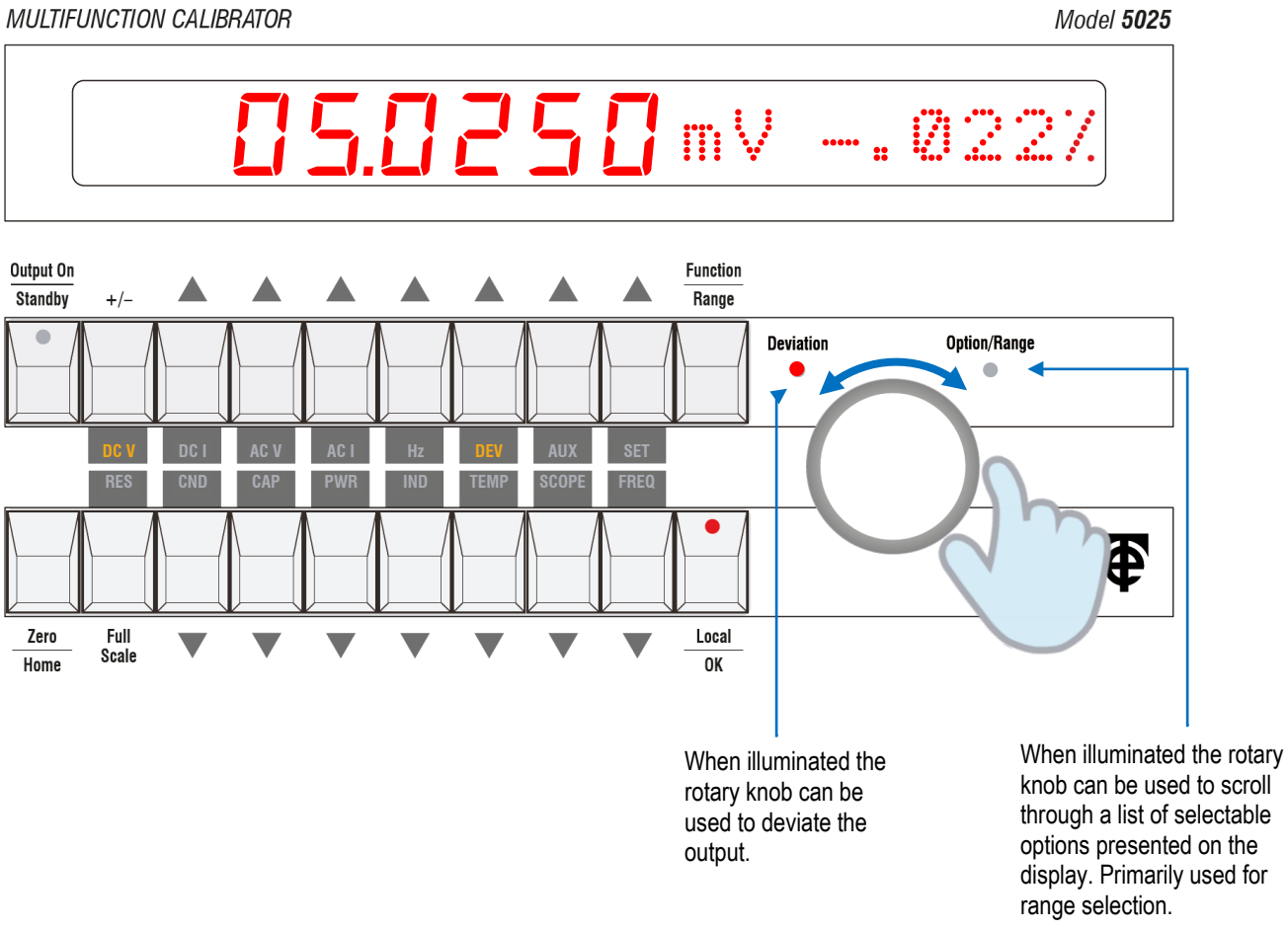
Note: Display resolution depends on the function and operating range.

2.4 Rotary Knob

The rotary knob is used to select ranges, settings and options. It is adjusted clockwise or anti-clockwise to the required selection. The "**Deviation**" or "**Option/Range**" LEDs illuminate to prompt usage of the rotary knob for the required operation. Ranges, options and settings are activated by pressing the "**OK**" button after selection. Deviation is a mode that provides percentage increase/decrease of an output and is active in real time.

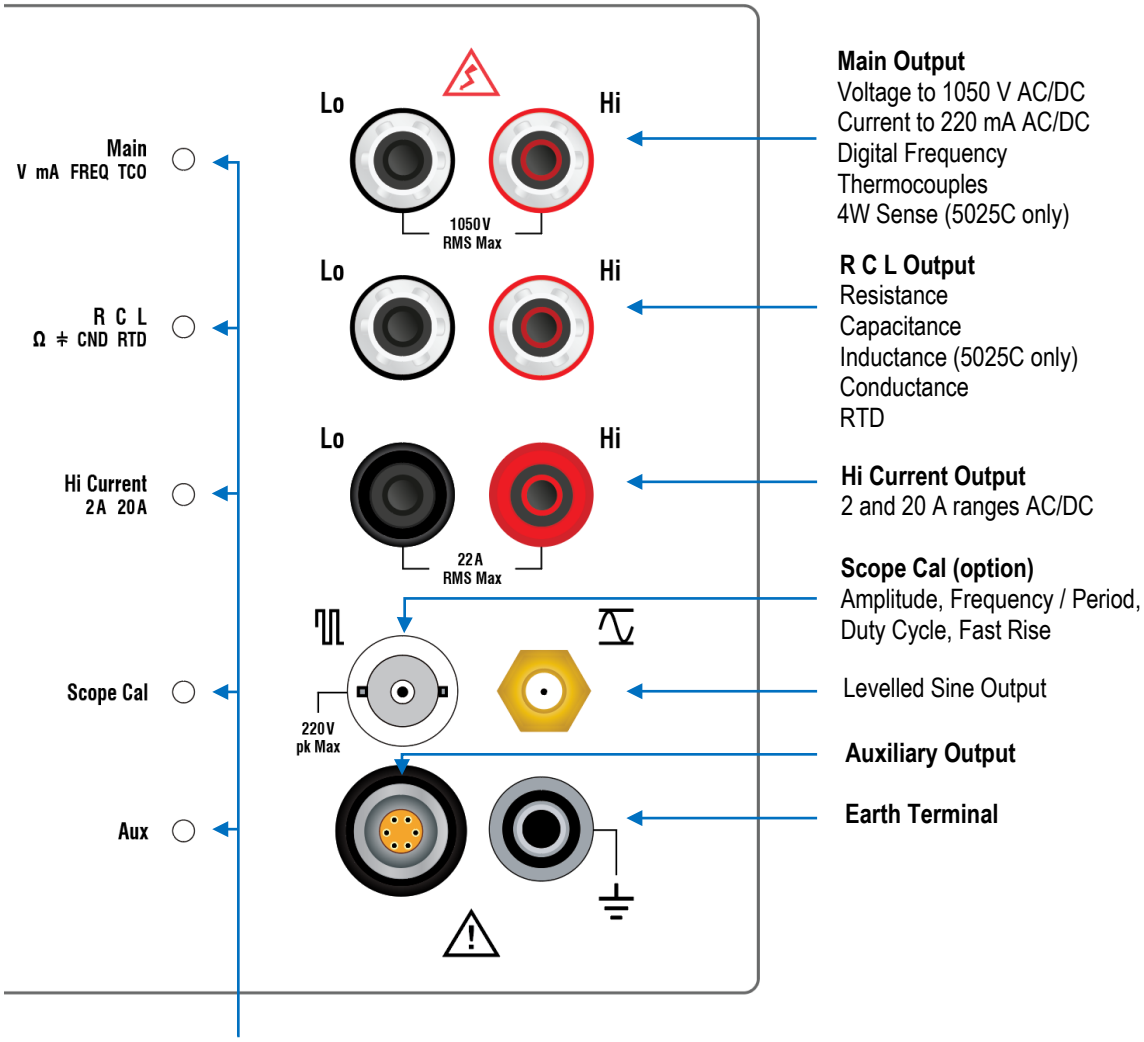
The rotary knob is used for the following:

- Range selection (DC V, DC I, AC V, AC I, Resistance).
- Entering the fixed point values of Capacitance, Conductance.
- Function settings (RTD or thermocouple type selection).
- Deviation mode.
- Settings options.



2.5 Terminals

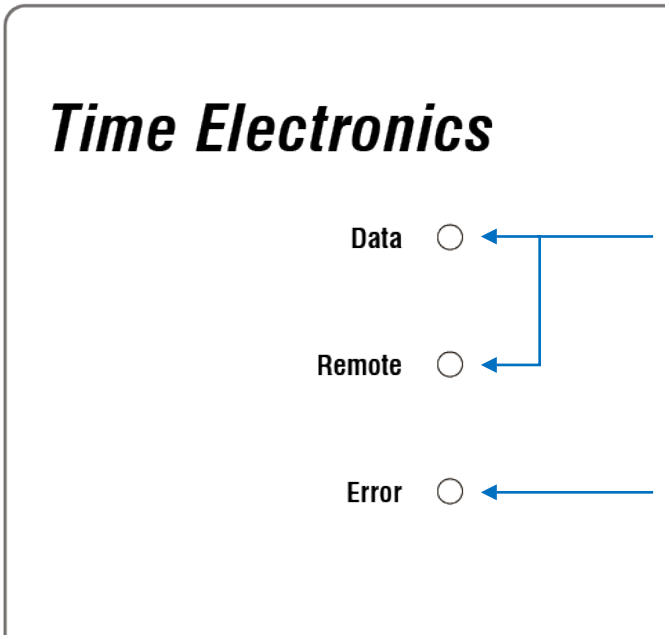
The terminal configuration will alter depending on the functions fitted to the 5025.



Terminal LED Indicators
LED indicates active terminal:

- ON when outputting
- FLASHING when in standby (no output)

2.6 Display LEDs



Data and Remote LEDs

Used to indicate remote mode activity.
See “Remote Operation” section of this manual for more details.

Error LED

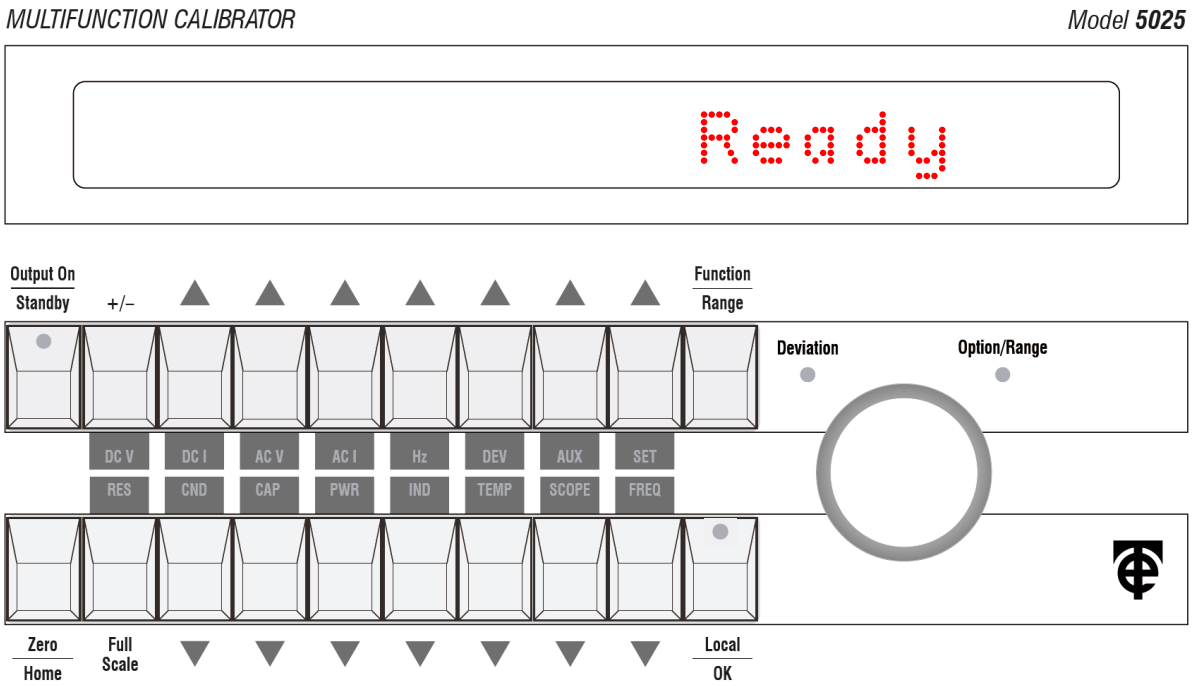
Flashes to indicate an output error condition, e.g. if no load is connected during current output.
Stays lit to indicate a remote interface error.
See “Remote Operation” section for details.

3 Front Panel Operation

3.1 Unit start-up

After switching on, the 5025 goes through a start-up routine that includes:

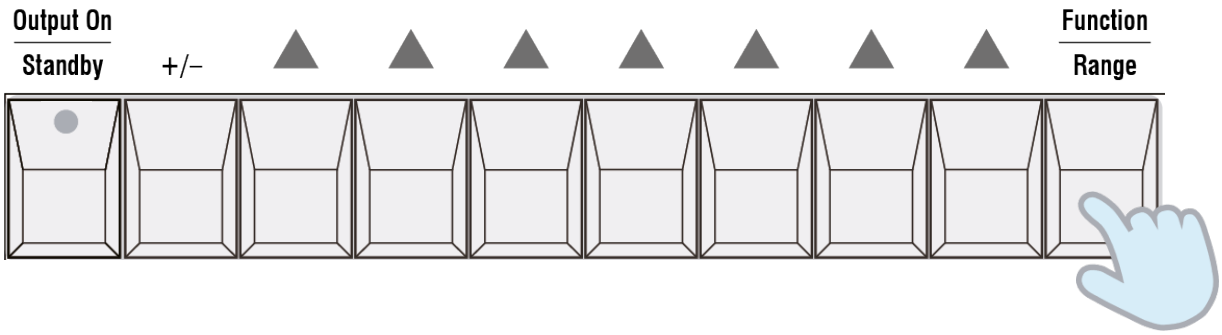
- Instrument self-test and health check routine.
- Relay cleaning routine: A sequence of contacts ‘buzzing’. This is a feature that removes any oxide build up on the contacts.
- Front panel LEDs illuminate.
- Sounds the buzzer.
- Displays the model number and the firmware version number.
- Displays the communication type and setting.
- On completion of the start-up routine, the word “Ready” is shown on the display.



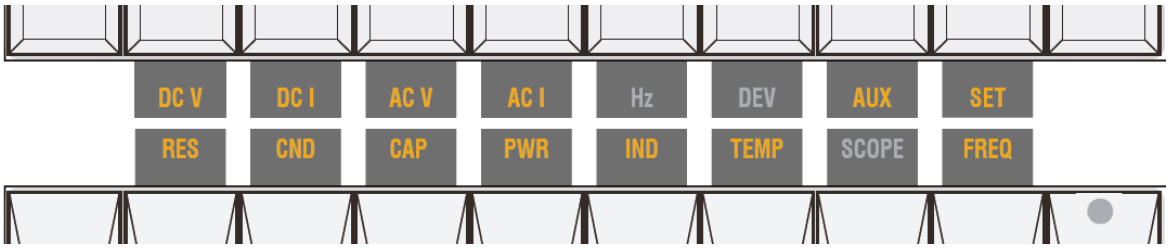
Note:
If any error codes are displayed during start-up, please refer to the “Fault Diagnosis” section later in this manual.

3.2 How to select a Function

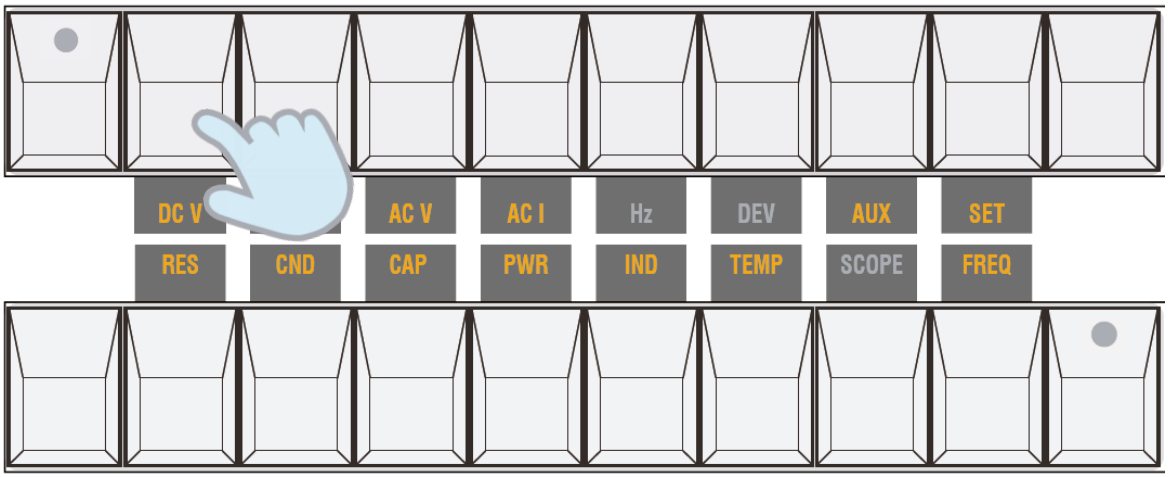
1. Press the "**Function**" button.



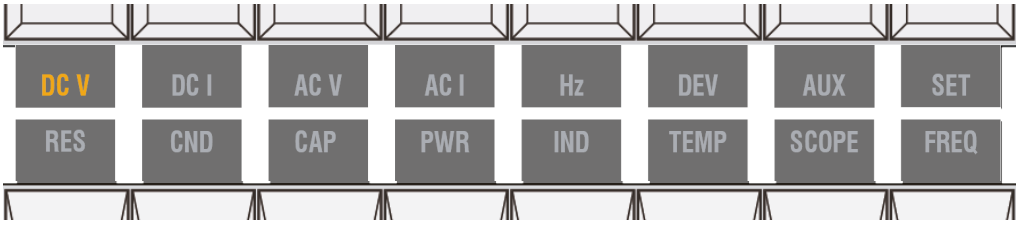
2. The function indicators will then flash to prompt a selection.



3. Select the desired function by pressing adjacent button. In this example **DC V**.



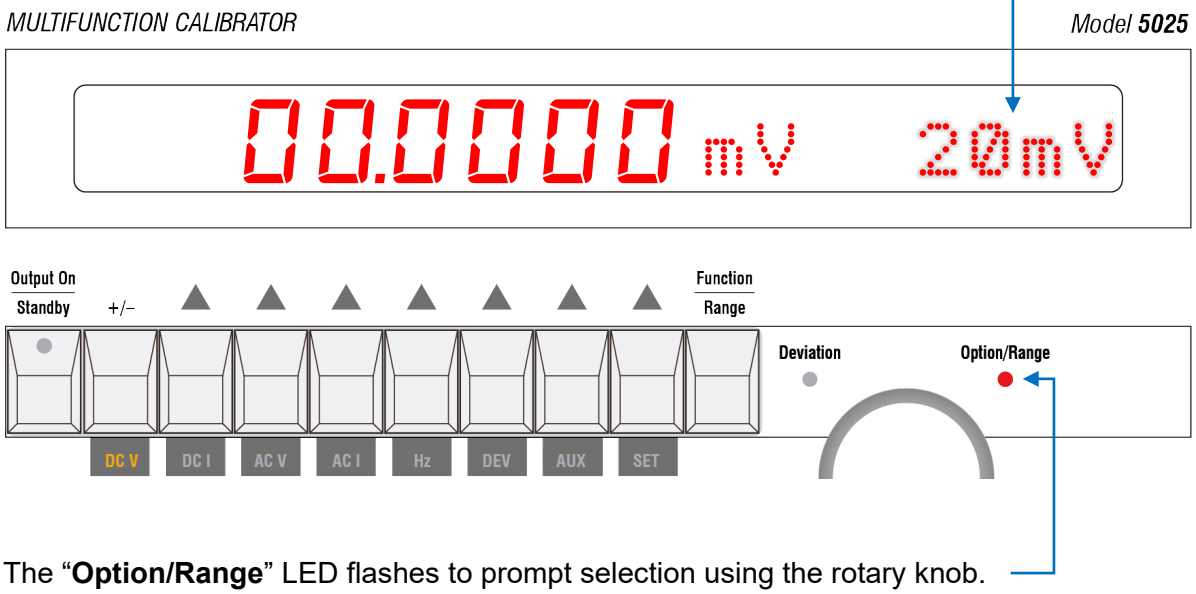
Once pressed, the function (DC V) will be the only indicator to remain illuminated, showing it is the selected function.



3.3 DC Voltage or Current **DCV DCI**

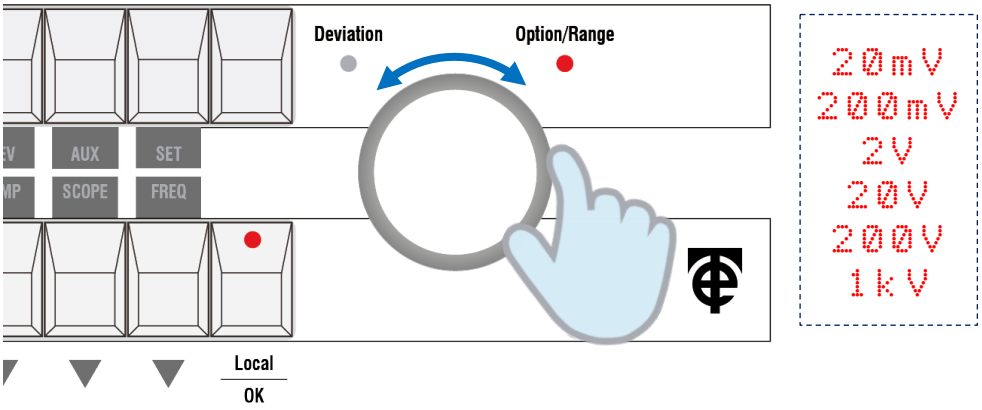
DC Voltage and DC Current have common operation steps. Shown here is DC V.

1. Press the “**Function”** button then “**DC V”** button.
2. The function range will now flash in the right-hand side of the display.

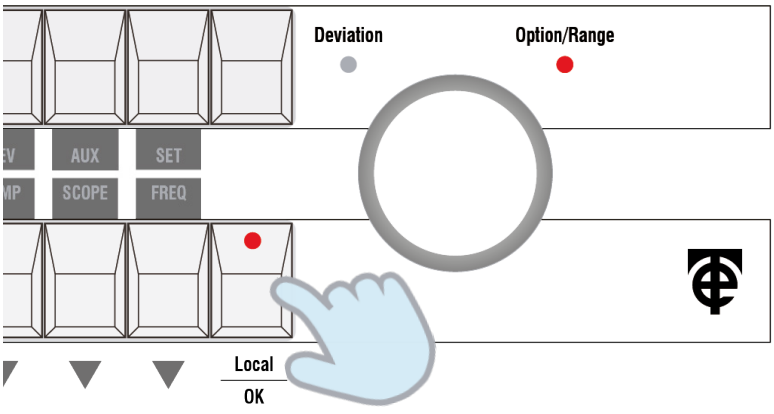


The “**Option/Range**” LED flashes to prompt selection using the rotary knob.

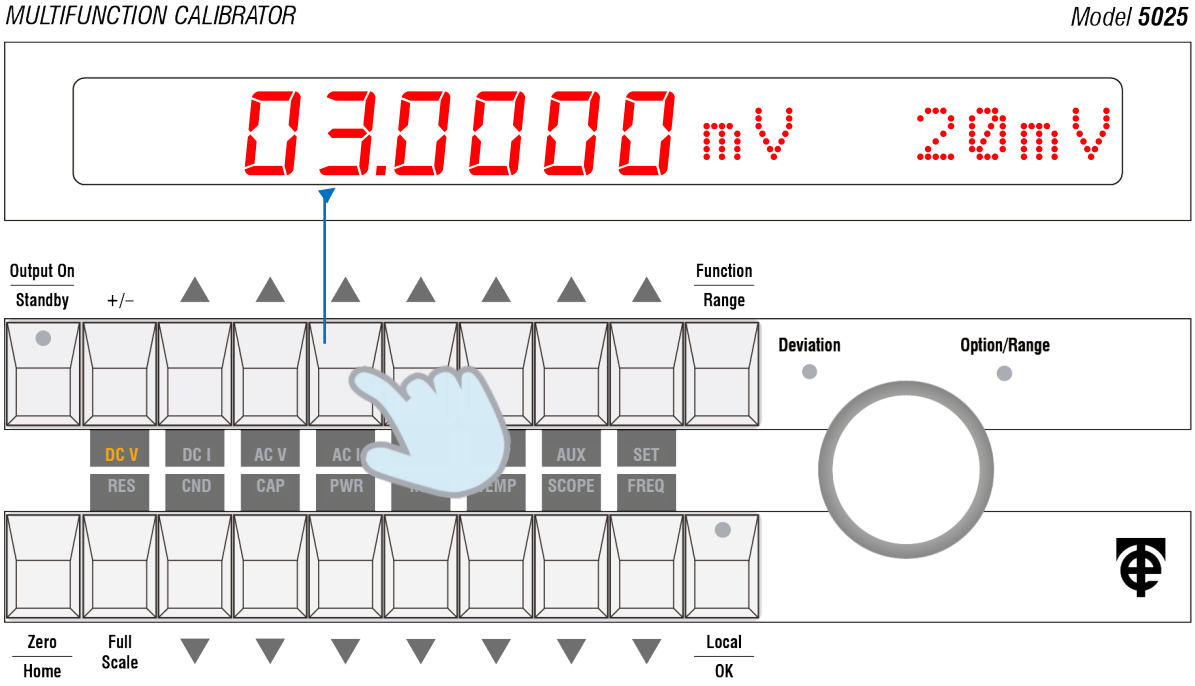
Adjust the knob to the required range.



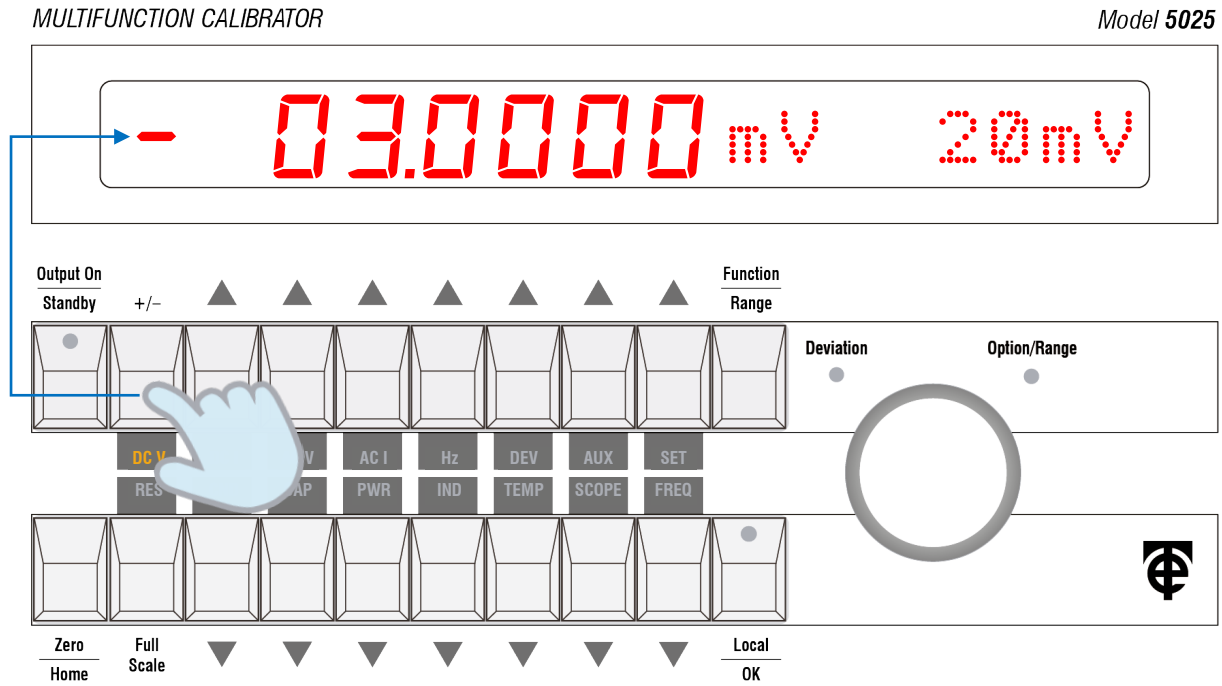
When the required range is displayed, press the “**OK**” button as highlighted by the flashing LED.



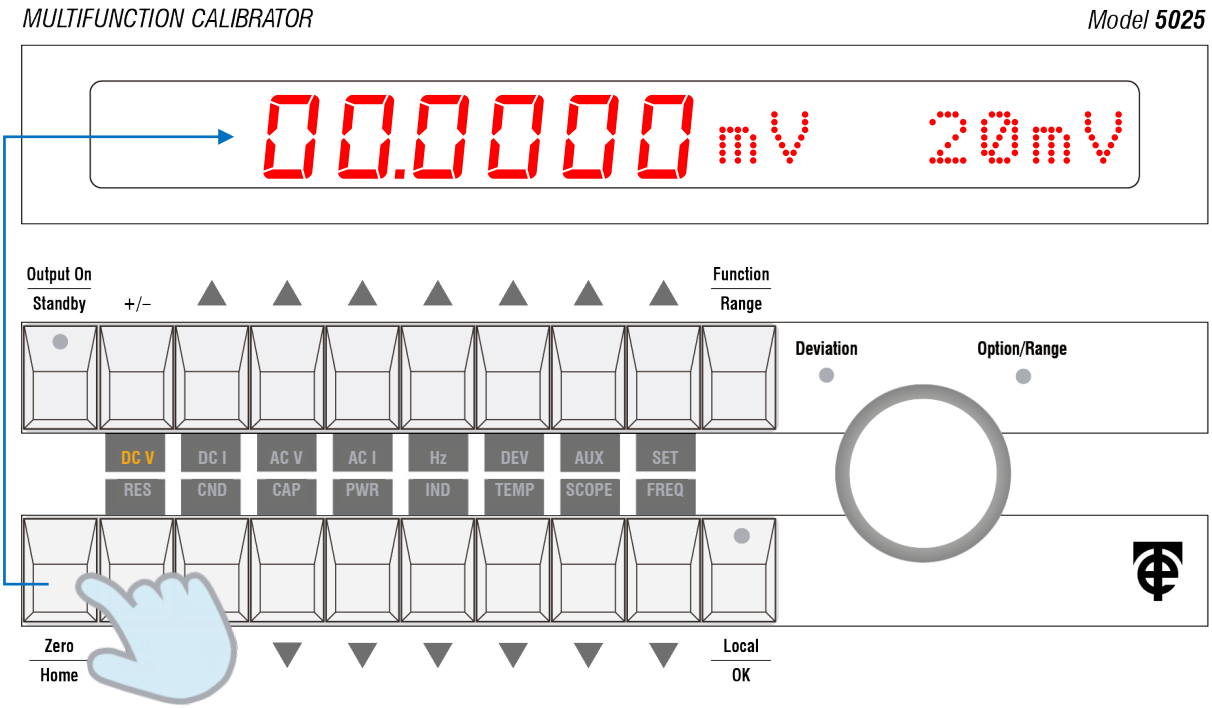
3. To set the required output voltage, increment or decrement the individual digits by using the "**Up (Δ) or Down (∇)**" buttons.



The polarity of the output can be changed by pressing the "**+/-**" button.

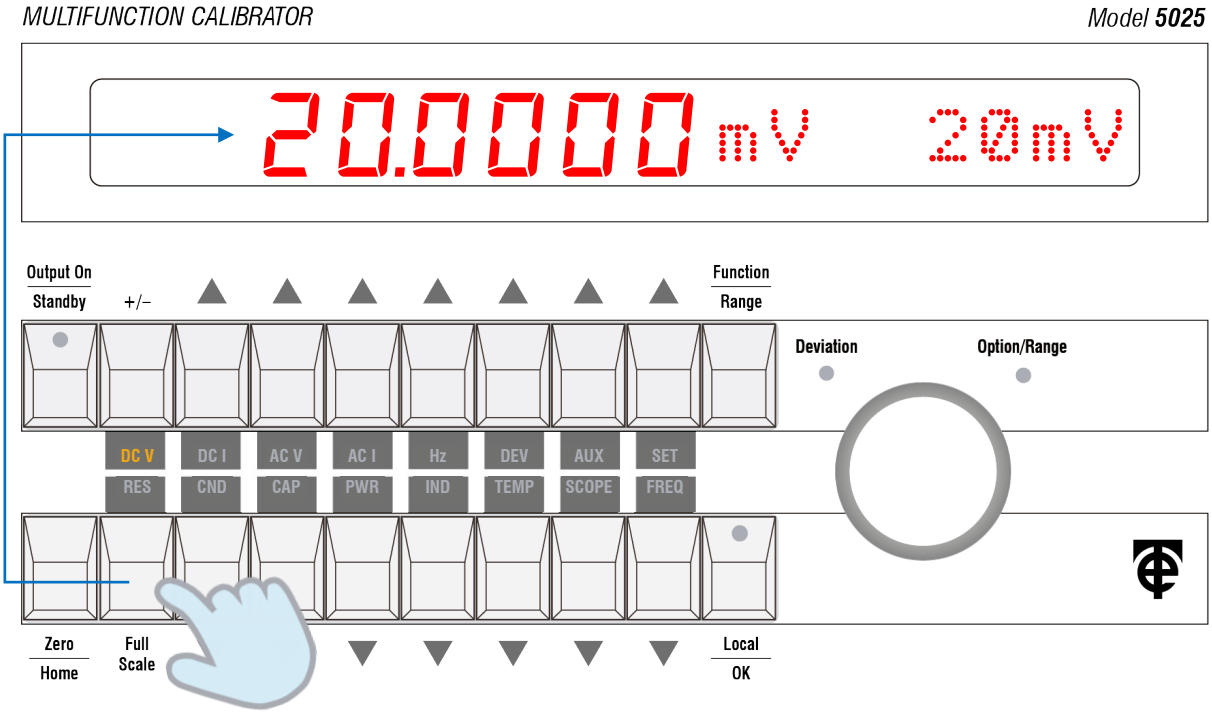


It is possible to set the output to zero in one step by pressing the “**Zero**” button.



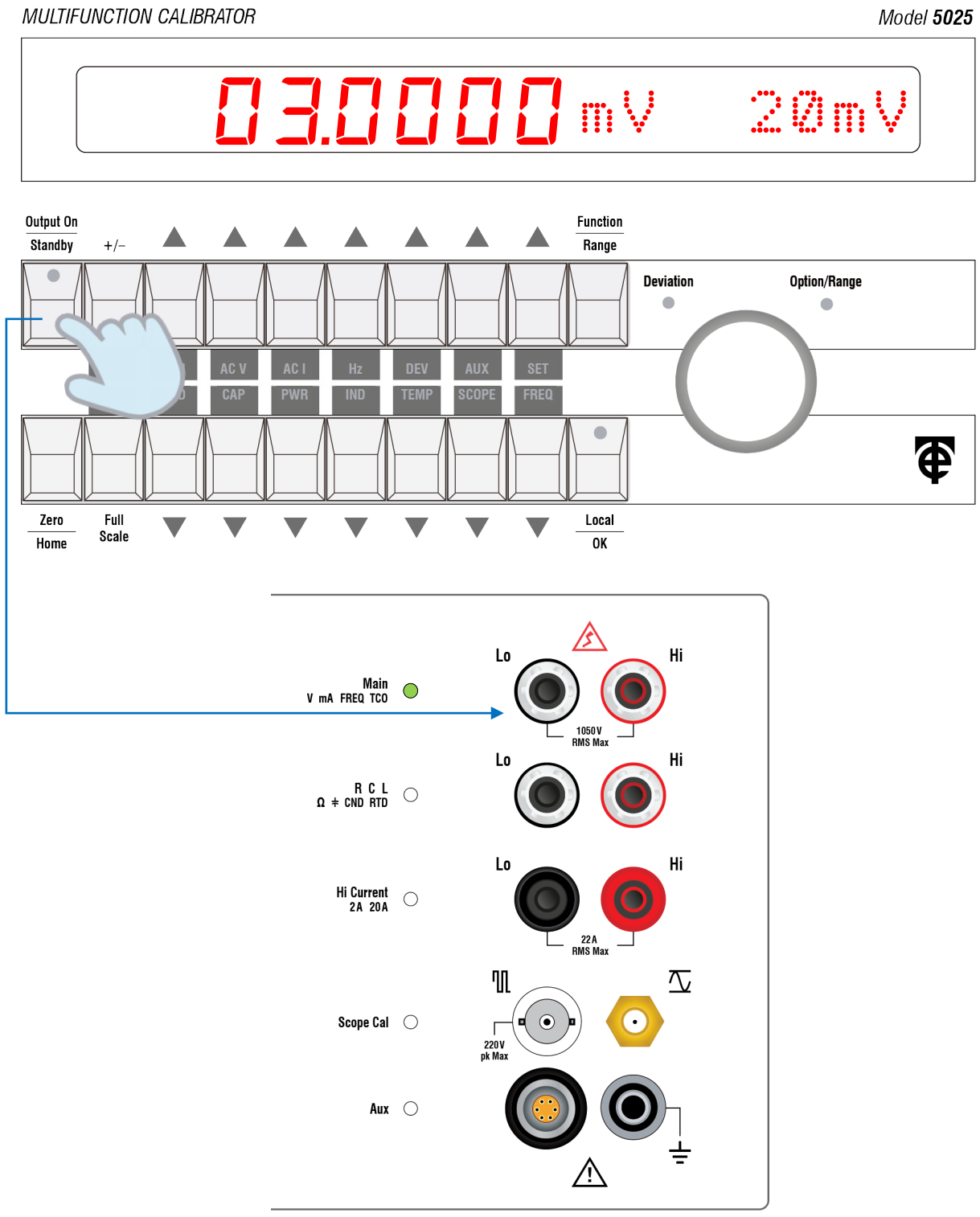
Return to the previous setting by pressing the “**Zero**” button once more.

Full-scale of the present range can also be selected in one step by pressing the “**Full Scale**” button.



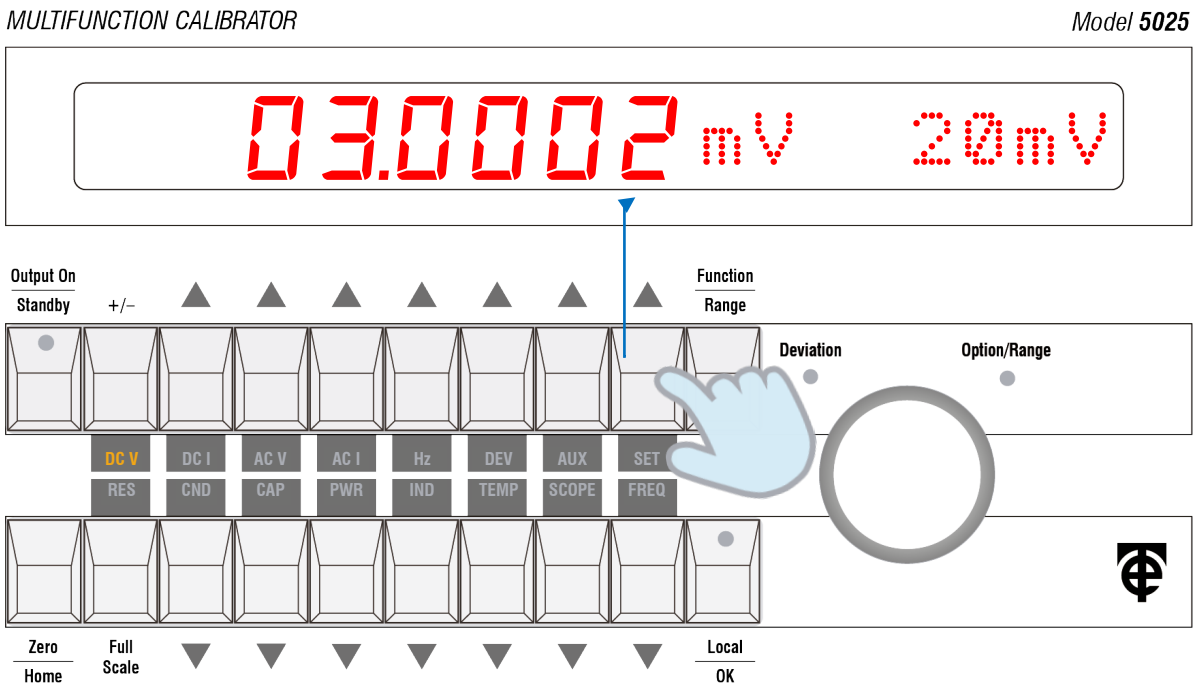
Return to the previous setting by pressing the “**Full Scale**” button once more.

4. Output is initially disconnected from the output terminals. This is indicated by the LED on the Output On button flashing (on for 25% of the time, off for 75% of the time).
   In addition, the LED beside the output terminals also flashes.
   Connect the signal to the output terminals by pressing the "**Output On**" button.

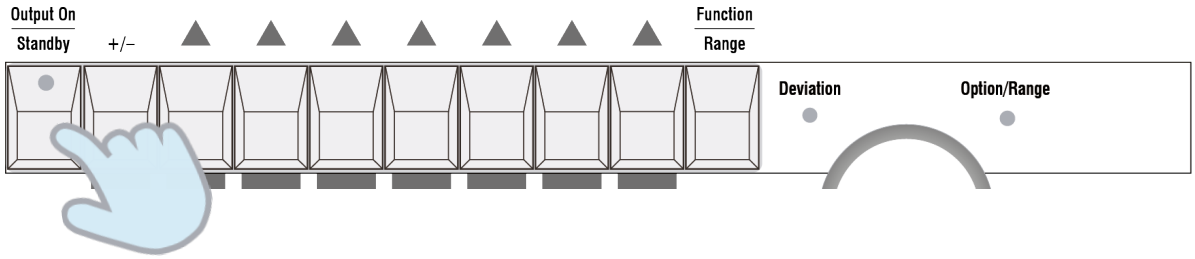


The Output button LED lights up constantly to indicate that the output terminals are live. The LED adjacent to the live output terminals also illuminates steadily.

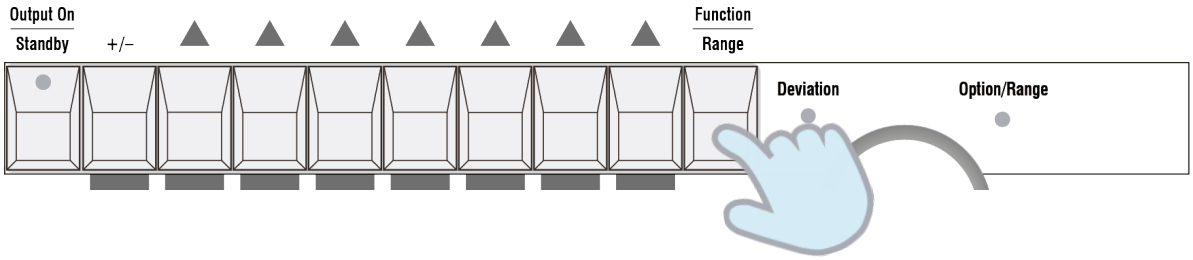
5. To change the output level, the **Up (Δ) / Down (∇)** buttons can be used at any time.



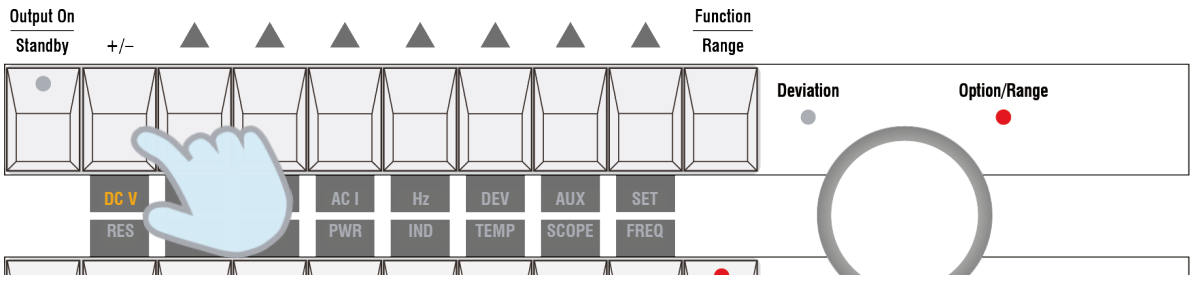
If necessary, the output can be turned off by pressing the "**Standby**" (output on) button.



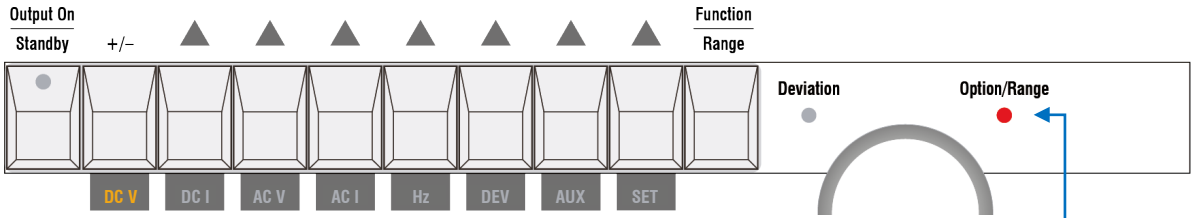
6. To change range, press the "**Function/Range**" button.



Now reselect the present function. For example, for DC volts, press the "**DC V**" button.

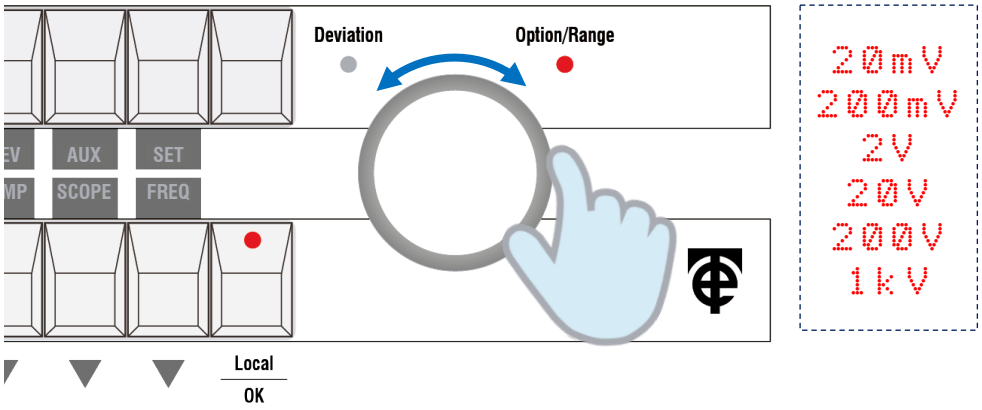


The present range will be shown flashing in the right-hand display.
Next is a repeat of step 2 to 5, but select the new range required.

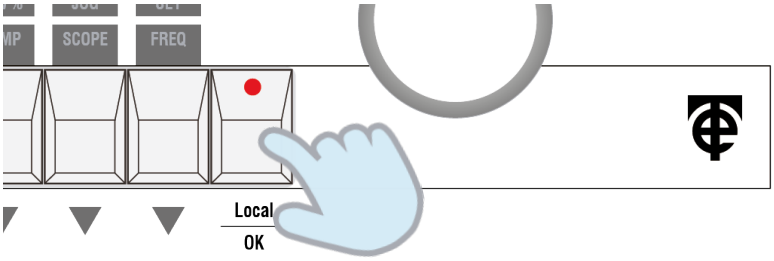


The "**Option/Range**" LED flashes to prompt selection using the rotator knob.

Adjust the knob to the required range.



When the required range is displayed (for example 200mV), press the "**OK**" button as highlighted by the flashing LED.



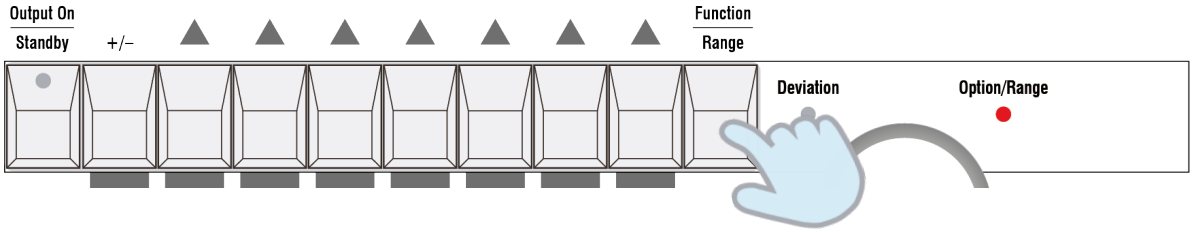
3.4 Using Deviation Mode **DEV**

This feature allows the output to be deviated in percentage steps. There are 3 options:

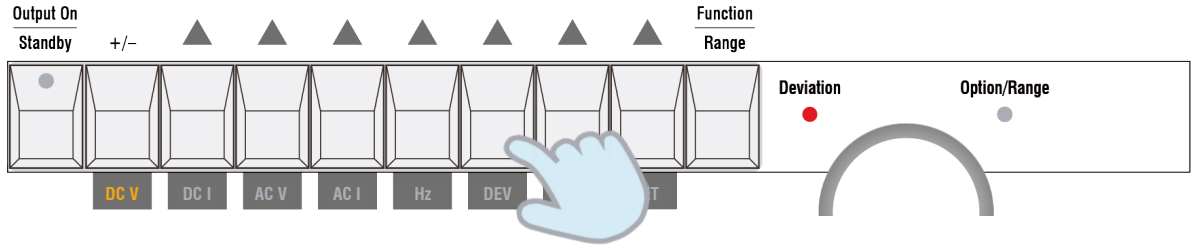
- Fine deviation: 0.001%
- Medium deviation: 0.01%
- Coarse deviation: 0.1%

The preference can be set in the Setup menu. *See Setup Menu section*.

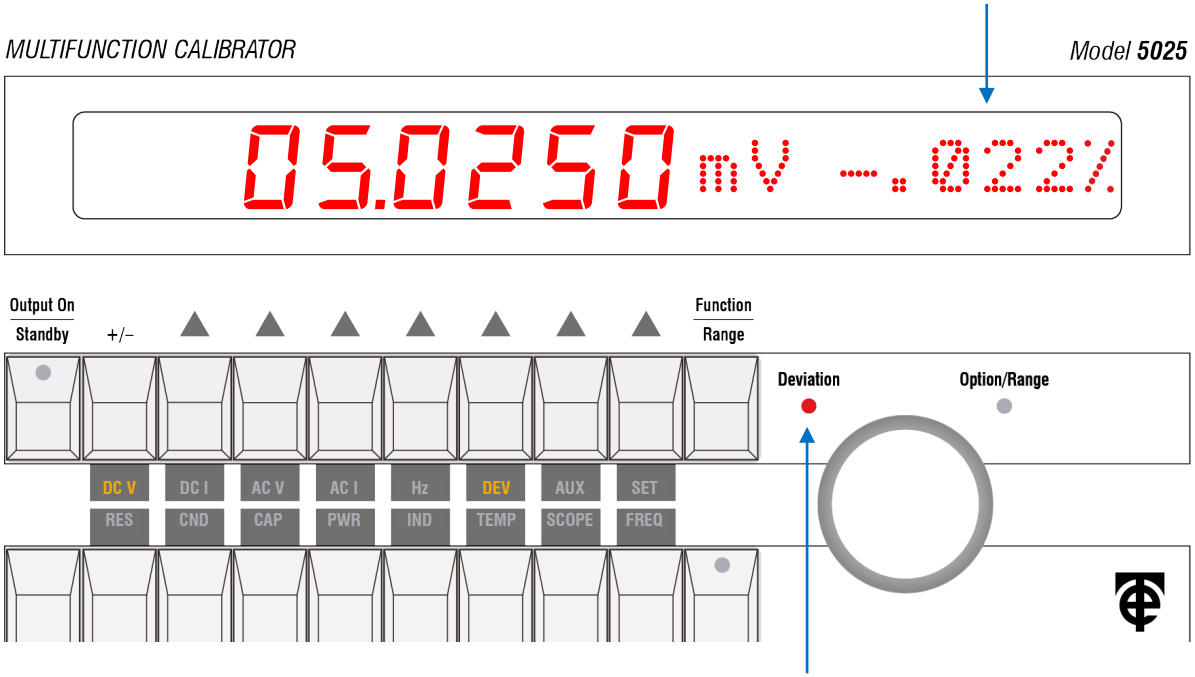
1. To use Deviation mode start by pressing the "**Function**" button.



2. Then press the "**DEV**" button.

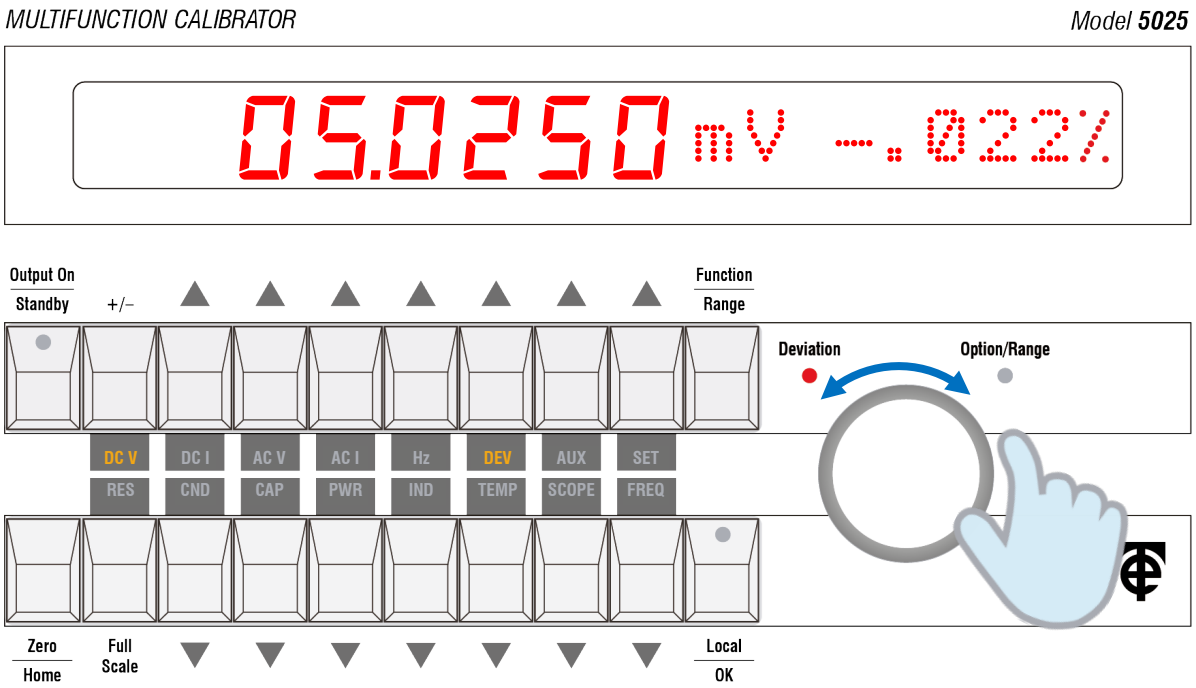


The right-hand side of the display then shows the deviation figure in + or - % terms.



Deviation mode is highlighted by illumination of the "Deviation" LED. This prompts the use of the rotary knob.

3. To adjust the deviation, turn the rotary knob clockwise to increase, and anticlockwise to decrease.



Note: It is not possible to adjust the deviation if the output setting is zero, since the deviation is a percentage of value. The deviation will be displayed as zero percent in this case.

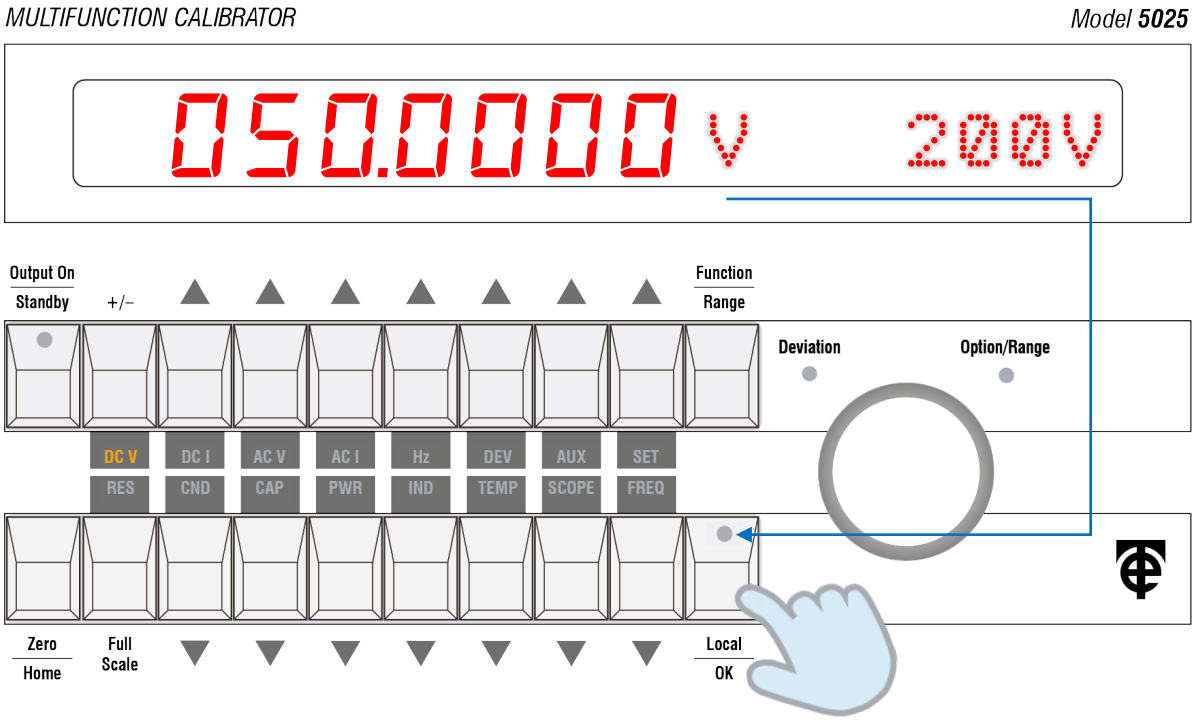
4. To turn off Deviation mode press the "**Function**" button followed by the "**DEV**" button.

3.5 Safety Interlock Feature

For voltages above 40V there is a safety interlock feature incorporated. This ensures that the user must perform an additional action before the signal will appear at the terminals.

The feature is indicated by both the readout units designator and OK button LED flashing.

To accept the voltage, press the "**OK**" button.



Also, at voltages above 40V the user is warned by an internal beeper sounding every 4 seconds.

3.6 DCHV Normal and Hi Drive Modes

Normal mode provides the highest accuracy and stability for the 200 V and 1kV DC ranges. A Hi Drive mode is selectable that provides a higher output current to power more demanding instruments such as analogue meters and voltage detectors. This is mode is activated using the Setup Menu option or via remote command.

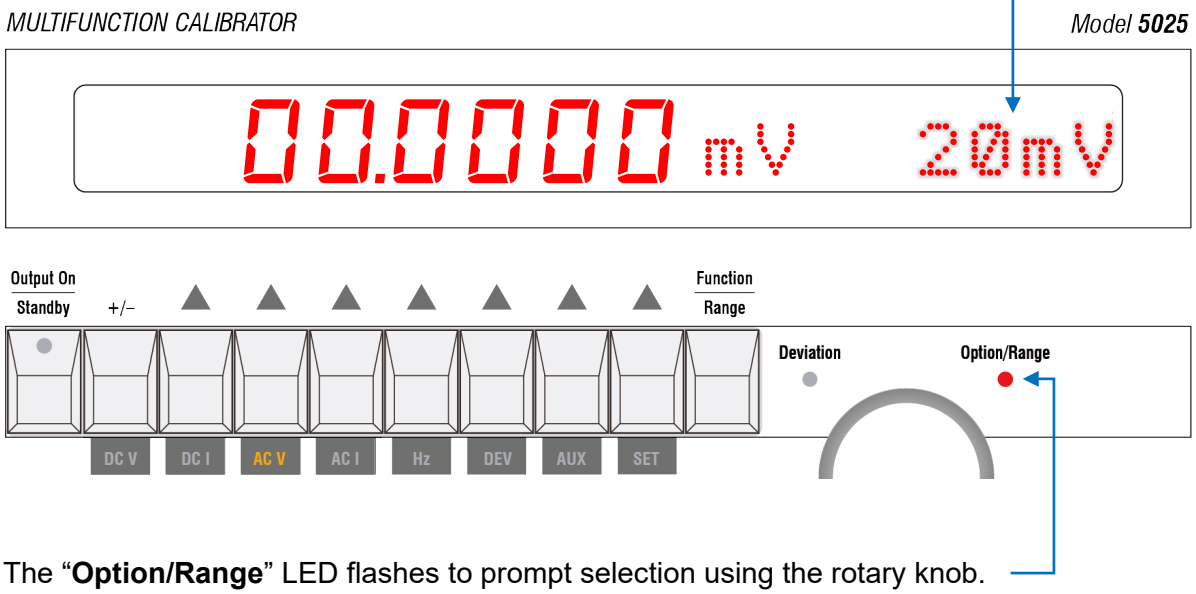
When Hi Drive mode is active a symbol is shown next to the range.

See the Setup Options chapter for further details on activating this mode.

3.7 AC Voltage or Current **ACV ACI**

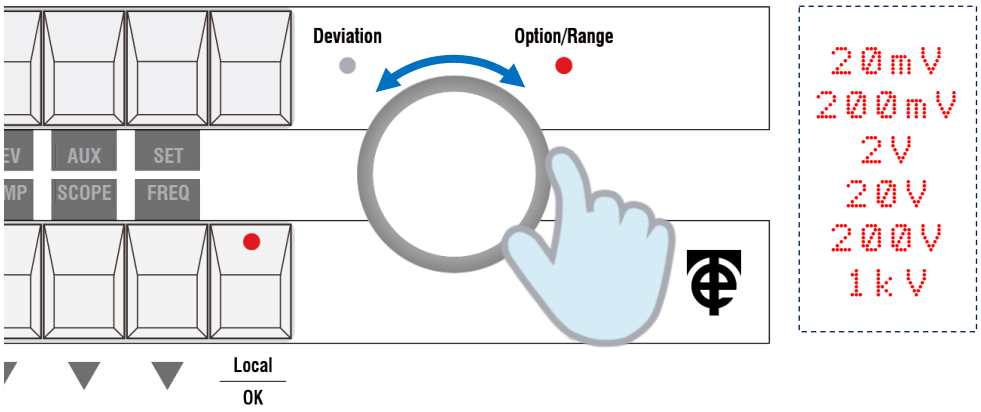
AC Voltage and AC Current have common operation steps. Shown here is AC V.

1. Press the "**Function"** button then "**AC V"** button.
2. The function range will now flash in the right-hand side of the display.

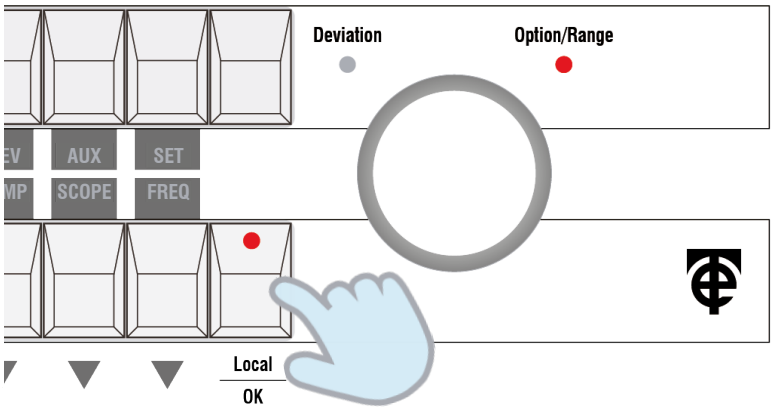


The "**Option/Range**" LED flashes to prompt selection using the rotary knob.

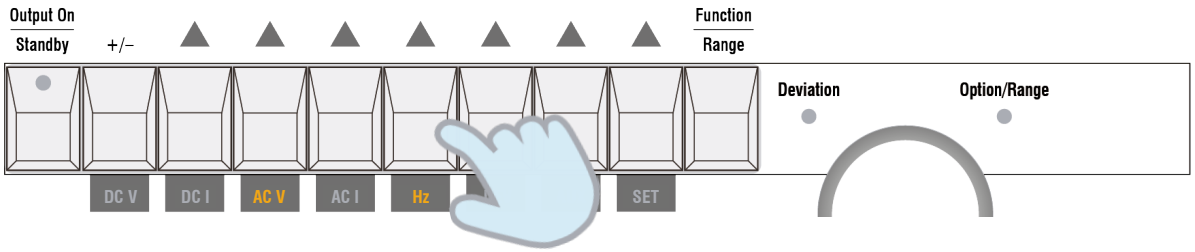
Adjust the knob to the required range.



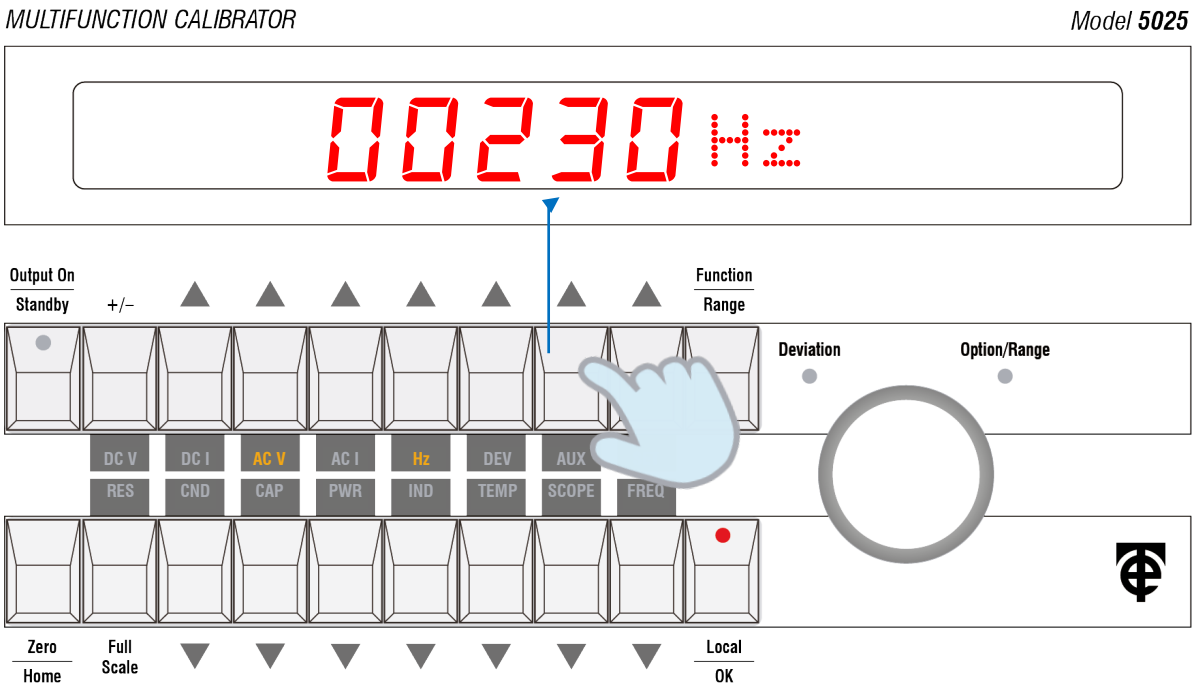
When the required range is displayed, press the "**OK**" button as highlighted by the flashing LED.



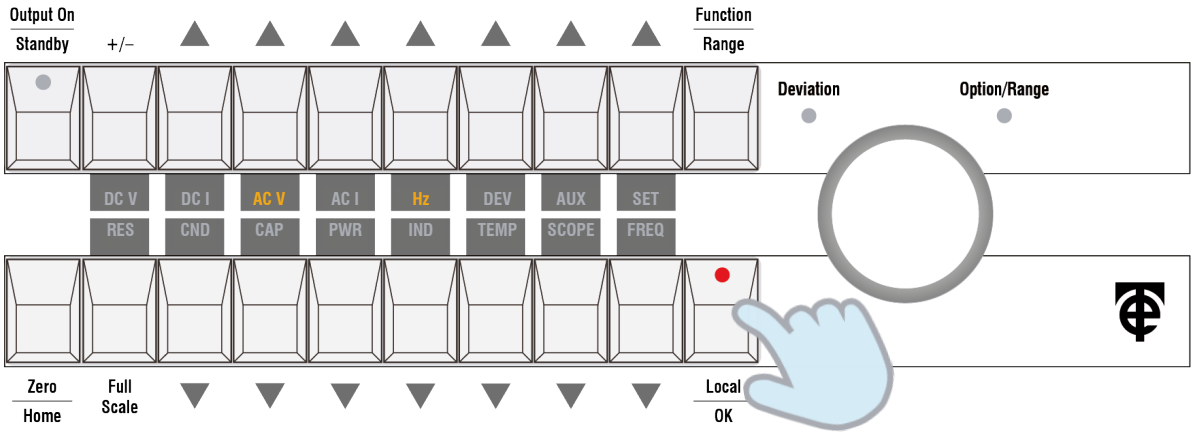
3. The frequency can be set by pressing "**Function**" button followed by the "**Hz**" button.



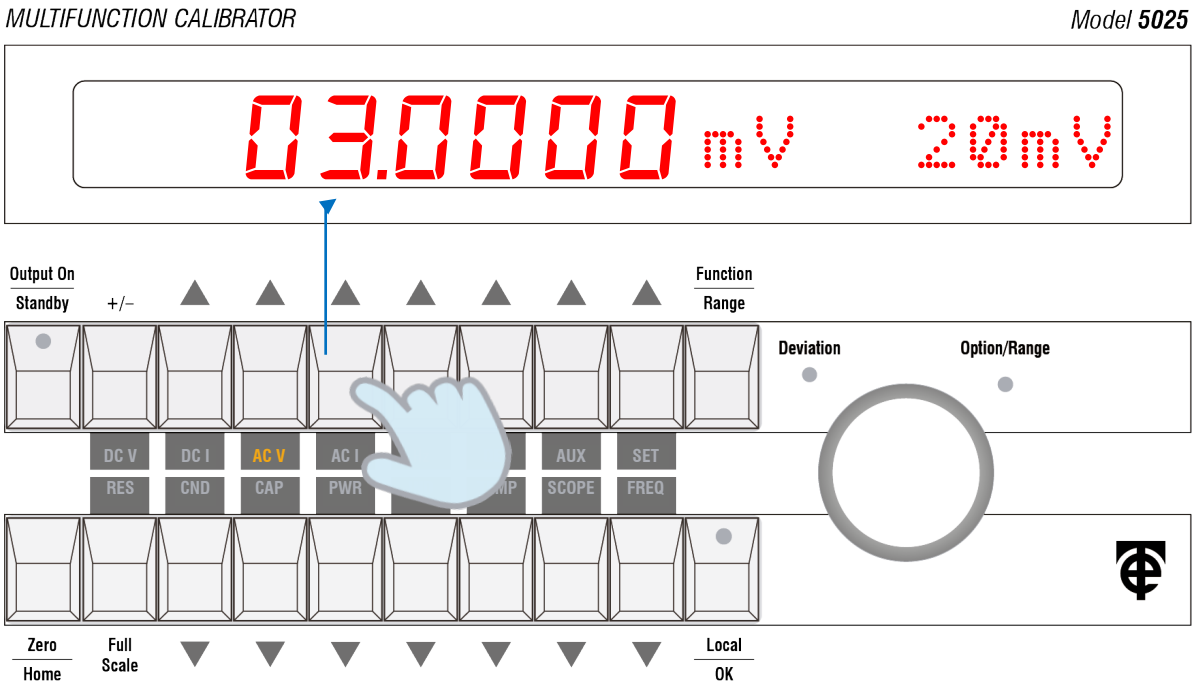
4. Select the frequency using the "**Up (Δ) / Down (∇)**" buttons.



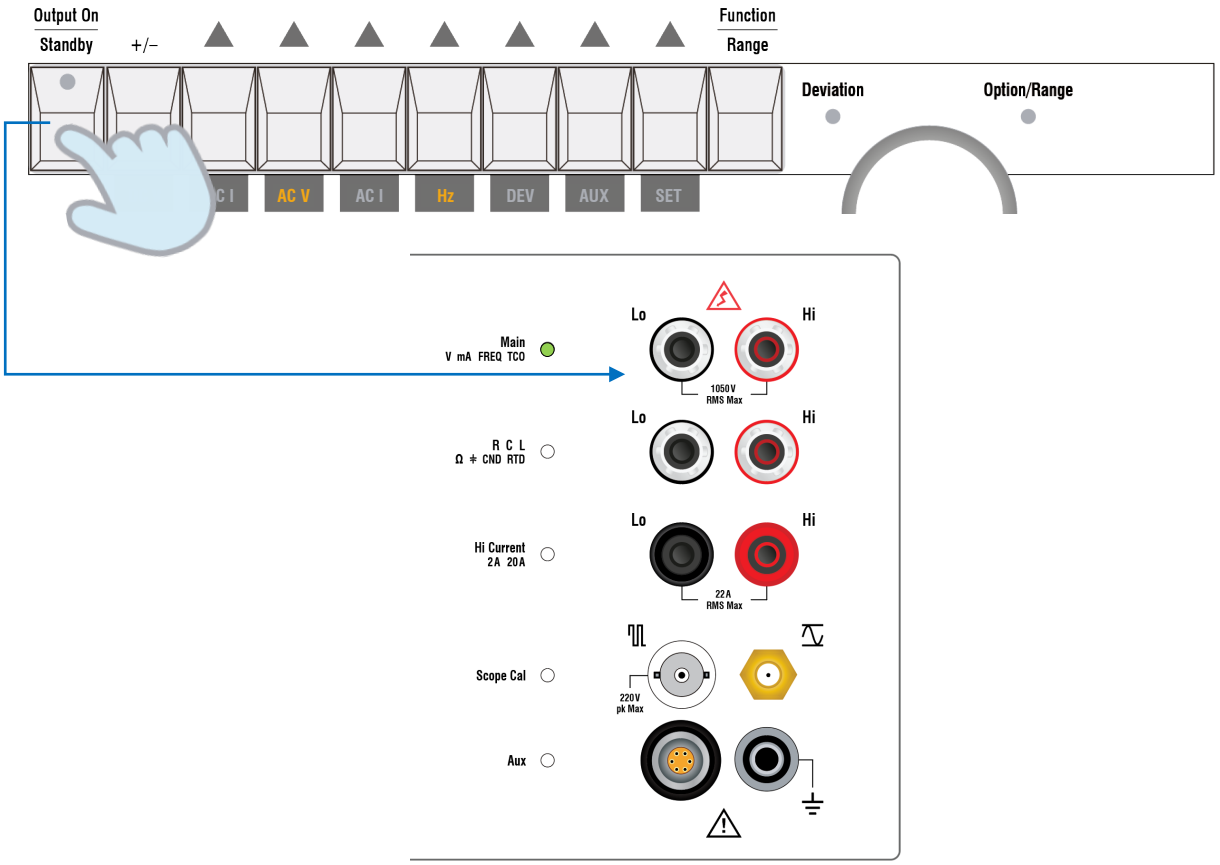
Then press the "**OK**" button to set it.



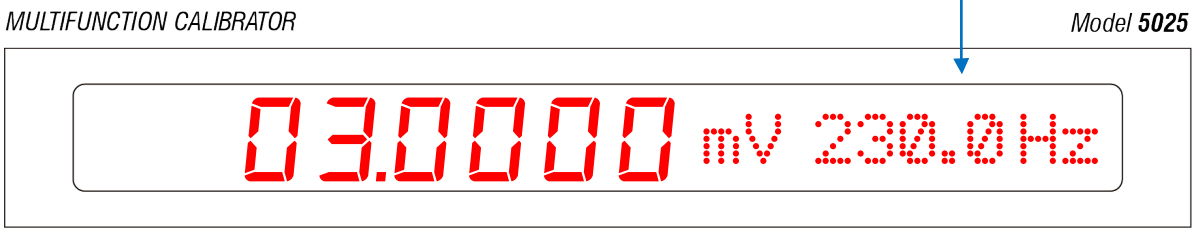
5. Once the frequency is set, the display readout will show the output voltage and operating range. The output value can be entered using the "**Up (∆) / Down (∇)**" buttons.



6. Output is initially disconnected from the output terminals. The LED on the Output On button flashes to indicate this. The LED beside the output terminals also flashes. Connect the signal to the output terminals by pressing the "**Output On**" button.

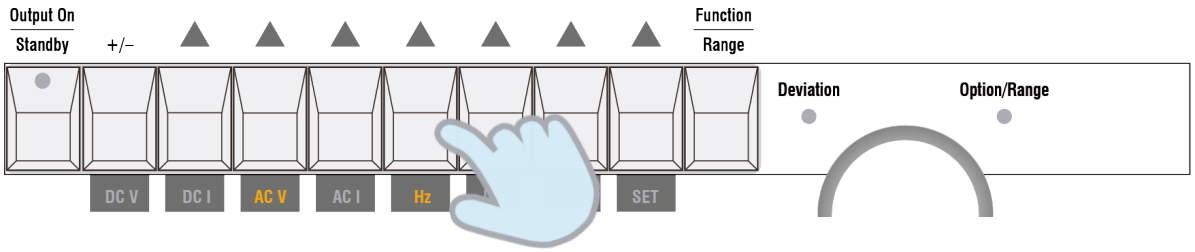


7. When the output is switched on, the operating range is no longer displayed and the set frequency is shown.

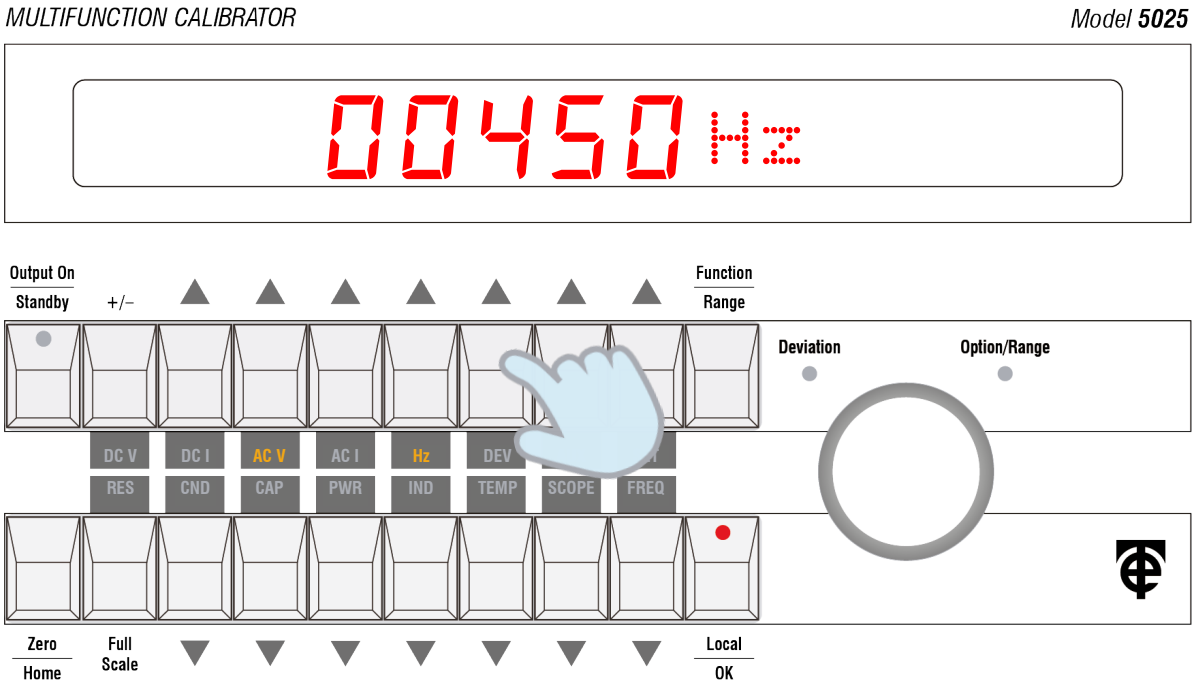


This is a user feature that is set by default. It can be disabled in the set-up menu if preferred.

8. The frequency setting can be adjusted in real time when the output is on.
   This is done by the pressing "**Function**" button followed by the "**Hz**" button.



9. Then adjust the frequency using the "**Up (Δ) / Down (∇)**" buttons whilst the output is on.



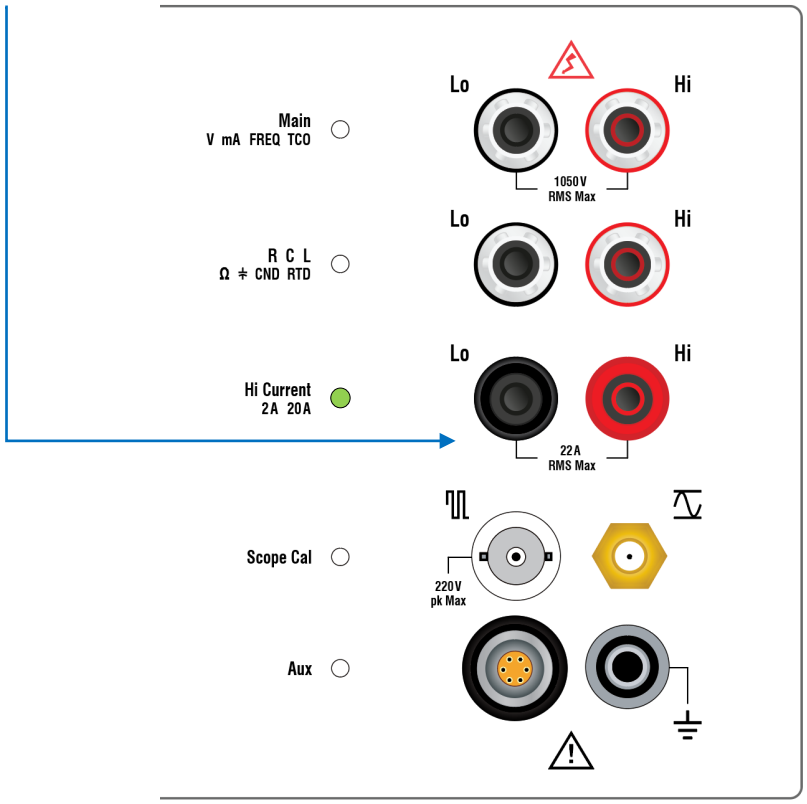
Press the "**OK**" button to exit the real time frequency setting mode.

The frequency adjustment utilizes an interlock feature. For ACV, this requires the user to press the OK button when changing between frequencies above or below 20 kHz.

For ACI interlock is set at 100 Hz for the 2 and 20 A ranges and 1 kHz for all others.

Notes on High Current Output

It should be noted that for the 2 A and 20 A ranges the output signal is routed via the "**Hi Current**" terminals.



Warning: Currents in excess of 10A can be dangerous and leads with the correct current rating should be used. Do not leave high current switched for more than 20 Minutes.

3.8 Operational Error Messages

3.8.1 Current

O/P Error

This will occur if the current compliance voltage is exceeded. The output is also automatically put into standby. The most common situation for this error is when nothing is connected to the output terminals and the calibrator is attempting to drive an open circuit.

HiAmp °C

If the high current ranges are in constant use the over temperature warning will appear and the output will disconnect.

To monitor this temperature select the Int Temp > HI CURR setup option as described in the *Setup Menu section*. Normal operation is between 30 and 60 °C. Above 80 °C the cut-out will activate. After the cut-out has activated it is recommended not to use the high ranges until the temperature has returned to the normal operating temperature range.

3.8.2 Voltage

HV VTrip

The over voltage trip has activated during operation of the high voltage ranges. Capacitive loading can cause this error.

HV ITrip

The over current trip has activated during operation of the high voltage ranges. The HV ITrip error message usually means too much current being drawn by the unit under test, causing the HV function to trip.

If you are using DCV, the DCHV Hi Drive option provides more drive current for the 200 V and 1 kV ranges but sacrifices some accuracy. This option is set from the settings menu DCHV > Hi Drive.

3.9 Turn Coil Ranges **TurnCoil**

The DCI and ACI functions have extra ranges to complement the 9780 clamp coil.
The current amplitudes displayed are multiplied by the range selected.

These ranges are:

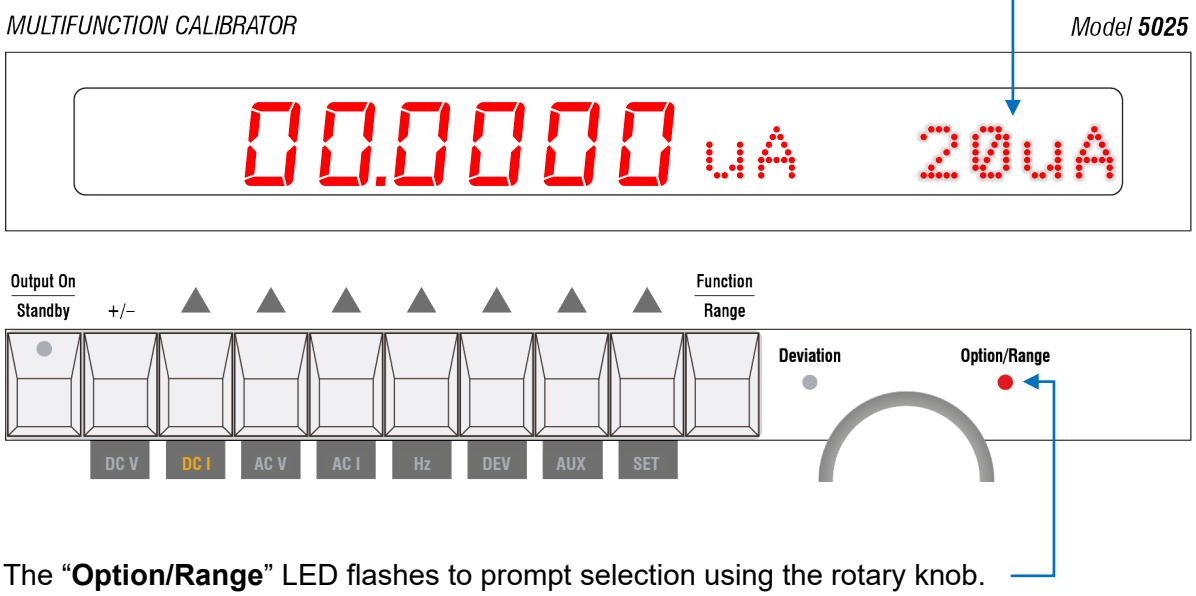
- 2 A x 1 and 20 A x 1
- 2 A x 5 and 20 A x 5
- 2 A x 50 and 20 A x 50

The inductance loading for DCI is higher when using the Turn Coil ranges.
The frequency for ACI is limited to 100 Hz.

To use the Turn Coil ranges, go to the DC I or AC I function.

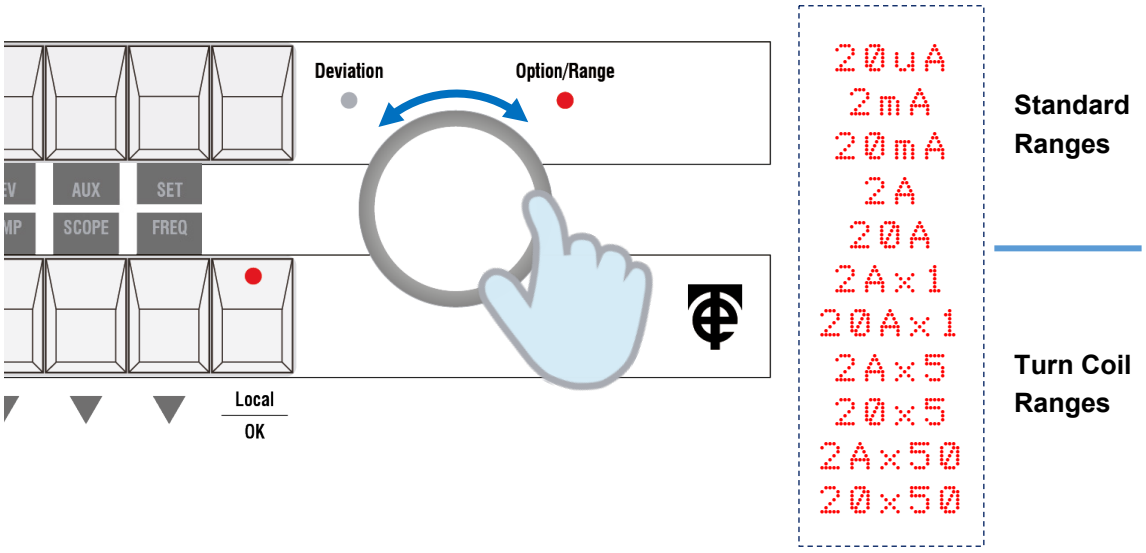
1. Press the “**Function”** button then “**DC I”** button.

2. The function range will now flash in the right-hand side of the display.



The “**Option/Range**” LED flashes to prompt selection using the rotary knob.

Adjust the knob to the required range. In addition to the standard ranges, the six extra Turn Coil ranges will be selectable.



When the required range is displayed, press the “**OK**” button as highlighted by the flashing LED.

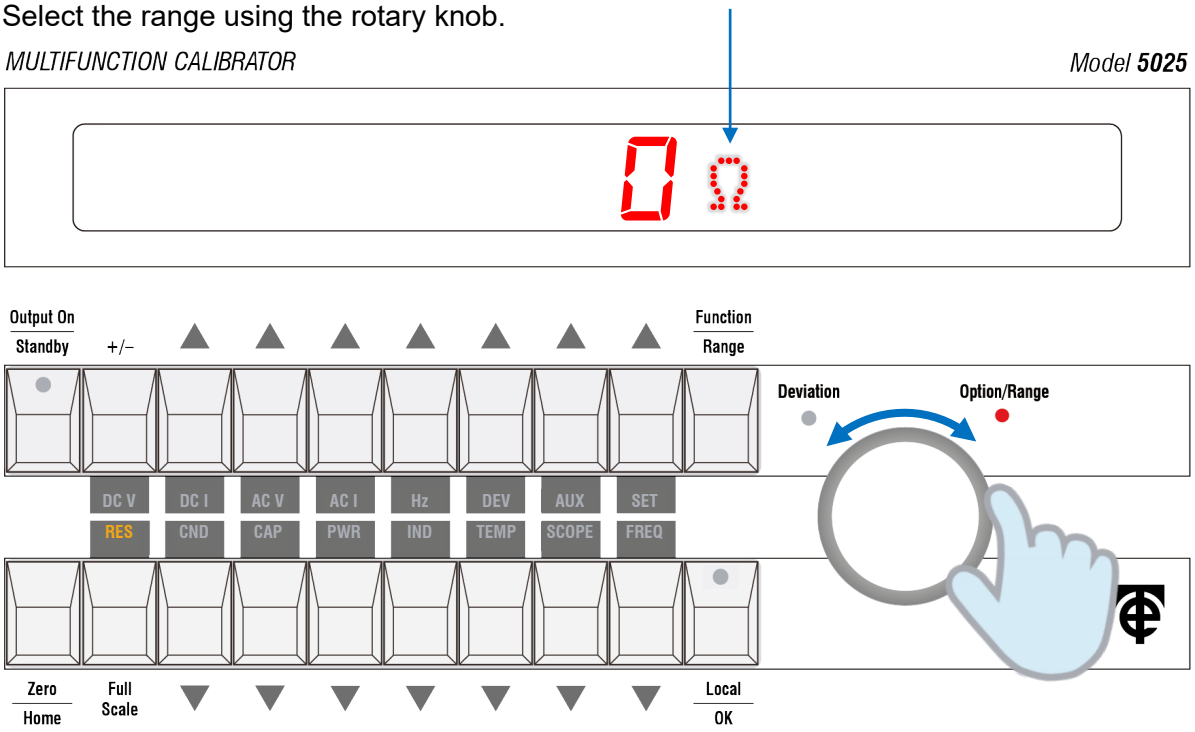
Example Turn Coil range selected:

3.10 Resistance **RES**

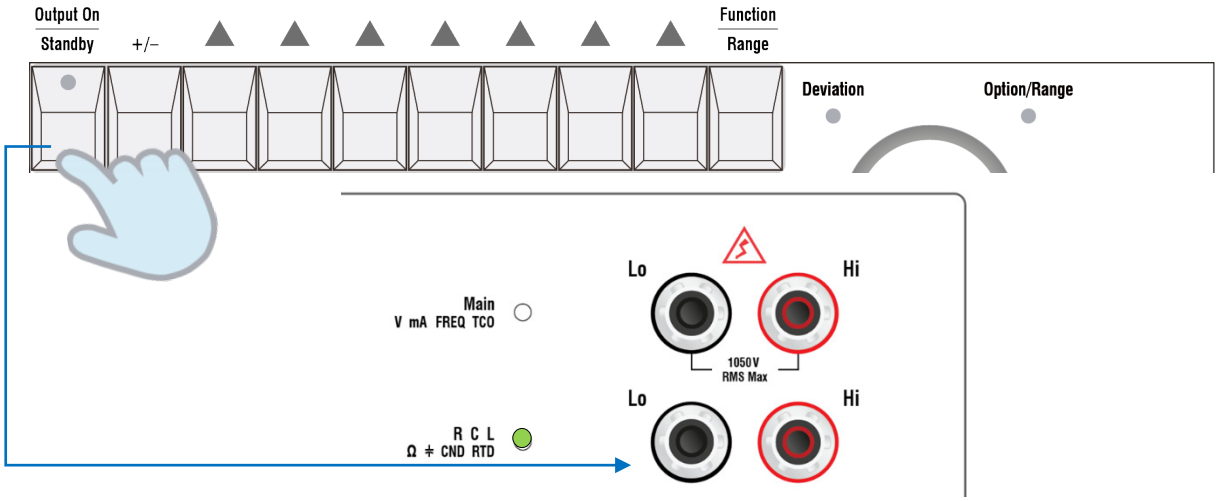
To select the resistance function, press the "**Function**" button followed by "**RES**" button.

5025C only: Use the rotary knob to select either 2-wire (variable) or 4-wire (decade) resistance.
4-wire resistance is a set of fixed resistors that are displayed on the readout as calibrated values. Selection of each value is made using the rotary knob.

The variable resistance ranges are indicated by the flashing ohms units on the display readout.
Select the range using the rotary knob.



Press the "**OK**" button once the required range is selected.
Then set the required resistance value using the "**Up (Δ) / Down (∇)**" buttons.
Deviation mode is not available. To use press the "**Function**" button, then "**DEV**" button.
Connect the output to the terminals by pressing the "**Output On**" button.



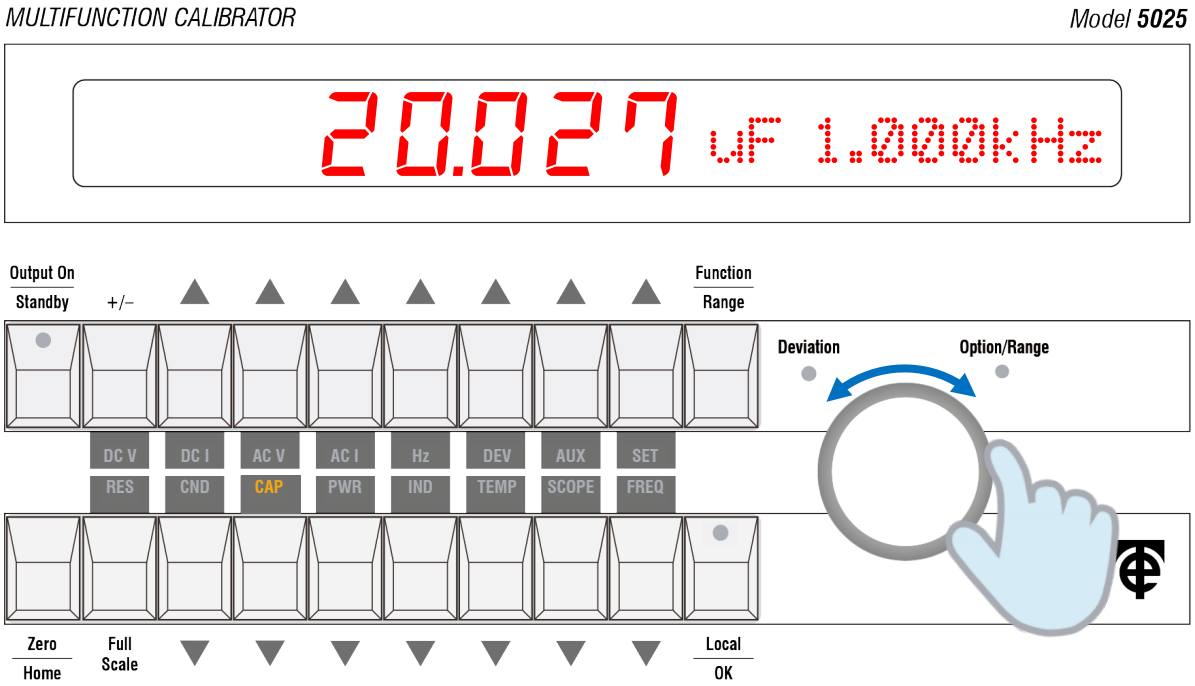
Note: External lead resistance must be subtracted from the final output value.

3.11 Capacitance **CAP**

To select the capacitance function, press the "**Function**" button followed by "**CAP**" button.

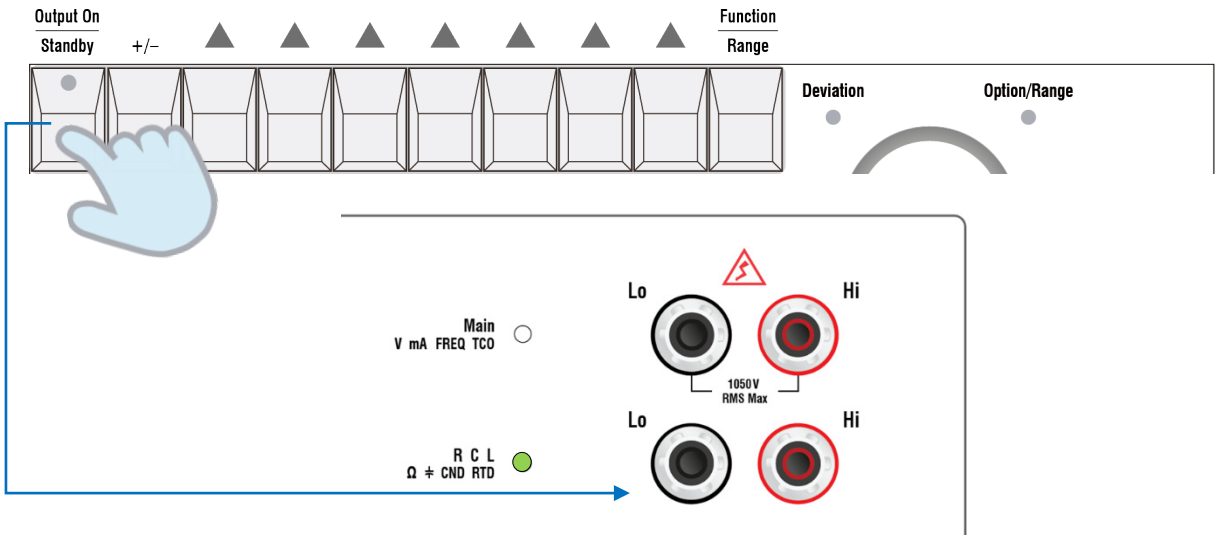
Note: This function is a set of fixed capacitors that are displayed on the readout as calibrated values.

Select the value required using the rotary knob.



Press the "**OK**" button once the required value is selected.

Connect the output to the terminals by pressing the "**Output On**" button.

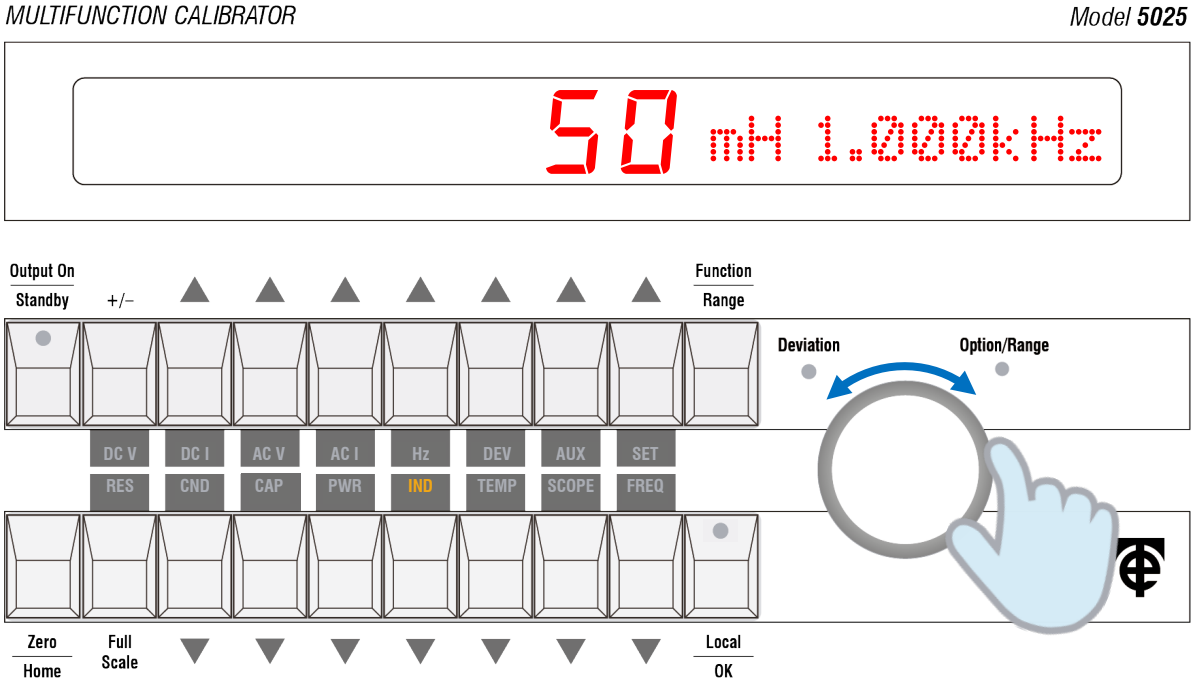


3.12 Inductance **IND**

The inductance function is only fitted to 5025C models.
To select the inductance function, press the “**Function**” button followed by “**IND**” button.

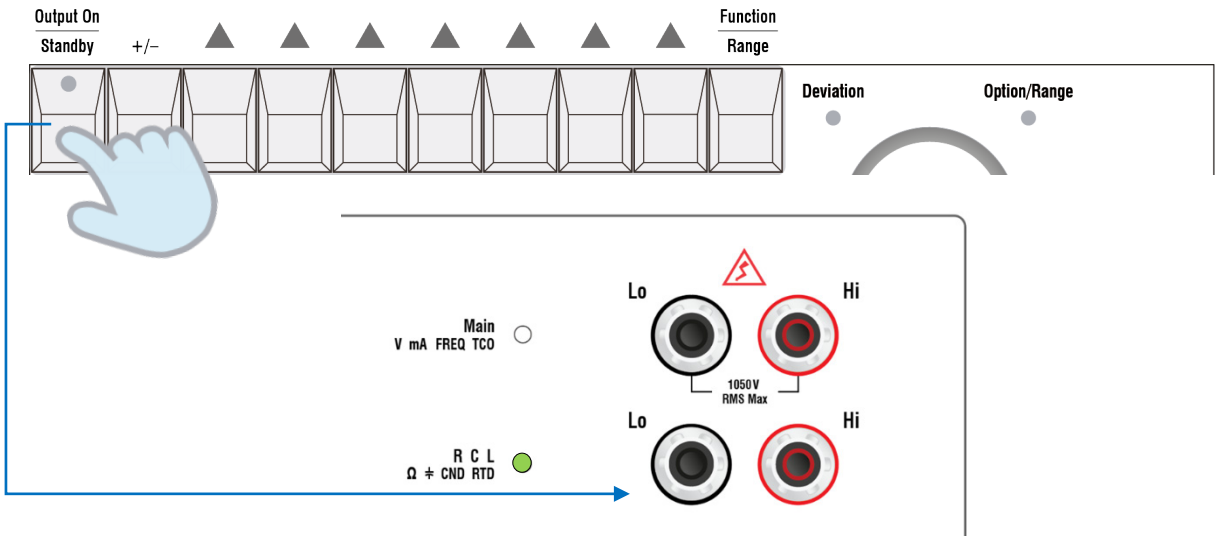
Note: This function is a set of fixed inductors that are displayed on the readout as calibrated values.

Select the value required using the rotary knob.



Press the “**OK**” button once the required value is selected.

Connect the output to the terminals by pressing the “**Output On**” button.

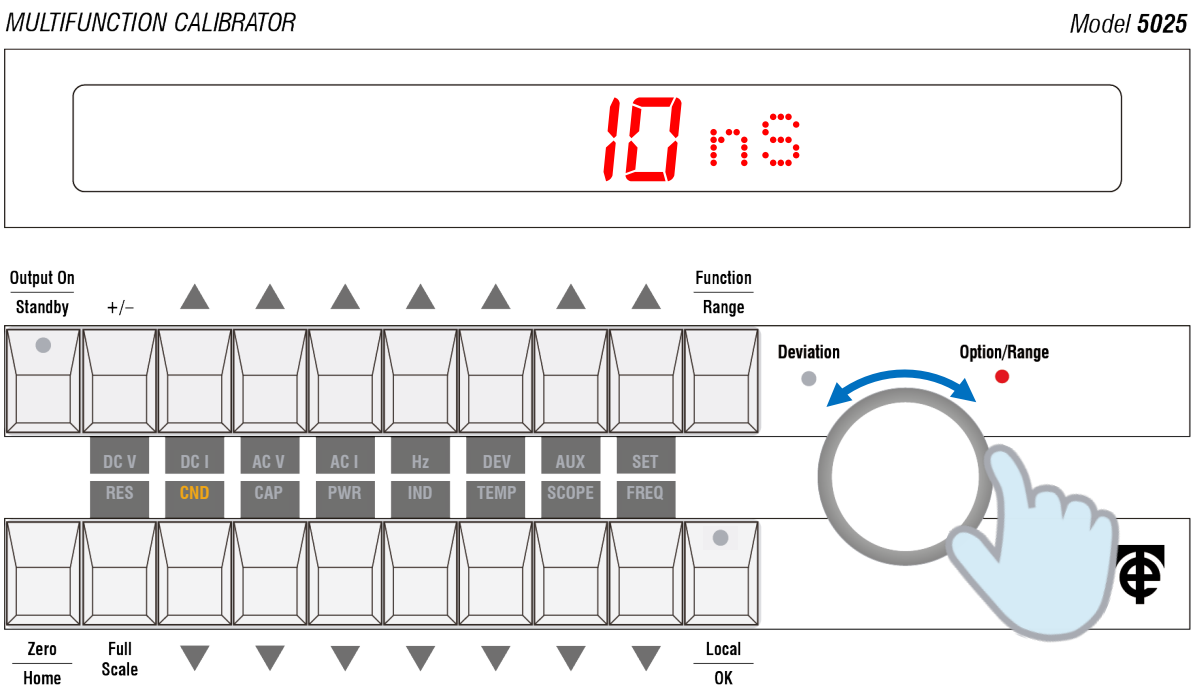


3.13 Conductance **CND**

To select the conductance function, press the “**Function**” button followed by “**CND**” button.

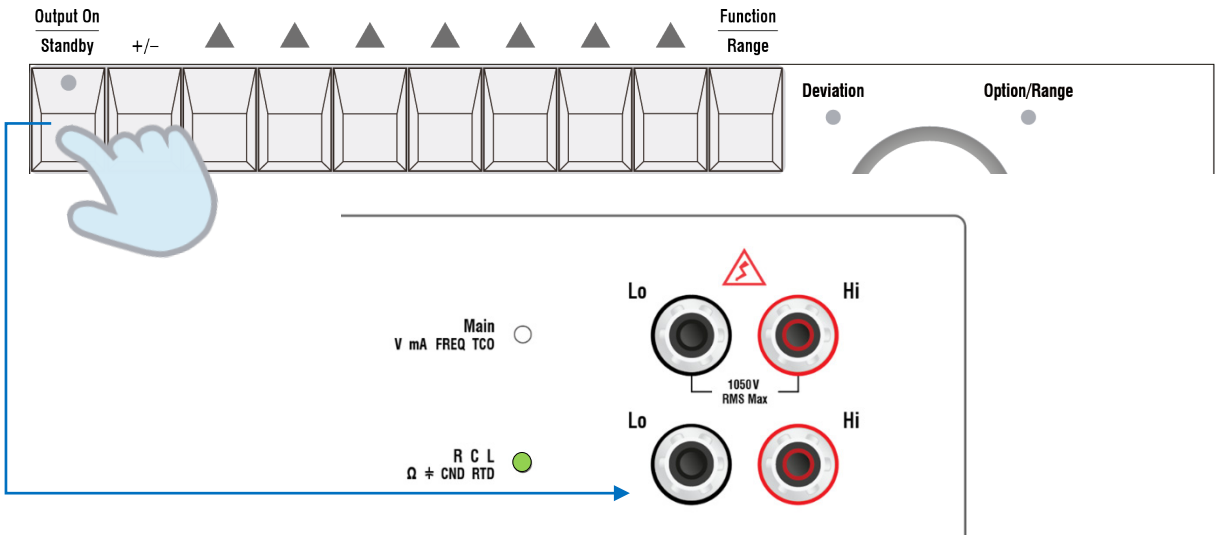
5025C only: Use the rotary knob to select either 2-wire or 4-wire conductance.

The set values can be selected using the rotary knob.



Press the “**OK**” button once the required range is selected.

Connect the output to the terminals by pressing the “**Output On**” button.

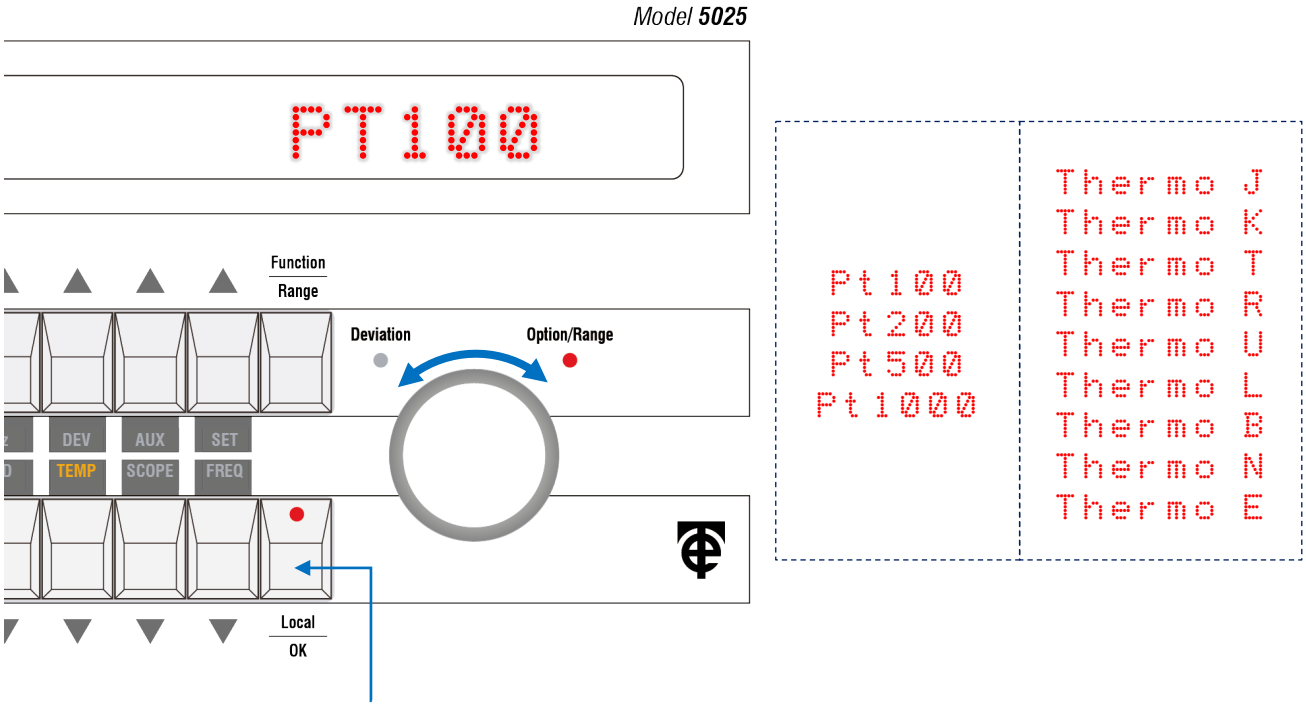


3.14 Simulated Temperature **TEMP**

To use the temperature function, press the "**Function**" button followed by "**TEMP**" button.

The display flashes to prompt selection of the temperature element required.

Turn the rotary knob to the required thermocouple or RTD.

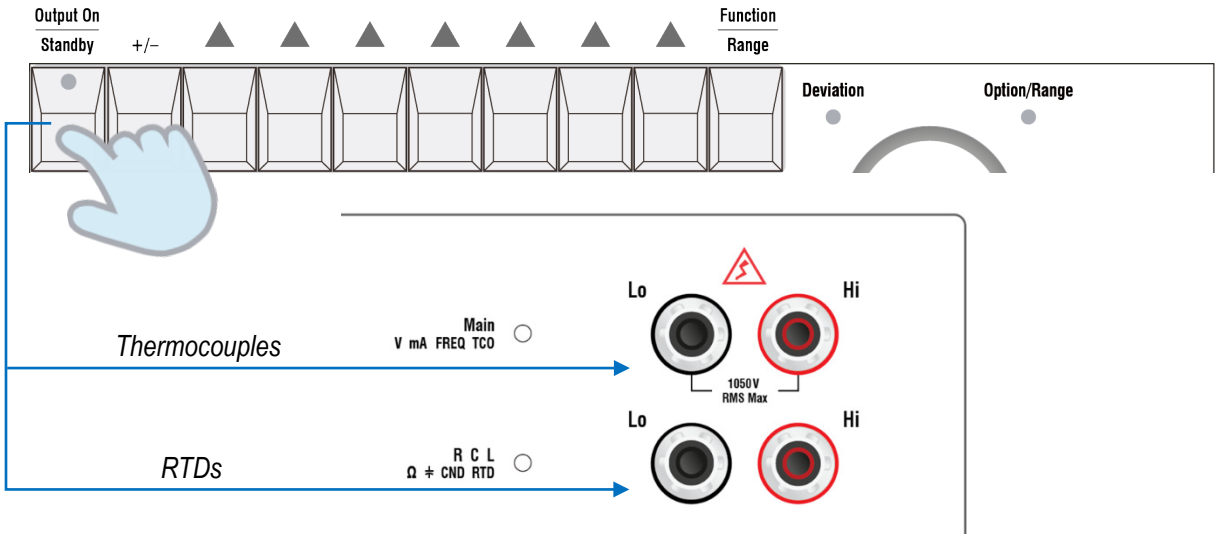


Press the "**OK**" button to confirm the selection.

Then set the required temperature value using the "**Up (Δ) / Down (∇)**" buttons.

Deviation mode is available. To use press the "**Function**" button, then "**DEV**" button.

Connect the output to the terminals by pressing the "**Output On**" button.



Temperature units can be changed in the Setup Menu (°C, °F, K). *See Setup Menu section*.

3.14.1 RTD Simulation

When an RTD is selected the display will show the output value, temperature unit and the temperature element.

In deviation mode the element is replaced by the % up/down setting.

3.14.2 Thermocouple Simulation

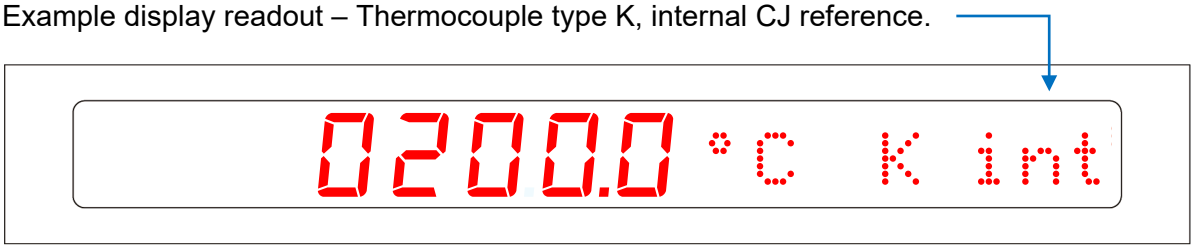
When a thermocouple is selected, the display shows the output value, temperature unit and the thermocouple type. It also indicates the setting currently being used for the cold junction reference (off, int, man, or i*).

Cold Junction Settings

The effects of cold junction can be simulated by the 5025. Three cold junction reference settings are available via the Setup Menu (Option CJ Ref): Off, Internal and Manual.

- **Off**: This setting disables any cold junction reference. Use this if the UUT's cold junction compensation can be set to zero or if the junction from thermocouple alloy to copper wire is made in an ice bath.
- **Internal:** This setting uses the front panel terminals as the cold junction. Use this if the UUT is connected to the front panel terminals using compensating cables (cables of the same alloy as the thermocouple being simulated).
- **Manual:** This setting allows a simulated cold junction temperature to be manually entered (see Setup menu option CJ Val). Use this option if the junction from thermocouple alloy to copper is made externally and measured in temperature. This is common when using non-compensating cables and the UUT cold junction compensation is enabled.

Example display readout – Thermocouple type K, internal CJ reference.



Example display readout – Thermocouple type K, manual CJ reference.

Example display readout – Thermocouple type K, no CJ reference.

Cold Junction Trim (CJ Trim)

The 5025 internal cold junction reference value can be trimmed by this additional setting, to correct for any thermal drifts or inaccuracies due to the UUT's cold junction compensation.

In effect it is a zeroing mechanism that allows the accuracy of the UUT's cold junction compensation to be disregarded and calibration performed purely on the UUT's capability to measure the EMF voltages for the specified thermocouple type. This output is adjusted real time using the rotary knob (via the Setup Menu).

Note: CJ Trim does not affect the calibration of the internal CJ reference temperature sensor.

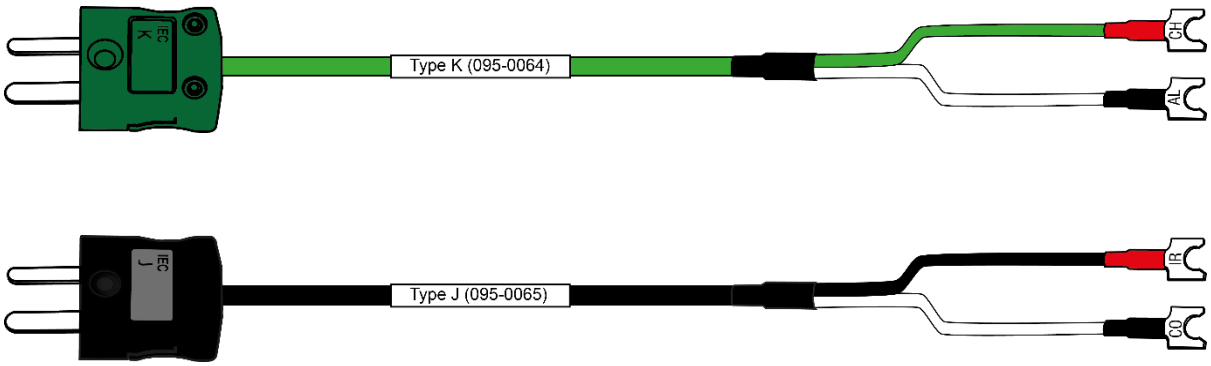
When the CJ Trim feature is active an "**i** ✱" is shown next to temperature unit. The "**i**" refers to internal CJ reference and the asterix informs the user that the CJ trim temperature entered is being applied to the output.

Example display readout – Thermocouple type K, internal CJ reference with CJ trim.

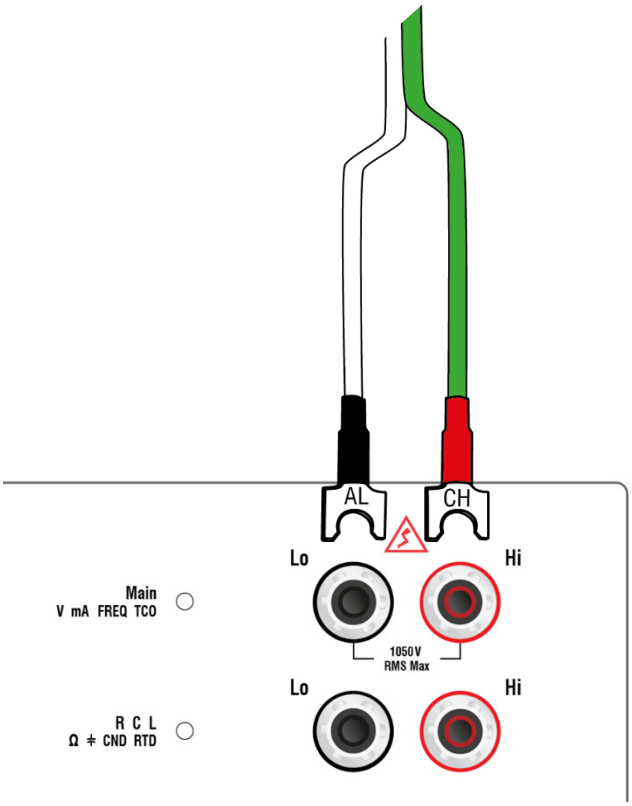
For further details on CJ Trim setting see the Setup Menu options.

Thermocouple Test Leads

The correct thermocouple compensated lead must be used if the cold junction of the UUT is to be verified correctly. The 5025 series 2 test lead kit is supplied a mini Type K and Type J test lead.



The lug is inserted into the binding post and the binding post tightened. The positive lead is marked with a red band.

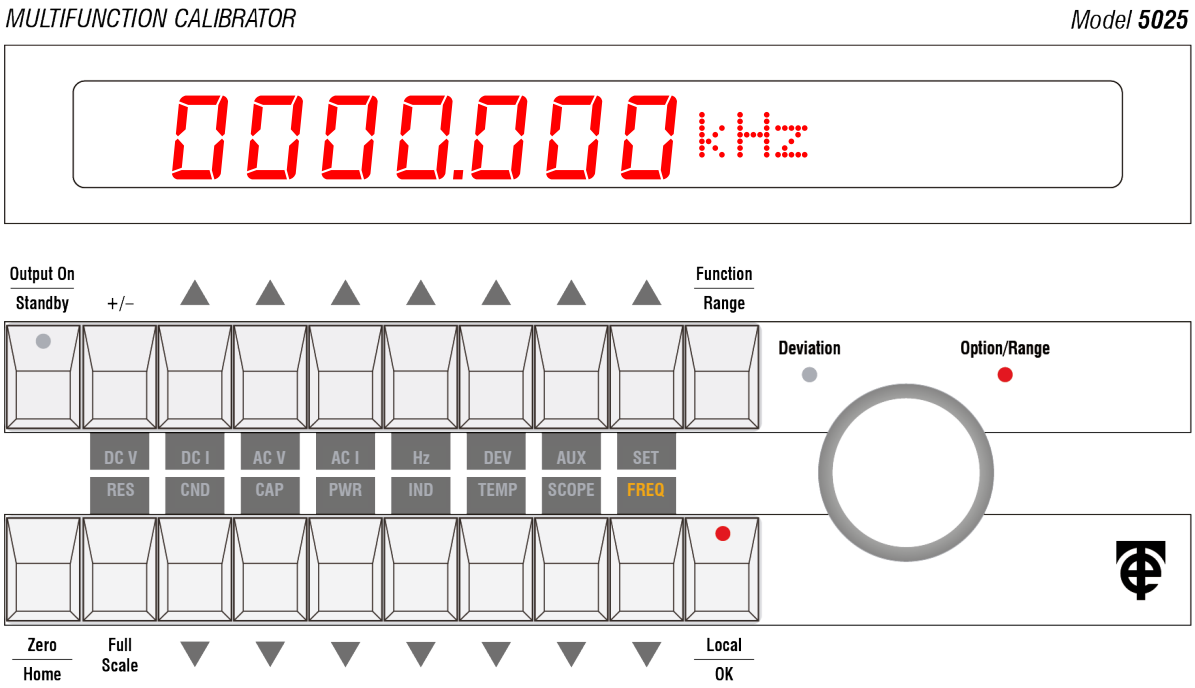


3.15 Digital Frequency **FREQ**

Variable output setting 0.1 to 10MHz.
To use the frequency function, press the “**Function**” button followed by “**FREQ**” button.

The display flashes to prompt selection of either frequency or period.

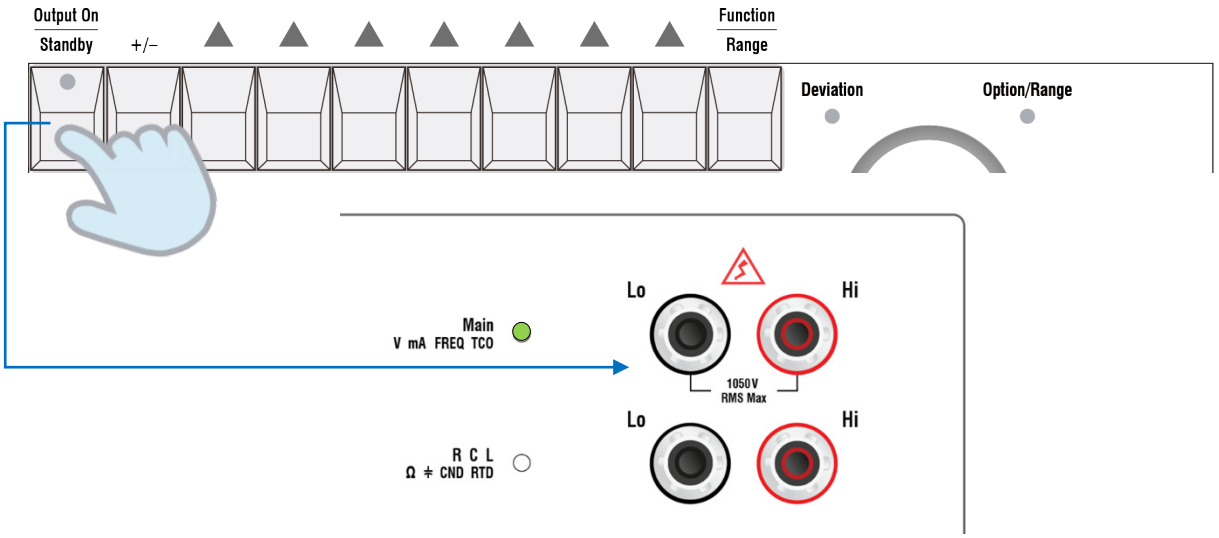
Using the rotary knob to choose the frequency or period range, Hz, kHz or MHz.



Select the required frequency / period using the “**Up (∆) / Down (∇) buttons**”.

Deviation mode is available. To use press the “**Function**” button, then “**DEV**” button.

Connect the output to the terminals by pressing the “**Output On**” button.



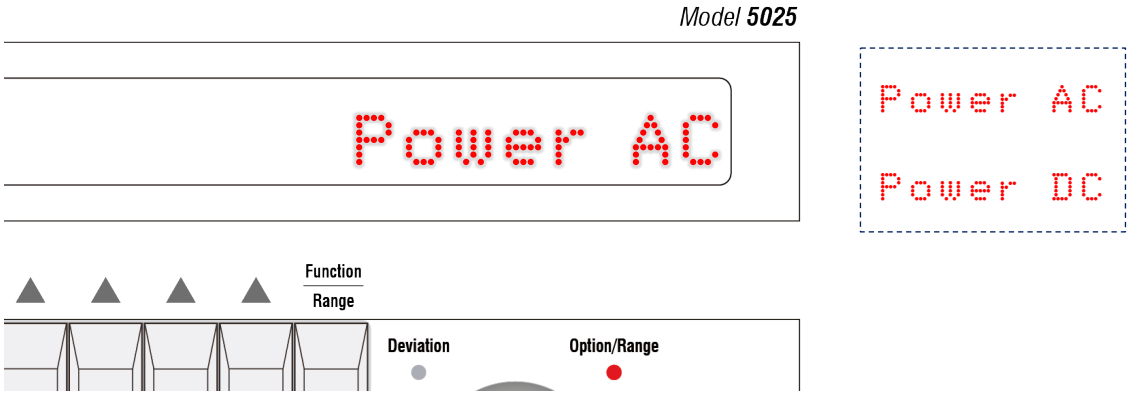
3.16 Power Mode **PWR**

Note: Connection between the current and voltage High (positive) terminals is **not** allowed.
If the Low (negative) terminals are common additional uncertainties apply.
If in doubt use either a clamp meter adaptor (9780) or current transformer for power functions.

Power units can be set as Watts (W) or Volt-ampere (VA) in the Setup Menu.
Phase angle or Power factor can also be selected in the Setup Menu.

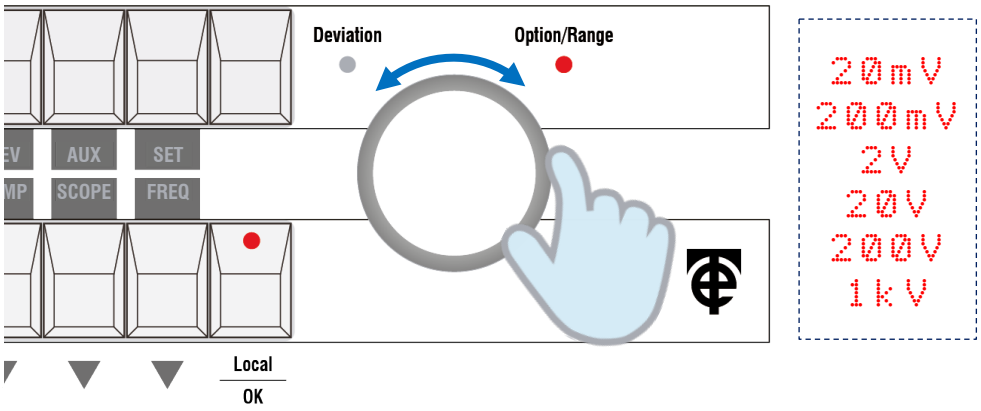
1. To use the Power function, press the "**Function**" button followed by "**PWR**" button.

2. The display flashes to prompt selection of either Power AC or Power DC.



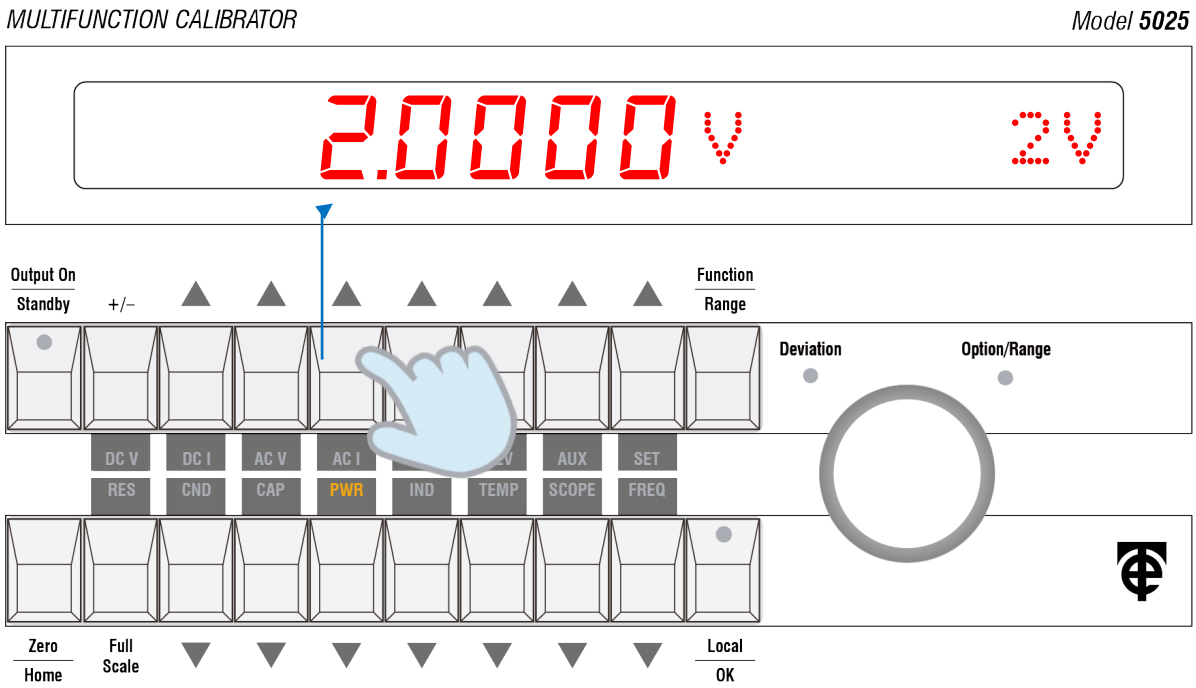
3. Use the rotary knob to make the required selection. In this case **Power AC**. Press "**OK**".

4. Next adjust the rotary knob to the required voltage range.

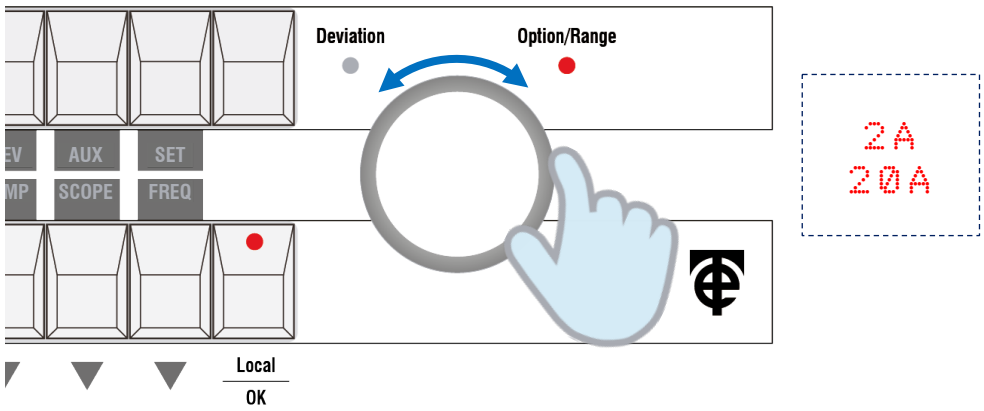


5. When the required voltage range is displayed, press the "**OK**" button.

6. Once the range is set, enter the voltage using the "**Up (Δ) / Down (∇)**" buttons.

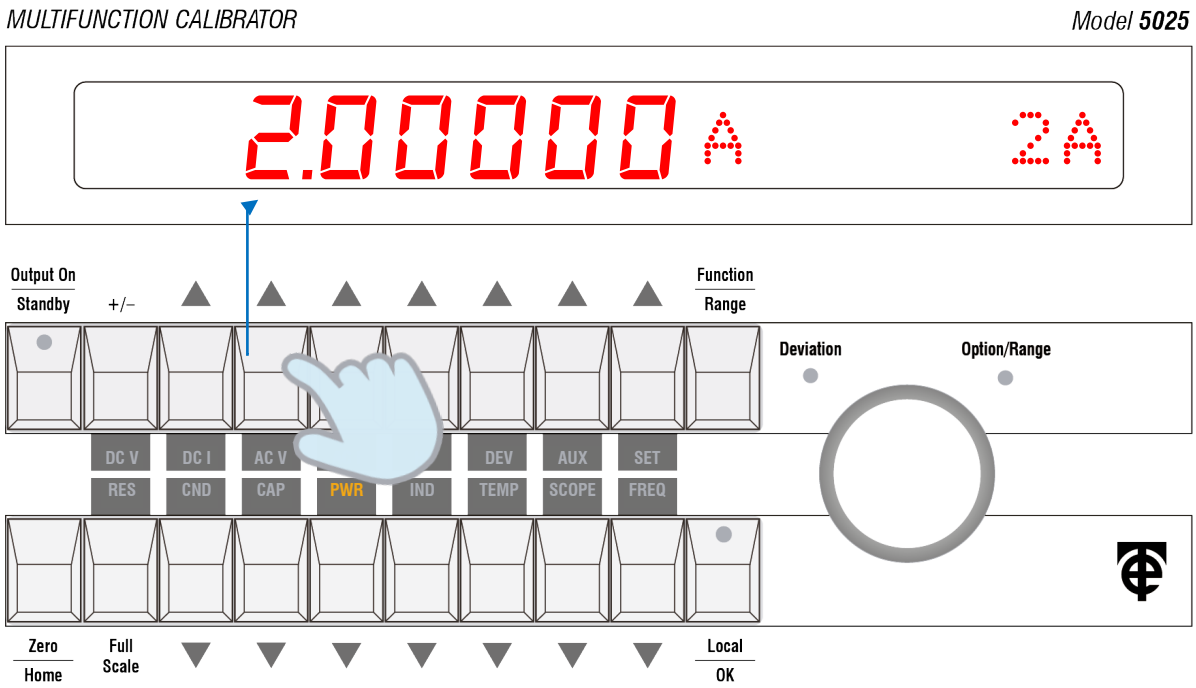


7. Press "**OK**" to confirm the voltage value.
8. Next adjust the rotary knob to the required current range (2A or 20A).



9. When the required current range is displayed, press the "**OK**" button.

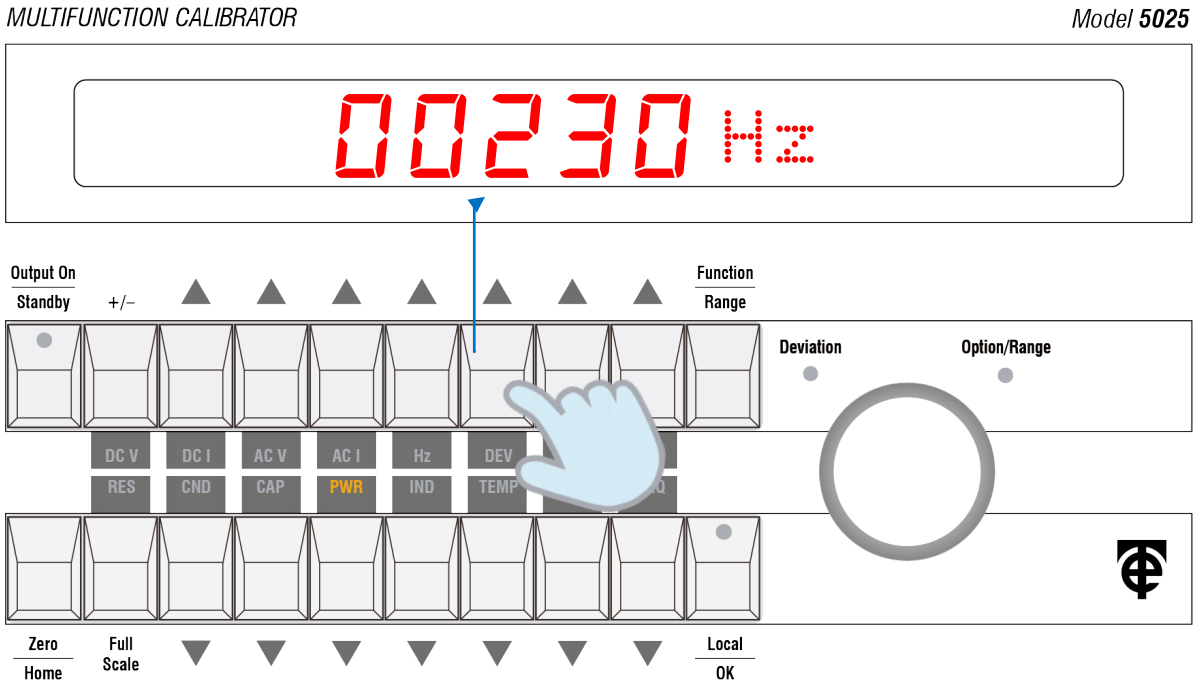
10. Once the range is set, enter the current using the "**Up (Δ) / Down (∇)**" buttons.



11. Press "**OK**" to confirm the current value.

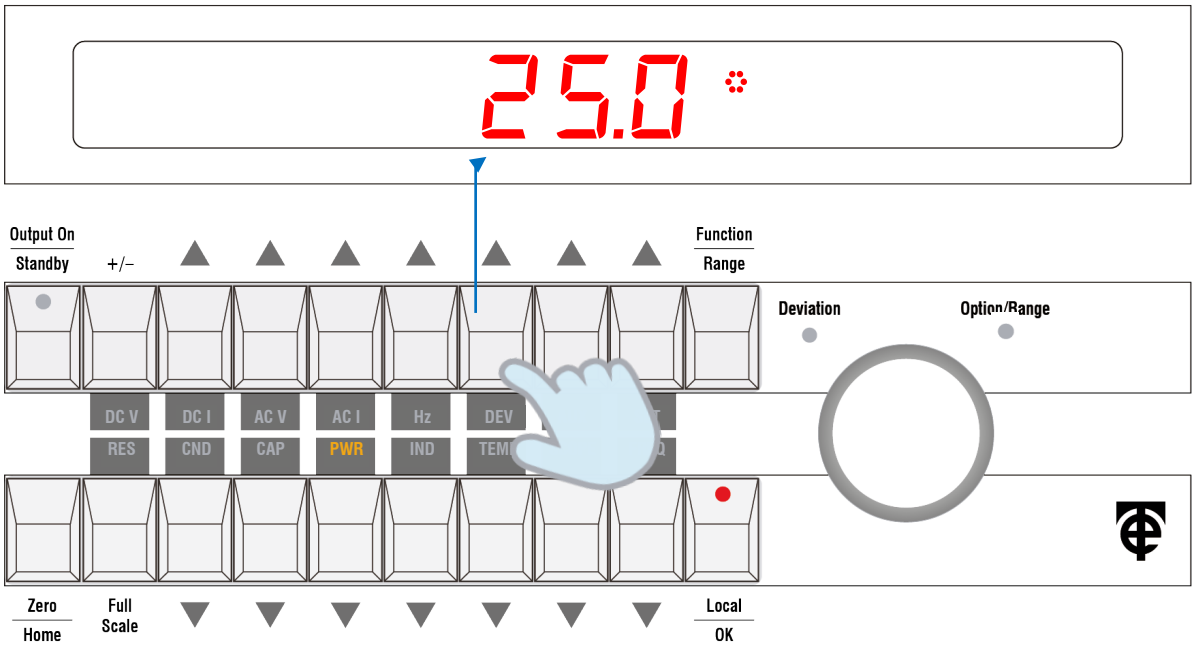
12. Next adjust the rotary knob to the required current range (2A or 20A).

13. Next set the frequency using the "**Up (Δ) / Down (∇)**" buttons.

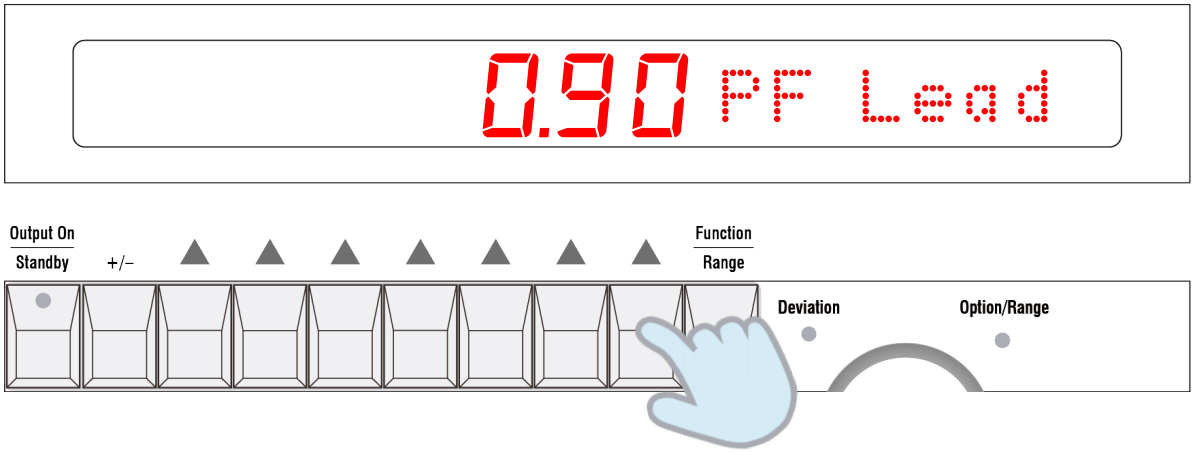


14. Then press the "**OK**" button to set it.

15. If Phase is selected in the Setup Menu, this will display next for setting.
    Enter the Phase angle using the "**Up (Δ) / Down (∇)**" buttons.

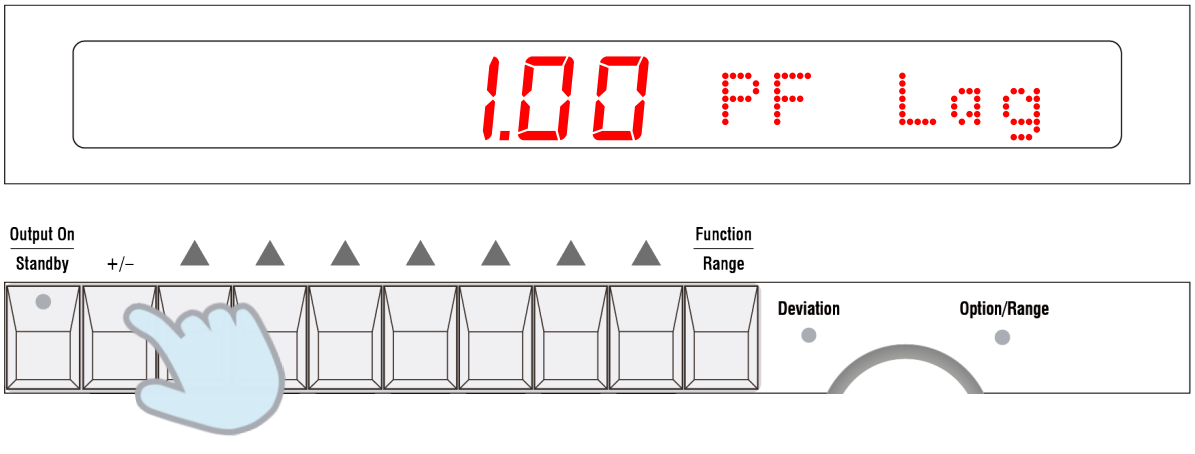


If Power Factor (PF) is selected in the Setup Menu, this will display instead of phase.

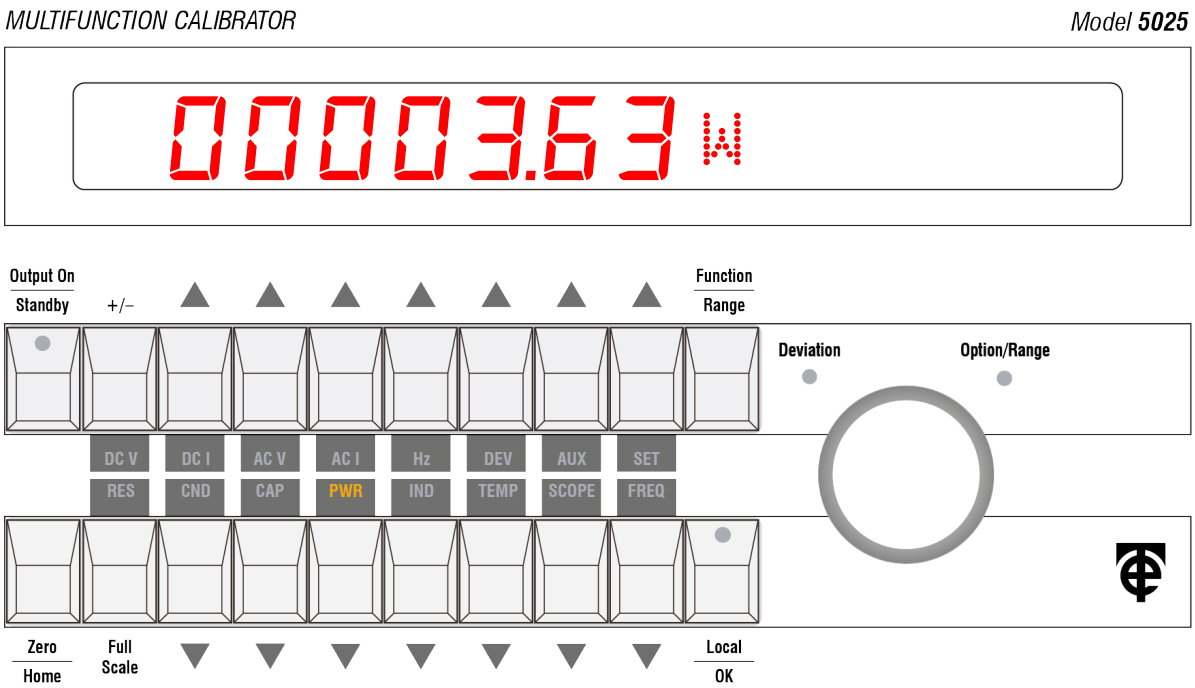


Use the "**+/-** " button to set either positive / negative phase or lead / lag PF.

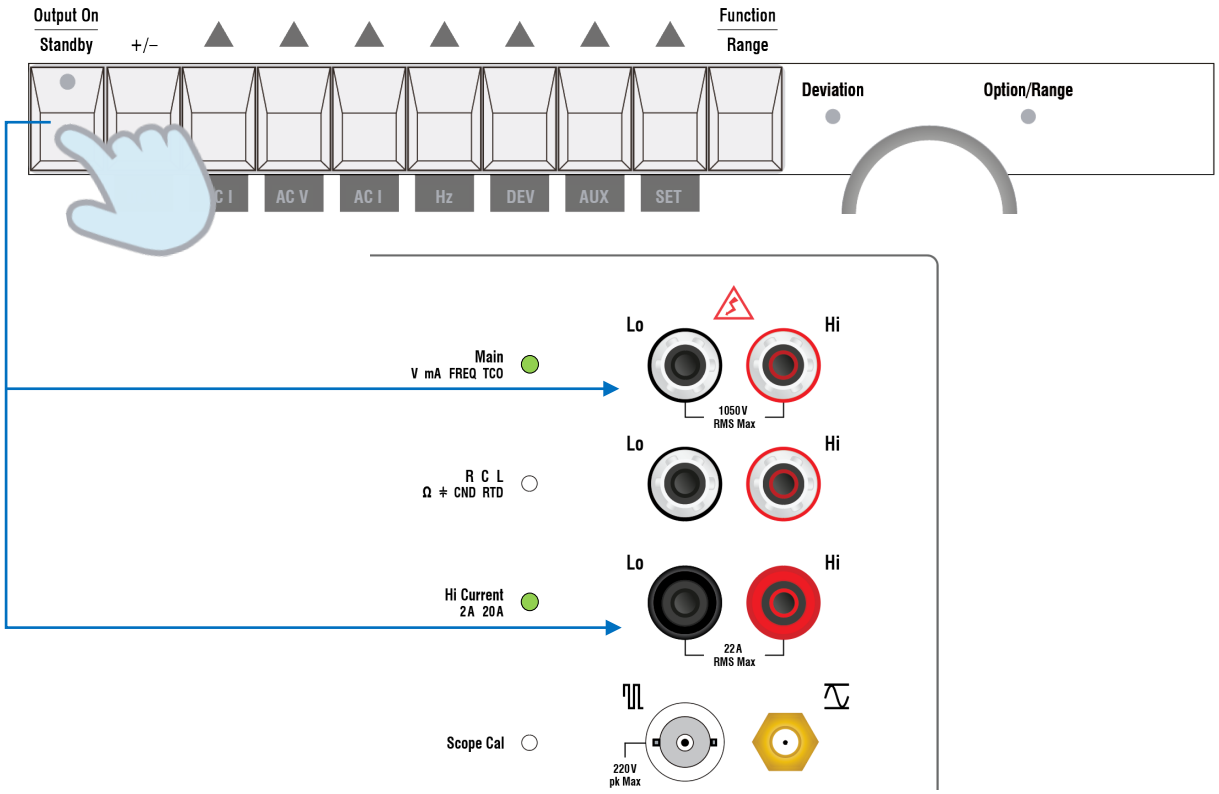
MULTIFUNCTION CALIBRATOR *Model **5025***



16. The display now shows the power output.



17. Output on/off is used to turn output on and off (ramping if Hi volts/Hi current).



To change the output the previous steps must be taken to adjust voltage, current, phase and frequency. The 5025 will show and store the previous values for each of the settings.

3.17 Oscilloscope **SCOPE**

Oscilloscope calibration (Scope-Cal) is an optional internal fitting for the 5025.

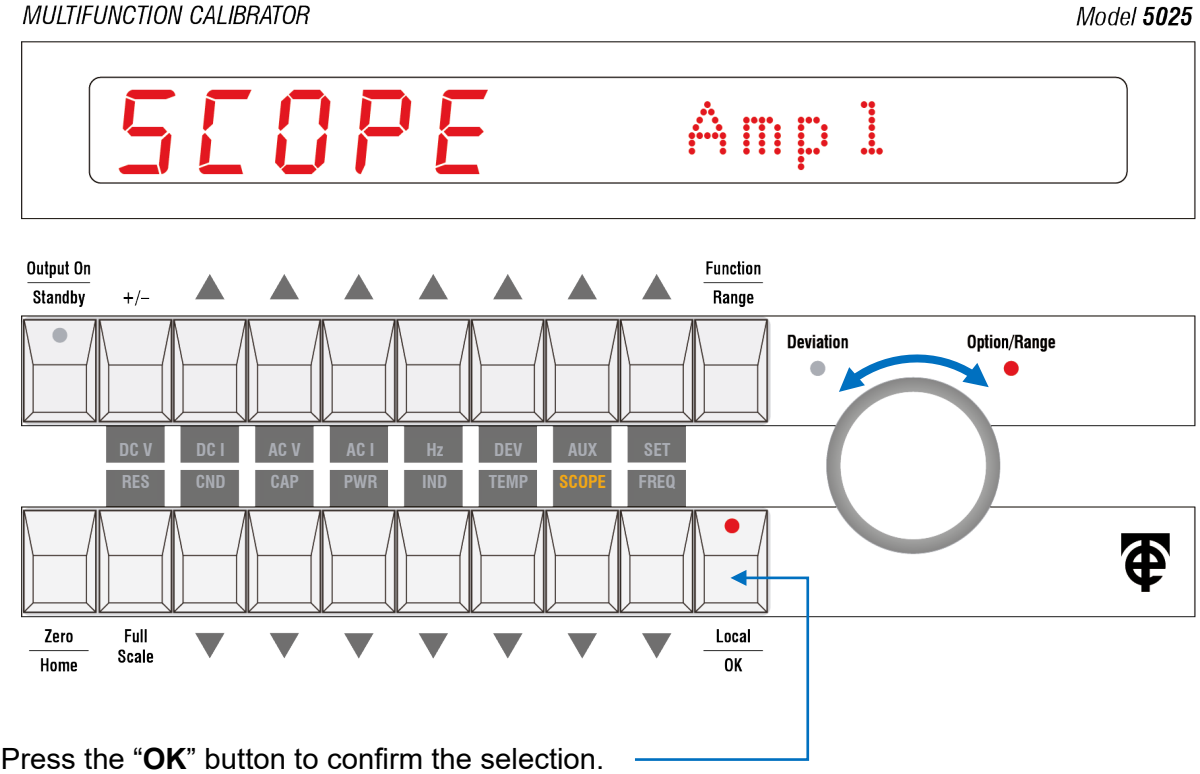
It provides:

- **Amplitude** for calibrating the voltage gain. (Vertical deflection)
- **Frequency and Period** for calibrating the time base. (Horizontal deflection)
- **Fast Rise** for rise time calibration and bandwidth determination.
- **Duty Cycle** for verifying duty cycle measurements.
- **Levelled Sine** for bandwidth calibration (frequency response) and trigger functions.

Press the "**Function**" button then the "**SCOPE**" button to access to the oscilloscope calibration function.

The display flashes to prompt selection. Turn the rotary knob to the required function:

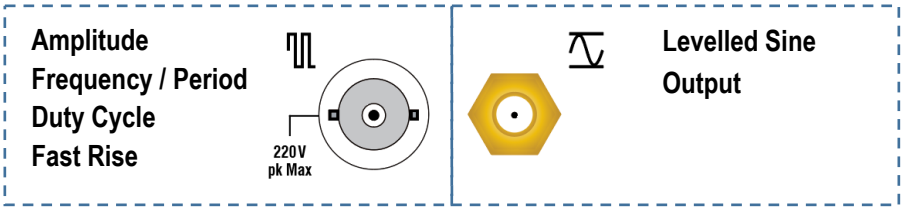
- Ampl (Amplitude)
- Ampl 50 Ω (Amplitude 50 Ω)
- Frequency
- Period
- Duty Cyc (Duty Cycle)
- FastRise (Fast Rise)
- Lvl Sine (Levelled Sine)



Press the "**OK**" button to confirm the selection.

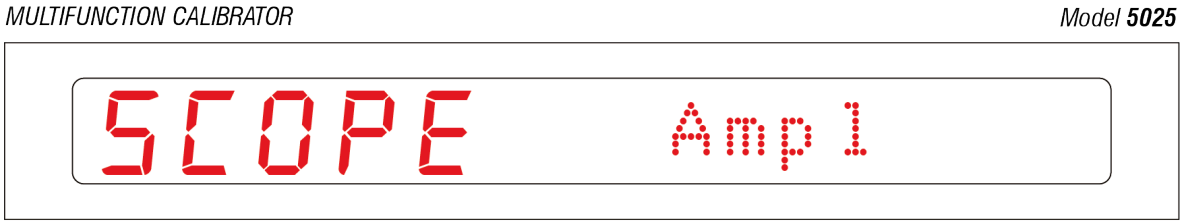
3.17.1 Terminal Outputs

The scope calibration functions output from the terminals as shown below:



3.17.2 Amplitude

The Amplitude function is suitable for driving high impedance inputs. This allows outputs between 2 mV and 220 V. The output waveform is a 1 kHz square wave.



The ranges available are 200 mV, 20 V and 200 V.

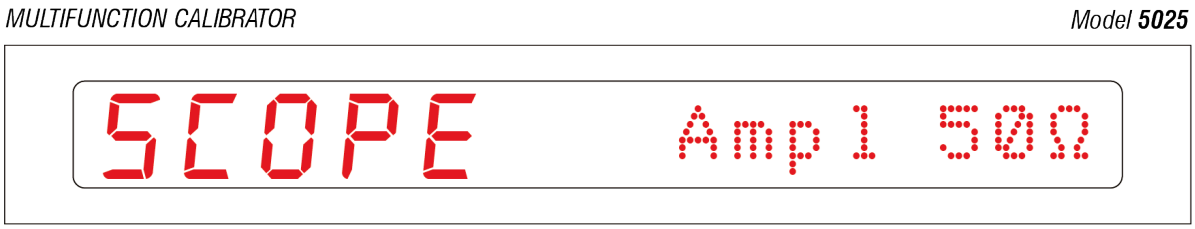
Select the appropriate range for the required output.

To change the output level, the "**Up (Δ) / Down (∇)**" buttons can be used at any time.

If necessary, the output can be disconnected by pressing the "**Standby**" (output on) button.

3.17.3 Amplitude 50 Ω

The Amplitude (50 Ω) function is suitable for driving a 50 Ω inputs. It allows outputs between 1 mV and 2.2 V. The output waveform is a 1 kHz square wave.

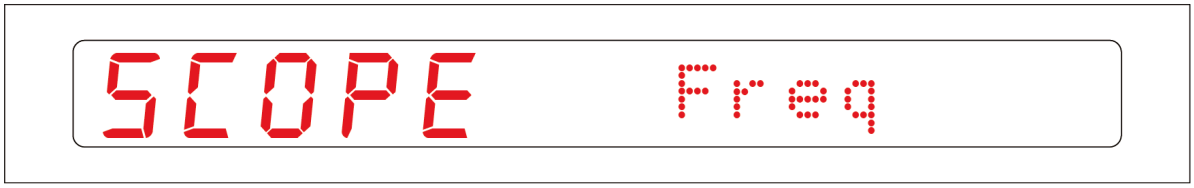


IMPORTANT NOTE
The quality of the BNC bayonet connection can have a significant effect on the accuracy. They can have a connection resistance of 0.1 Ω or more. Therefore, using a normal BNC lead to connect to the oscilloscope can add 0.2 Ω and this will reduce the signal appearing at the scopes input by 0.4%. For accurate 50 Ω calibrations allowance for this error must be made. However, the connection resistance is not stable and can vary as the connector is moved.

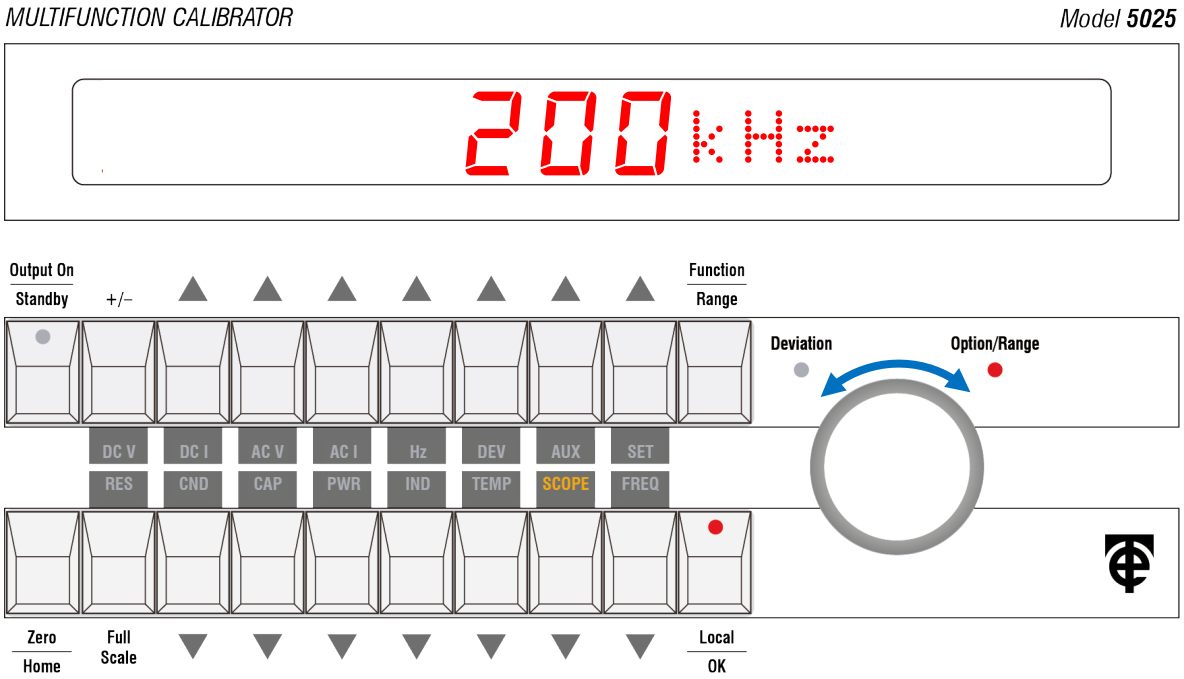
For this function only 200 mV and 2 V ranges are available. The output is set in the same way as the amplitude function.

3.17.4 Frequency and Period

The frequency / period functions allow output signals of fixed frequencies / periods 0.1 Hz to 100 MHz / 10 ns to 10 s in a 1, 2, 5 sequence.



To set the output level, use the rotary knob to select.

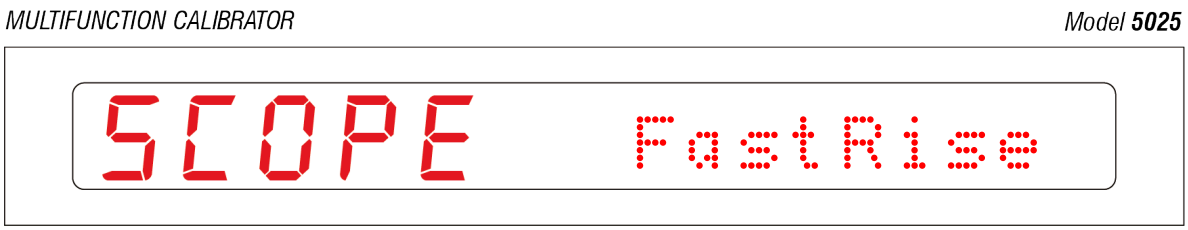


It should be noted that at 10 ns / 100 MHz the output is approximately sinusoidal.

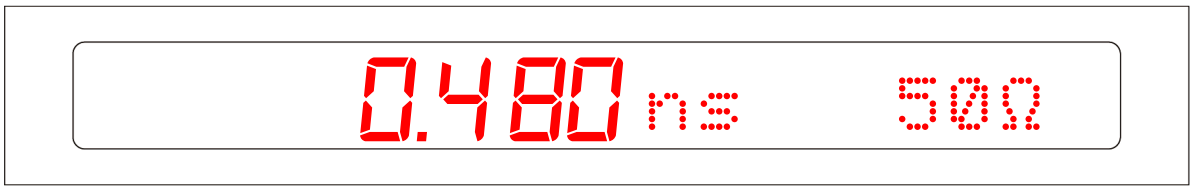
3.17.5 Duty Cycle

Select the frequency (100 Hz, 1 kHz, 10 kHz) using the rotary knob. Press the “**OK**” button to confirm selection. Now enter the required % Duty cycle using **“Up (Δ) / Down (∇)”** buttons. Deviation mode is available in the duty cycle function.

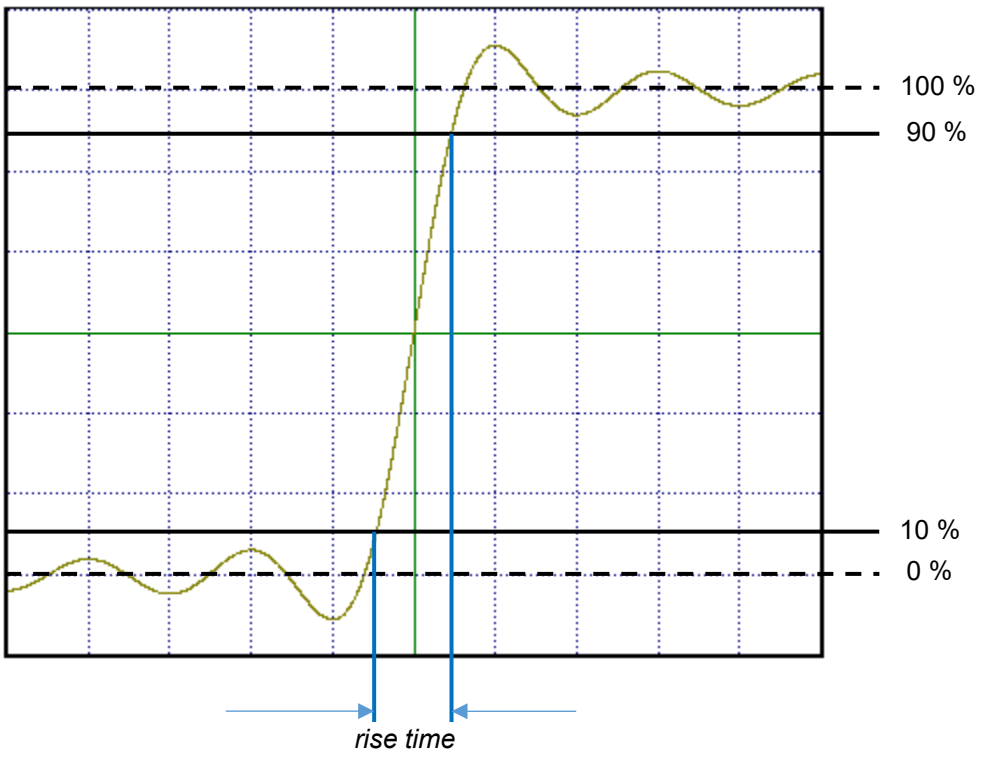
3.17.6 Fast Rise



The Fast Rise signal is present on the Scope-Cal BNC terminal and must be used with the 50 Ω feed through terminator or the oscilloscopes in-built 50 Ω termination.



To calibrate the rise time of an oscilloscope a fast rise pulse is generated by the 5025. The rise time on the oscilloscope is the time difference between the displayed 10 and 90 % amplitude value.



The rise time of the 5025's fast rise signal is between 0.4 and 0.55 ns. The exact value is recorded on the calibration certificate. The oscilloscope's rise time can be calculated using the following formula:

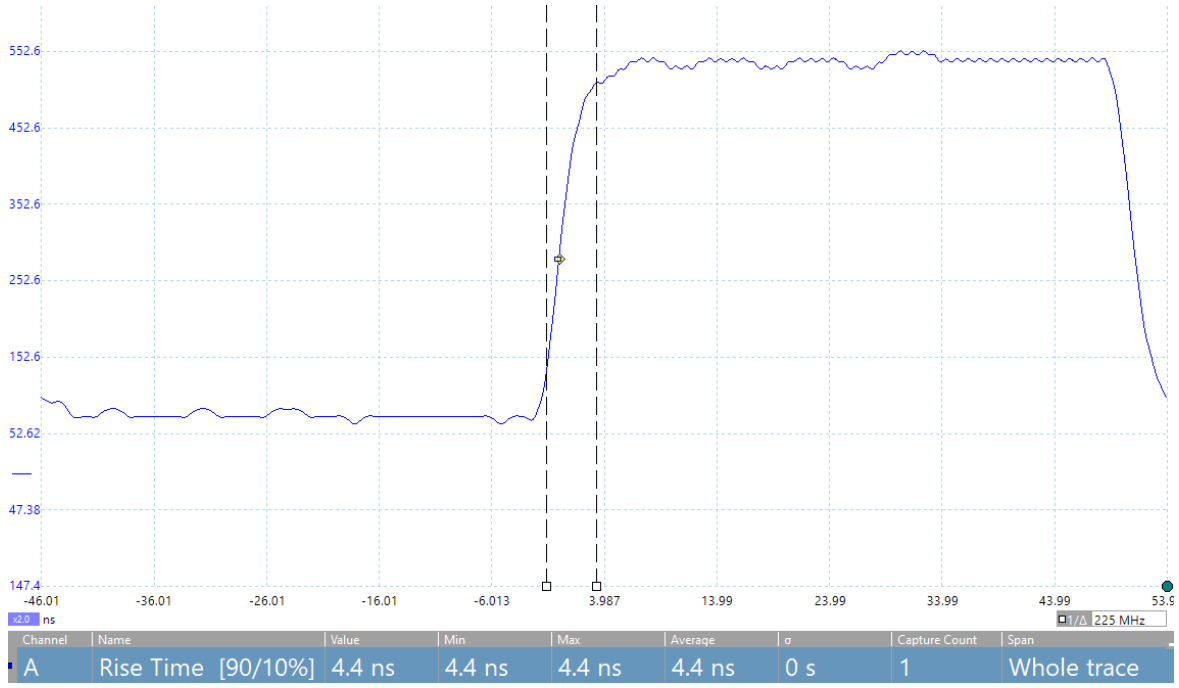
$$rise\ time = \sqrt{t^2{}_{measured} - t^2{}_{Fast\ Rise}}$$

Bandwidth Calculation using Fast Rise

The Fast Rise function also provides a means for calculating the approximate bandwidth of an oscilloscope and is recommended for oscilloscopes where the bandwidth is not covered by the Levelled Sine function.

The bandwidth is calculated by first measuring and calculating the oscilloscope's rise time. The formula below is then used to calculate the oscilloscope's bandwidth.

$$\text{Bandwidth (MHz)} = \frac{350}{rise\ time\ (ns)}$$



Shown above is an example of bandwidth determination using the 5025's (0.48 ns) fast rise signal. The measured rise time is 4.4 ns. Using the formula, the bandwidth is calculated as follows:

$$80\ MHz = \frac{350}{\sqrt{4.4^2\ - 0.48^2}}$$

3.17.7 Levelled Sinewave (Lvl Sine)

Introduction

The Levelled Sinewave function provides a calibrated sinewave where the peak to peak amplitude remains flat over the frequency range. It is used to calibrate the bandwidth by finding the frequency at which the output drops to 70.7 % (the -3 dB point) on the oscilloscope.

The low frequency ‘reference’ range is from 50 kHz to 1000 kHz and the high frequency range is from 10 MHz to 2.2 GHz. For both ranges 10 amplitude levels are selectable.

Scope-Cal Test Lead and Adaptors

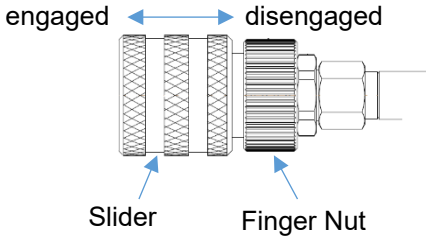
SMA to BNC Test Lead

The Levelled Sinewave function has been calibrated for use with the SMA to BNC test lead supplied. It is fitted with a quick release adaptor which simplifies connection to the SMA on the 5025’s front panel.

Quick Release SMA to BNC Test Lead (095-0069)

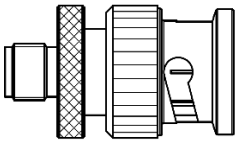
Using the quick release adaptor

With the slider in the disengaged position slide the connector on to the 5025’s font panel SMA connector by pushing on the finger nut. Engage the slider while maintaining light forward pressure on the finger nut. This action is best done by slipping you fingers from the knurled nut to the slider in one motion. Although it is not required to engage the connection fully, the finger nut can be turned by 1 turn or less. To disengage simply pull the slider towards the finger nut.

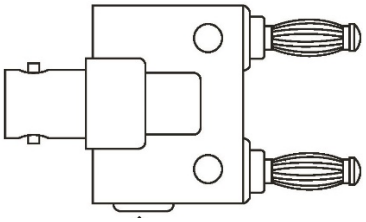


Connection to Reference Range on Main Terminals

A BNC Socket to 4mm plug and BNC Plug to SMA socket are supplied with the Scope-Cal test lead kit. These are used to connect to the MAIN terminals for the reference (kHz) range.



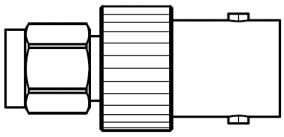
BNC Plug to SMA socket
(062-0120)



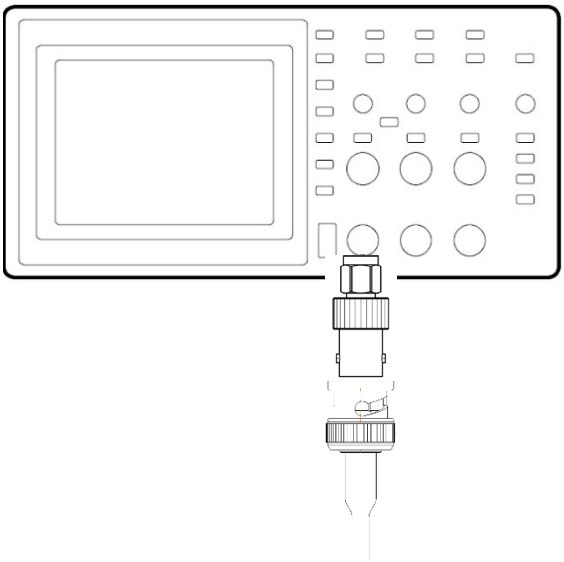
BNC Socket to 4mm plug
(062-6279)

Connection to an Oscilloscope with SMA input

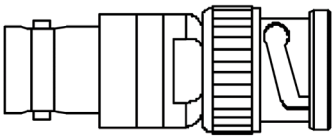
A BNC Socket to SMA plug is supplied with the Scope-Cal test lead kit. As the Levelled Sine output is calibrated with the supplied lead, it should be used [in conjunction] with this connector.



BNC Socket to SMA Plug
(062-0121)



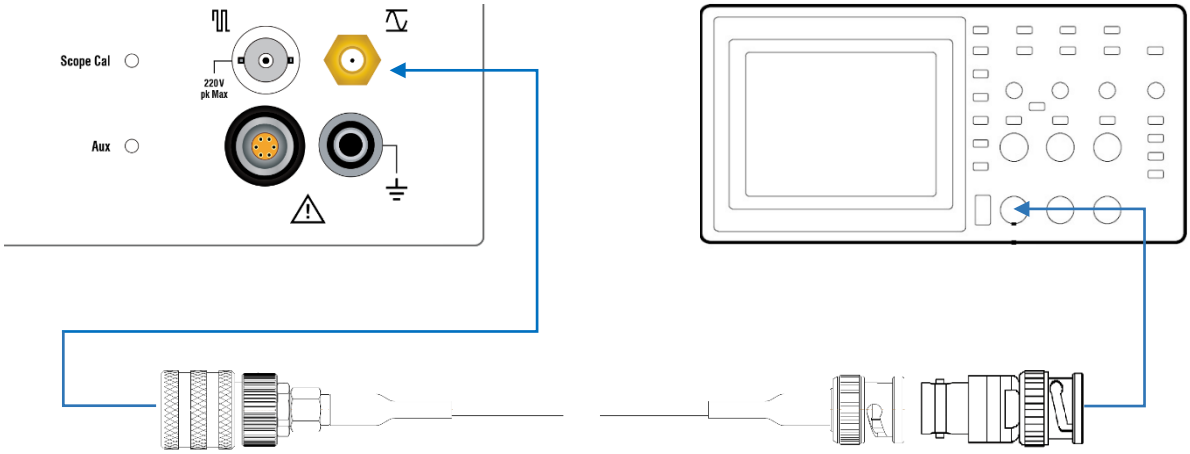
50 Ω Feedthrough Terminator



or

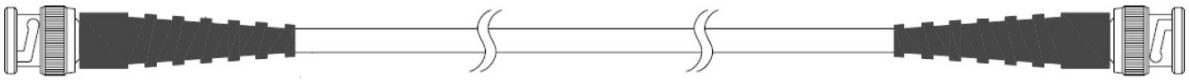
For oscilloscopes that do not have an inbuilt 50 Ω impedance setting, a 50 Ω feedthrough terminator must be used. The device supplied with the Scope-Cal option is designed for use up to 500 MHz without noticeable losses.

Example Connection with 50 Ω Feedthrough Terminator

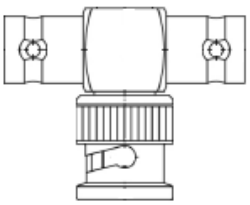


BNC to SMA Cable 50 Ω Feedthrough

BNC Test Leads & Tee Adaptor



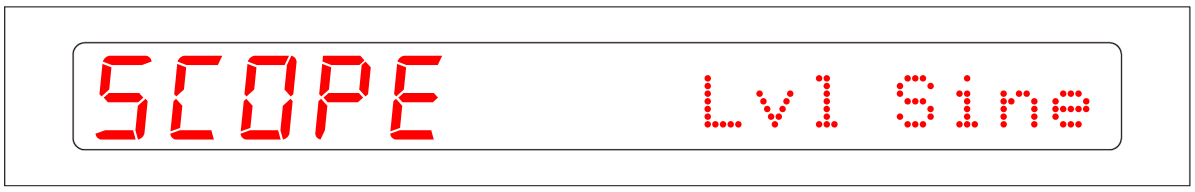
These test leads are used to calibrate amplitude and time base.



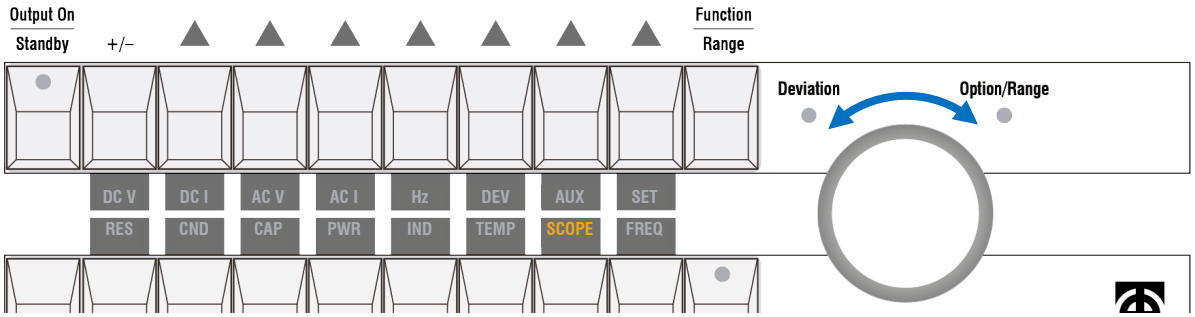
A BNC Tee is also supplied with the Scope-Cal test lead set. This is use in conjunction with the BNC test leads to verify external trigger functions.

Operation

From the scope menu select Lvl Sine function and press the “**OK**” button.

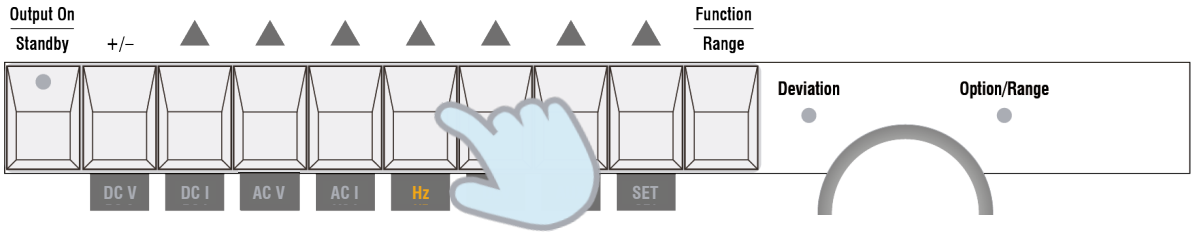


Select the amplitude level (Vpp) using the rotary knob and press OK to confirm.

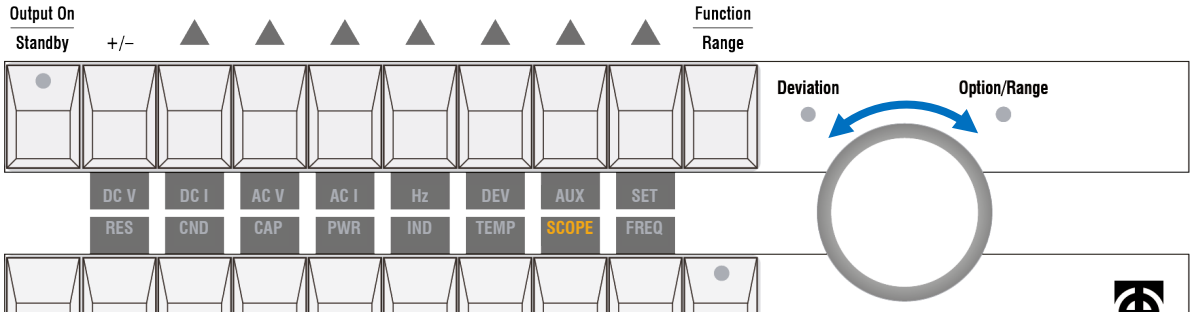


Low Frequency Reference Range

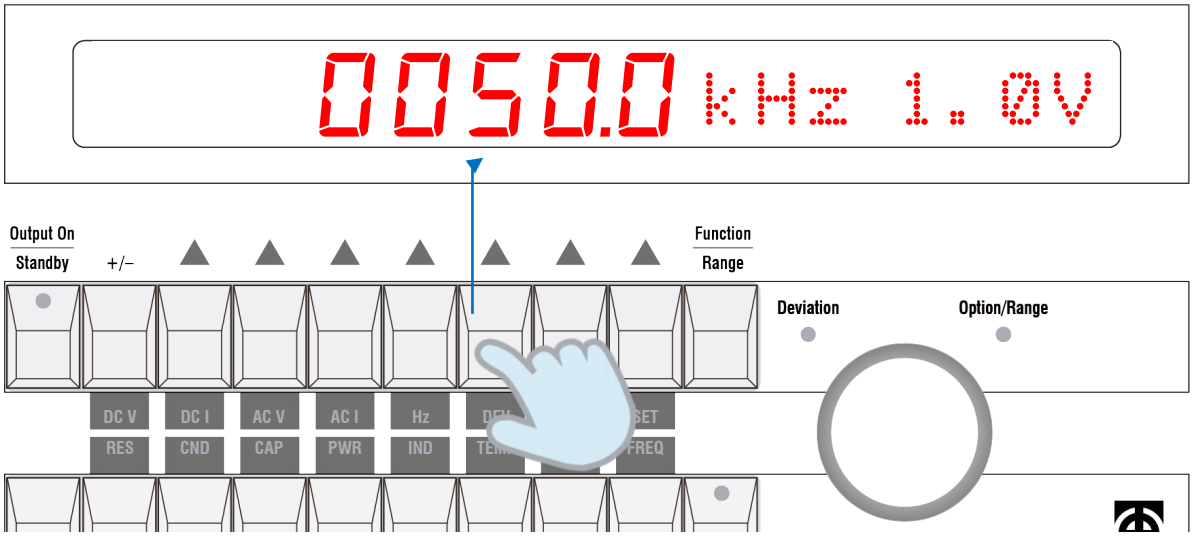
To select the low frequency reference range press the function button followed by the **“Hz”** button.



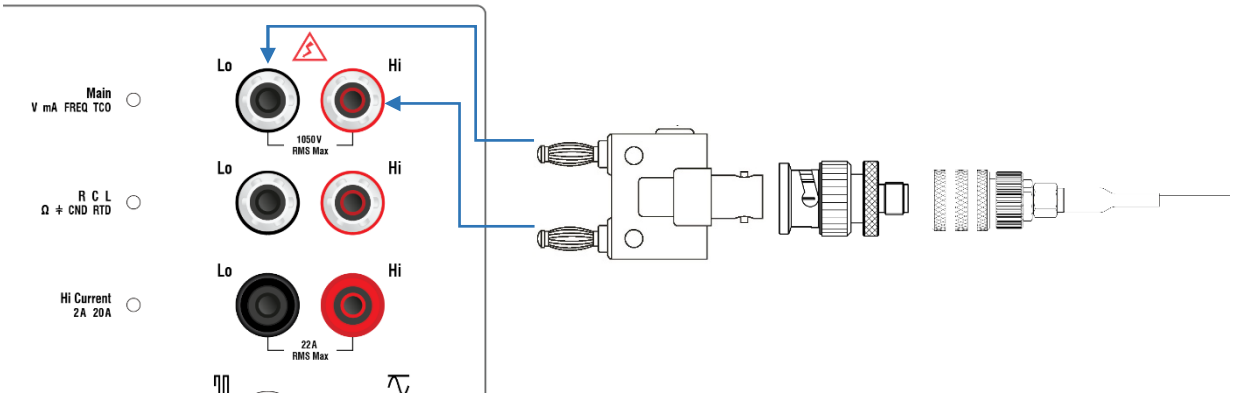
Select the **kHz** range using the rotary knob. Press the **“OK”** button to confirm.



Select the required frequency by using **“Up (Δ) / Down (∇)”** buttons.



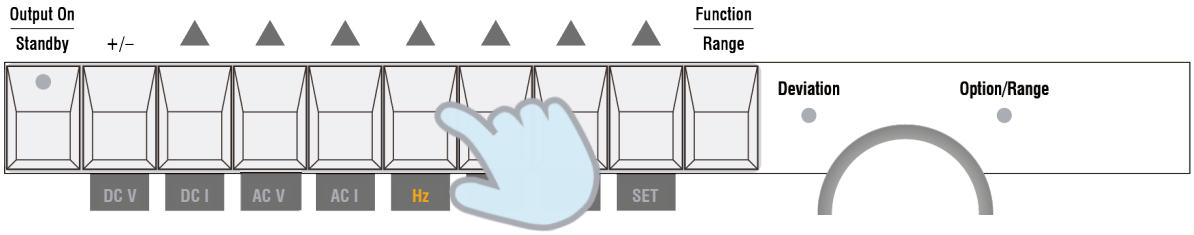
The output for the reference kHz range will appear on the Main Terminals. Use the 4mm to BNC and BNC to SMA adaptor and connect the SMA to BNC lead.



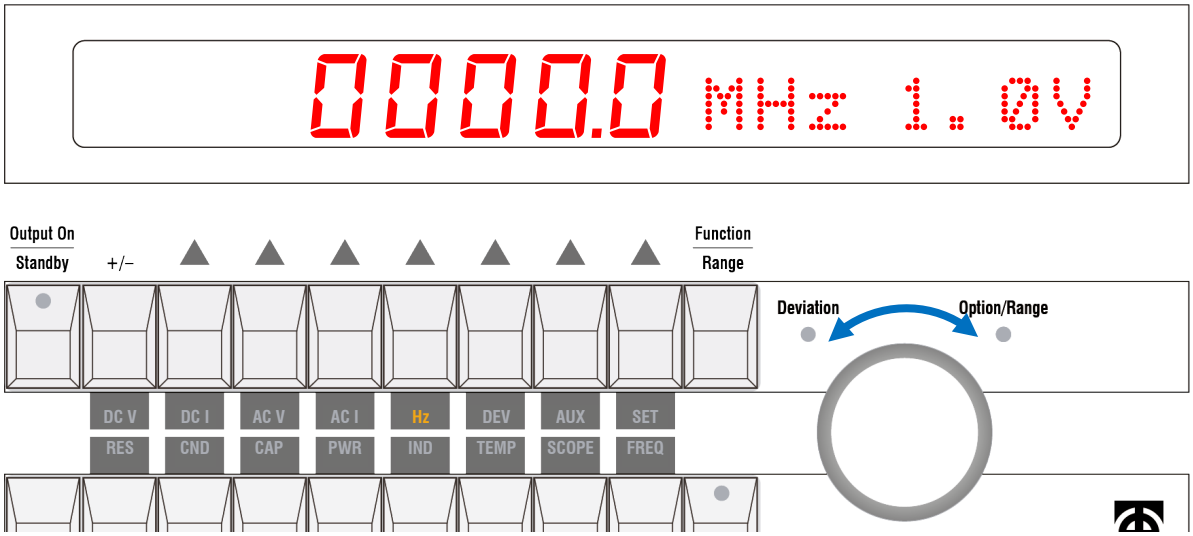
Note: The tab on the 4mm to BNC is connected to the Lo terminal.

High Frequency Range

To select the high frequency MHz range press the function button followed by the **“Hz”** button.

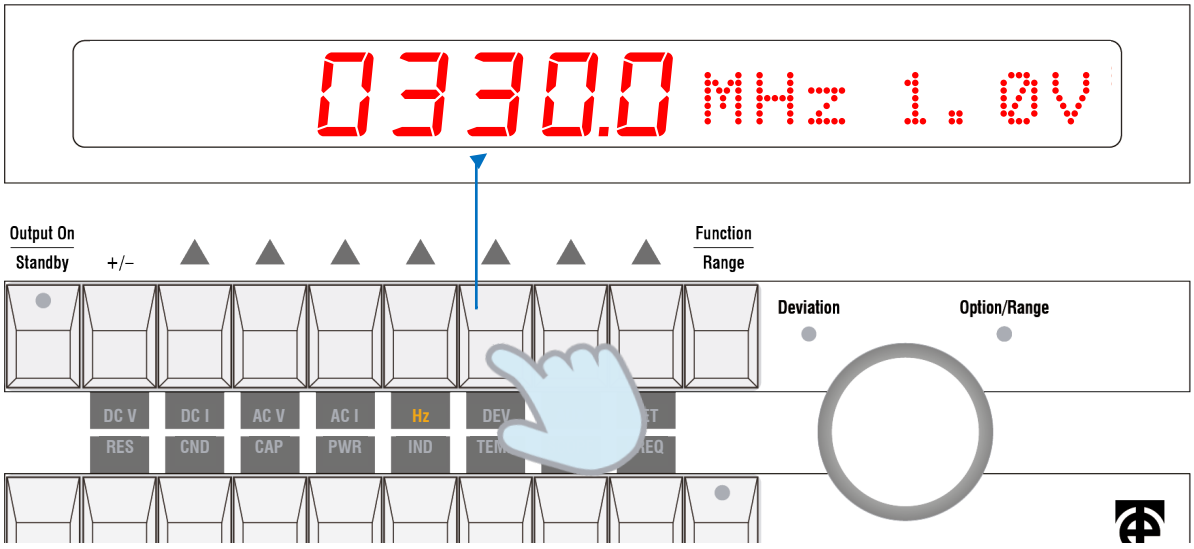


Select the **MHz** range using the rotary knob

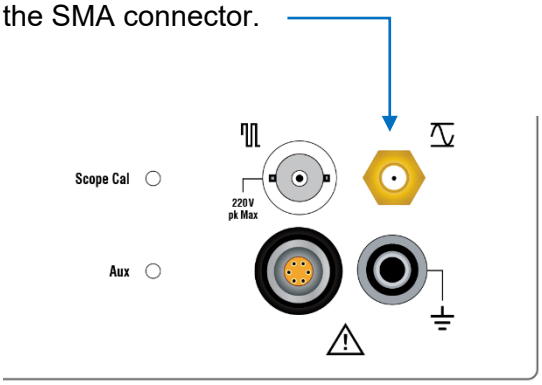


Select the required frequency by using **“Up (Δ) / Down (∇)”** buttons.

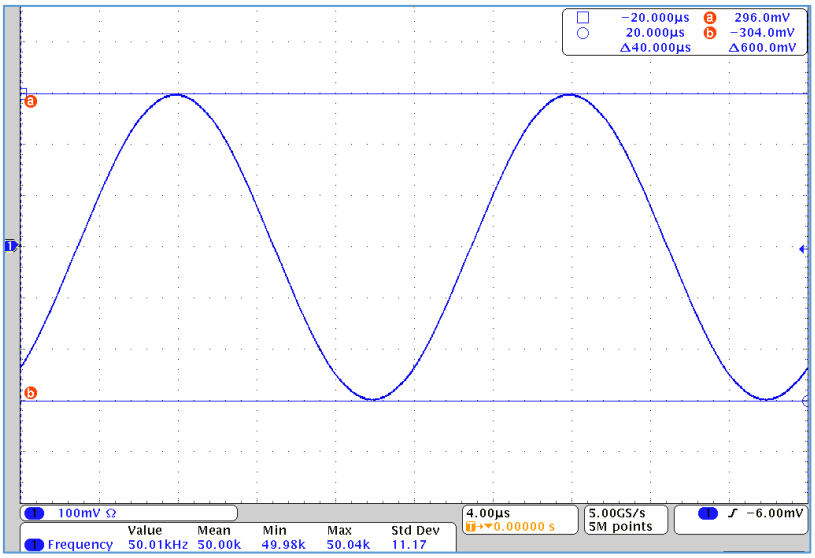
To ‘sweep’ the frequency **press and hold** the desired **“Up (Δ) / Down (∇)”** button.



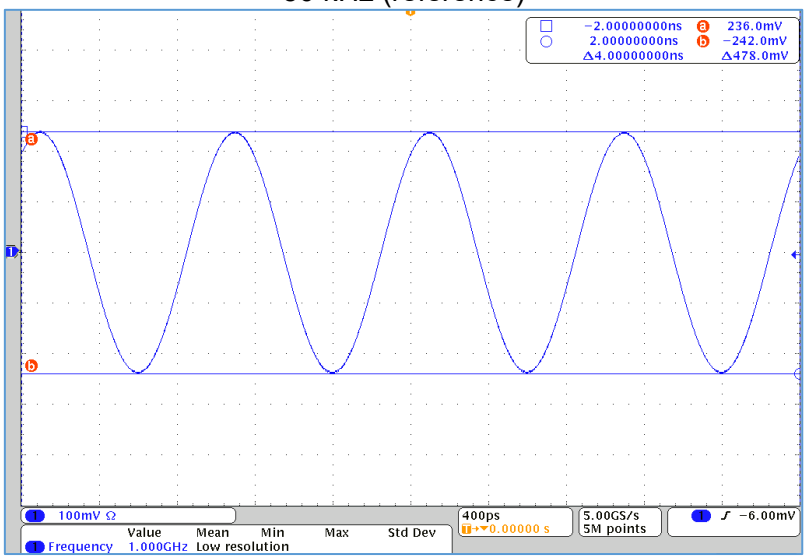
The signal will appear on the SMA connector.



The traces below show a test performed on a 1 GHz oscilloscope. The 50 kHz reference test is set to 600 mVp-p. At 1 GHz the output has remained above 420 mVp-p, verifying the bandwidth is correct. Note the oscilloscope's acquisition averaging is set to 16.



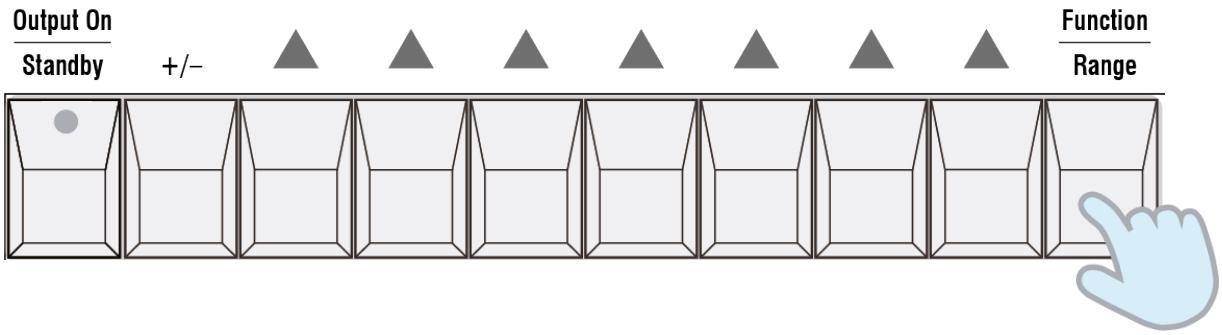
50 kHz (reference)



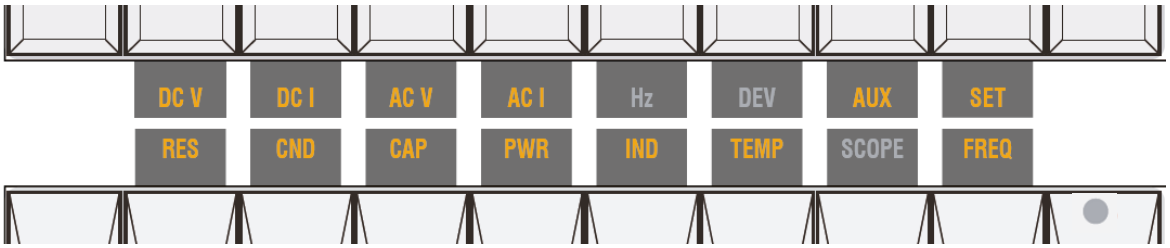
1 GHz

3.18 Setup Options **SET**

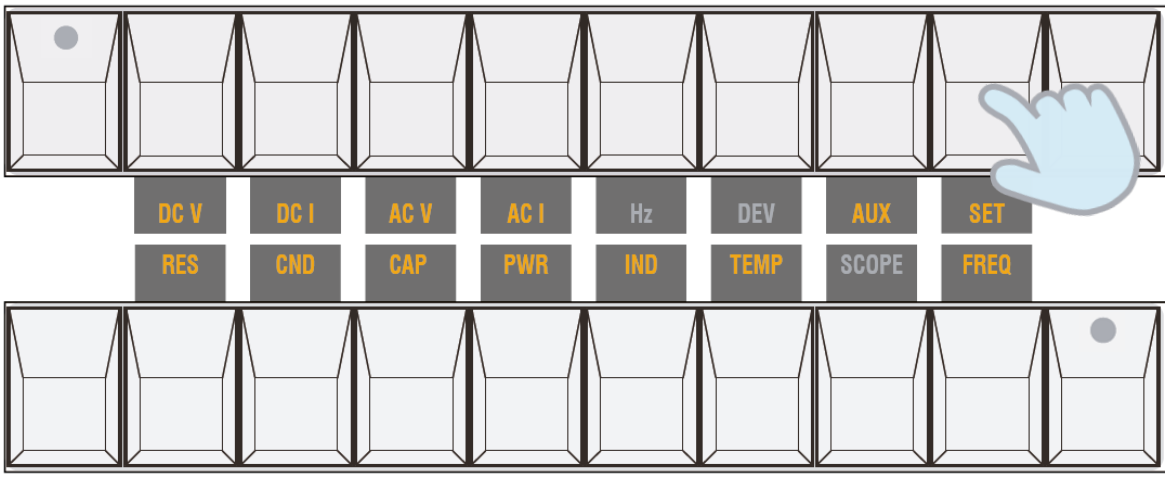
1. Press the “**Function**” button.



2. The function indicators will then flash to prompt a selection.



3. Press the “**SET**” button.



Once pressed, you will access the Setup Menu.

Use the rotary knob to scroll through the various options.

Press the “**OK**” button to store any new setting.
Alternatively, press the “**SET**” button to exit the Setup Menu without making any changes.

The settings in the Setup Menu are stored in non-volatile memory. This means they are retained even when power to the unit is switched off.

3.18.1 Options/Settings Summary

Readout	Option/Setting
Dev Rsln	**Deviation Resolution** Set of deviation resolution to: 0.001 % (fine), 0.01 % (medium) or 0.1 % (coarse) per step.
°C/°F/K	**Temperature Units** Degrees Celsius (°C), Degrees Fahrenheit (°F), or Kelvin (K).
Click	**Click** Set to On or Off. If on, then an audible click will be heard when the rotary knob scrolls from one setting/option to another.
Pwr Unit	**Power Units** Set to Watts or VA.
Phase/PF	**Phase Units** Set to degrees or PF.
CJ Ref	**Cold Junction Reference** Set to Off, Internal or Manual. Sets the method of cold junction reference for thermocouples.
CJ Trim	**Cold Junction Trim (Only shown if CJ Ref is set to Internal)** Turn on the CJ Trim option and enter the trim value.
CJ Value	**Cold Junction Value (Only shown if CJ Ref is set to Internal)** Set the value for manual cold junction reference, in °C only.
DCHV	**DC High Voltage** Set to Normal, Hi Drive All, or Hi Drive 1kV.
Int Temp	**Internal Temperature** View the internal temperature settings (Ref, CJ, Hi Curr).
OvrRange	**Over Range** Set to On or Off. Allows operation outside of specified ranges.
Show Hz	**Show Hz** Set to On or Off. Shows frequency instead of range on ACV/ACI.
IOA Mode	**Intelligent Output Adjust** Set to On or Off. A display adjustment feature that helps value setting after changing a range.
Pnl Test	**Panel Test** Test the operation of the front panel displays and buttons.
Com Type	**Communication Type** Set to RS-232 or GPIB.
Com Set	**Communication Set** Set to Baud Rate (RS-232) or Address (GPIB) based on Com Type selected.

3.18.2 Deviation Resolution (Dev Rsln)

Deviation Resolution is the first menu shown when you enter the setup menu.
See Deviation Mode section for the operation of this mode.
It can be used with DC V, DC I, AC V, AC I, frequency, resistance, temperature functions.

This feature allows the output to be deviated in percentage steps. There are 3 options:

- Fine deviation: 0.001%
- Medium deviation: 0.01%
- Coarse deviation: 0.1%

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
   Now in the Setup menu, Option Dev Rsln appears first on the list.
2. Press “**OK**” button.
   Display now reads the deviation resolution setting currently selected.
3. Adjust the setting using the rotary knob.
4. Once selection is made, press “**OK**” button.

3.18.3 Temperature Units (°C/°F/K)

Temperature units can be changed in the Setup menu. These units are shown on the display readout when using the temperature function and in the settings menu when viewing internal temperature settings or entering the manual CJ value (CJ trim only available in °C). 3 units are available:

- Degrees Celsius (°C)
- Degrees Fahrenheit (°F)
- Kelvin (K)

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option °C/°F/K
3. Press “**OK**” button.
   Display now reads the temperature unit currently selected.
4. Change the unit using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.4 Rotary Knob Scroll Sound (Click)

The Click option is a feature that can be set so that an audible click/beep is heard when the rotary knob scrolls from one setting/option to another. It is a user preference feature.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Click
3. Press “**OK**” button.
   Display now reads the setting currently selected, ie On or Off.
4. Change the setting using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.5 Power Units (Pwr Unit)

Power units can be changed in the Setup menu. These units are shown on the display readout when using the power function. 2 units are available:

- Watt (W)
- Volt-ampere (VA)

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Pwr Unit
3. Press “**OK**” button.
   Display now reads the power unit currently selected.
4. Change the unit using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.6 Phase or Power Factor (Phase/PF)

Allows setting of either Phase (°) or Power Factor (PF), used when setting a power output.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Phase/PF
3. Press “**OK**” button.
   Display now reads the setting currently selected.
4. Change the unit using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.7 Cold Junction Reference (CJ Ref)

For selection of the cold junction reference to be used when simulating thermocouples.
See Thermocouple Simulation section for details and how to apply this to an output.
There are 3 options:

- Internal: Uses the internal CJ reference.
- Manual: A user settable temperature.
- Off: This setting disables any cold junction reference.

Setting Method:

1. Press "**Function**" button, then press "**SET**" button.
2. Use the rotary knob and scroll to option CJ Ref
3. Press "**OK**" button.
   Display now reads the currently selected reference setting.
4. Adjust the setting using the rotary knob.
5. Once selection is made, press "**OK**" button.

3.18.8 Cold Junction Trim (CJ Trim)

Cold junction trim is an option that requires the CJ reference to be set to internal.
The option will not appear for selection unless this is method is selected.
CJ trim is a feature commonly used to make a offset that zeroes the temperature compensation of a UUT, so just the EMF voltage for the thermocouple type are measured.

See Thermocouple Simulation section for details on when to use CJ trim.

Setting Method:

1. Press "**Function**" button, then press "**SET**" button.
2. Ensure CJ Ref is set to "**internal**".
3. Use the rotary knob and scroll to option CJ Trim
4. Press "**OK**" button.
   Display then shows 0.00°C.
5. Change this temperature value using the rotary knob. The output is adjustment is made in real time, so it can be done whilst viewing the measurement on a UUT.
6. Once selection is made, press "**OK**" button.

Note: The CJ Trim setting can only be made in °C.

3.18.9 Cold Junction Value (CJ Value)

This setting allows a simulated cold junction temperature to be manually entered.
See Thermocouple Simulation section for details and how to apply this to an output.

Setting Method:

1. Press "**Function**" button, then press "**SET**" button.
2. Use the rotary knob and scroll to option CJ Value
3. Press "**OK**" button.
   Display then shows an adjustable value in °C (CJ value can only be set in °C).
4. Change this temperature value using the rotary knob.
5. Once selection is made, press "**OK**" button.

Note: The CJ Ref option must set to "**manual**" to use the CJ value entered.

3.18.10 DC High Voltage (DCHV)

This option enables activation of the Hi Drive mode (applies to 200V and/or 1kV ranges).
See DCHV section for further details.

Note: The user must exit the 200 V or 1000 V range when activating or deactivating this option.

Setting Method:

1. Press "**Function**" button, then press "**SET**" button.
2. Use the rotary knob and scroll to option DCHV
3. Press "**OK**" button.
   Display now reads the setting currently selected, ie "**Normal**".
4. Change the setting using the rotary knob, to "**HiDri All** or **HiDri 1kV**".
5. Once selection is made, press "**OK**" button.

3.18.11 Internal Temperature Check (Int Temp)

Access to check internal working temperatures monitored by sensors.

- Ref: Main reference voltage temperature.
- CJ: Cold junction sensor temperature.
- Hi Curr: High current assembly temperature.

Setting Method:

1. Press "**Function**" button, then press "**SET**" button.
2. Use the rotary knob and scroll to option Int Temp
3. Press "**OK**" button.
4. View the temperature readings from using the rotary knob.

3.18.12 Over Range (OvrRange)

As standard the 5025 functions are limited to their published specification ranges.
To operate outside of these ranges the over range option must be switched off.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option OvrRange
3. Press “**OK**” button.
   Display now reads the setting currently selected, ie Off.
4. Change the setting using the rotary knob.
5. Once selection is made, press “**OK**” button.

Note: With over range on and operating outside the specified range a warning symbol will appear.
The range indictor will also flash 3 times.

3.18.13 Show Hz Option for ACV/ACI (Show Hz)

This option displays the selected frequency instead of the operating range when outputting ACV or ACI. It can be enabled or disabled, as per user preference.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Show Hz
3. Press “**OK**” button.
   Display now reads the setting currently selected, ie On (by default).
4. Change the setting using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.14 Intelligent Output Adjust (IOA Mode)

A display adjustment feature that helps value setting after changing a range.

When operating the 5025 via the front panel pressing the most significant digit key after entering a new range will automatically set the proceeding digit to 0.

Example:

0. 20000 is displayed after changing to a new range.

Pressing the 0. 20000 digit key will automatically adjust the value to 1. 00000.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option IOA Mode
3. Press “**OK**” button.
   Display now reads the setting currently selected, ie On.
4. Change the setting using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.15 Panel Test (Pnl Test)

Test the operation of the front panel displays and buttons. This option runs a routine that illuminates all the LEDs on the panel section by section.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Pnl Test
3. Press “**OK**” button.
4. The panel test routine runs until stopped by pressing the “OK” button once more.

3.18.16 Communication Type (Com Type)

For setting the communication type. RS-232 or GPIB.

Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Use the rotary knob and scroll to option Com Type
3. Press “**OK**” button.
   Display now reads the setting currently selected, ie RS232 (by default).
4. Select RS232 or GPIB using the rotary knob.
5. Once selection is made, press “**OK**” button.

3.18.17 Communication Settings (Com Set)

Once the communication type is selected, settings for the communications can be entered.
RS-232 communication settings are 9600 to 115200 baud rate.
GPIB is a settable IEEE-488 bus address 1 to 30.

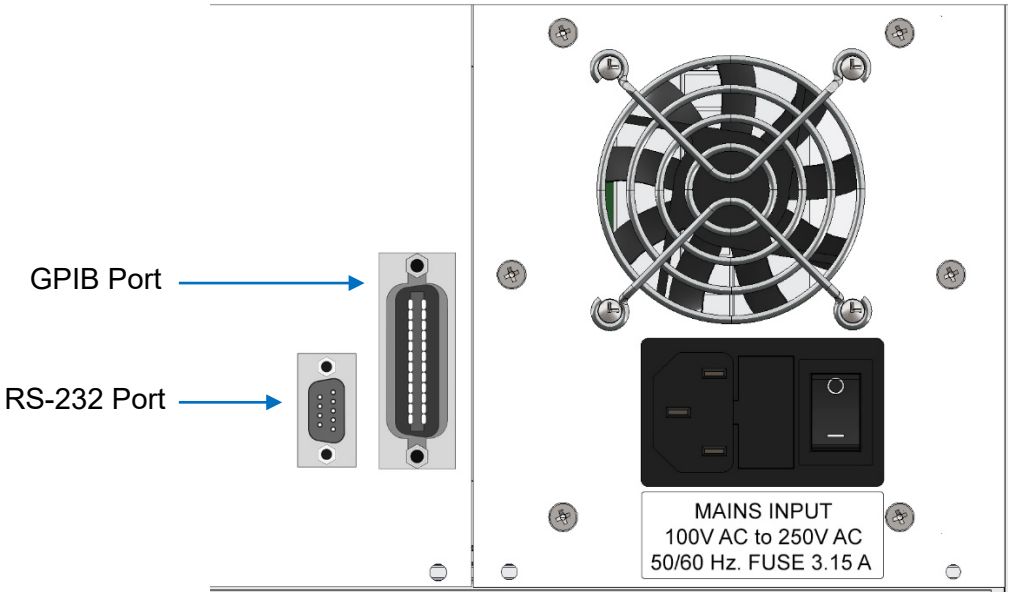
Setting Method:

1. Press “**Function**” button, then press “**SET**” button.
2. Ensure Com Type is set to your required communication interface.
3. Use the rotary knob and scroll to option Com Set
4. Press “**OK**” button.
   Display now reads the current setting (Baud Rate for RS232 or Address for GPIB)
5. Adjust the setting to the required using the rotary knob.
6. Once selection is made, press “**OK**” button.

4 Remote Operation

4.1 Communications Interface

The 5025 may be controlled by a PC via a RS-232, USB or GPIB.
Ports are located on the rear panel:



Communication options are selected from the front panel Setup Menu.

```
Com Type: RS232 / GPIB
Com Set: Baud Rate (9600 to 115.2k) / Address (1 to 30)
```

Note: The baud rate must be set to 9600 for EasyCal.

4.1.1 For RS-232 / USB Adaptor Communications

A straight-through (pin to pin) RS-232 lead, male to female is supplied with the unit.

The RS-232 communication settings are 9600 to 115200 baud rate, no parity, 8 data bits and 1 stop bit. When using the supplied USB adaptor, connect this to the RS-232 port on the 5025. After installing the driver and connecting the device to a PC, check ‘Device Manager’ to see which comm. port the USB adaptor has been assigned.

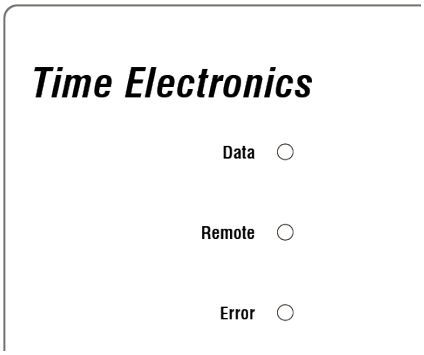
4.1.2 GPIB Communication

A standard GPIB interface connector to operate the 5025 in remote control mode over the IEEE-488 Bus. See Remote Operation for programming instructions.

4.1.3 Entering Remote Mode

The unit will automatically enter remote mode as soon as it receives a command on the remote interface. While in remote mode, the keypad will be disabled apart from the Confirm/Local key.

LED Displays in Remote Mode



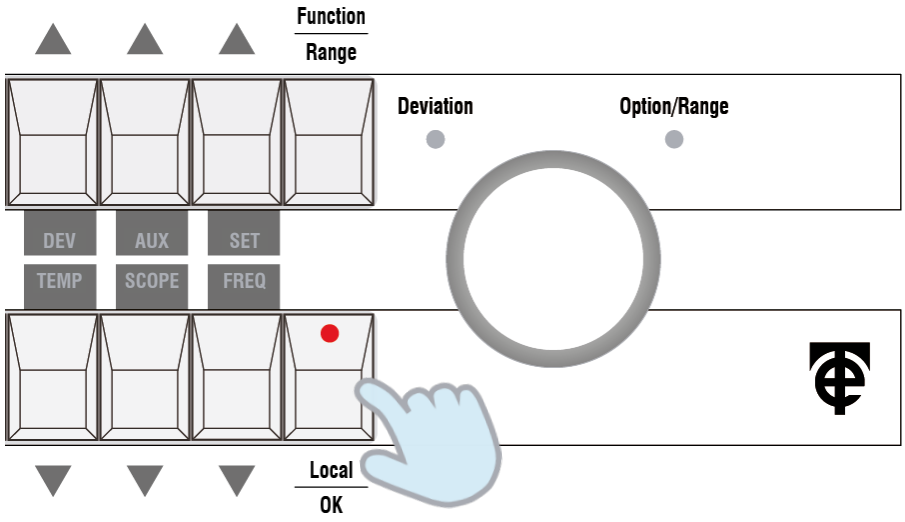
There are 3 LEDs located on the left-hand side of the unit's front panel.
These indicate the status of the unit in remote mode:

LED	Usage
Data	Blinks to indicate reception/transmission of data through the RS-232 port.
Remote	Lights up when the unit is in remote mode. Goes out when the unit is in local mode.
Error	Lights up when an invalid remote command is received. Stays on until the error is read (the **SYSTem:ERRor?** command) or the error buffer is cleared (e.g. by a ***CLS** command).

4.1.4 Returning to Local Mode

The unit will return to local mode when either:

a) The "OK/Local" key is pressed



b) The unit receives the **SYSTem:LOCal** remote command (see Commands for details).

4.2 Remote Commands

4.2.1 Introduction to SCPI

The 5025's remote commands follow the SCPI standards. If you are already familiar with SCPI, then you can skip this section. SCPI commands are based on a tree-like hierarchy. Associated commands are grouped together under a common node (or root), into "subsystems". For example, here is a part of the SOURce subsystem:

```
SOURce:
      VOLTage:
            RANGe <voltage>
            RANGe?
            [LEVEl:][IMMediate:][AMPLitude] <voltage>
            [LEVEl:][IMMediate:][AMPLitude]?
      FREQuency:
            [:CW] <Hz>
            [:CW]?
      FUNCtion
            [:SHAPe] {DC|SINusoid}
            [:SHAPe]?
```

SOURce is the root keyword of the command. VOLTage, FREQuency and FUNCtion are second-level keywords, RANGe is a third level keyword, and so on. A colon (:) is used to separate different levels of keywords.

Command Format Used in this Section

For example, take this command:

```
[:SOURce]:VOLTage:RANGe <volts>
```

The commands are shown as a mixture of lower and upper case letters. The upper case letters represent the short form of the keyword, while the mixture of upper and lowercase letters represent the long form. For instance:

- `SOURCE` is the long form
- `SOUR` is the short form

You may use either the long form or the short form of any keyword. However you must not use a cross between the two, e.g. SOURC is invalid and well generate an error.

Please note that SCPI is case-insensitive and it does not matter what case you enter the commands in. The use of lower and upper case letters in the command formats is purely to show the long and short forms of the commands.

Braces (`{,}`) are used to enclose a set of choices for a given parameter. The braces should not be entered.

A vertical bar (`|`) is used to separate multiple parameter choices.

Triangle brackets (**<**,**>**) are used to indicate a value you need to specify for the parameter. For example, with the command above a valid command would be:

```
SOUR:VOLT:RANG 10
```

If a parameter or command keyword is enclosed in square brackets (**[**,**]**) then it is optional and can be omitted. The brackets should not be entered. For example if the command specification is this:

```
[:SOURce]:VOLTage:RANGe <volts>
```

then these commands are equivalent:

```
SOUR:VOLT:RANG 10

VOLT:RANG 10
```

Command Separators

A colon (:) is used to separate command keywords from a lower-level keyword. For example:

```
SOUR:VOLT:RANG 20
```

You must separate a command from its first parameter with one or more spaces. For example:

```
SOUR:VOLT:RANG 20
```

You may include a series of commands in the same command line (up to 250 characters). To separate the commands use a semi-colon (**;**). For example:

```
SOUR:VOLT:RANG 20;LEV 10
```

That is the same as entering these separate commands:

```
SOUR:VOLT:RANG 20

SOUR:VOLT:LEVEL 10
```

Use a colon **and** a semi colon to link commands from different levels of the tree. For example:

```
FUNC SIN;:FREQ 300;:SOUR:VOLT:RANG 20;:OUTP ON
```

That is the same as this series of commands:

```
FUNC SIN

FREQ 300

SOUR:VOLT:RANG 20

OUTP ON
```

Query Commands

You can query the setting of most commands by appending a question mark (**?**) to the command. For example:

```
FREQ?
```

This will return the AC frequency setting, in Hz.

Parameter Types

Numerical Parameters

Commands that accept numerical values as parameters also allow units to be specified, e.g. mV, uA, C (deg C), kR (kilo-ohms). For instance, all of these are valid:

```
VOLT  10MV
VOLT 0.01
VOLT 1e-2
RES 100KR
THERM 75.6C
```

If you do not specify the unit then the default unit will be used (i.e. the unified units – volts, amps, ohms, seconds, Hz, Henrys etc.)

Discrete Parameters

A discrete parameter has a limited set of choices. For example:

```
[:SOURce]:THERmocouple:TYPE {B|E|J|K|N|R|S|T}
```

In this case, choose one of the options separated by the vertical bar. These are examples of valid commands:

```
SOUR:THER:TYPE B

THER:TYPE J

SOUR:THER:TYPE N
```

Boolean Parameters

A Boolean parameter is used where the setting is either true or false, on or off. The value may be entered as **ON** or **OFF**. In addition it may be entered as a number – a non-zero number is treated the same as **ON**, and zero is treated the same as **OFF**. For example, with this command specification:

```
:OUTPut[:STATe] <Boolean>
```

These are valid commands:

```
OUTPut ON

OUTPut 1

OUTPut OFF

OUTPut 0
```

SCPI Command Terminator

Each command line must end with a command terminator. In the case of GPIB, this may be either through use of the IEEE488 EOI (End Or Identity) message, or using a Carriage Return (ASCII 13) or Linefeed (ASCII 10) character, or any combination of the three. In the case of RS232, the command terminator must be a Carriage Return or a Line Feed character or both.

Note: A command terminator always resets the SCPI tree to the root level.

4.2.2 Command Set

Setting AC or DC Voltage and Current

`[:SOURce]:FUNCtion[:SHAPe] {DC|SINusoid}`

Select shape of the voltage and current functions. Selecting “DC” will make the present and future functions output in DC volts or DC amps. Selecting “SINusoid” will make the functions output in AC volts or AC amps. This setting is remembered until the unit is reset or turned off. At startup, this setting is “DC”.

Examples:

func sin

selects AC output

func sin;:volt:rang 20

selects 20V AC Range

func DC;:volt:rang 20

selects 20V DC Range

func sin;:volt:rang 20;:volt 5.4;:freq 200;:output on

selects the 20V AC range, sets the voltage to 5.4 V, frequency to 200 Hz and switches the output on

`[:SOURce]:FUNCtion[:SHAPe]?`

Query the shape of voltage and current functions.

Example:

func?

> DC

Voltage

[:SOURce]:VOLTage:RANGe <volts>

Select the voltage function and a range. <volts> may be 20mv, 200mv, 2V, 20V, 200V or 1kV.

Example:

volt:rang 20

selects the voltage function and 20V range

[:SOURce]:VOLTage:RANGe?

Query the present voltage range.

Example:

volt:rang?

> 0.2

[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude] <volts>

Set the voltage output in the present voltage range.

Example:

Volt 150.67mv

sets the output voltage to 150.67mV

[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude]?

Query the present voltage output.

Example:

volt?

> 1.7352

Current

`[:SOURce]:CURRent:RANGe <amps>[,{1Turn|5Turn|50Turn}]`

Select the current function and a range. <current> may be 200ua, 2ma, 20ma, 200ma, 2a or 20a. If <current> is 2a or 20a, then a turn coil parameter may be added.

Examples:

curr:rang 2ma

selects the current function and 2mA range

curr:rang 2a
selects the current function and 2A range

curr:rang 2a,5t
selects the current function and 2A (5-turn coil) range

curr:rang 20a,50t
curr 789.12
selects the current function and 20A (50-turn coil) range
then selects an output of 789.12A from the 50-turn coil

`[:SOURce]:CURRent:RANGe?`

Query the present current range.

Examples:

curr:rang?

> 0.002

curr:rang?
> 2.0,5TURN

Setting the Frequency for AC Voltage and Current

[:SOURce]:FREQuency[:CW|:FIXed] <Hz>

Set the frequency of the AC voltage or AC current function. <Hz> is an integer between 0 and 20kHz for AC volts in the 20V range or lower. For other ranges the maximum frequency settable is as per the specification section of this manual.

Example:

freq 1.2kHz

sets the AC frequency to 1.2kHz

[:SOURce]:FREQuency[:CW|:FIXed]?

Query the frequency of the AC voltage or AC current function.

Example:

freq?

> 1200

2-wire Variable Resistance

[:SOURce]:RESistance[:LEVel][:IMMediate][:AMPLitude] <ohms>

Select the resistance function and set the output level. <ohms> can be 0r, 1r, 10r, 500r, 1kr, 10kr, 200kr, 1mr, 10mr or 100mr.

Example:

res 10kr

sets the output resistance to 10kohm

[:SOURce]:RESistance[:LEVel][:IMMediate][:AMPLitude]?

Query the present resistance output.

Example:

res?

> 10000

4-wire Decade Resistance

[:SOURce]:FRESistance[:LEVel][:IMMediate][:AMPLitude] <ohms>

Select the resistance function and set the output level. <ohms> can be 0r, 1r, 10r, 100r, 1kr, 10kr, 100kr, 1mr, 10mr or 100mr.

Example:

fres 10kr

sets the output resistance to 10kohm

[:SOURce]:FRESistance[:LEVel][:IMMediate][:AMPLitude]?

Query the present resistance output.

Example:

fres?

> 10000

Capacitance

[:SOURce]:CAPacitance[:LEVel][:IMMediate][:AMPLitude] <farads>

Select the capacitance function and set the output level. <farads> can be 1nf, 10nf, 100nf, 1uf, 10uf or 100uf.

Example:

cap 0.0001

selects the capacitance function and sets the output to 100uF

[:SOURce]:CAPacitance[:LEVel][:IMMediate][:AMPLitude]?

Query the present capacitance output.

Example:

cap?

> 0.000001

RTD

[:SOURce]:RTD:TYPE {PT100}

Select the RTD simulation function and sets the type of RTD to be simulated (PT100 always in this case).

Example:

rtd:type pt100

selects the rtd simulation function type PT100

[:SOURce]:RTD:TYPE?

Query the type of RTD simulation selected.

Example:

rtd:type?

> PT100

[:SOURce]:RTD[:LEVel][:IMMediate][:AMPLitude] <temperature>

Set the temperature to be simulated by the RTD function. <temperature> can be any temperature value supported by the selected RTD simulation. Units can be c (Celsius), f (Fahrenheit) or K (Kelvin). If the units are specified, then these become the default units for any future temperature simulation.

Example:

rtd 12.5C

sets the simulated output temperature of the RTD function to 12.5 deg C.

[:SOURce]:RTD[:LEVel][:IMMediate][:AMPLitude]?

Query the present RTD simulation temperature. The value is returned in the temperature units last used (default is Celsius).

Example:

rtd?

> 12.5

Thermocouples

[:SOURce]:THERmocouple:TYPE {B|E|J|K|N|R|S|T}

Select the thermocouple simulation function and set the type of thermocouple to be simulated (type B, E, J, K, N, R, S or T).

Example:

ther:type k

selects the thermocouple simulation function type K

[:SOURce]:THERmocouple:TYPE?

Query the type of thermocouple selected.

Example:

ther:type?

> B

[:SOURce]:THERmocouple[:LEVel][:IMMediate][:AMPLitude] <temperature>

Set the temperature to be simulated by the thermocouple function. <temperature> can be any temperature value supported by the selected thermocouple simulation. Units can be c (Celsius), f (Fahrenheit) or K (Kelvin)

Example:

ther 75.8

sets the simulated output temperature of the thermocouple function to 75.8, using the temperature units last used.

[:SOURce]:THERmocouple[:LEVel][:IMMediate][:AMPLitude]?

Query the present thermocouple simulation temperature. The value is returned in the temperature units last used (default is Celsius).

Example:

ther?

> 875.4

Standard Period / Frequency (10MHz)

[:SOURce]:PULSe:PERiod <seconds>

Example:

puls:per 50us

selects the period function and sets its output to 50us

[:SOURce]:PULSe:PERiod?

Query the setting of the period function.

Example:

puls:per?

> 0.0001

[:SOURce]:PULSe:SFREQuency <hz>

Example:

puls:freq 2.5MHz

selects the frequency function and sets its output to 2.5MHz

[:SOURce]:PULSe:FREQuency?

Query the setting of the frequency function.

Example:

puls:freq?

> 2000000

Scope Period / Frequency (100MHz)

[:SOURce]:PULSe:SPERiod <seconds>

Select the period function set the output. <seconds> can be 10ns, 20ns, 50ns, 100ns, 200ns, 500ns, 1us, 2us, 5us, 10us, 20us, 50us, 100us, 200us, 500us, 1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, 5s or 10s.
Example:

puls:sper 50us

selects the period function and sets its output to 50us

[:SOURce]:PULSe:SPERiod?

Query the setting of the period function.
Example:

puls:sper?

> 0.0001

[:SOURce]:PULSe:SFRequency <hz>

Select the frequency function set the output. <hz> can be 0.1hz, 0.2hz, 0.5hz, 1hz, 2hz, 5hz, 10hz, 20hz, 50hz, 100hz, 200hz, 500hz, 1khz, 2khz, 5khz, 10khz, 20khz, 50khz, 100khz, 200khz, 500khz, 1Mhz, 2Mhz, 5Mhz, 10Mhz, 20Mhz, 50Mhz or 100Mhz.

Example:

puls:sfr 2MHz

selects the frequency function and sets its output to 2MHz

[:SOURce]:PULSe:SFRequency?

Query the setting of the frequency function.
Example:

puls:sfr?

> 2000000

[:SOURce]:PULSe:DCYCle <percentage>

Select the duty cycle function and set the output. <percentage> can be any value between 0% and 100%. Note: to set the frequency to be used for duty cycle, use the [:SOURce]:PULSe:FREQuency command before this, in order to select either 100Hz, 1kHz, or 10kHz.
Example:

puls:dcycl 33.33

selects the duty cycle function and sets the duty to 33.3%

[:SOURce]:PULSe:DCYCle?

Query the setting of the duty cycle function.
Example:

puls:dcycl?

> 12.5

GHZ Sweep

NOTE: The frequency set before the amplitude command is sent.

[:SOURce]:PULSe:GFREquency <hz>

Example:

puls:gfreq 1.2GHz

selects the frequency function and sets its output to 1.2GHz

[:SOURce]:PULSe:GFREquency?

Query the setting of the frequency function.

Example:

puls:gfreq?

> 12000000

[:SOURce]:PULSe:GAMPlitude <Volts>

<hz> can be 0.5V, 1.0V, 1.5V.

Example:

puls:gamp 1V

selects the amplitude to 1V

[:SOURce]:PULSe: GAMPlitude?

Query the setting of the frequency function.

Example:

puls:gamp?

> 1.0

Power

[:SOURce]:POWer:RANGe <volts>,<amps>

NOTE: This command can only be used when output is off.

Selects the power function plus the voltage and current ranges. <volts> may be 20mV, 200mV, 2V, 20V, 200V or 1kV. <amps> may be 2A or 20A.

Example:

pow:rang 20,2

selects the power function, the 20V range and the 2A current range

[:SOURce]:POWer:RANGe?

Query the present voltage and current ranges.

Example:

pow:rang?

> 20,2

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude] <volts>,<amps>

NOTE: This command can only be used when output is off.

Set the voltage and current output in the present voltage and current ranges.

Example:

pow 10,2

sets the output voltage to 10V and the current output to 2A

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?

Query the present voltage and current outputs.

Example:

pow?

> 10,2

[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]:POWer?

Query the present power output. Units are VA or Watts, as selected by the **UNIT:POWer** command.

Example:

p**ow:pow?**

> 490

[:SOURce]:POWer:PHASe <phase>

NOTE: This command can only be used when output is off and when AC power is selected.

Sets the phase difference between current and voltage. <phase> is either in degrees (-90.0 to +90.0) or power factor (-1.00 to +1.00). The units of phase have been previously selected using the **UNIT:PHASe** command. A positive value of <phase> means the current is leading the voltage. A negative value of <phase> means the current is lagging the voltage.

Example:

pow:phase 0.98

assuming units are set to power factor, selects a phase of 0.98 current leading.

[:SOURce]:POWer:PHASe?

Queries the phase difference between current and voltage. The phase returned is either in degrees (-90.0 to +90.0) or power factor (-1.00 to +1.00). The units of phase have been previously selected using the **UNIT:PHASe** command. A positive value of phase means the current is leading the voltage. A negative value of phase means the current is lagging the voltage.

Example:

pow:phase?

> -10.3

assuming units are set to degrees, this means the current is lagging voltage by 10.3 degrees

[:SOURce]:FUNCtion[:SHAPe] {DC|SINusoid}

NOTE: This command can only be used when output is off.

Select shape of the power functions. Selecting “DC” will make future output DC. Selecting “SINusoid” will make future output AC. The setting is remembered until the unit is reset or turned off. At startup, this setting is “DC”.

Example:

func sin

selects AC output

[:SOURce]:FUNCtion[:SHAPe]?

Query the shape of the power function.

Example:

func?

> DC

[:SOURce]:FREQuency[:CW|:FIXed] <Hz>

NOTE: This command can only be used when output is off.

Set the frequency of the AC power function. <Hz> is an integer between 40 and 400Hz.

Example:

freq 50Hz

sets the AC frequency to 50Hz

[:SOURce]:FREQuency[:CW|:FIXed]?

Query the AC frequency set. Example:

freq?

> 110

General Commands

[:SOURce]:NONE

Set all outputs off and return the unit to the “Ready” state. Note, the unit is still in remote mode operation.

Example:

none

:OUTPut[:STATe] <Boolean>

Turns output from the terminals on (if <Boolean> is ON) or off (if <Boolean> is OFF). At startup, the default state is ON.

Example:

outp on

turns output on

:OUTPut[:STATe]?

Query the terminal output state.

Example:

func?

➢ **0**

:SYSTem:REMote

Puts the unit into remote (RS232) operation mode. The unit’s keypad is disabled apart from the “Local/Confirm” button. If pressed once while in remote operation, the unit will return to local operation.

Note also that the unit is automatically switched from local to remote operation if it receives a command over the RS232 port.

:SYSTem:LOCal

Puts the unit into local operation mode. The unit’s keypad is enabled.

:SYSTem:ERRor[:NEXT]?

Query the oldest error code in the remote error buffer. The error code is also deleted from the remote error buffer. If no errors are present in the buffer, then it returns “0”.

Example:

syst:err?

> -380

:SYSTem:ERRor:COUNt?

Query the number of errors in the unit's remote error buffer. The buffer has room for 64 entries.

Example:

syst:err:coun?

> 2

:SYSTem:VERSion?

Query the version of SCPI supported by the unit.

Example:

syst:vers?

> 1999.0

:SYSTem:INFormation?

Query the version numbers of the unit's firmware and the modules within the unit. The format of the returned information is one line of text per module:

<Board Code>,<Software version>

:SYSTem:MODule:VSource:TEMPerature?

Query the internal temperature of the unit. The temperature returned is in the currently selected temperature units.
Example:

syst:mod:vs:temp?

> 38.2

:UNIT:TEMPerature {C|CEL|F|FAH|K}

Set the units to be used for future temperature settings and queries. The units selected are stored in non-volatile memory and remain selected the next time the unit is switched on.
Example:

unit:temp f

sets unit of temperature to degrees Fahrenheit

:UNIT:TEMPerature?

Query the units of temperature being used.
Example:

unit:temp?

> C

SYSTem:MODule:CURRent:TURNcoil:ENABle {ON|OFF}

Enable or disable the use of turn coil ranges.

Example:

syst:mod:curr:turn:enab on
enables use of turn coil ranges

SYSTem:MODule:CURRent:TURNcoil:ENABle?

Query the use of turn coil ranges. Returns 1 if enabled or 0 if disabled.

Example:

syst:mod:curr:turn:enab?
> 1
use of turn coil ranges is enabled

IEEE488.2 Compliant Commands

***CLS**

Clear the remote error buffer.

***IDN?**

Query the identity of the unit. The information returned is in standard SCPI format, i.e.:

TIME ELECTRONICS,5025,0,1.0.0

where 1.0.0 is the version number of the unit's firmware.

***OPC?**

Returns "1" when the previous command has completed operating.

***RST**

Make the unit perform a complete reset. All output is turned off and unit returns to Ready state.

***WAI**

Waits for the last command to complete before continuing. Since all commands to the 5025 are treated sequentially, this command is redundant, but is kept for SCPI-compatibility.

4.2.3 Command Listing

Command	Use
[:SOURce]	
:VOLTage[:LEVel][:IMMediate][:AMPLitude] <volts>	Set voltage output
:VOLTage[:LEVel][:IMMediate][:AMPLitude]?	Query
:VOLTage:RANGe <volts>	Set voltage range
:VOLTage:RANGe?	Query
:CURRent[:LEVel][:IMMediate][:AMPLitude] <amps>	Set current output
:CURRent[:LEVel][:IMMediate][:AMPLitude]?	Query
:CURRent:RANGe <amps>[,{1Turn|5Turn|50Turn}]	Set current range
:CURRent:RANGe?	Query
:RESistance[:LEVel][:IMMediate][:AMPLitude] <ohms>	Set 2-wire variable resistance output
:RESistance[:LEVel][:IMMediate][:AMPLitude]?	Query
:FRESistance[:LEVel][:IMMediate][:AMPLitude] <ohms>	Set 4-wire decade resistance output
:FRESistance[:LEVel][:IMMediate][:AMPLitude]?	Query
:CAPacitance[:LEVel][:IMMediate][:AMPLitude] <farads>	Set capacitance output
:CAPacitance[:LEVel][:IMMediate][:AMPLitude]?	Query
:INDuctance[:LEVel][:IMMediate][:AMPLitude] <henrys>	Set inductance output
:INDuctance[:LEVel][:IMMediate][:AMPLitude]?	Query
:CONDuctance[:LEVel][:IMMediate][:AMPLitude] <siemens>	Set 2-wire conductance output
:CONDuctance[:LEVel][:IMMediate][:AMPLitude]?	Query
:FCONDuctance[:LEVel][:IMMediate][:AMPLitude] <siemens>	Set 4-wire conductance output
:FCONDuctance[:LEVel][:IMMediate][:AMPLitude]?	Query
:RTD[:LEVel][:IMMediate][:AMPLitude] <temperature>	Set simulated RTD output
:RTD[:LEVel][:IMMediate][:AMPLitude]?	Query
:RTD:TYPE {PT100}	Select type of simulated RTD output
:RTD:TYPE?	Query
:THERmocouple[:LEVel][:IMMediate][:AMPLitude] <temperature>	Set simulated thermocouple output
:THERmocouple[:LEVel][:IMMediate][:AMPLitude]?	Query
:THERmocouple:TYPE {B|E|J|K|N|R|S|T}	Select type of simulated thermocouple output
:THERmocouple:TYPE?	Query
:FREQuency[:CW|:FIXed] <Hz>	Set AC frequency of output
:FREQuency[:CW|:FIXed]?	Query
:VOLTage:RAMP:RATe	Set the voltage ramp rate for the select range in Volts/Sec. (smooth ramping)
:VOLTage:RAMP:RATe?	Query the ramp rate
:CURRent:RAMP:RATe	Set the current ramp rate for the select range in A/Sec. (smooth ramping)
:CURRent:RAMP:RATe?	Query the ramp rate
SYSTem:UNIT:RAMP:ENABle	Set ramping mode to on or off
SYSTem:UNIT:RAMP:ENABle?	Query ramp enable

4.2.4 Command Listing (Continued)

Command	Use
[:SOURce]	
:PULSe:PERiod <seconds>	Set period of standard (10MHz) pulse output
:PULSe:PERiod?	Query
:PULSe:FREQuency <hz>	Set frequency of standard (10MHz) pulse output
:PULSe:FREQuency?	Query
:PULSe:SPERiod <seconds>	Set period of Scope/100MHz pulse output
:PULSe:SPERiod?	Query
:PULSe:SFRequency <hz>	Set frequency of Scope/100MHz pulse output
:PULSe:SFRequency?	Query
:PULSe:DCYCle <percentage>	Set duty cycle of Scope/100MHz pulse output
:PULSe:DCYCle?	Query
:PULSe:GFREQuency <hz>	Set frequency of GHz sweep output
:PULSe:GFREQuency?	Query
:PULSe:GAMPlitude <volts>	Set amplitude of GHz sweep output (0.5V,1.0V & 1.5V) Note frequency must be set first
:PULSe:GAMPlitude?	Query
:POWer:RANGe <volts>, <amps>	Set voltage and current ranges
:POWer:RANGe?	Query
:POWer:PHASe <phase>	Set phase (only applies to AC power)
:POWer:PHASe?	Query
:POWer[:LEVel][:IMMediate][:AMPLitude] <volts>, <amps>	Set the voltage and current levels
:POWer[:LEVel][:IMMediate][:AMPLitude]?	Query voltage and current levels
:POWer[:LEVel][:IMMediate][:AMPLitude]:POWer?	Query power level (query only)
:FUNCtion[:SHAPe] {DC|SINusoid|SQuare}	Set output to DC, sinusoidal wave (for AC) or squarewave (for amplitude)
:FUNCtion[:SHAPe]?	Query
:NONE	Select no function, i.e. turns all outputs off and returns the unit to the Ready state (but remains in Remote operation mode)

4.2.5 Command Listing (Continued)

Command	Use
:OUTPut	
[:STATe] <Boolean>	Turn on/off output.
[:STATe]?	Query.
:IMPedance {HIGH|50}	Select high impedance or 50ohm impedance of Scope Output.
:IMPedance?	Query.
:SYSTem	
:ERRor[:NEXT]?	Report error code.
:ERRor:COUNt?	Reports error count.
:LOCal	Puts unit into local mode, i.e. controlled by front panel .
:REMote	Puts unit into remote mode, i.e. controlled by remote interface. Disables all buttons on front panel except Local key.
:UNIT:INFormation? {1|2|3}	Returns information about the unit comprising list of firmware versions of each installed module. Optional number returns next set of information, if required.
SYSTem:UNIT	
:TEMPerature {C|CEL|F|FAH|K}	Set unit of temperature to be used if none specified, and in returned queries.
:TEMPerature?	Query.
:POWer {WATT|VA}	Set unit of power to be used if none specified, and in returned queries.
:POWer?	Query.
:PHASe {PF|DEG}	Set unit of phase to be used if none specified, and in returned queries.
SYSTem:MODule	
:CJ:ENABle OFF|ON|MANual	Sets the type of CJ reference to be used.
:CJ:ENABle?	Query the CJ reference type.
:CJ:MANual:TEMPerature < temperature >	Sets the manual CJ value to be used when in manual CJ temperature mode. 0.0 to 50.0 °C in °C only.
:CJ:MANual:TEMPerature?	Query the manual CJ temperature in °C, °F or K.
:CURRent:TURNcoil:ENABle {ON|OFF}	Enable use of turn coil ranges
:CURRent:TURNcoil:ENABle?	Query
:DCHV:ENAB {ON|OFF|200V}	Sets the DCHV mode to Normal, High Drive All or Hi Drive 1kV
IEEE488.2 commands	
*IDN?	Unit identification query.
*OPC	Operation Complete.
*OPC?	Operation Complete query.
*CLS	Clear Error Buffer.
*RST	Reset unit.

4.2.6 Remote Error Codes

When an error occurs during remote operation, e.g. if an invalid command is received, then an error code is added to the remote error buffer. In addition, a beep is emitted and the Error LED on the front panel lights up.

The error codes may be retrieved, oldest error first, using the **:SYSTem:ERRor[:NEXT]?** and **:SYSTem:ERRor:COUnt?** commands.

Code	Description
-102	Syntax error in the command line.
-104	Invalid data type. For example, a number was entered where a string was required.
-108	Too many parameters.
-109	Not enough parameters.
-113	Undefined header. The command was not recognised.
-131	Invalid suffix. A number was given but the units were not valid.
-151	Invalid string, e.g. a quote was missing.
-221	Settings Conflict. The command was incompatible with the present state. For example, a voltage output was request while the unit was not in a voltage range.
-222	Data out of range. The value of one/more parameters was outside range allowed.
-224	Illegal parameter value. The parameter given was beyond the allowed limits.
-350	Too many errors. An error has occurred but the buffer of error codes is full.
-380	Internal Error. A problem has occurred with the operation of the unit. Restart the unit before continuing.

5 Fault Diagnosis

5.1 Basic Troubleshooting

Problem	Possible Cause
O/P Err	The current output is trying to drive an open circuit. Check leads are connected correctly. Check any fuses in the UUT.
HV ITrip	High Voltage Over Current Error. See Operational Error Messages Section for further details.
HV VTrip	High Voltage Over Voltage Error. See Operational Error Messages Section for further details.
HiAmp °C	High Current range over temperature. See Operational Error Messages Section for further details.
Remote Mode: No communications with unit	Check the comms cable is the correct type (e.g. a straight-through cable if using RS-232). Check the remote communication settings in Setup > Com Type (e.g. wrong interface selected) or Setup > Com Set. (e.g. incorrect baud rate)
Remote Mode: Invalid command	Check command end of string terminator is present
Unit does not turn on.	Check Mains fuses on the rear panel. Both are 3.18A anti-surge. (Note there are 2 fuses)

5.2 Startup Errors

If any of the following errors occur during start up, please contact Time Electronics.

Error Displayed	Meaning
!Err SRQ	A Service Request has been made by one or more boards, but the main controller is unable to communicate with those boards.
V/I Cal!	The voltage and current calibration factors are invalid. The unit should be calibrated/recalibrated before the voltage and current functions are used again.
!ErM HV	High voltage module not found.
!ErM HI	High current module not found.
!ErM VRC	Voltage source module not found.
!ErM DCH	DC high voltage module not found.
!ErM AC	AC synth module not found.
!ErM CUR	Low Current module not found.
!ErM MAT	Matrix relay module not found.
!ErM FRR	Full range resistance module not found.
!ErM RES	Decade resistance module not found.
!ErM CL	Capacitance and/or inductance source module not found.
!ErM SCP	Scope/Timer module not found.
!ErM TIM	Scope/Timer module not found.
!ErM TER	Terminal relay module not found.

5.3 Module Reset Errors

This type of error will occur if a module unexpectedly resets during operation. In this situation the calibrator will automatically restart after indicating one of the module reset error messages below. After the restart and self-test has been completed the 5025 will show !RST for a short period before returning to the ready state, meaning the 5025 can be operated as normal. A module may reset unexpectedly if there is temporary power supply issue or static is inadvertently applied to the output terminals. A module reset error is usually followed by an SRQ error.

Error Displayed	Meaning	SCPI Error
!Err SRQ	If this error occurs during operation of the calibrator, then the most common cause is one or more modules have unexpectedly reset.	100
!RST	The 5025 has automatically restarted after a module reset.	-
!RST MUL	Two or more modules have unexpectedly reset.	200
!RST VRC	The V-Source module has unexpectedly reset.	201
!RST CL	The C/L module has unexpectedly reset.	202
!RST CUR	The Current module has unexpectedly reset.	203
!RST MAT	The Matrix relay module has unexpectedly reset.	204
!RST RES	The Decade Resistance module has unexpectedly reset.	205
!RST TER	The Terminal Relay module has unexpectedly reset.	206
!RST HV	The High Voltage module has unexpectedly reset.	207
!RST HI	The High Current module has unexpectedly reset.	208
!RST FRR	The Full Range Resistance module has unexpectedly reset.	212
!RST DHV	The DC High Voltage module has unexpectedly reset.	213
!RST SCP	The Scope Amplitude module has unexpectedly reset.	214
!RST GHZ	The GHz module has unexpectedly reset.	215
!RST AC	The AC module has unexpectedly reset.	216
!RST TIM	The Scope Time Marker module has unexpectedly reset.	217

5.4 Power Supply Errors

If any of the following power supply errors occur please contact Time Electronics.

Error Displayed	Meaning	SCPI Error
HiAmp P-	High Current module PSU error	404
HiAmp P+	High Current module PSU error	405
Curr Amp	Low Current module PSU error	407

6 Re-Calibration

The 5025 should be re-calibrated at recommended intervals in order to ensure its outputs remain within specification. Normally re-calibration is done at 12 month intervals.

The 5025 calibration software and manual are supplied separately and only available by request from Time Electronics.

It is recommended that the unit is returned to Time Electronics or an authorised service centre for re-calibration.

7 Warranty and Servicing

Warranty

Time Electronics products carry a one-year manufacturer's warranty as standard.

Time Electronics products are designed and manufactured to the highest standards and specifications to assure the quality and performance required by all sectors of industry. Time Electronics products are fully guaranteed against faulty materials and workmanship.

Should this product be found to be defective, please contact us using the below details. Inform us of the product type, serial number, and details of any fault and/or the service required. Please retain the supplier invoice as proof of purchase.

This warranty does not apply to defects resulting from action of the user such as misuse, operation outside of specification, improper maintenance or repair, or unauthorized modification. Time Electronics' total liability is limited to repair or replacement of the product. Note that if Time Electronics determine that the fault on a returned product has been caused by the user, we will contact the customer before proceeding with any repair.

Calibration and Repair Services

Time Electronics offers repair and calibration services for all the products we make and sell. Routine maintenance by the manufacturer ensures optimal performance and condition of the product. Periodic traceable or accredited calibration is available.

Contacting Time Electronics

Online:
Please visit **www.timeelectronics.com** and select Support Request from the Contact links. From this page you will be able to send information to the Time Electronics service team who will help and support you.

By phone:
+44 (0) 1732 355993

By email:
mail@timeelectronics.co.uk

Returning Instruments

Prior to returning your product please contact Time Electronics. We will issue a return merchandise authorization (RMA) number that is to accompany the goods returning. Further instructions will also be issued prior to shipment. When returning instruments, please ensure that they have been adequately packed, preferably in the original packing supplied. **Time Electronics Ltd will not accept responsibility for units returned damaged.** Please ensure that all units have details of the service required and all relevant paperwork.

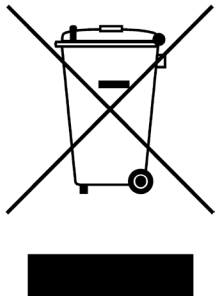
Send the instrument, shipping charges paid to:

Time Electronics Ltd
Unit 5, TON Business Park, 2-8 Morley Road,
Tonbridge, Kent, TN9 1RA.
United Kingdom.

Tel: +44(0)1732 355993
Fax: +44(0)1732 350198

Email: mail@timeelectronics.co.uk
Web Site: www.timeelectronics.com

Disposal of your old equipment



1. When this crossed-out wheeled bin symbol is attached to a product it means the product is covered by the European Directive 2002/96/EC.
2. All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.
3. The correct disposal of your old appliance will help prevent potential negative consequences for the environment and human health.
4. For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service or return to Time Electronics.