TRANSMILLE
SOLUTIONS IN CALIBRATION



TRANSMILLE 4610M ADVANCED MULTIPRODUCT CALIBRATOR

OPERATION MANUAL

V3.01

1.Introduction 5

1.1 : Main Features 5
1.2 : Accuracy and Functionality 5
1.3 : True Multiproduct Calibration 5
1.4 : Retro Fit Options 5
1.5 : USB Interface 6
1.6 : GPIB (IEEE488) Interface 6
1.7 : Output Connections 6

2.Preparing the Calibrator for Use 7

2.1 : Initial inspection 7
2.2 : Lifting and Carrying the Calibrator 7
2.3 : Positioning the Calibrator 7
2.4 : Rear Panel Connections and Controls 8
2.5 : Setting and checking the Line Voltage 8
2.6 : Power Line Inlet Fuse and rating 10
2.7 : Powering up the calibrator 11
2.8 : Output Connections 12
2.9 : Warning and output Overload indications. 14
2.9.1 : High Voltage Timeout 15
2.9.2 : 30 Amp Temperature Cut-out 15

3.Operation 16

3.1 : Safety Warnings 16
3.2 : Introduction to Operation 16
3.3 : Front Panel Controls 17
3.4 : Digital Control 19
3.5 : Error Message Indicator 21
3.6 : Wait Indicator 21
3.7 : Touchscreen Interface Functionality 22
3.8 : Connection Help Prompts 23
3.9 : Main Menu 25
3.10 : View Configuration 26

3.11 : Function Menu 26
3.11.1 : Function Menu – Voltage 27
3.11.2 : Function Menu – Current 28
3.11.3 : Function Menu – Resistance 28
3.11.4 : Function Menu – Capacitance 30
3.11.5 : Function Menu – Pulse Width Modulation / Duty Cycle 31
3.11.6 : Function Menu – PRT / RTD 32
3.11.7 : Function Menu – Thermocouple 33
3.12 : General Settings 33
3.12.1 : General Settings – Configure Beeper 34
3.12.2 : General Settings – Specification Display Mode 34
3.12.3 : General Settings – Set GPIB Address 35
3.12.4 : General Settings – Command Mode 35
3.12.5 : General Settings – Specifications Display During Warmup 35
3.12.6 : General Settings – Default Negative to Ground State 36
3.12.7 : General Settings – High Voltage Timeout 36
3.12.8 : General Settings - Default Frequency 36
3.12.9 : General Settings - View Error Log 37
3.13 : System Settings 37
3.13.1 : System Settings - Set time & Date 38
3.13.2 : System Settings – Change Passcode 39
3.13.3 : System Settings - Update via USB Service Port 40
3.13.4 : System Settings - Hardware error detection 40
3.13.5 : System Settings – Restart Calibrator 41
3.14 : Calibration Menu 42
3.14.1 : Calibration / Adjustment Mode 44
3.14.2 : Backup Calibration Data 44
3.14.3 : Restore Calibration Data 44
3.15 : Calibrate Touchscreen 45
3.15.1 : Export Calibration to USB 47
3.16 : Special Functions Available Using the 'Soft' Keys 47
3.16.1 : Connecting Output Negative to Line Earth (Ground) 48
3.16.2 : Selecting front panel control when in Remote Mode 48
3.17 : Terminal Status LED's 49

4.Connection Diagrams 52

4.1 : Voltage - AC/DC 53
4.2 : Current Up To 2A - AC/DC 53
4.3 : Current Above 2A - AC/DC 54
4.4 : Resistance - 2 Wire Passive / 2 Wire Simulated Variable / 2 Wire Simulated Variable PRT 54

4.5 : Resistance - 2 Wire Compensated Simulated 55
4.6 : Resistance - 4 Wire Passive / 4 Wire Simulated 55
4.7 : Capacitance – Passive & Variable 56
4.8 : Frequency 56
4.9 : Pulse Width Modulation (PWM) / Duty Cycle 57
4.10 : Thermocouple Source 57
4.11 : Thermocouple Measurement 58
4.12 : Current Simulation Up To 1500A Using EA002 Coil Adapter 58

5.Setting Outputs 60

5.1 : Setting the Output 60
5.2 : Adjusting the Set Output Using the Digital Control 60
5.3 : Automatic Display of % or PPM Error and Reference Key 61
5.4 : Range Hold 62
5.5 : Wait Indicator 62
5.6 : Low Impedance Loads 63
5.7 : Setting a DC Voltage Output 64
5.8 : Setting a DC Current Output 65
5.9 : Setting an AC Voltage Output 66
5.10 : Setting an AC Current Output 67
5.11 : Setting 2-Wire Simulated Resistance Output 68
5.12 : Setting 4-Wire Simulated Resistance Output 70
5.13 : Setting 2-Wire Simulated Compensated Resistance 71
5.14 : Setting 2-Wire Passive Resistance Output. 72
5.15 : Setting 4-Wire Passive Resistance Output 74
5.16 : Setting Simulated Capacitance Output 76
5.17 : Setting Passive Capacitance Output 78
5.18 : Thermocouple Simulation (Source) Mode 80
5.19 : Thermocouple Measurement Mode 83
5.20 : Setting Frequency Output 86
5.21 : Setting Pulse Width Modulation (P.W.M., Mark Space Ratio) Output .. 86
5.22 : Setting Simulated PRT (RTD) Output 88
5.23 : Setting DC Current Output using EA002 Coil 90
5.24 : Setting AC Current Output using EA002 Coil 92

6.Guarantee and Service 95

1 Introduction

The 4610M calibrator offers the most advanced and up to date means of calibration of a wide variety of electrical measuring instruments. The 4610M advanced multi product calibrator provides a fully functional, precision programmable calibration source.

1.1 Main Features

- AC/DC Volts to 1020 V
- AC/DC Current to 30 Amps
- AC/DC Current to 1500 Amps with EA002 50 turn clamp coil adapter (option)
- 2 and 4 wire passive resistance to 1 GΩ
- 2 wire, 2 wire compensated, and 4 wire simulated resistance
- Capacitance to 100 mF (passive and simulated modes)
- Frequency to 1 MHz
- Pulse width modulation / duty cycle
- RTD (PRT) simulation
- Thermocouple source simulation and measurement (°C & °F)
- USB Interface
- GPIB (IEEE488) Interface

1.2 Accuracy and Functionality

The 4610M integrates powerful calibration capabilities using built-in software.

1.3 True Multiproduct Calibration

From one instrument

Designed to provide an accurate cost-effective instrument for the calibration of multimeters, clamp meters, frequency meters, temperature meters, and capacitance meters.
Designed for use in the laboratory or portable on site calibration, the 4610M calibrator is suitable for use in a standards laboratory. The 4610M boasts a fast-warm up time combined with connection to a PC/laptop (via a USB / GPIB interface) allowing for a fast return on investment and premium accuracy.

1.4 Retro Fit Options

Allows additional functions to be added.

Several internal retrofit options including oscilloscope and power allow the user to select the most cost-effective solution for the calibration work with the ability to add extra functions at a later date. External options include current coil adapter for the calibration of clamp meters.

1.5 USB Interface

All functions and outputs of the 4610M calibrator are fully programmable over the USB interface. The USB Interface presents the calibrator as an RS232 port to the computer. A driver from FTDI is required if the driver is not detected automatically, which can be downloaded from **https://ftdichip.com/drivers/d2xx-drivers/.** Drivers are available for Windows, Linux and Mac computers.

1.6 GPIB (IEEE488) Interface

All functions and outputs of the 4610M calibrator are fully programmable over the GPIB (IEEE488) interface.

1.7 Output Connections

The output terminal configuration is designed to match the majority of multimeter input connections, e.g. volts/ohms, low current and high current eliminating the need for lead changing during calibration. All outputs are isolated when not in use and an L.E.D. indicator shows the active output(s).

2 Preparing the Calibrator for Use

2.1 Initial inspection

After shipment the calibrator should be inspected for any signs of external damage. Should external damage be found contact the carrier immediately. Do not connect a damaged instrument to the line power as this may result in internal damage. Please retain the original packaging; this should be used when returning the calibrator for service and recalibration.

2.2 Lifting and Carrying the Calibrator



NOTE :Observe all normal practices for health and safety when carrying heavy items.

The calibrator weighs 23 kg / 51 lbs with most of the weight at the right rear corner. The calibrator can be carried by one person supporting the underneath, carrying in a horizontal position. The front handles, fitted as standard, can be used to move the calibrator short distances or to reposition. A custom carry case with shoulder strap is available if the calibrator is to be regularly transported - see options list. The calibrator should always be placed down on a firm flat surface on its base feet. Avoid knocking or banging the calibrator and always place down smoothly.



NOTE :Warning: DO NOT DROP THE CALIBRATOR
This may cause internal damage.

2.3 Positioning the Calibrator

The calibrator can be used free standing on a bench or mounted in a standard rack enclosure. The calibrator can be operated at any angle; the two front feet have tilt legs for bench operation. For all installations care must be taken not to cover the ventilation slots underneath or block the fan. A 2” (5cm) space behind the instrument is also required for line and interface connections.

2.4 Rear Panel Connections and Controls

Connections on the rear panel are provided for Line Power via a 3 Pin Filtered IEC connector incorporating the Line Fuse and Voltage Selection.

A USB Type B socket is provided for connection to computers for remote control of the calibrator through software.

A GPIB interface is provided to allow remote control of the 4610M calibrator via GPIB (IEEE488).

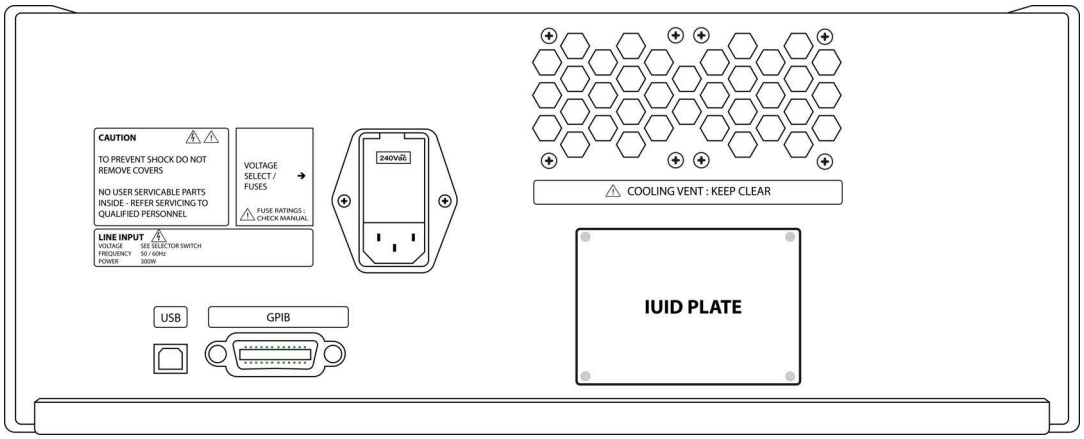


Figure 2-1 : 4610M Rear Panel

2.5 Setting and checking the Line Voltage

NOTE :Warning: The line power cord must have an earth conductor to avoid risk of shock.

NOTE :This instrument must be correctly earthed.

The calibrator has been designed to work from either 100, 120, 220 or 240 Volt line supply. Check that the voltage selector is set at the correct voltage before connecting the power to the instrument. Connecting the calibrator to the wrong supply will cause internal damage to the instrument. The

calibrator is set for 100V operation in Japan, 120V operation in the USA & Americas, 220V operation in Europe and 240V operation in the UK.

The set mains voltage can be confirmed by looking at the Mains Inlet on the rear panel. The selected mains voltage is visible through a small window in the inlet

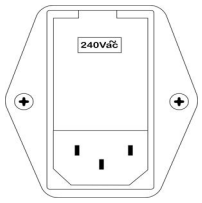


Figure 2-2 : Mains Inlet, 240V Mains Selection

To change the line voltage, open the voltage selector housing using a blade screwdriver. Gentle pressure is required to open the cover which contains the voltage selector barrel and the mains input fuses.

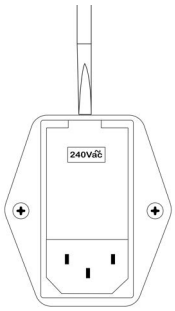


Figure 2-3 : Position of Flat Bladed Screwdriver to open Fuse Tray

Gently hinge the fuse holder flap forward so that the interior of the inlet is visible, and then remove the barrel

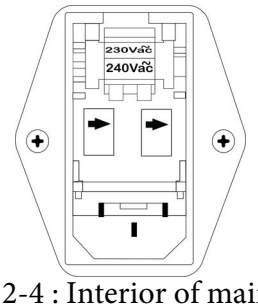


Figure 2-4 : Interior of mains inlet

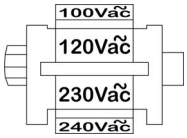


Figure 2-5 : Mains Selector Barrel

Rotate so that the desired mains voltage is facing outwards and visible through the hole in the inlet and replace the barrel. Close the flap using gentle force

2.6 Power Line Inlet Fuse and rating

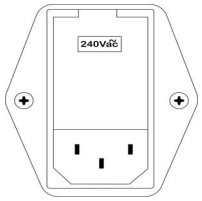


Figure 2-6 : Mains Inlet, 240V Mains Selection

The power line inlet fuse is located directly above the power inlet within the voltage selector housing. The correct fuse rating is 3.15A anti-surge for 230V operation and 3.15A anti-surge for 110V operation. Fuses should be rated for 250V Operation regardless of mains voltage input.

To replace the fuse, open the voltage selector housing using a blade screwdriver. Gentle pressure is required to open the cover which contains the voltage selector barrel and the mains input fuses.

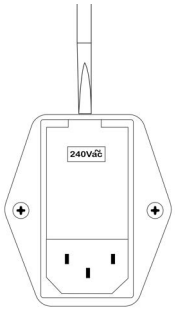


Figure 2-7 : Position of Flat Bladed Screwdriver to open Fuse Tray

Gently hinge the fuse holder flap forward so that the interior of the inlet is visible, and then remove both fuse holders (marked with arrows pointing to one side)

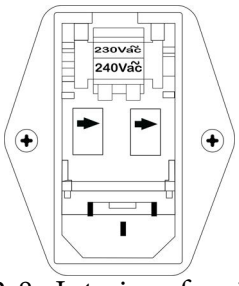


Figure 2-8 : Interior of mains inlet

Remove the damaged/incorrect fuse and replace using gentle force into the carrier, and then replace the fuse holder.

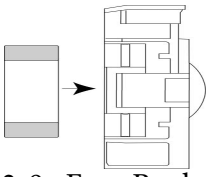


Figure 2-9 : Fuse Replacement

Once both fuses have been checked/replaced, close the flap using gentle force. Take care to ensure that the mains voltage barrel is still at the correct setting.

2.7 Powering up the calibrator

After connecting line power, the calibrator can be switched on with the line power switch on the right-hand side of the front panel.

Push the power switch in to power up the calibrator (pushing the power switch again will release the button and the calibrator will switch off).

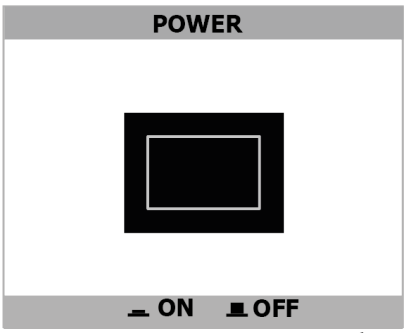


Figure 2-10 : Power Switch

The fan will start, and the front panel display will illuminate indicating power. The display will show the Transmille logo and state that it is initializing.

After a short delay, during which time the processor performs a self-test of the instrument, the display will show an output of 000.00000mV DC.

Allow the calibrator to warm up for 30 minutes to obtain full accuracy; the fast start feature of the calibrator will give approximately 90% of full specifications within 10 minutes. The calibrator has been designed to be powered up continuously.

- **If the calibrator is being used using a remote interface, the control program can be run once the calibrator has fully initialized.**

2.8 Output Connections



NOTE :High voltages may be present on the output binding posts.



NOTE :Ensure calibrator is in the STANDBY condition before changing leads or connections.



NOTE :For voltages greater than 30V AC RMS, 42V AC Peak or 60V DC, the binding posts must be in the closed position.
ONLY 4mm banana connections should be used for outputs above these voltages.



NOTE :Do not touch exposed metal on banana plugs, spade connections or bare wires. These outputs may have lethal voltages present



NOTE :Warning: Under no circumstances should any voltage be connected to the calibrator outputs. Although the output terminals are protected against voltage/current being applied, repeated application of voltage/current may affect the performance and reliability of the protection circuitry.

Output binding posts are all low thermal tellurium copper 4mm binding posts. The binding posts accept 4mm style connectors, as well as spade and bare wire connections when the binding post is in the open position.
The 4610M calibrator outputs have been designed to allow most multimeters to be calibrated without changing connections. There are 4 separate ‘sets’ of binding posts that are used for outputs.

- AC / DC Voltage, 2 Wire Resistance, Capacitance, Frequency, PWM & PRT
- AC / DC Current up to 2A, 2 Wire compensated and 4 Wire Resistance
- AC / DC Current above 2A.
- Earth Terminal
- Thermocouple ‘mini’ socket (thermocouple source and measure)

When an output terminal pair is not active, they are completely open circuit (except for the Earth Terminal) and isolated from the other outputs. As only one pair is active at any one time (except 4 wire Ohms) they may be combined if required to match the meters input arrangement.

The Earth Terminal is always connected to earth via the earth pin on the IEC connector on the rear. The earth terminal can be used to connect a floating instrument under test to a common ground.



NOTE :To avoid ground loops, do not connect the front panel Earth Terminal to ground. The Earth Terminal is always connected to earth via the rear panel IEC terminal

One example is the configuration of multimeter inputs with a single common low and inputs with voltage, low and high current. To match this to the calibrator, simply connect the 3 low outputs of the calibrator together and connect the voltage, low & high current outputs to the appropriate meter's inputs. Note that when outputting resistance, the calibrator will use the voltage output terminals.

A second example is where the meter has separate voltage and current inputs, often using four wire ohms on both pairs. In this case simply connect the voltage and current outputs to the meter's inputs, the calibrator will use both the voltage and current pair on 4 wire ohms.

It is recommended that the voltage and low current leads be of high-quality screened cable with gold plated 4mm plugs fitted. The cable must be able to withstand 1025 volts AC and have an insulation resistance greater than 1TΩ to avoid introducing any shunting effect on the high resistance ranges.

Poor quality test leads will introduce noise, thermal E.M.F. and leakage errors on low voltage & current ranges and unstable readings on resistance and capacitance outputs. Special test leads are available from Transmille.

The low output can be connected to line earth or allowed to float as selected - see operation section of this manual. It is recommended that the low is earthed which will help to reduce noise on high ohms and low current. If allowed to float with respect to line earth the low must remain within 50 volts of line earth. Outputs are optically isolated from the USB and GPIB interfaces.

2.9 Warning and output Overload indications.

The self-test function of the 4610M calibrator continuously monitors the output of the calibrator for overload or fault conditions. In the event of the calibrator not being able to drive the load, it will automatically trip into standby – the Standby indicator will be shown on the screen. The required drive current being too high on a voltage range, or the required compliance voltage being too high on a current range causes the 'standby' condition. Pressing the Output On key after the load has been corrected can restore the output.

2.9.1 High Voltage Timeout

As an additional safety feature, the calibrator will automatically return to standby if the output is on the 200V or 1kV ranges after a set time period (refer to general settings menu - Page 33). The default setting is 20 minutes, where after the output will switch off and the instrument return to standby mode.

The remaining time before the output will return to standby is displayed on the screen while the output is on.

2.9.2 30 Amp Temperature Cut-out

The 4610M calibrator can supply high currents for sustained periods of up to 30A. Above this value the calibrator will enter a standby / cool-down period until the instrument's temperature has reduced. The output amplifier operating temperature is monitored by the micro controller, which will shut down the output if required. The time before shutting down occurs will vary depending on the set output current and the load. (see extended specifications). During this shutdown period, the calibrator will be set to standby with a warning message shown on the display indicating the temperature limit has been reached. It is safe to reselect the output at any time as the microprocessor will automatically protect the output amplifier from damage.

3 Operation

3.1 Safety Warnings

NOTE :The information in this section is intended only for qualified personnel. The user must at all times be adequately protected from electric shock. Qualified personnel must ensure that operators of the equipment are adequately insulated from connection points.

NOTE :WARNING: This instrument is capable of generating both DC and AC high voltages.

3.2 Introduction to Operation

All functions of the 4610M Calibrator can be controlled from the front panel soft keys, touch screen interface or controlled remotely by a computer. During remote control the front panel is 'locked out', but local control may be resumed by pressing the 'local' button - it must be remembered that this action may disrupt the computer program.

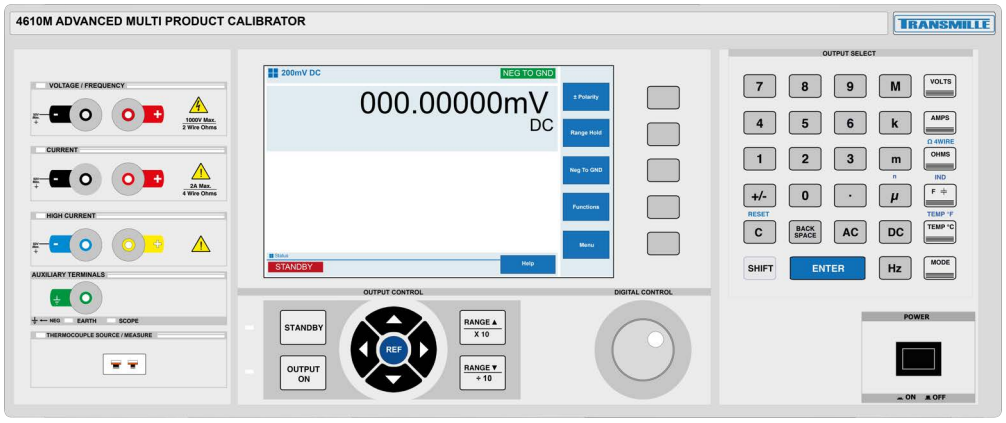


Figure 3-11 : 4610M Front Panel

3.3 Front Panel Controls

The front panel of the 4610M Calibrator utilizes a high-quality custom rubber keyboard with tactile feel buttons and integrated touchscreen interface. The front panel is therefore sealed against the ingress of moisture and dirt enabling the calibrator to be used in most working environments without risk of early failure of the operating buttons. The front panel can easily be wiped clean with a soft cloth. Care should be taken not scratch the touchscreen interface. All graphics are 'under printed' making them rugged and durable.



NOTE :The front panel key buttons are for use with fingers only - do not press the key with hard or sharp objects e.g. Ball-point pens, pencils, screwdrivers etc. Repeated actions like this will almost certainly cause the keyboard to fail. (This will not be covered under warranty). Care should also be taken when transporting the instrument, do not place test leads or other objects on top of the panel which may come into contact with the display area and cause damage.



NOTE :The touchscreen offers a capacitive touch capability. This means that a stylus is not required to operate the screen. Hard or sharp objects e.g. Ball-point pens, pencils, screwdrivers etc. should not be used to enter parameters on the screen. The screen will not operate if a glove is worn over the operating hand, in cases where this is unavoidable the physical soft keys can be used to select functions as opposed to utilizing the touchscreen. Please note that the warranty DOES NOT cover damage caused to the touchscreen by using objects other than fingers to use the touchscreen interface.

The keyboard is divided into sections to allow easy operation. These sections are displayed in the table below :

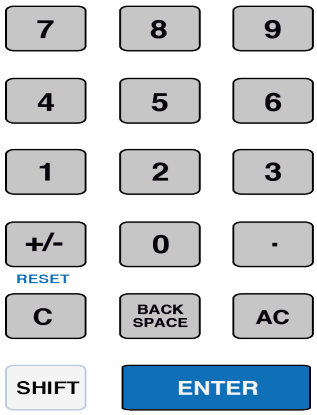
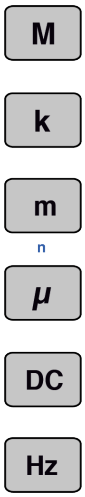
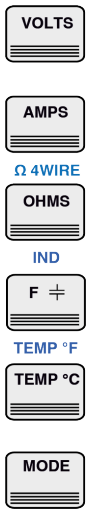
Numerical Keypad Allows numeric values to be entered.	
Multiplier Keys Mega (M), kilo (k), milli (m), micro(µ) or nano (n).	
Function Keys Volts (V), Amps(A), Ohms (2 & 4 Wire), Farads(F), Celsius(°C), & Fahrenheit (°F)	

Table 1: Keyboard Functions

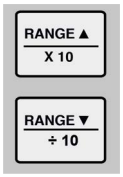
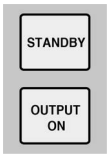
Range Up / Range Down Keys Allow the output to be multiplied / divided by 10.	
Left / Right / Up / Down Arrow Keys To select the digit to be controlled by the rotary control.	
Output On / Standby Keys Allow the calibrators output to be disconnected from the terminals. LED indicators are incorporated in these switches to clearly show the output status.	

Table 1: Keyboard Functions

3.4 Digital Control

A digital potentiometer allows the 'highlighted digit' on the display to be incremented (turning clockwise) or decremented (turning anti-clockwise). As an output is changed the deviation from the original value entered on the keyboard is shown in either in% or ppm, depending upon the magnitude of deviation from the previous set point

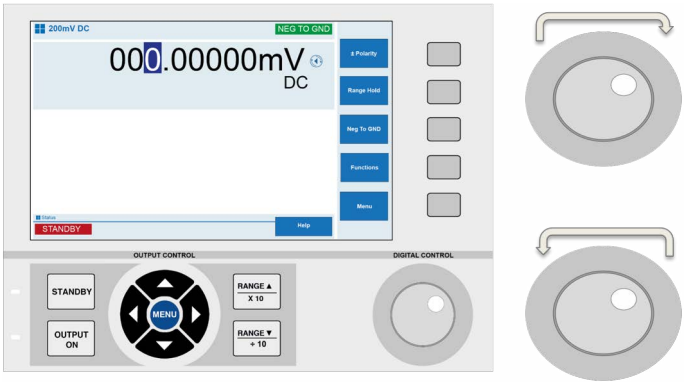


Figure 3-12 : Front Panel Control

When the digital control is active allowing the output value to be increased or decreased the following symbol appears next to the output value.

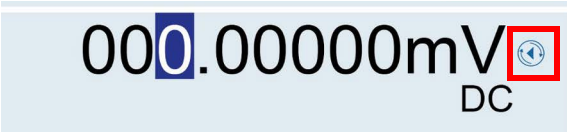


Figure 3-13 : Single Parameter

This enables the control, allowing the highlighted digital to be increased or decrease.
When the screen has two parameters shown at the same time there is a second symbol displayed as shown below:

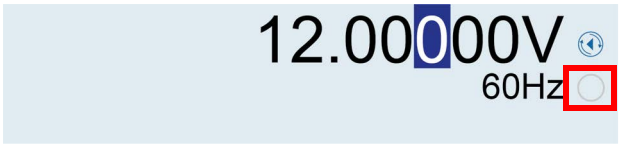


Figure 3-14 : Dual Parameters, 1st Parameter Selected

Using the touchscreen, touch this symbol will toggle the digital control to the lower display and highlight the active digit.

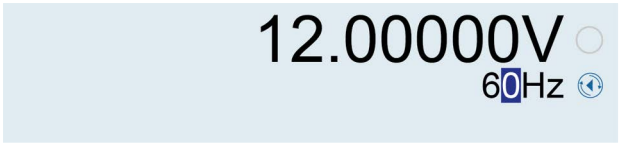


Figure 3-15 : Dual Parameters, 1st Parameter Selected

The digital control can be pushed to select the highlighted functions on the display instead of using the 

button on the screen as shown below.

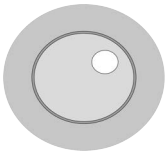


Figure 3-16 : Digital Control (Push to Select)

3.5 Error Message Indicator

The error message indicator appears at the bottom of the screen when the maximum or minimum permitted values have been exceeded for a particular parameter, this can occur if the value is increased or decreased beyond the specified limits using the cursor arrows or digital control and also by entering a value via the keyboard which exceeds the allowed limits. This can also occur if a hardware error or timeout event occurs.

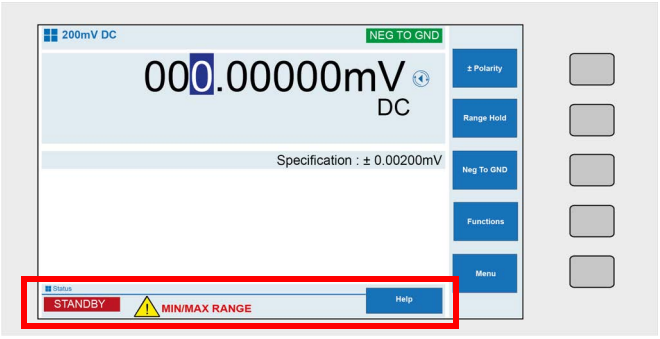


Figure 3-17 : Front Panel Error Message Indicator

3.6 Wait Indicator

After setting an output or turning the output on, the calibrator will require time for the output to settle to the new value (including ramp time). To assist the operator, a 'WAIT' indicator is displayed in the lower left of the screen to indicate that the output of the calibrator is still settling.

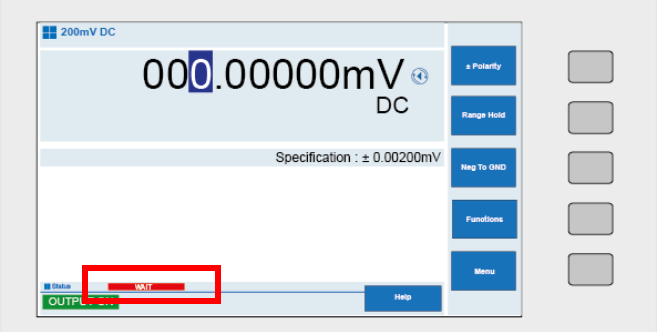


Figure 3-18 : Front Panel Wait Indicator

NOTE :Note that this does not indicate that the UUT / DUT has settled, only that the output of the calibrator has settled.

3.7 Touchscreen Interface Functionality

The touchscreen interface provides additional control alongside the keyboard functionalities. The 7-inch LCD display shows the present output, instrument status, % or ppm change from the entered value, and also the new value being entered. The right-hand portion of the display is used to assign the function of the five soft keys (these functions can be directly touched to activate as well as using the soft keys). A 'connection help' button is also located at the bottom of the LCD display. This provides detailed user assistance in the form of connection schematics for each type of measurement. The touchscreen features are shown below:

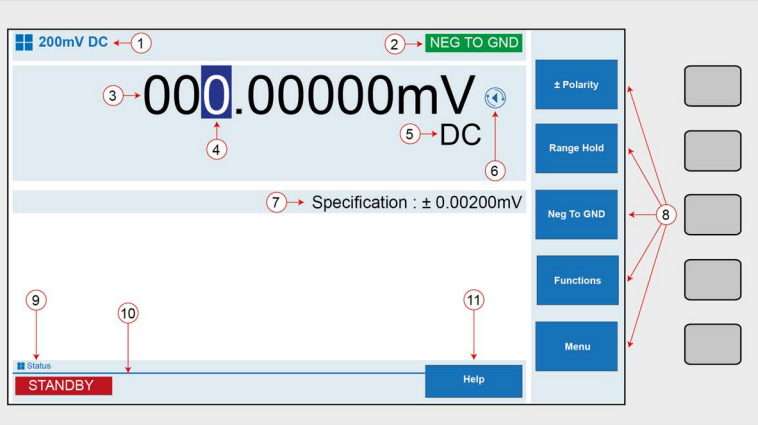


Figure 3-19 : Annotated Display

1. Output range and function
2. Negative to Ground indicator
3. Output value
4. Active (highlighted) digit for digital control / up & down arrows
5. Function specific configuration display
6. Digital Control active
7. Specification
8. Dynamic soft key and direct touch menu
9. Instrument status indicator
10. Error Message Indicator
11. Connection Help

3.8 Connection Help Prompts

To ensure ease of use, the 4610M Calibrator features inbuilt connection help prompts which can be displayed on the screen. These prompts are designed to assist with making connections to typical test equipment.

Connection prompts are function specific, and the correct prompt is displayed automatically for the function selected (i.e. a connection prompt suitable for DC Voltage will be displayed when in the DC Voltage function).

To view the connection prompt, press the 'Help' key in the lower right of the main output screen. A full screen color image of an example connection will appear on the screen

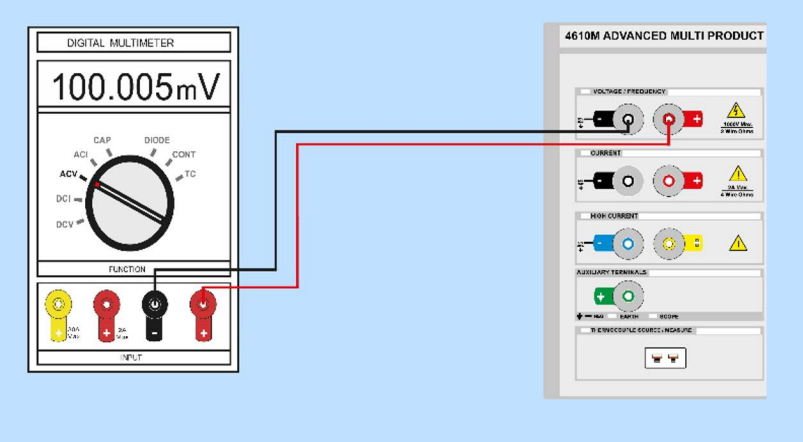


Figure 3-20 : Example Connection Help Prompt

Connection prompts can be updated via the USB connection while performing a Firmware Update to custom images for specific applications.

To leave the connection help screen, press the either ‘Close’ button in the lower left corner of the screen or touch the screen anywhere.

NOTE :The output of the calibrator will return to standby during display of a connection prompt.

NOTE : The image is a generic image and does not show a specific UUT / DUT. The operation manual for the UUT / DUT should always be referred to for settings and input connections.

3.9 Main Menu

The 4610M calibrator provides a host of easily accessible menu's including configuration, functions, general and system settings and calibration. To enter the menu page, press the 'MENU' soft key or touch the screen whilst on the main output screen.

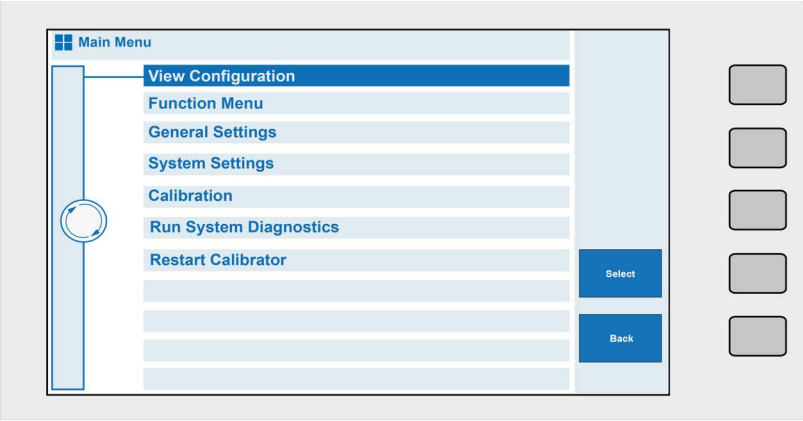


Figure 3-21 : Main Menu

- **View configuration**

Select this option to show the status of the calibrator, serial number, firmware, options etc.

- **Function Menu**

Select this option to access all the functions of the calibrator.

- **General Settings**

Select this option to access general settings. No passcode is required to enter this menu.

- **System Settings**

Select this option to access system settings – System Time & Date, Change Passcode, Hardware Error Detection, Reset Calibrator. The passcode is required to enter this menu.

- **Calibration**

Select this option to access calibration settings – Calibration / Adjustment Mode, Backup Calibration Data, Restore Calibration Data, Calibrate Touchscreen and Export Calibration to USB. The passcode is required to enter this menu.

- **Run System Diagnostics**

Select this option to access the self test menu. No passcode is required

3.10 View Configuration

To view the calibrator configuration, use the digital control to scroll to 'View Configuration' on the main menu, then either touch Select or press the soft key adjacent to the function, the configuration will display, touch the screen (OK) to clear this message.

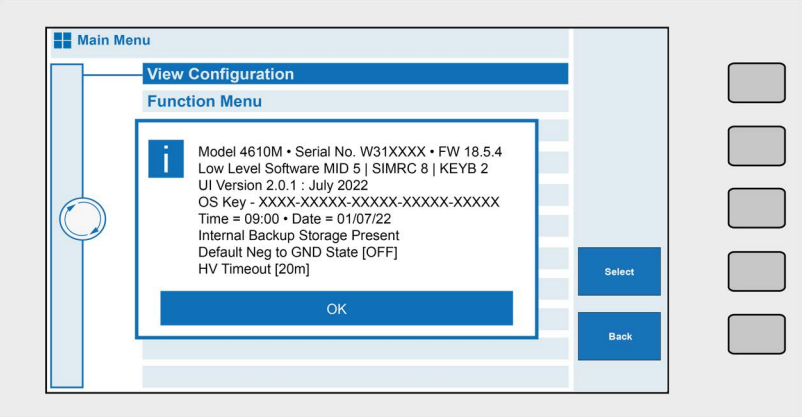


Figure 3-22 : View Configuration Menu

3.11 Function Menu

To view the function menu, use the digital control or touchscreen directly to highlight 'Function Menu'. Press the Select Soft key or the 'Enter' keyboard key to enter the Function Menu

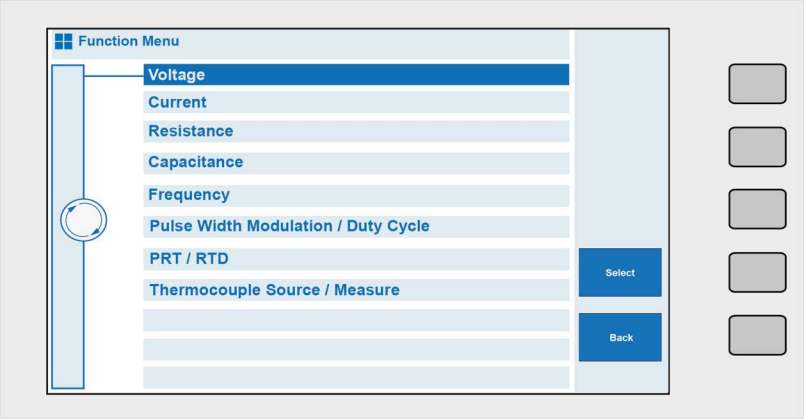


Figure 3-23 : Function Menu

3.11.1 Function Menu – Voltage

Using the digital control and soft keys or the touchscreen directly, navigate to the voltage function (DC or AC).

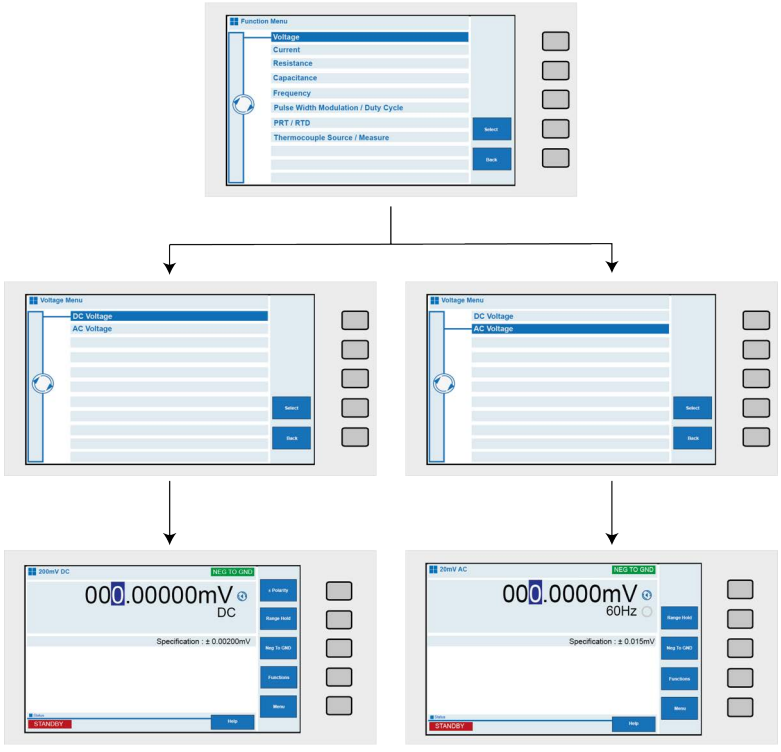


Figure 3-24 : Voltage Menu Tree

3.11.2 Function Menu – Current

Using the digital control and soft keys or the touchscreen directly, navigate to the current function (DC or AC).

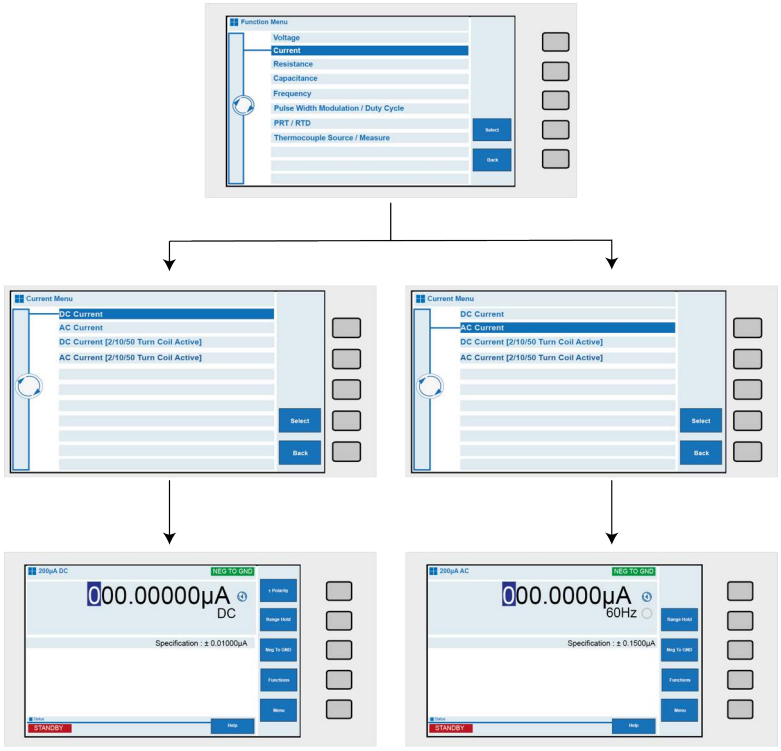


Figure 3-25 : Current Menu Tree

3.11.3 Function Menu – Resistance

Using the digital control and soft keys or the touchscreen directly, navigate to the resistance function. There are 5 resistance modes available :

- 2 Wire Simulated
- 2 Wire Simulated (Compensated)
- 4 Wire Simulated
- 2 Wire Passive
- 4 Wire Passive.

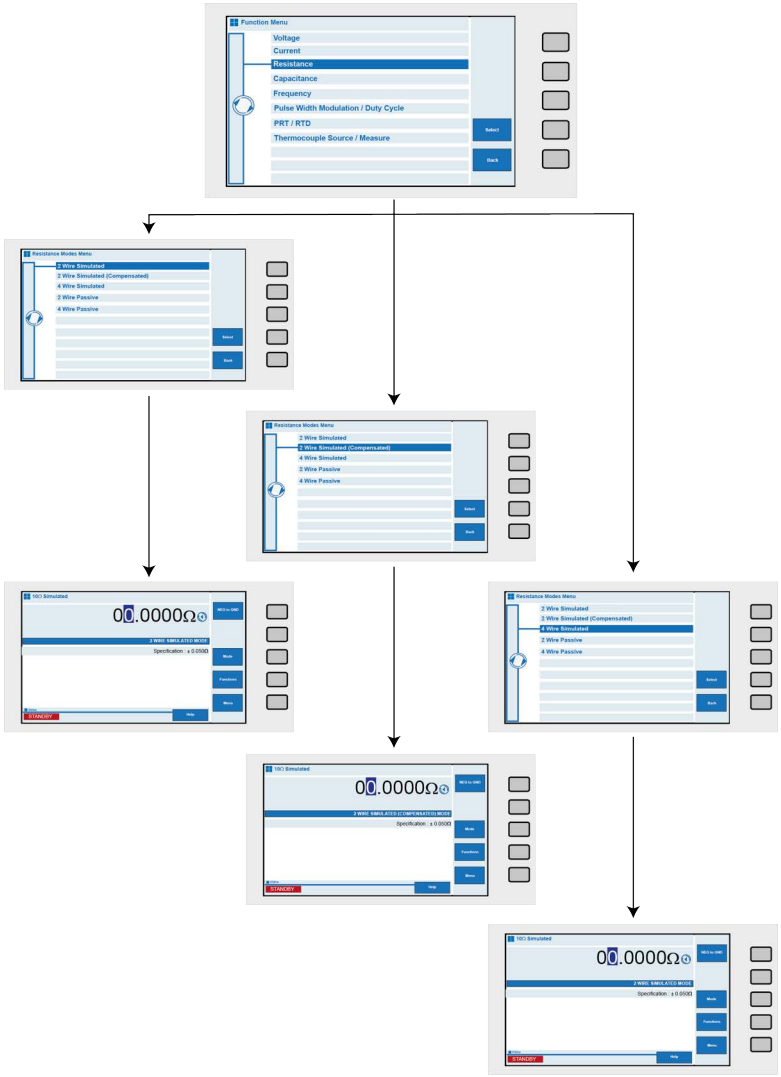


Figure 3-26 : Resistance Menu Tree - Simulated Options

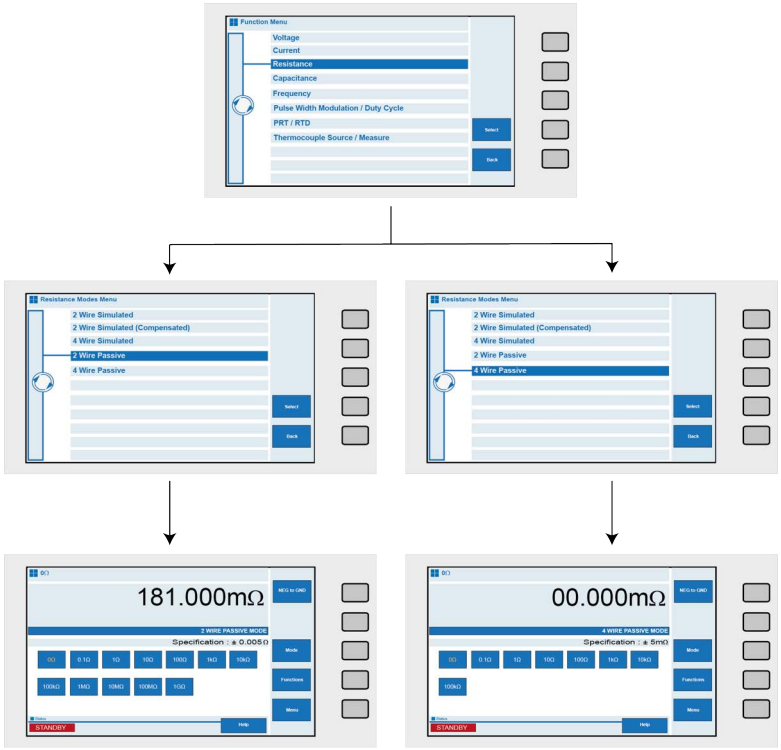


Figure 3-27 : Resistance Menu Tree - Passive Options

3.11.4 Function Menu – Capacitance

Using the digital control and soft keys or the touchscreen directly, navigate to the capacitance function (passive or simulated).

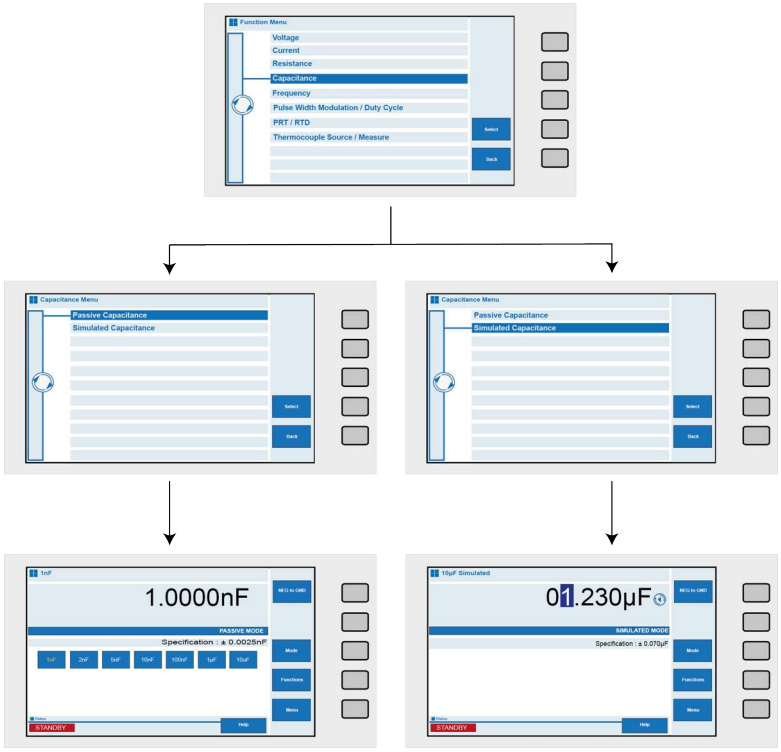


Figure 3-28 : Capacitance Menu Tree

3.11.5 Function Menu – Pulse Width Modulation / Duty Cycle

Using the digital control and soft keys or the touchscreen directly, navigate to the Pulse Width Modulation (PWM) / Duty Cycle function.

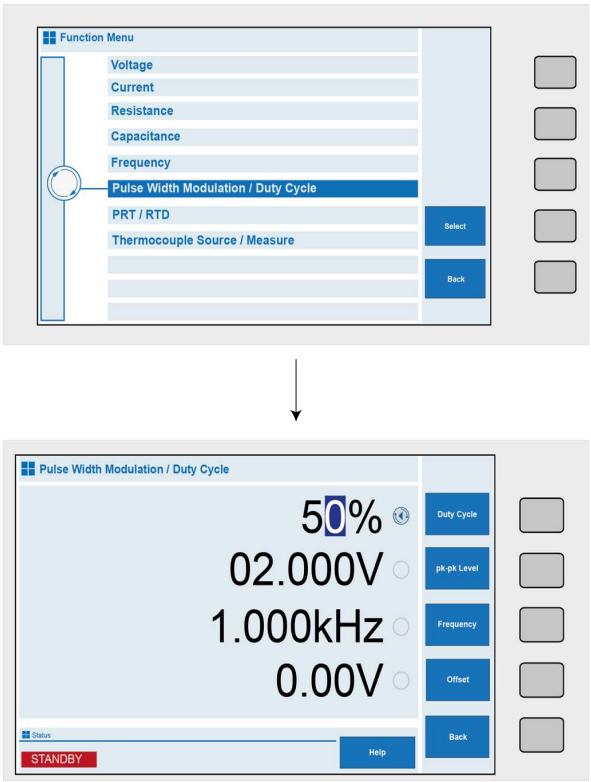


Figure 3-29 : PWM / Duty Cycle Menu Tree

3.11.6 Function Menu – PRT / RTD

Using the digital control and soft keys or the touchscreen directly, navigate to the PRT / RTD function.

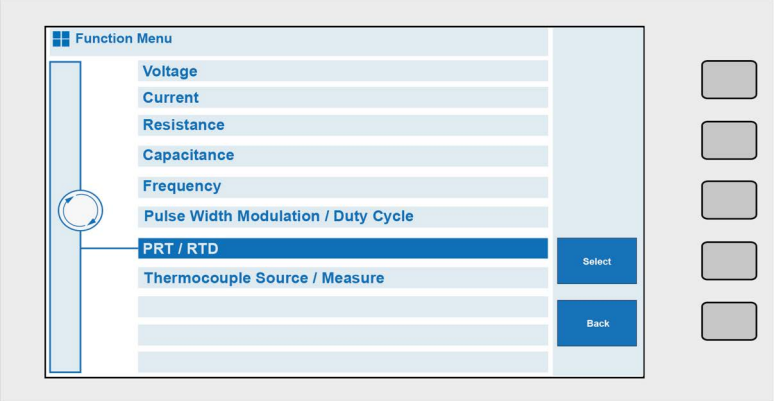


Figure 3-30 : Capacitance Menu Tree

3.11.7 Function Menu – Thermocouple

Using the digital control and soft keys or the touchscreen directly, navigate to the Thermocouple function (source or measurement).

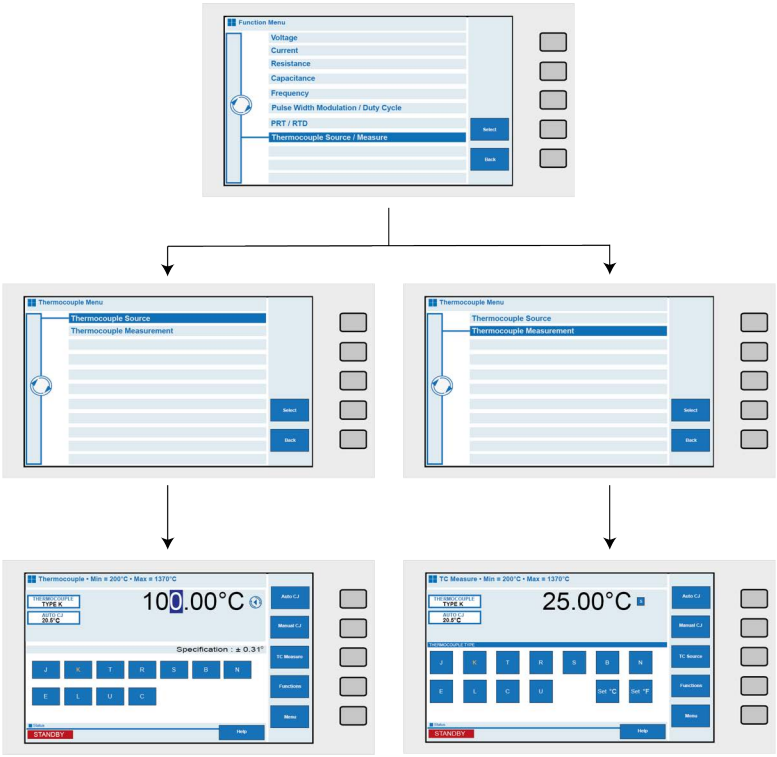


Figure 3-31 : Thermocouple Menu Tree

3.12 General Settings

To view the general settings, use the digital control or touchscreen directly to highlight 'General Settings' on the main menu,

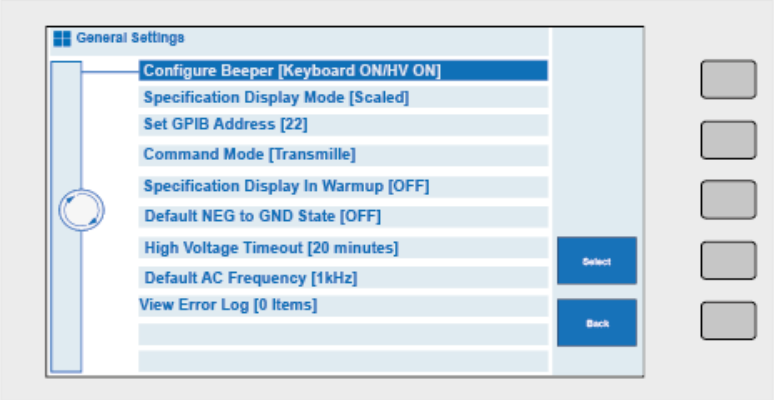


Figure 3-32 : General Settings Menu

3.12.1 General Settings – Configure Beeper

Select the required beeper mode from the following:

Key & HV Beep = beeper will sound when any of the keys are pressed and when a high voltage output is present:
Key Beep only = beeper will sound when any of the keys are pressed:
Disable Beep = switch off beeper

To view the configure beeper settings use the digital control to highlight 'Configure Beeper' on the general settings menu and then press the Select key or use the touchscreen directly to highlight the function. Use the digital control to highlight the desired mode and press the ENTER key.

3.12.2 General Settings – Specification Display Mode

Select the required specification display mode from the following:

Main Display Units = displays the specification in the same units as the output i.e. 10V DC output, specification = ± 0.000104V
Scaled Units = displays the specification in scaled units in respect the output i.e. 10V DC output, specification = ± 104µV

To view the specification display mode settings, use the digital control to highlight 'Specification Display Mode' on the general settings menu and then press the Select key or use the touchscreen

directly to highlight the function. Use the digital control to highlight the desired mode and press the ENTER key.

3.12.3 General Settings – Set GPIB Address

Select the required GPIB address as follows:

GPIB address = enter the GPIB address number from 0 to 31

To view the Set GPIB Address settings, use the digital control to highlight 'Set GPIB Address' on the general settings menu and then press the Select key or use the touchscreen directly to highlight the function. Enter the address number (0 to 31) and press the ENTER key. ENTE

3.12.4 General Settings – Command Mode

Select the required command mode from the following:

Transmille = Transmille protocol

55XXA = Calibrator able to emulate (look like) other manufacturers instruments. With this option selected the calibrators response to a *IDN? Request will return as configured, allowing full emulation when controlled remotely.

To view the Command Mode settings, use the digital control to highlight 'Command Mode' on the general settings menu and then press the Select key or use the touchscreen directly to highlight the function. Use the digital control to highlight the desired mode and press the Select key.

3.12.5 General Settings – Specifications Display During Warmup

Select the required specification display during warmup from the following:

Disabled = specifications not displayed during warmup
Enabled = specifications displayed during warmup

To view the Specifications, display during warmup settings, use the digital control to highlight 'Specifications Display During Warmup' on the general settings menu and then press the Select

key or use the touchscreen directly to highlight the function. Use the digital control to highlight the desired mode and press the Select key.

3.12.6 General Settings – Default Negative to Ground State

Select the required default negative to ground state from the following:

[OFF] = Negative terminal to ground (earth) off
[ON] = Negative terminal to ground (earth) on

To change the Default negative to ground state, use the digital control to highlight 'Default Negative to Ground State' on the general settings menu and then press the Select key or use the touchscreen directly to highlight the function, this will change the state from either [OFF] to [ON] or [ON] to [OFF].

3.12.7 General Settings – High Voltage Timeout

Select the required high voltage (HV) timeout from the following:

HV Timeout [m] = enter the HV timeout (range 0 minutes to 1,440 minutes)

Note: Entering a value of 0 (zero) switches OFF the High Voltage Timeout i.e. the output will remain on until the 'STANDBY' button is pressed.

Entering a value of 1440 minutes (24 Hours) switches OFF the High Voltage Timeout, i.e. the output will remain on until the 'STANDBY' button is pressed or an output event occurs.

To view the Set High Voltage (HV) Timeout settings, use the digital control to highlight 'Set High Voltage Timeout' on the general settings menu and then press the Select key or use the touchscreen directly to highlight the function. Enter the time (0 minutes to 1440 minutes) and press the ENTER key.

3.12.8 General Settings - Default Frequency

Allows user to set the default AC Frequency at power up from 10Hz to 100kHz.

Note - This will not extend the range of ranges that cannot output these frequencies, but changes the behavior of the Hz button

To change the default AC Frequency, use the digital control to highlight 'Default AC Frequency 'in the general settings menu and then press the Select key or use the touchscreen directly to highlight the function.

Enter the default frequency (10Hz to 10,000Hz) and press the Enter key. For example, to set a default frequency of 12.34kHz, enter '1 2 · 3 4 k Hz' and press the ENTER key

3.12.9 General Settings - View Error Log

Allows the user to view any logged errors since the unit was last powered on. Pressing the Select key or using the touchscreen directly to highlight the function will show the list of errors (if any) since last power on, including time and date of the error as well as the error code.

Note : After error codes are read out over the remote interface the errors are removed and cleared from memory until there are no logged errors

3.13 System Settings

To view the system settings, use the digital control or touchscreen directly to highlight 'System Settings' on the main menu, touch Select or press the soft key adjacent to the function. The following screen will display.

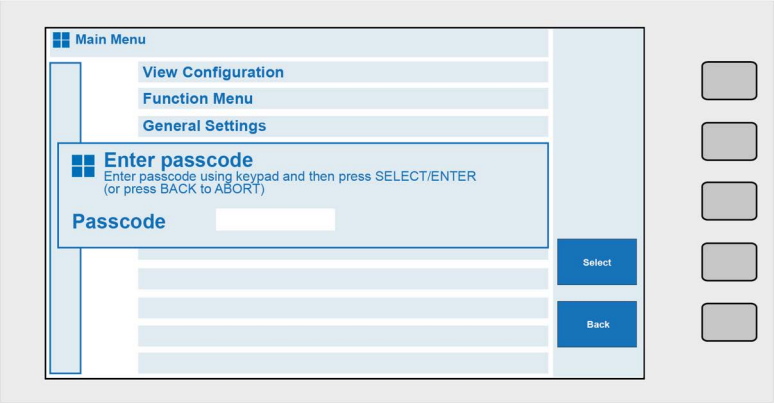


Figure 3-33 : System Settings Menu - Passcode Entry

Follow the instructions on the screen to enter the pass code (default: 1234) at which point the following screen displays.

NOTE : If the pass code has previously been entered the passcode screen will not display, the instrument will display the selected menu, however when the instrument is returned to the 'Main Menu' the pass code will need to be entered again to access either the 'System Settings' or 'Calibration' menu's.

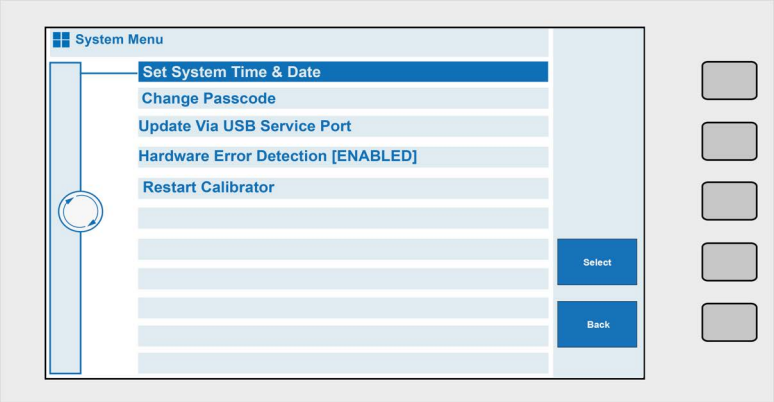


Figure 3-34 : System Settings Menu

3.13.1 System Settings - Set time & Date

To view the system time and date settings use the digital control to highlight 'Set System Time & Date' on the system settings menu and then press the Select key or use the touchscreen directly to highlight the function. Follow the instructions on the screen to change the time and date.

NOTE :Date is entered in Day / Month / Year (2 Digits) format, and time is entered in 24 Hour

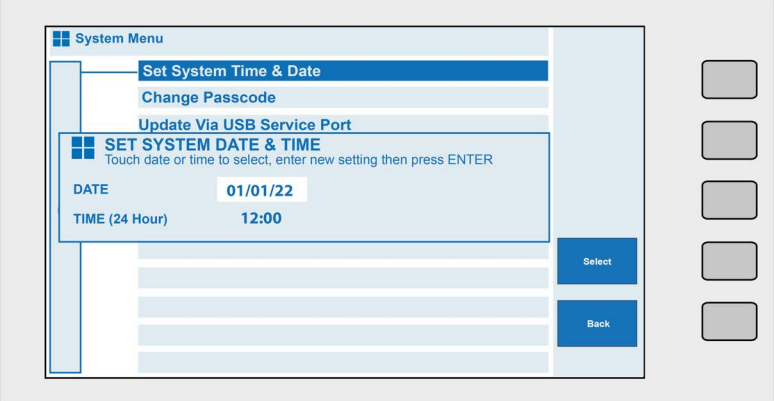


Figure 3-35 : System Settings Menu

3.13.2 System Settings – Change Passcode

To view the change pass code settings, use the digital control to highlight 'Change Passcode' on the system settings menu and then press the Select key or use the touchscreen directly to highlight the function. Follow the instructions on the screen.

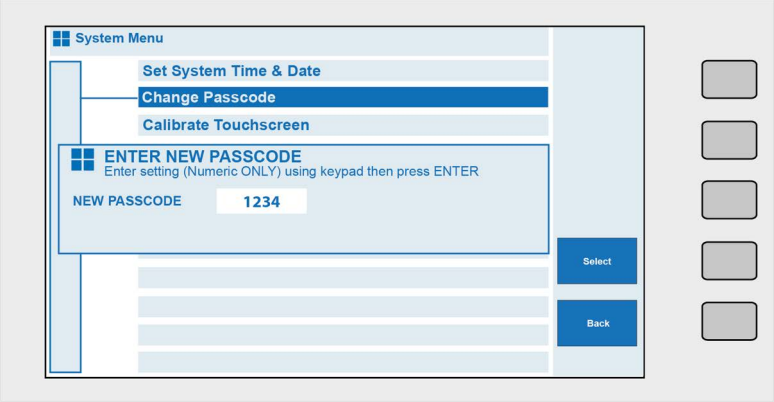


Figure 3-36 : Passcode Entry

After pressing the Enter key, the following screen will display.

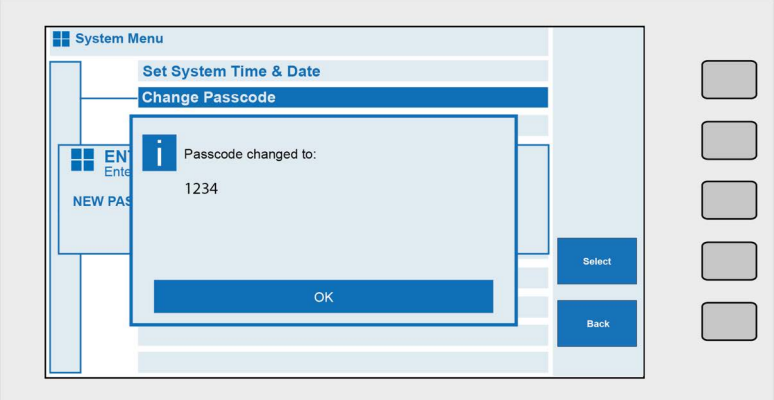


Figure 3-37 : Passcode Verified

3.13.3 System Settings - Update via USB Service Port

This menu option allows updating the UI via the internal USB service port. This function is used in the event that the USB stick is not detected on startup and the 'USB Update' key does not become visible.

If a USB drive is detected and appropriate updates (Calibrator UI, Connection prompts or specification files) then the update will proceed. A prompt will be displayed showing the progress of the update. When the update is completed, the prompt will indicate to the user that the USB drive should be removed.

Upon removal of the USB drive, after approximately 5 seconds a countdown will start, and the calibrator will be restarted, at which point any updates will be applied

NOTE :The screen will go blank/black for up to 10 seconds during the restart, this is normal

3.13.4 System Settings - Hardware error detection

When performing diagnostic tests for service and repair of the 4610M, it is sometimes advantageous to disable the hardware error detect.

To disable the hardware error detect, press the menu item or press the Enter key with ‘Hardware Error Detection’ highlighted.

The following text identifies the current state of the error detection, either ENABLED or DISABLED.

The calibrator will always reset to the error detection being ENABLED on a reset or power on

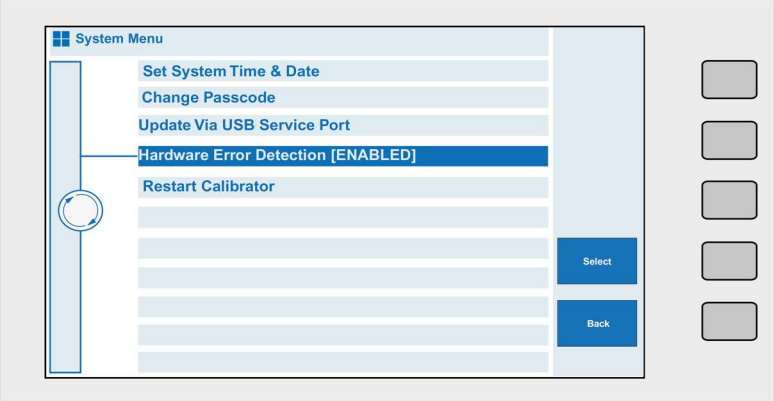


Figure 3-38 : Hardware Error Detection

NOTE :Using the calibrator in this mode has potential to cause further damage to both the instrument and any connected devices. The calibrator should not be used with the error detection disabled for extended periods

NOTE : Critical safety functions such as the High Voltage current trip will continue to function even when the hardware error detect is disabled

3.13.5 System Settings – Restart Calibrator

To restart the calibrator, use the digital control to highlight ‘Restart Calibrator’ on the system settings menu and then press the Select key or use the touchscreen directly to highlight the function. The calibrator will restart and go through its initialization.

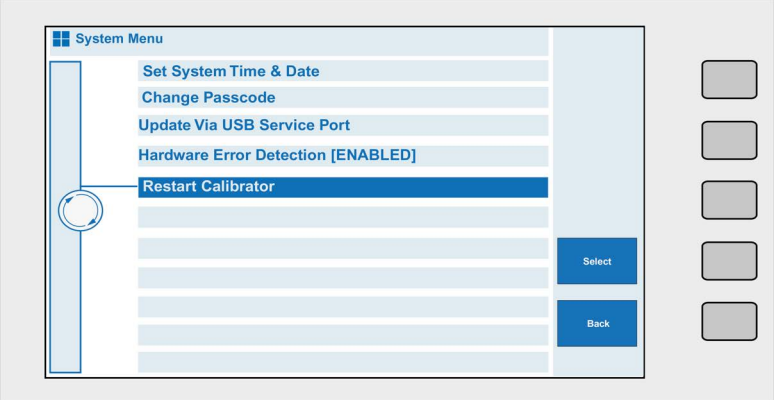


Figure 3-39 : Restart Calibrator

NOTE :No prompt/warning is displayed, the calibrator will restart immediately

3.14 Calibration Menu

To view the Calibration Menu, use the digital control or touchscreen directly to highlight 'Calibration' on the main menu, touch Select or press the soft key adjacent to the function, the enter passcode screen will appear.

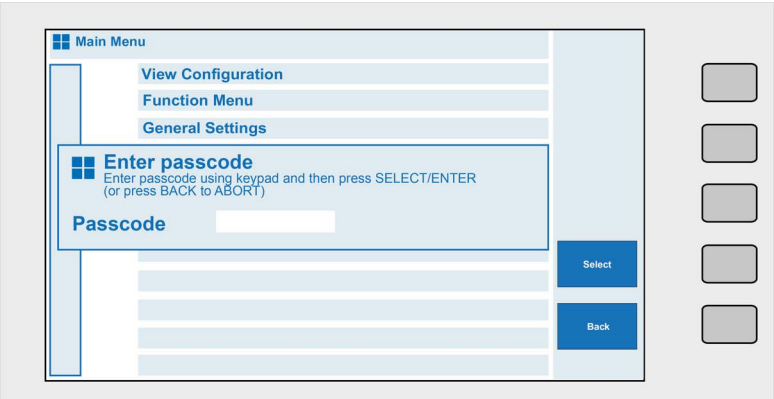


Figure 3-40 : Passcode Prompt

Follow the instructions on the screen to enter the pass code (default: 1234). Successful entry of the passcode will allow access to the calibration menu

NOTE : If the pass code has previously been entered the pass code screen will not display, the instrument will display the selected menu, however when the instrument is returned to the 'Main Menu' the pass code will need to be entered again to access either the 'System Settings' or 'Calibration' menu's.

If an invalid passcode is entered, the following warning will display

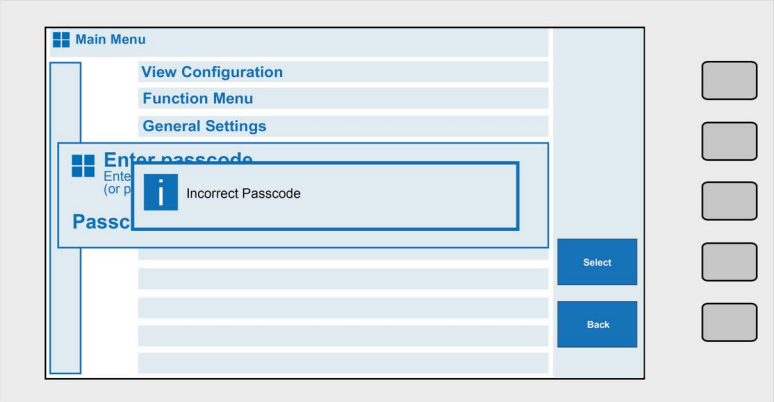


Figure 3-41 : Passcode Prompt

On correct entry of the passcode, the following menu will display

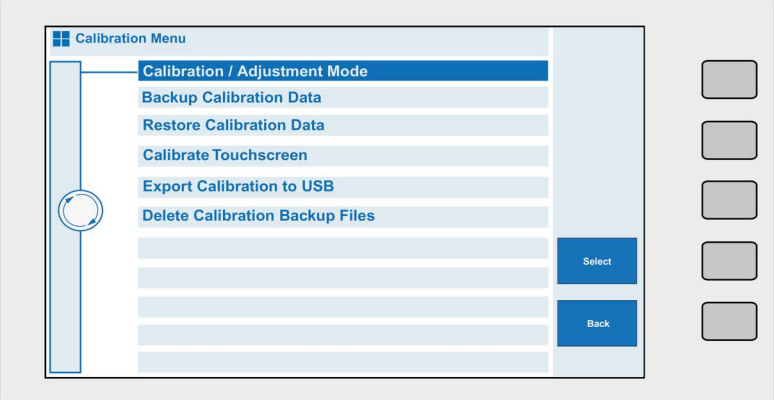


Figure 3-42 : Calibration Menu

3.14.1 Calibration / Adjustment Mode

Refer to the 4610M verification and Calibration Manual for information regarding calibration/ adjustment of the 4610M Calibrator

3.14.2 Backup Calibration Data

Selecting this option will perform a local backup of the calibration factors that can be restored if required

3.14.3 Restore Calibration Data

Selecting this item will show a selectable list of restore points. The top item is 'Factory' which is a backup of the last Factory calibration (either from New or from a repair/service). Other items are presented as the date and time of the backup, i.e. '2021_05_25_13_01' indicates the backup was performed at 13:01 on the 25th May, 2021

NOTE :Warning - Restoring from a backup will change the calibration of the instrument. Calibration Restoration is intended to restore the calibrator back to a known state if a bad/invalid calibration/adjustment is performed.

To select a backup to restore, use the digital control or the up/down arrows and then press the ENTER key or the Select key.

To abort restoring a backup, press the Back Key.

NOTE :Once a restore has been started, it cannot be stopped.

3.15 Calibrate Touchscreen

NOTE :The alignment of the touchscreen should only be performed if the touch detection is out of line with the on screen controls. This process will need to be performed if the screen or high level processor is replaced

To calibrate the touchscreen, use the digital control to highlight 'Calibrate Touchscreen' and then press the Select key or use the touchscreen directly to highlight the function. Follow the instructions on the screen.

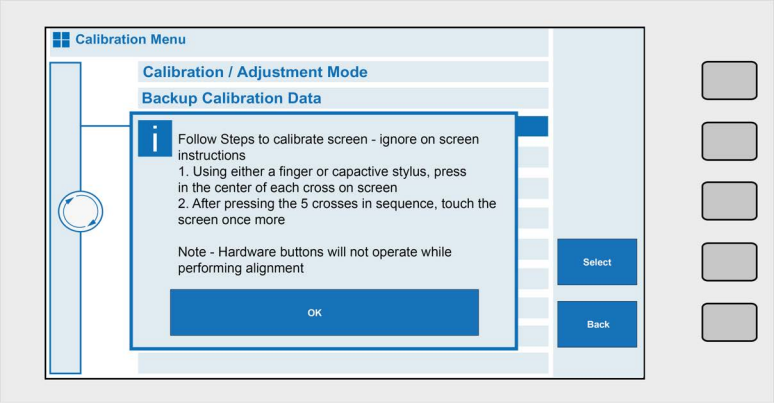


Figure 3-43 : Screen Calibration Menu

After pressing 'OK' on the screen, the screen will turn WHITE and state

‘Carefully press and briefly hold styles on the center of the target.
Repeat as the target moves around the screen.
Press the Esc key to Cancel’

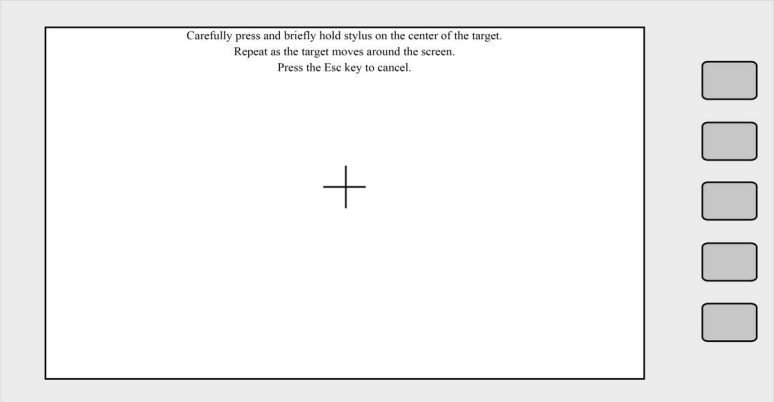


Figure 3-44 : Screen Calibration Compl

Using either the operators finger, or a capacitive stylus, press the center of each cross/target. There are 5 targets in sequence

After pressing the 5 crosses, the screen will state

‘New calibration settings have been measured.
Press the Enter key to accept the new settings
Press the Esc key to keep the old settings’

Press the screen anywhere with a finger or a stylus and the calibration screen will disappear and be replaced with the menu

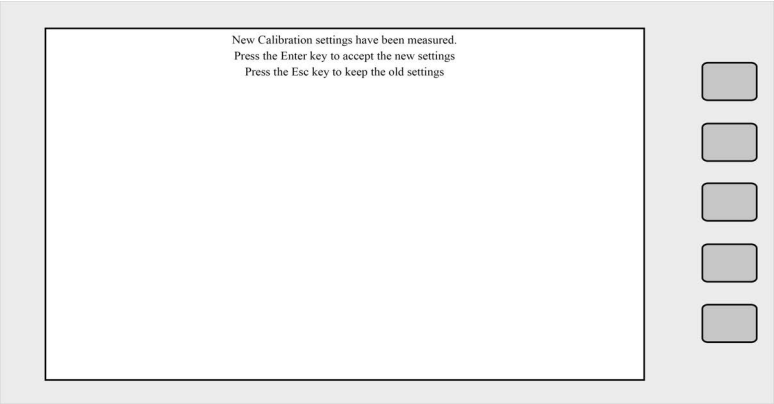


Figure 3-45 : Screen Calibration Complete

NOTE : The Calibrate Touchscreen will prompt the user to press a hardware key when complete. This prompt is to be ignored, and the correct operation is to press the touchscreen after pressing each of the alignment positions in sequence.

3.15.1 Export Calibration to USB

Selecting this menu option will attempt to export the current calibration factors of the unit to an attached USB stick. If no usb stick is attached a warning message stating 'USB Drive not found' will show briefly

The USB stick must be connected to the service port on the rear of the front panel assembly and formatted to FAT32 as per the instructions here : https://support.transmille.com/support/solutions/articles/9000204741-4610m-formatting-a-memory-stick-to-fat32-format

The calibration factors can then be offloaded onto a computer and stored for reference/archive purposes.

3.16 Special Functions Available Using the 'Soft' Keys

The 'soft' keys are positioned to the right-hand side of the touchscreen display. The function of these keys will change depending on the parameter of the calibrator.

3.16.1 Connecting Output Negative to Line Earth (Ground)

The soft key and touch button 'NEG TO GND' switches the output negative terminal from floating to ground (line earth). The 'on' condition is shown at the top right of the display, as well as by the front panel LED.

Transmille recommend that the output is connected to ground as this reduces noise and pick up and decreases the risk of damage to the calibrator, UUT and user by incorrect connection. If Negative to ground is disabled, there is potential for the negative of the calibrator to be 'floated' up if a voltage between ground/earth and the negative terminal is generated. This may be used in some applications, but if a UUT is then connected where the negative terminal is connected to the case, there is the potential for hazardous voltages to be present on the case of the UUT

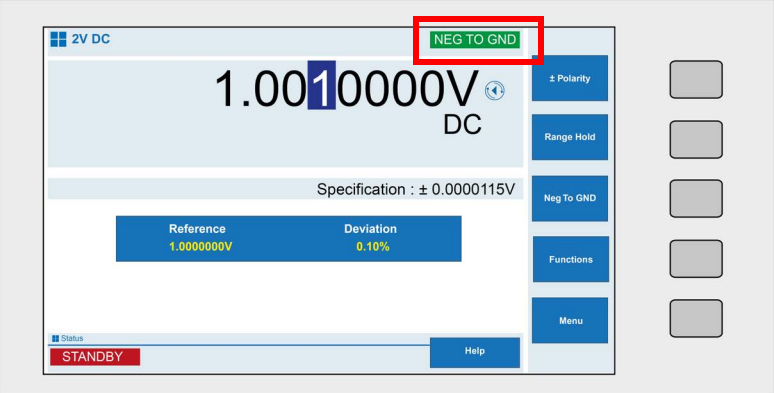


Figure 3-46 : Negative to Ground Indicator



Figure 3-47 : Negative to Ground LED / Terminal

3.16.2 Selecting front panel control when in Remote Mode

When the calibrator has been controlled from the interface, the front panel controls are disabled. To regain front panel control, use the 'LOCAL' soft key

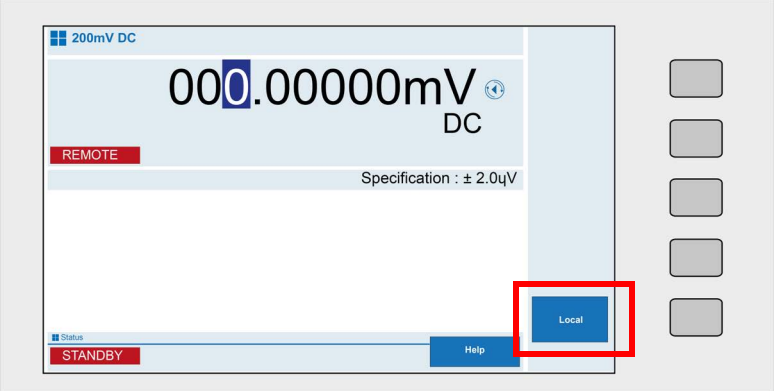


Figure 3-48 : Local Key

3.17 Terminal Status LED's

LED's above the terminals indicate which pair is active. When terminals are not active, they are electrically isolated from each other. This enables terminals to be linked together if required.

The function of each 'set' of terminals is described below :

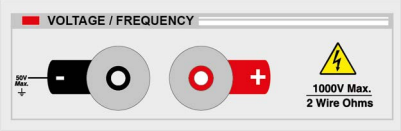
Voltage / Frequency Output Terminals (Black & Red) Low thermal 4mm safety terminals used for all voltage outputs up to 1020V, for 2 wire / 4 wire resistance (both passive and simulated), capacitance and frequency (also optional inductance). Fused via a 2A Fuse on front panel Note: the low 'black' terminal can be internally switched to line earth by a soft key function. When floating, the maximum voltage on this terminal with respect to ground should not exceed 50 Volts peak.	
Current Output Terminals (≤ 2 Amps) (Black & Red) 4mm safety terminals for all current outputs up to 2 Amps, sense connection for 4 wire resistance (both passive and simulated), compensated 2 wire simulated resistance and pulse width modulation / duty cycle. **Fused via a 2A Fuse on front panel** Note: the low 'black' terminal can be internally switched to line earth by a soft key function. When floating, the maximum voltage on this terminal with respect to ground should not exceed 50 Volts peak.	

Table 2: Terminal Descriptions

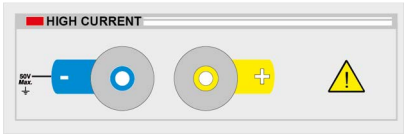
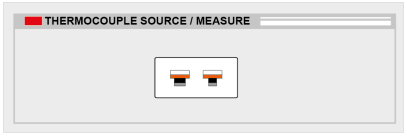
High Current Output Terminals (Blue & Yellow) 4mm safety terminals for all currents above 2 Amps to 30 Amps. Note: the low 'blue' terminal can be internally switched to line earth by a soft key function. When floating, the maximum voltage on this terminal with respect to ground should not exceed 50 Volts peak.	
Earth Terminal (Green) 4mm safety terminal provided for Earth Connection to UUT / DUT with no ground connection. Fused via a 2A Fuse on front panel	
Thermocouple Source / Measure Thermocouple mini connector for simulation and measurement of thermocouples, example K & J types	

Table 2: Terminal Descriptions



NOTE :Dangerous voltage or current may be present on these terminals

4 Connection Diagrams

Provided in this section are example connection diagrams for typical pieces of test equipment, indicating the terminals to use for each type of output.



NOTE :These connection diagrams are the default diagrams that the 4610M has loaded. It is possible to upload custom connection diagrams which will change the images.



NOTE :It is important to remember that these images are generic and not for specific UUT's / DUT's. These images are provided as examples, and the instruction manual for the UUT / DUT should be referenced prior to use.

4.1 Voltage - AC/DC

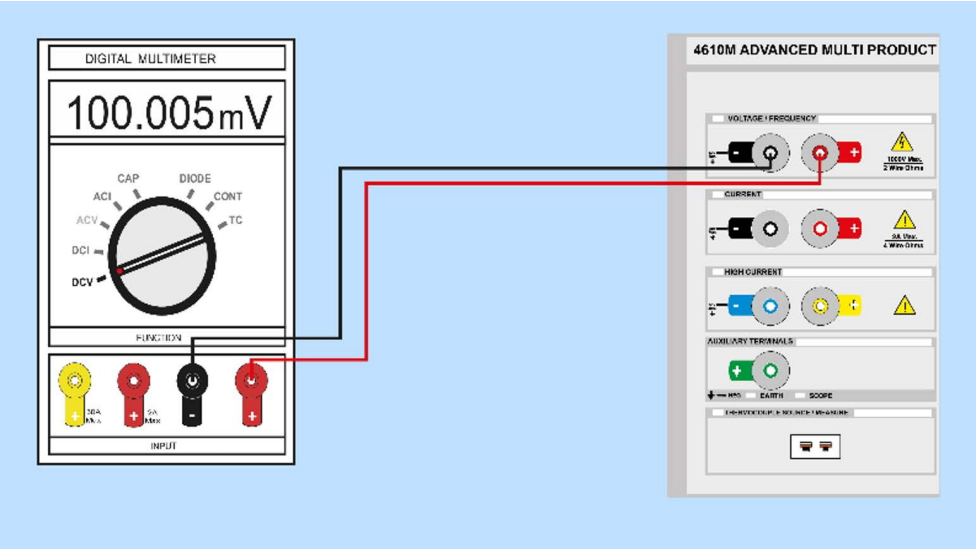


Figure 4-1 : AC / DC Voltage

4.2 Current Up To 2A - AC/DC

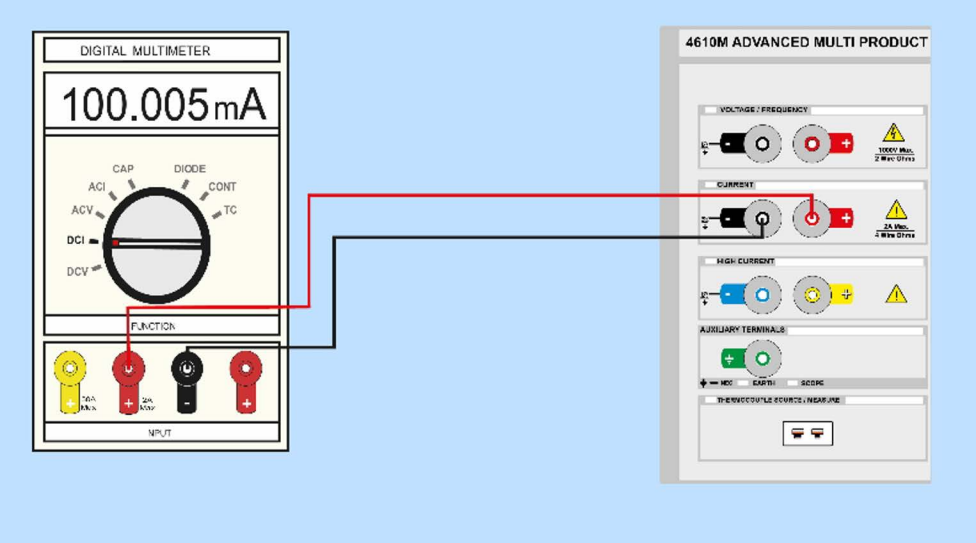


Figure 4-2 : AC / DC Current <= 2A

4.3 Current Above 2A - AC/DC

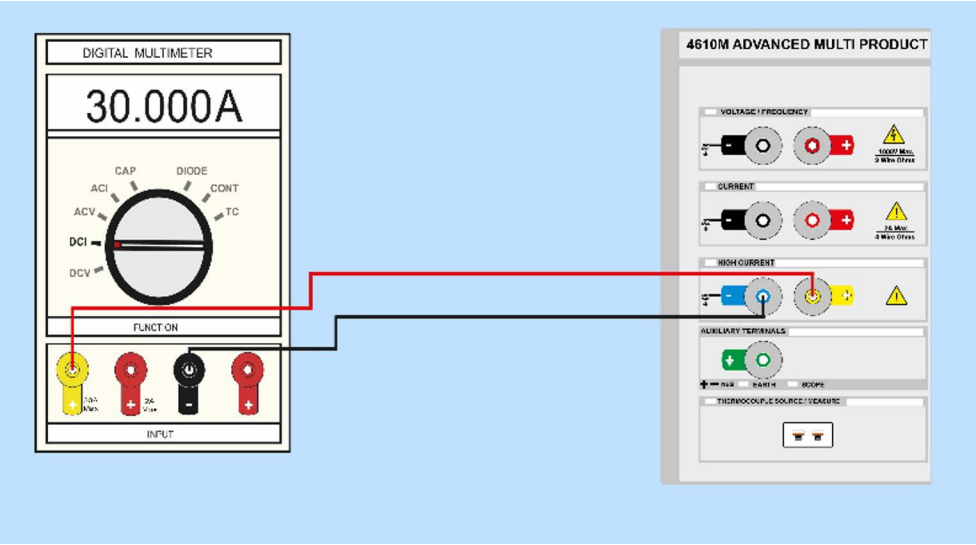


Figure 4-3 : AC / DC Current < 2A

4.4 Resistance - 2 Wire Passive / 2 Wire Simulated Variable / 2 Wire Simulated Variable PRT

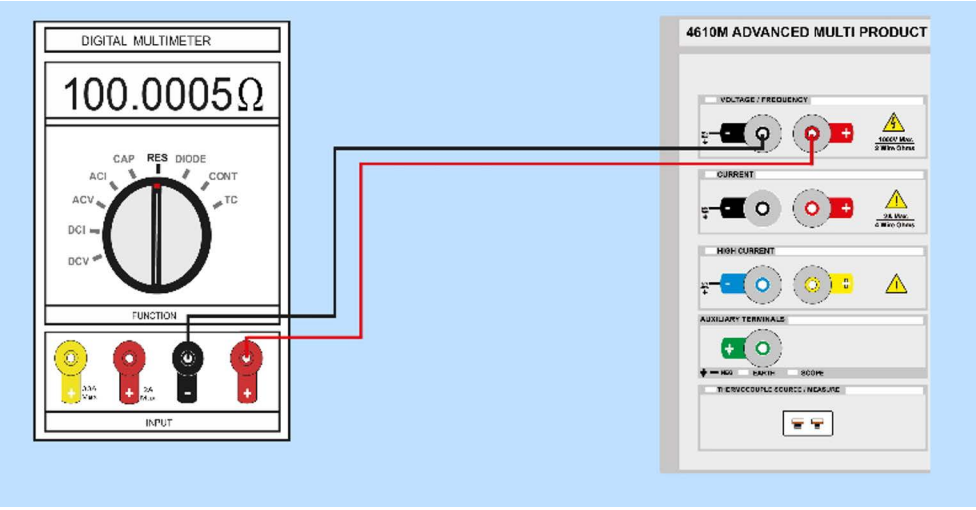


Figure 4-4 : Resistance - 2 Wire Connection

4.5 Resistance - 2 Wire Compensated Simulated

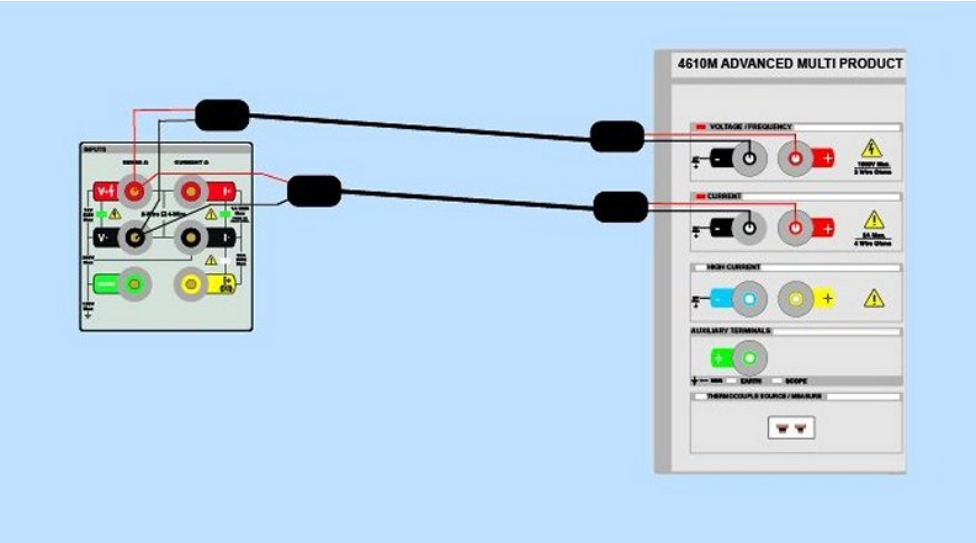


Figure 4-5 : Resistance - 2 Wire Compensated Connection

4.6 Resistance - 4 Wire Passive / 4 Wire Simulated

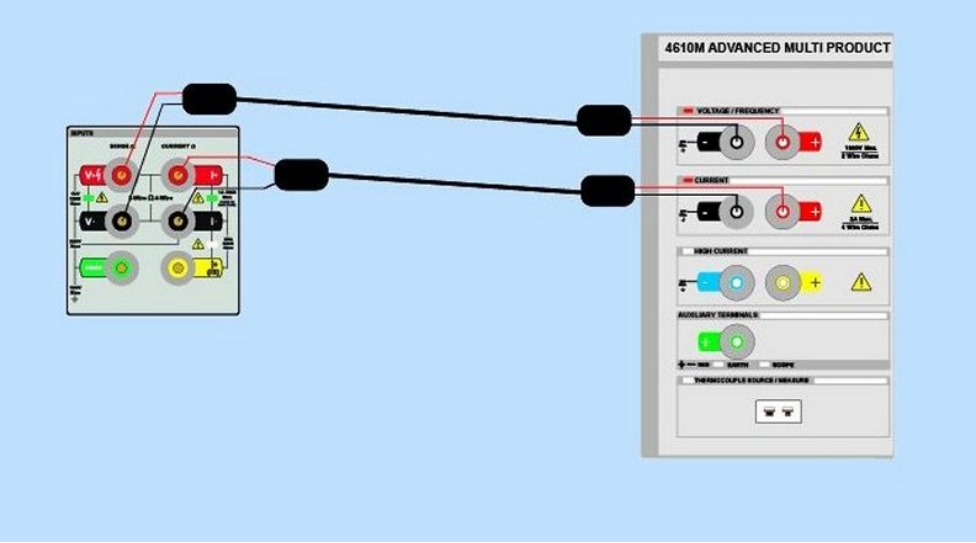


Figure 4-6 : Resistance - 4 Wire Connection

4.7 Capacitance – Passive & Variable

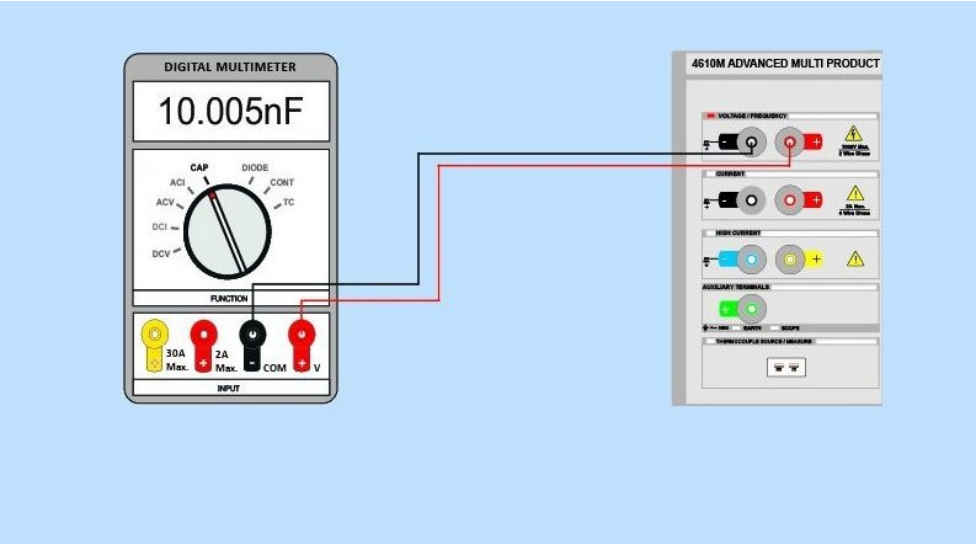


Figure 4-7 : Capacitance Connection

4.8 Frequency

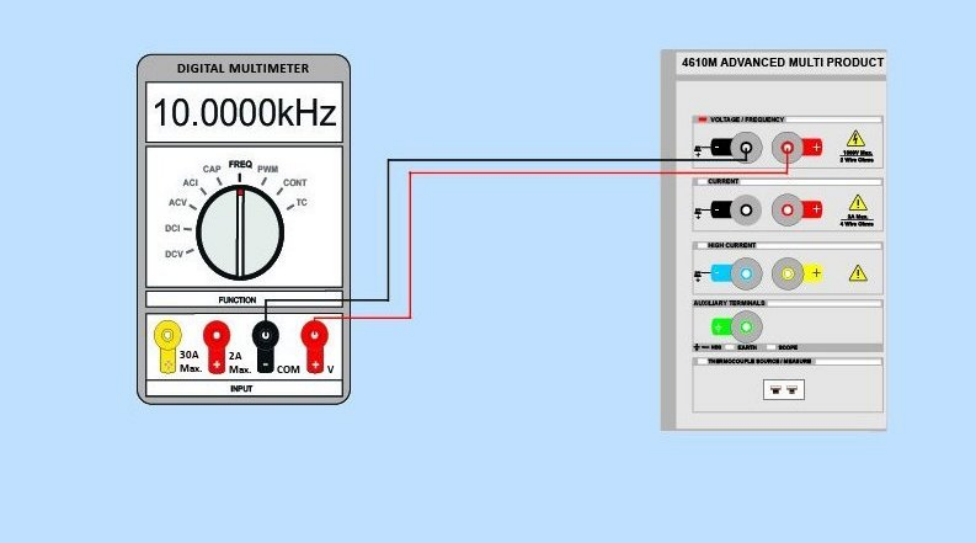


Figure 4-8 : Frequency Connections

4.9 Pulse Width Modulation (PWM) / Duty Cycle

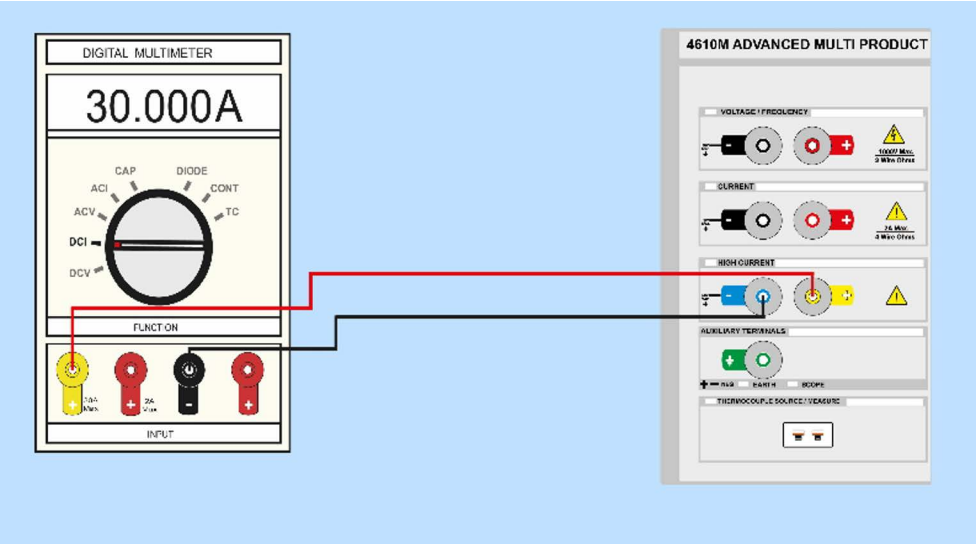


Figure 4-9 : PWM / Duty Cycle Connections

4.10 Thermocouple Source

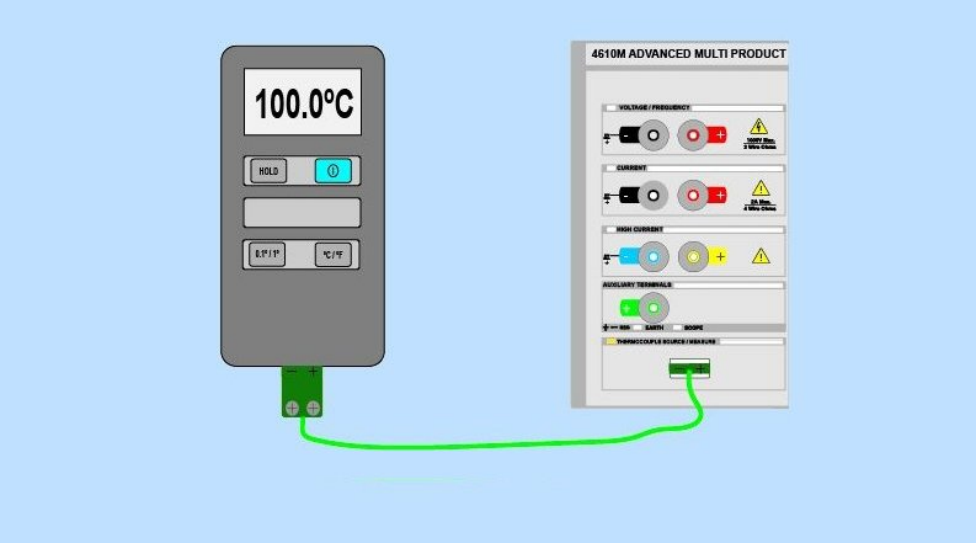


Figure 4-10 : Thermocouple Source Connection

4.11 Thermocouple Measurement

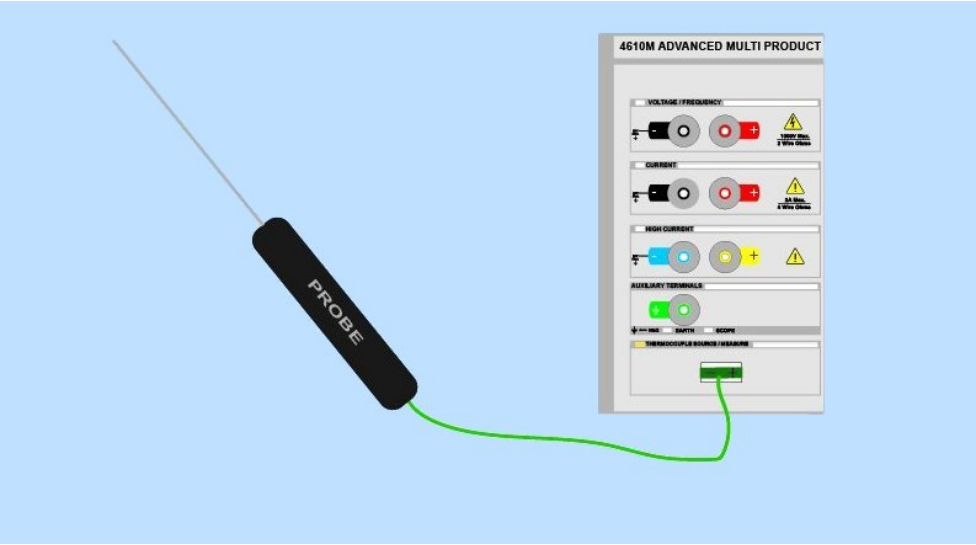


Figure 4-11 : Thermocouple Measurement Connection

4.12 Current Simulation Up To 1500A Using EA002 Coil Adapter

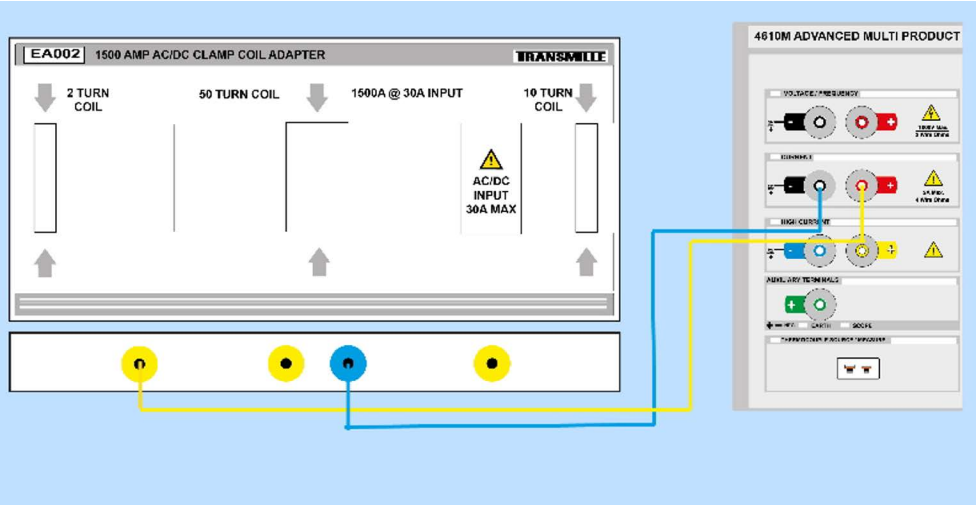


Figure 4-12 : EA002 - Source Current <= 2A AC/DC

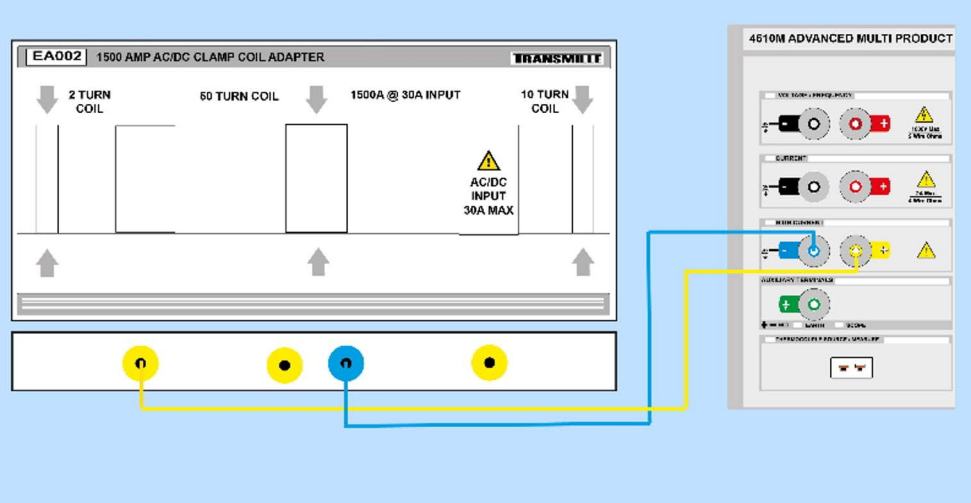


Figure 4-13 : EA002 - Source Current > 2A AC/DC

5 Setting Outputs

5.1 Setting the Output

In this section configuring calibrator outputs will be described, with worked examples. To set the calibrator output, push the numerical keys required followed by a multiplier key (if required) and then a function key to identify which unit of measurement (Volts, Amps, Ohms etc.). The front panel touchscreen shows the value and the units selected as you type them into the calibrator.

Once all numeric values and units have been entered press the ENTER key

key. If an entry error is made, the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

Press the OUTPUT ON key to activate the calibrator output.

For example, input the following example sequence to set a DC voltage output (12mV):

Press the OUTPUT ON key to activate the calibrator output.

Input the following example sequence to set an AC voltage output (12V @ 60Hz):

Press the OUTPUT ON key to activate the calibrator output.

To change between DC and AC press either the AC or DC keys.

5.2 Adjusting the Set Output Using the Digital Control

After the output has been set, any digit of the output display can be incremented or decremented using either the digital control or the up and down arrow keys. The digit selected is indicated by the cursor and can be changed by using the left and right arrow keys.

Ranges with 'fixed' values (i.e. passive resistance) will change by a decade up/down (if within output capability), ranges that allow deviation will have their output adjusted. If the deviation/ change takes the range outside of capability, the calibrator will automatically change to the next applicable range if Range Hold is disabled.

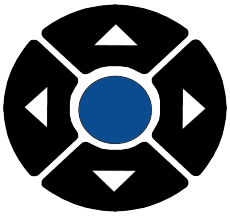


Figure 5-14 : Arrow Keys

5.3 Automatic Display of % or PPM Error and Reference Key

When the output value is changed by adjusting using the digital control or arrow keys, the display will show the change in ppm or % from the original reference value entered from the keyboard. If needed, the reference value can be reset to the present value on the display by pressing the REF key.

This feature is ideal for displaying the error in a meter under test by adjusting the output from the calibrator to make the meter read the nominal value. This is most useful for use with an analog UUT / DUT

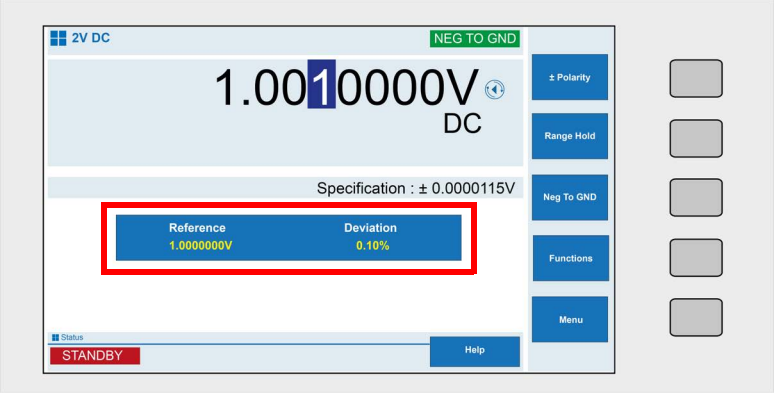


Figure 5-15 : Deviation from Reference Value

5.4 Range Hold

A soft key and direct touch button are available to toggle between manual and locked ranges. This function is primarily made to prevent small changes in the output through range changes, typically encountered when making linearity measurements. When 'Range Hold' is selected the selected range will not change when the output is edited. However, output values beyond that of the range cannot be entered. When 'Range Hold' is not selected the calibrator will automatically select the range that will give the best output resolution.

To enable Range Hold using the keyboard, press the SHIFT key, followed by RANGE ▲ X 10 or RANGE ▼ ÷ 10

To disable Range Hold, repeat the previous steps.

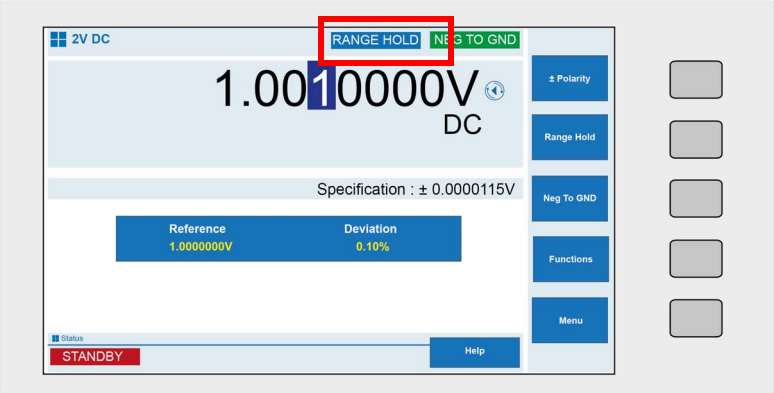


Figure 5-16 : Range Hold Active

5.5 Wait Indicator

After setting an output or turning the output on, the calibrator will require time for the output to settle to the new value (including ramp time). To assist the operator, a 'WAIT' indicator is

displayed in the lower left of the screen to indicate that the output of the calibrator is still settling.

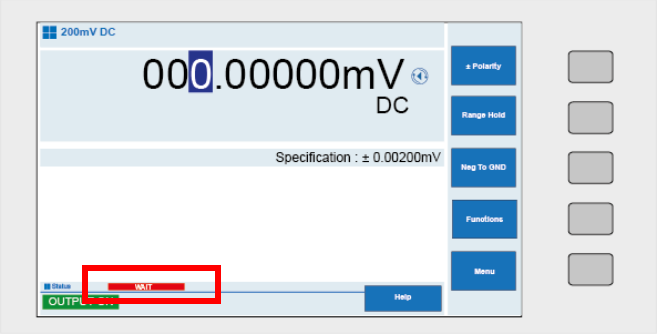


Figure 5-17 : Front Panel Wait Indicator

Note that this does not indicate that the UUT / DUT has settled, only that the output of the calibrator has settled.

5.6 Low Impedance Loads

All voltage ranges with exception of the 20mV AC and 200mV AC/DC Voltage Ranges have sufficient compliance current available for almost all loads. When driving analogue meters with low voltage ranges that would use the 20mV AC & 200mV AC/DC range, the 20mV & 200mV range may not have sufficient compliance current.

Using the Range Hold function allows lower voltages to be simulated using the 2V AC/DC Voltage range.

The accuracy levels of analogue meters are such that using the 2V ranges will not significantly affect TUR.

The reason for limited compliance current on the 200mV ranges is due to a precision voltage divider used for the 20mV & 200mV ranges of the 4610M calibrator. This results in significantly lower noise output on low voltage ranges than equivalent calibrators, at the expense of lower available compliance current.

For modern meters with high input impedances and higher resolutions, this provides improved noise performance and improves noise floor performance rather than using direct outputs.

5.7 Setting a DC Voltage Output

Complete the following procedure to set a DC voltage output. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following example sequence to set a DC voltage output:

1 2 m VOLTS ENTER

- Press the OUTPUT ON key to activate the calibrator output.

The calibrator will now produce 12 mV DC at the voltage terminals.

Once on a range, any new output within that range can be set without the calibrator returning to standby. If the new range is a high voltage range (Outputs greater than 20V) is selected, the output will automatically return to standby. To output the new value, press the OUTPUT ON key. This safety feature stops the accidental selection of high voltage or current when the UUT is not on the correct range or leads are not configured correctly

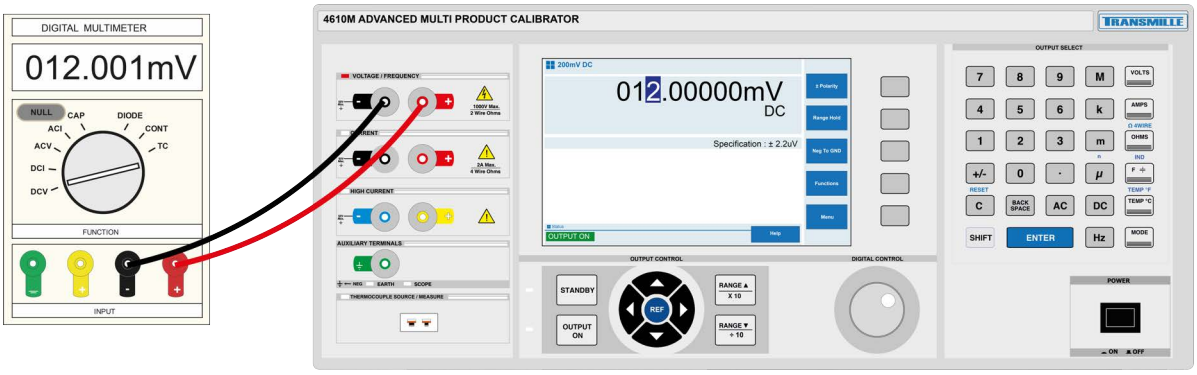


Figure 5-18 : DC Voltage Output

5.8 Setting a DC Current Output

Complete the following procedure to set a DC current output. This example sets an output of 12mA, however the same steps apply for any output. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following example sequence to set a DC Current output:

1 2 m AMPS 0 Hz ENTER

- Press the OUTPUT ON key to activate the calibrator output.

The calibrator will now produce 12 mA DC at the low current terminals.

Once on a range, any new output within that range can be set without the calibrator returning to standby. When a high voltage or high current values are entered the calibrator will automatically go into standby mode. To output this voltage or current, press the OUTPUT ON key. This safety feature stops the accidental selection of high voltage or current.

Note: Ensure the correct output terminals are used when setting an output >2A, see "Current Above 2A - AC/DC" on page 54

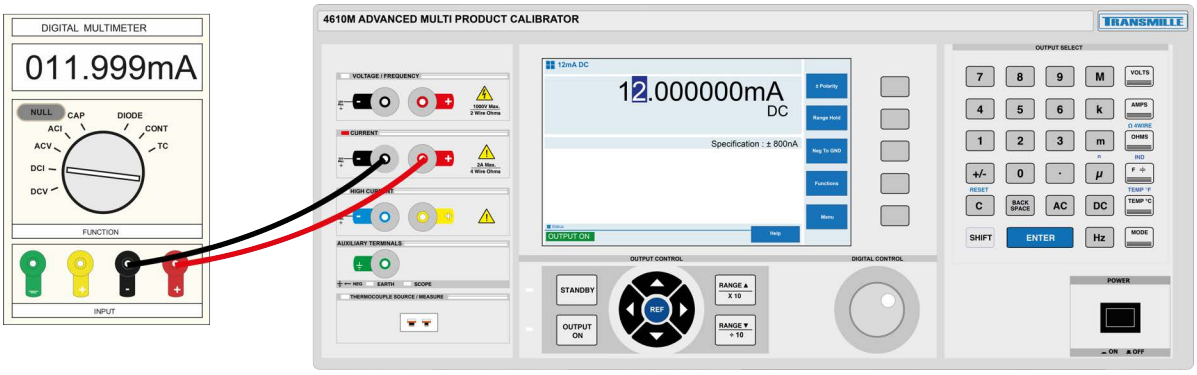


Figure 5-19 : DC Current Output

5.9 Setting an AC Voltage Output

Complete the following procedure to set an AC voltage output. This example sets 12V, 60Hz but the same steps apply for any output. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following example sequence to set an AC voltage output:

1 2 AMPS 6 0 Hz ENTER

- Press the OUTPUT ON key to activate the calibrator output.

The calibrator will now produce 12 V, 60 Hz AC at the appropriate terminals.
Once on a range, any new output within that range can be set without the calibrator returning to standby. When high voltage values are entered the calibrator will automatically go into standby mode. To output this voltage or current, press the OUTPUT ON key. This safety feature stops the accidental selection of high voltage or current.

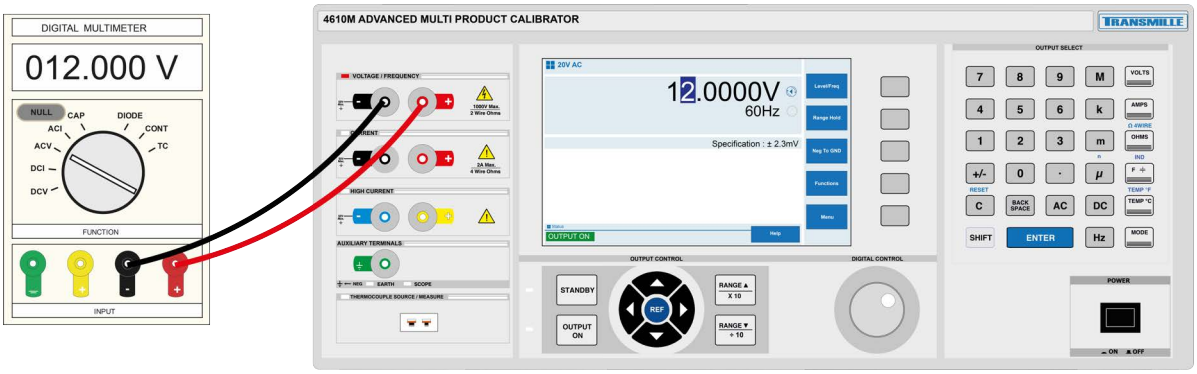


Figure 5-20 : AC Voltage Output

5.10 Setting an AC Current Output

Complete the following procedure to set an AC current output. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following example sequence to set an AC current output:

5 0 μ AMPS 1 k Hz ENTER

- Press the OUTPUT ON key to activate the calibrator output.

The calibrator will now produce 50 µA, 1kHz AC at the appropriate terminals.
Once on a range, any new output within that range can be set without the calibrator returning to standby. When a high voltage or high current values are entered the calibrator will automatically go into standby mode. To output this voltage or current, press the OUTPUT ON key. This safety feature stops the accidental selection of high voltage or current.

Note: Ensure the correct output terminals are used when setting an output >2A, see "Current Above 2A - AC/DC" on page 54

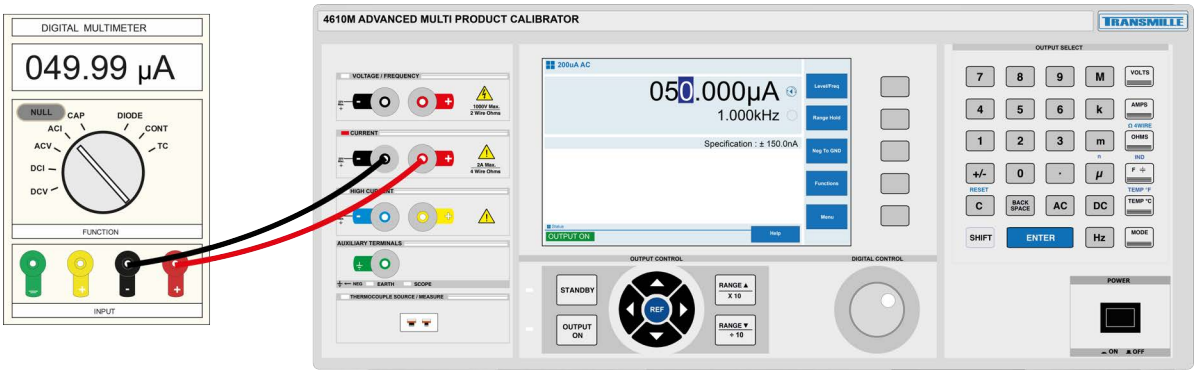


Figure 5-21 : AC Current Output

5.11 Setting 2-Wire Simulated Resistance Output.

The calibrator can simulate 2-wire resistance values in the range of 0Ω to 1GΩ.



NOTE :It is important to make sure that a Relative/Null operation is performed to the 0 Ohm output of the 2 Wire Simulated Resistance Output as all outputs are relative to the 0 Ohm Output



NOTE : Resistance outputs above 1 MOhm will be affected by poor quality leads. Ensure that leads are not PVC which may suffer from leakage and cause resistance outputs to appear LOW. Avoid twisting wires together and separate on the bench if possible. Transmille offer training materials which demonstrate this effect

Complete the following procedure to select 200kΩ in 2-wire simulated mode. If an entry error is made, use the 'BACKSPACE' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following example sequence to set 0 Ohms, 2 Wire Simulated Output

0 OHMS ENTER

- Press the OUTPUT ON key to activate the calibrator output.
- Press the 'Null' or 'Rel' key on the UUT / DUT - refer to the instruction manual. This will null out the connecting leads and any residual resistance at the terminals. Some UUT's / DUT's will perform a range hold when pressing the 'Null' or 'Rel' key, so range hold the UUT / DUT to the appropriate range prior to pressing 'Null' or 'Rel'
- On the 4610M, input the following sequence

2 0 0 k OHMS ENTER

- As the output is already on and a hazardous function is not being selected, the calibrator will not return to standby

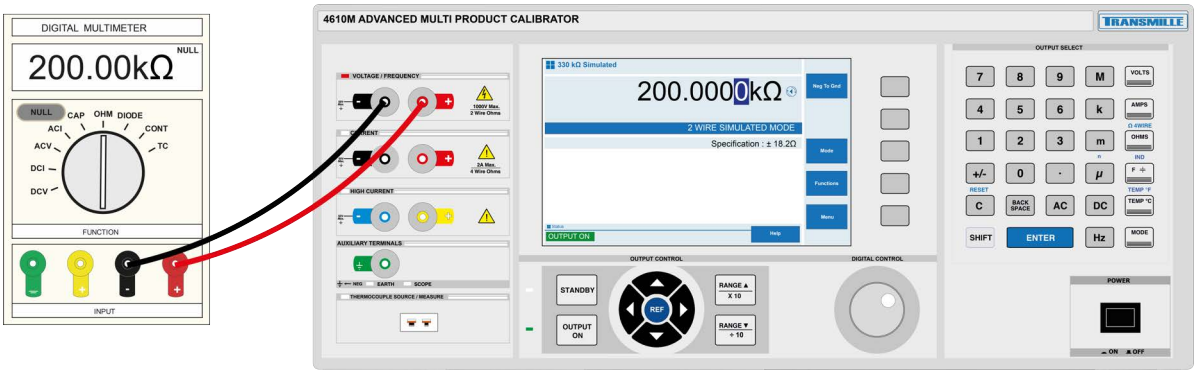


Figure 5-22 : 2 Wire Simulated Resistance Output

5.12 Setting 4-Wire Simulated Resistance Output

NOTE :It is important to make sure that a Relative/Null operation is performed with leads from the UUT / DUT Shorted at the point of connection to the Calibrator to remove offsets from interconnecting leads

Complete the following procedure to select 10kΩ in 4 Wire Simulated Ohms mode. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the UUT / DUT to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following sequence

1 0 k SHIFT OHMS ENTER

- Press the OUTPUT ON key to activate the calibrator output.

4 Wire Ohms is indicated on the terminal LED's by both the voltage and current terminal LEDs illuminated

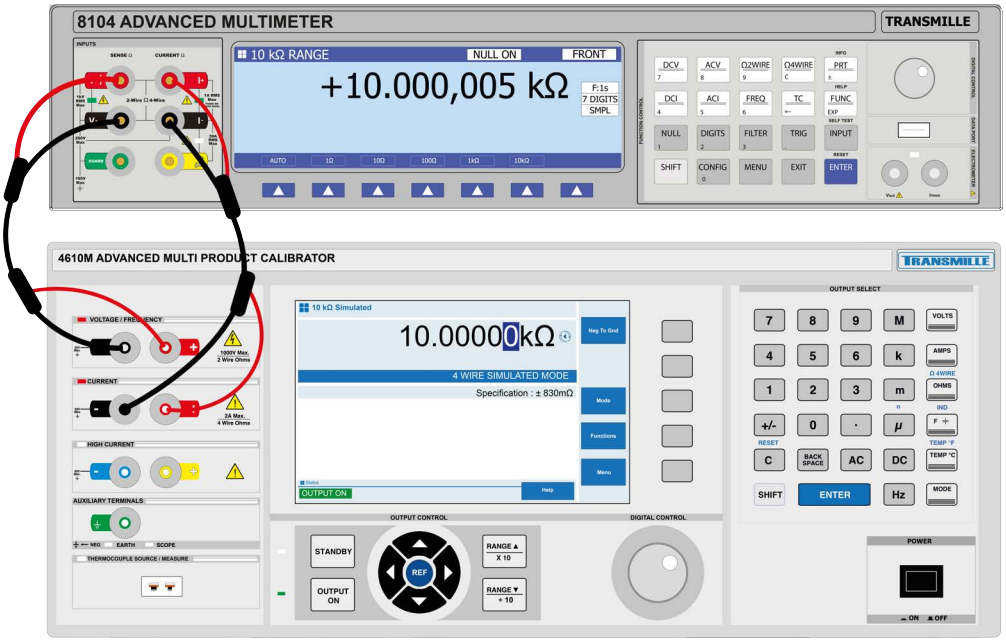


Figure 5-23 : 4 Wire Simulated Resistance Output

5.13 Setting 2-Wire Simulated Compensated Resistance

NOTE :It is essential that the zero on the UUT / DUT is verified at the UUT / DUT Terminals. A high quality shorting link should be connected directly across the terminals of the UUT / DUT and the Null / Relative function used to remove any offsets on the UUT / DUT

To access 2-wire simulated compensated resistance mode, the calibrator must be in a resistance mode (2 wire simulated, 4 wire simulated, 2 wire passive or 4 wire passive), and then the mode changed to compensated. The Instructions below are from a reset status and will work from any state.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the unit under test to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, input the following sequence

1 0 OHMS ENTER

- Press the Mode soft key to display the Ohms menu
- Select '2 Wire Simulated (Compensated) from the menu
- Press the OUTPUT ON key to activate the calibrator output

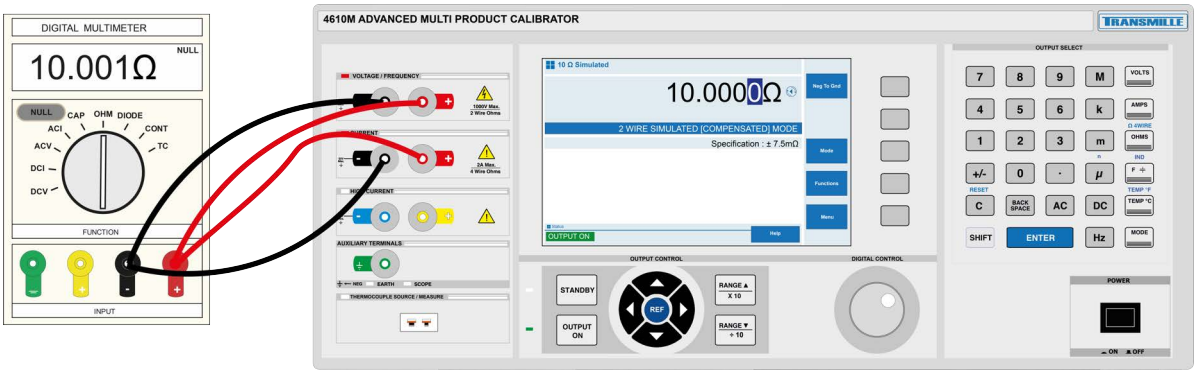


Figure 5-24 : 2 Wire Simulated (Compensated) Resistance Output

5.14 Setting 2-Wire Passive Resistance Output.



NOTE :It is important to make sure that a Relative/Null operation is performed with leads from the UUT / DUT Shorted at the point of connection to the Calibrator to remove offsets from interconnecting leads. The Displayed value on the calibrator is the value at the terminals, and does not include lead resistance.



NOTE :The calibrator uses standard resistors of fixed decade values. The nearest available resistance to the entered value will be automatically selected.

To access 2 Passive resistance mode, the calibrator must be in a resistance mode (2 wire simulated, 4 wire simulated, 2 wire passive or 4 wire passive), and then the mode changed to 2 Wire Passive. The Instructions below are from a reset status and will work from any state.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the unit under test to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, Press the MODE key
- Select Resistance from the menu
- Select 2 Wire Passive. The calibrator will switch to Resistance mode.
- Either select 10 MΩ from the on screen buttons, or press the following key sequence

1 0 M OHMS ENTER

- Press the OUTPUT ON key to activate the calibrator output

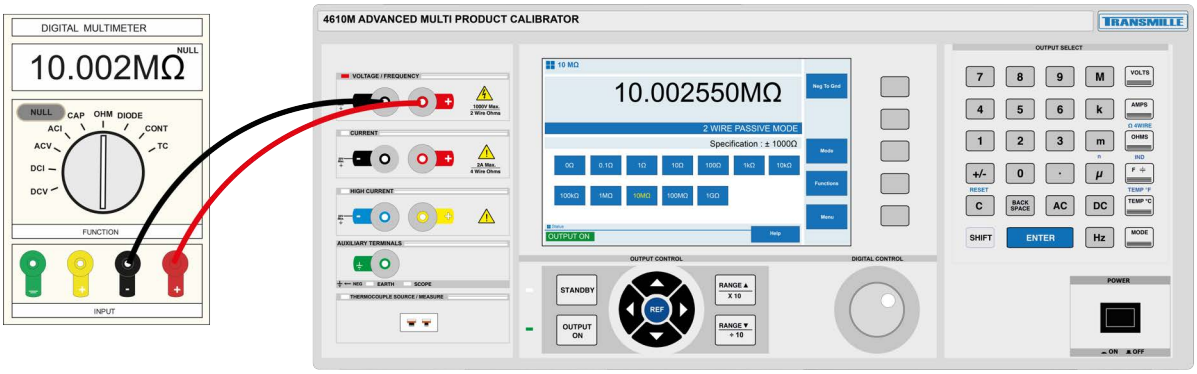


Figure 5-25 : 2 Wire Passive Resistance Output

5.15 Setting 4-Wire Passive Resistance Output



NOTE :It is important to make sure that a Relative/Null operation is performed with leads from the UUT / DUT connected to the calibrator, with the 0 mOhm Output set . The Displayed value on the calibrator is the value relative to the 0 mOhm output. Performing a Zero to this output will remove any offsets caused by interconnecting leads



NOTE :The calibrator uses standard resistors of fixed decade values. The nearest available resistance to the entered value will be automatically selected.

To access 4 Wire Passive resistance mode, the calibrator must be in a resistance mode (2 wire simulated, 4 wire simulated, 2 wire passive or 4 wire passive), and then the mode changed to 4 Wire Passive. The Instructions below are from a reset status and will work from any state.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the unit under test to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, Press the MODE key
- Select Resistance from the menu
- Select 4 Wire Passive. The calibrator will switch to Resistance mode.
- Either select 0Ω from the on screen buttons, or press the following key sequence

0 ENTER

- Press the OUTPUT ON key to activate the calibrator output
- Press the 'Null' or 'Rel' key on the UUT / DUT - refer to the instruction manual. This will null out the connecting leads and any residual resistance at the terminals. Some UUT's / DUT's will perform a range hold when pressing the 'Null' or 'Rel' key, so range hold the UUT / DUT to the appropriate range prior to pressing 'Null' or 'Rel'
- Either select 0.1Ω from the on screen buttons, or press the following key sequence

1 0 0 m OHMS ENTER

- Press the OUTPUT ON key to activate the calibrator output

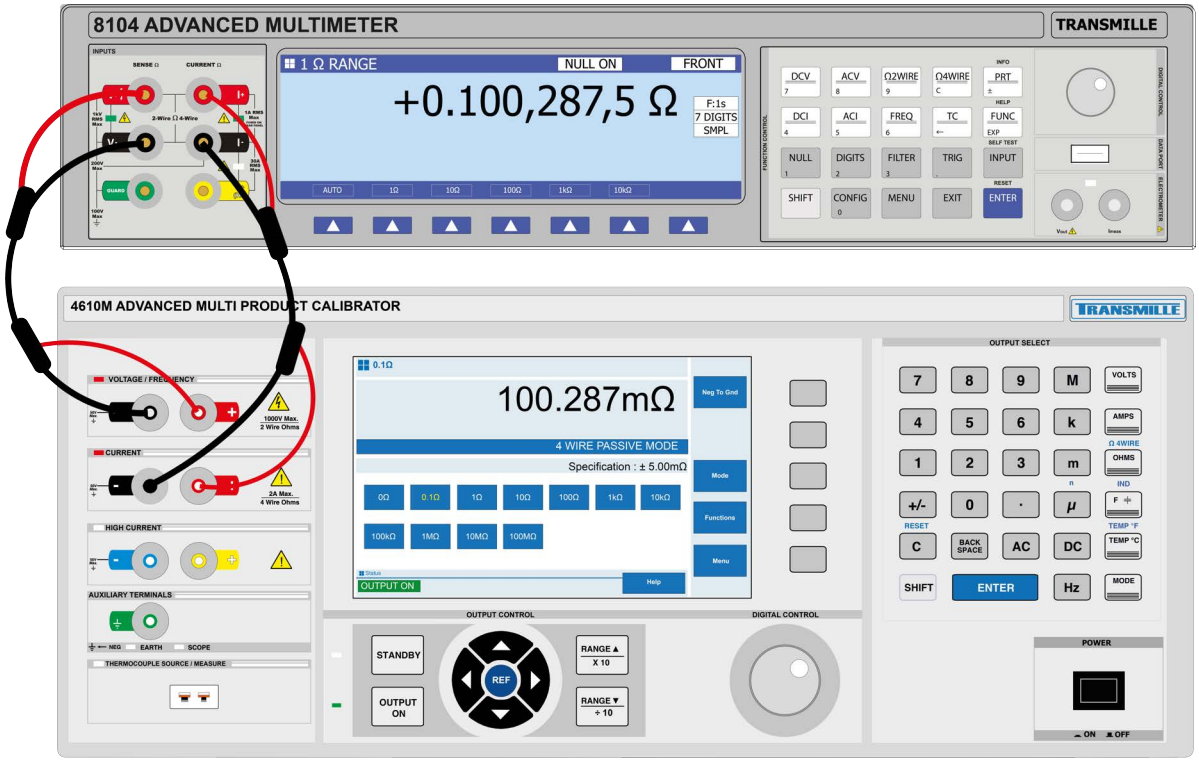


Figure 5-26 : 4 Wire Passive Resistance Output

5.16 Setting Simulated Capacitance Output



NOTE : Meters must have Null / Zero / Rel performed against 0.00nF Output. Set calibrator to 0.00nF, turn the output of the calibrator ON and press the Null/Rel soft key on the UUT / DUT to zero the UUT to the output. All outputs are relative to this 0.00nF Output.



NOTE :The Simulated Capacitance output is for use with Pulsed/Constant DC measurement method only. LCR Meters that test with an AC Signal are not supported. Passive Capacitance should be used for AC LCR Meters

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the unit under test to the 4610M calibrator after ensuring the output is turned OFF
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, press the following key sequence



- Press the OUTPUT ON key to activate the calibrator output
- Press the ‘Null’ or ‘Rel’ key on the UUT / DUT - refer to the instruction manual. This will null out the connecting leads and any residual resistance at the terminals. Some UUT’s / DUT’s will perform a range hold when pressing the ‘Null’ or ‘Rel’ key, so range hold the UUT / DUT to the appropriate range prior to pressing ‘Null’ or ‘Rel’
- On the 4610M, press the following key sequence

1 · 2 μ F ÷ ENTER

- Press the OUTPUT ON key to activate the calibrator output

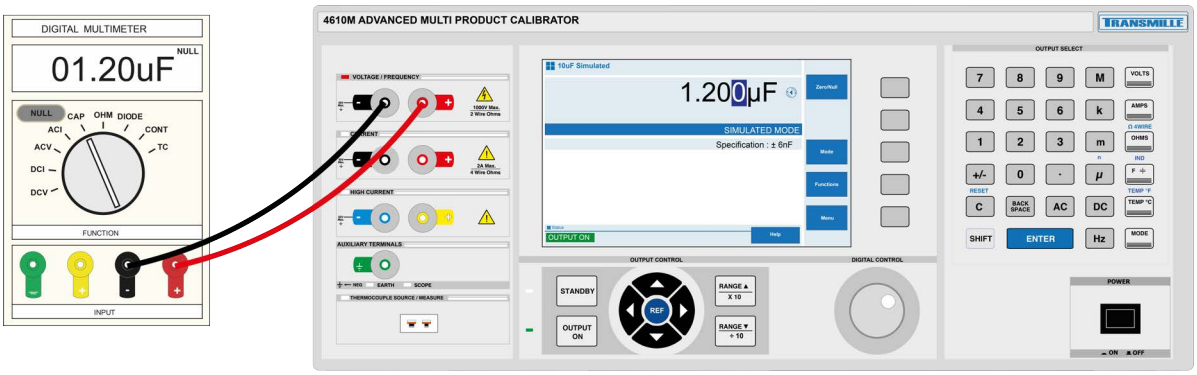


Figure 5-27 : Simulated Capacitance Output

5.17 Setting Passive Capacitance Output



NOTE :It is important to note that the zero procedure differs for DC/Pulsed meters and LCR Meters. DC / Pulsed meters should have their leads Nulled to the Current terminals, with the calibrator in Standby. LCR Meters (using an AC Test Signal) should have their NULL performed with the leads disconnected from the 4610M



NOTE :The calibrator uses fixed value capacitors, with the reported value being the value at 1kHz. The nearest available capacitance to the entered value will be automatically selected.

To access Passive capacitance mode, the calibrator must be in a capacitance mode, and then the mode changed to Passive capacitance Mode. The Instructions below are from a reset status and will work from any state.

- Reset the calibrator using the SHIFT key, followed by the C key
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, Press the MODE key
- Select Capacitance from the menu
- Select Passive Capacitance. The calibrator will switch to Passive Capacitance mode.
- Either select 1nF from the on screen buttons, or press the following key sequence

1 SHIFT μ F ÷ ENTER

- If testing a DC Meter (typically a hand held multimeter), with the output of the calibrator OFF, connect the UUT / DUT to the Low Current Terminals, and Press the 'Null' or 'Rel' key on the UUT / DUT - refer to the instruction manual. This will null out the connecting leads and any

residual capacitance at the terminals. Some UUT's / DUT's will perform a range hold when pressing the 'Null' or 'Rel' key, so range hold the UUT / DUT to the appropriate range prior to pressing 'Null' or 'Rel'.

- If testing an LCR Meter, with the leads disconnected, perform a Zero Trim operation - refer to the instruction manual
- Connect the unit under test to the Voltage terminals of the 4610M calibrator after ensuring the output is turned OFF
- Press the **OUTPUT ON** key to activate the calibrator output

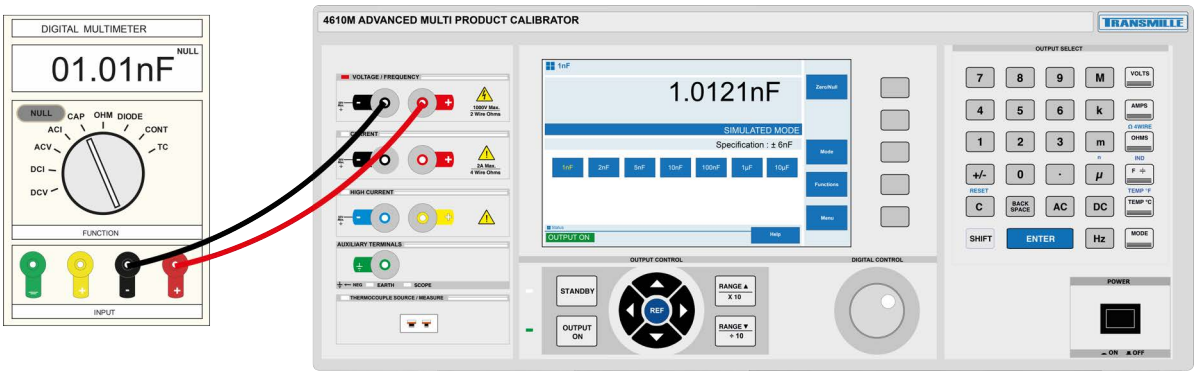


Figure 5-28 : Passive Capacitance Output

5.18 Thermocouple Simulation (Source) Mode

NOTE : It is essential that the correct type of Thermocouple cable is used. Using the incorrect type of interconnecting cable can result in large errors

Thermocouple simulation allows the user to enter a temperature in °C or °F which sets the calibrator to the specific voltage output which corresponds to the thermocouple type selected. The default thermocouple is 'K' type.

- Reset the calibrator using the SHIFT key, followed by the C key
- Ensure the UUT / DUT has been set to measure the correct input on the desired range. Ensure that the correct type of Thermocouple lead is being used.
- On the 4610M, press the following key sequence

  2 3 TEMP °C ENTER
- On the screen of the 4610M, ensure that the required type is selected. Press the button on the screen to change the Type
- The default condition is for auto cold junction to be ENABLED. If a manual Junction temperature is required, press 'Manual CJ' and then enter the desired temperature using the keyboard, followed by the ENTER key.
- Press the OUTPUT ON key to activate the calibrator output

The display will indicate the current selected range / thermocouple type and output status:

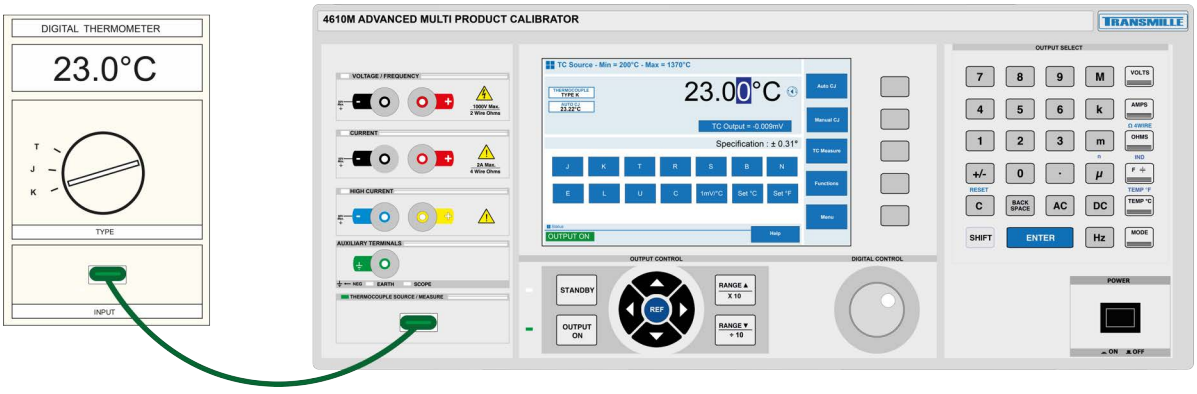


Figure 5-29 : Thermocouple Source

To select / change the thermocouple type, touch the screen on the appropriate thermocouple type (J, K,T,R,S,B,N,E,L,U & C and 1mV/).

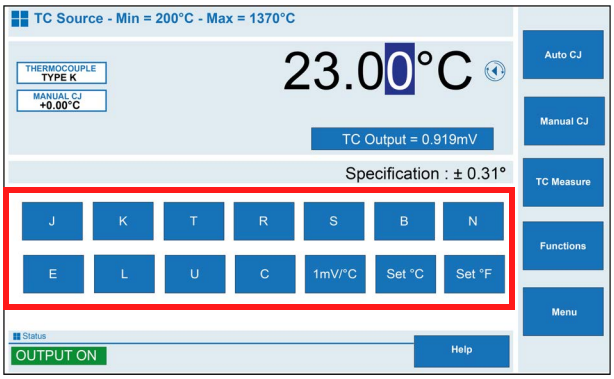


Figure 5-30 : Thermocouple Type Selection

To change between °C and °F, press either 'Set °C' or 'Set °F' as required. Alternatively, to enter a temperature in °F, press the SHIFT key while entering the desired temperature which activates the °F Entry.

When in Auto Cold Junction, a measurement of the 4610M internal cold junction is taken approximately every 5 seconds. The reported cold junction is displayed on the left hand side of the screen, alongside the currently selected thermocouple Type

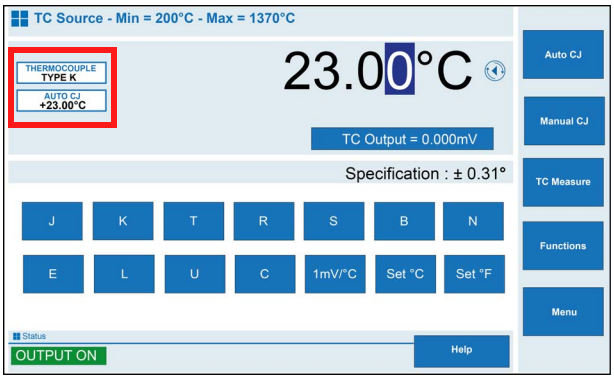


Figure 5-31 : Cold Junction Temperature Display

To edit the cold junction temperature, press the 'Manual CJ' soft key, and then enter the desired CJ in the currently set units using the numeric keypad entry

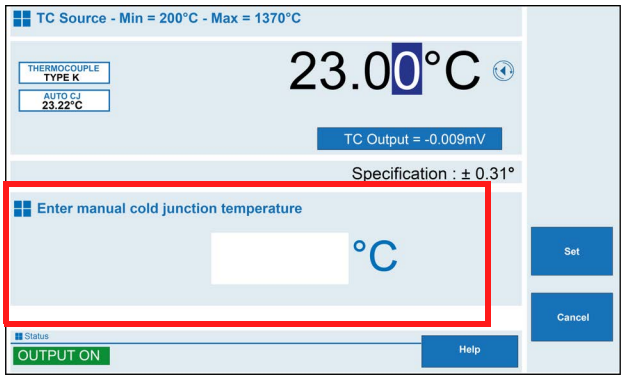


Figure 5-32 : Manual Cold Junction Entry

5.19 Thermocouple Measurement Mode

NOTE : It is essential that the correct type of Thermocouple cable is used. Using the incorrect type of interconnecting cable can result in large errors

Thermocouple measurement allows the user to measure the output of a thermocouple source / probe and display the calculated temperature on the display. To enter Thermocouple Measurement mode, follow the below instructions

- Reset the calibrator using the SHIFT key, followed by the C key
- Ensure the UUT / DUT has been set to measure the correct input on the desired range. Ensure that the correct type of Thermocouple lead is being used.
- On the 4610M, Press the MODE key
- Select 'Thermocouple Source / Measure' from the Menu
- Select 'Thermocouple Measurement' from the Thermocouple Menu
- On the screen of the 4610M, ensure that the required type is selected. Press the button on the screen to change the Type
- The default condition is for auto cold junction to be ENABLED. If a manual Junction temperature is required, press 'Manual CJ' and then enter the desired temperature using the keyboard, followed by the ENTER key.

The display will indicate the current selected range / thermocouple type and the measured input. If the input is outside of valid limits then 'OVERRANGE' will be displayed. The measured input mV is displayed underneath the temperature readout.
If a large change to the input is detected, for example changing connection leads, the reading will be paused for 4-5 seconds while the input stabilizes.



Figure 5-33 : Thermocouple Measurement

When the 4610M is taking a reading from the input, the Sample Indicator (S) flashes.

To select / change the thermocouple type, touch the screen on the appropriate thermocouple type (J, K,T,R,S,B,N,E,L,U & C and 1mV/).

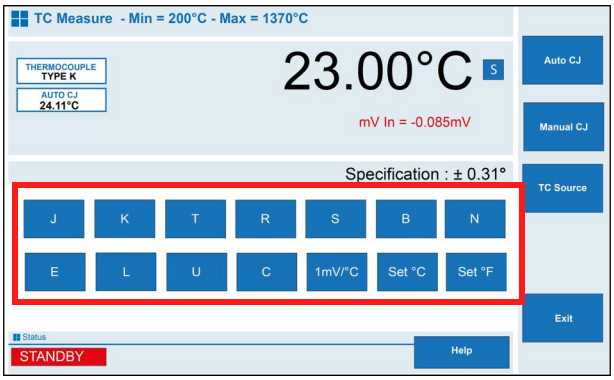


Figure 5-34 : Thermocouple Type Selection

To change between °C and °F, press either 'Set °C' or 'Set °F' as required.
When in Auto Cold Junction, a measurement of the 4610M internal cold junction is taken approximately every 5 seconds. The reported cold junction is displayed on the left hand side of the screen, alongside the currently selected thermocouple Type

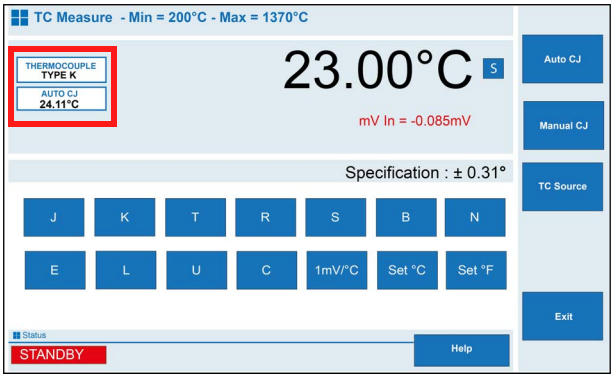


Figure 5-35 : Cold Junction Temperature Display

To edit the cold junction temperature, press the 'Manual CJ' soft key, and then enter the desired CJ in the currently set units using the numeric keypad entry. The 4610M will stop sampling the input while the manual cold junction entry prompt is visible.

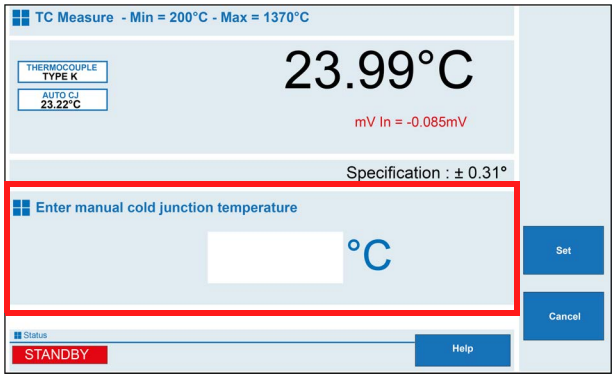


Figure 5-36 : Manual Cold Junction Entry

5.20 Setting Frequency Output

To calibrate the frequency function of a UUT / DUT, the AC Voltage or AC Current functions should be used.

Follow the instructions See “5.9 Setting an AC Voltage Output” on page 66. or See “5.10 Setting an AC Current Output” on page 67. and then set the desired frequency.

Note that the widest range of frequencies (from 1Hz to 1.2MHz) is available on the 2V AC Range

5.21 Setting Pulse Width Modulation (P.W.M., Mark Space Ratio) Output

To access the Pulse Width Modulation (PWM) / Duty Cycle output go to the ‘Function Menu’ as described in “Function Menu” on page 26, use the digital control to highlight the ‘Pulse Width Modulation / Duty Cycle’ function and then press the key or use the touchscreen directly to highlight the function.

The following screen will be displayed

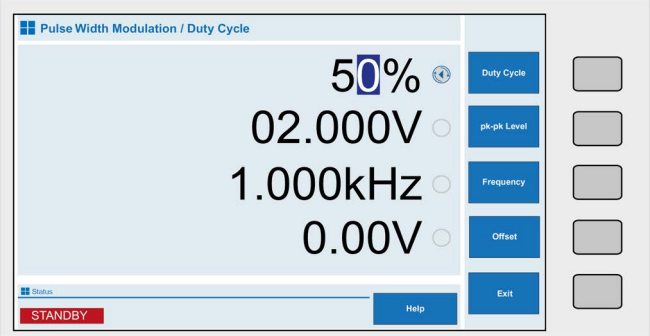


Figure 5-37 : Pulse Width Modulation / Duty Cycle Screen

Pulse Width Modulation / Duty Cycle)

The calibrator can produce an accurate mark space ratio output within the frequency range 5Hz to 50kHz. The width of the pulse can be adjusted from 1% to 99% in 1% steps.
The output level can be adjusted in the range 2V to 10V with an adjustable offset in the range of 0V to +5V.
Complete the following procedure to set a PWM. If an entry error is made, use the ‘backspace’ or ‘C’ (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, Press the MODE key
- Select 'Pulse Width Modulation / Duty Cycle' from the Menu
- On the screen of the 4610M, Edit the Duty Cycle, pk-pk Level, Frequency and DC Offset using the soft keys to select the parameter and the arrow keys or digital control to edit to the desired output
- Press the OUTPUT ON key to activate the calibrator output

To adjust the duty cycle (%), select then either use the arrow keys, digital control or enter the value via the keypad directly, for example: (62%)

To adjust the peak to peak level, select then either use the arrow keys, digital control or enter the value via the keypad directly, for example: (7.5V)

To adjust the offset level, select, then either use the arrow keys, digital control or enter the value via the keypad directly, for example: (1.12V)

To change the any of functions (Duty Cycle, pk-pk Level, Frequency or Offset) from the nominal value, select the required function and use the deviation function. This is controlled by using the left and right arrow keys to select the digit to be incremented. To increase or decrease the highlighted digit, use the up and down of the cursor keys or use the digital control potentiometer.

To return to the front screen press the Exit soft key

5.22 Setting Simulated PRT (RTD) Output

To access the PRT / RTD output go to the 'Function Menu' as described in "Function Menu" on page 26, use the digital control to highlight the 'PRT / RTD' function and then press the ENTER key or use the touchscreen directly to highlight the function.
Function Menu (PRT / RTD)

The following screen will be displayed

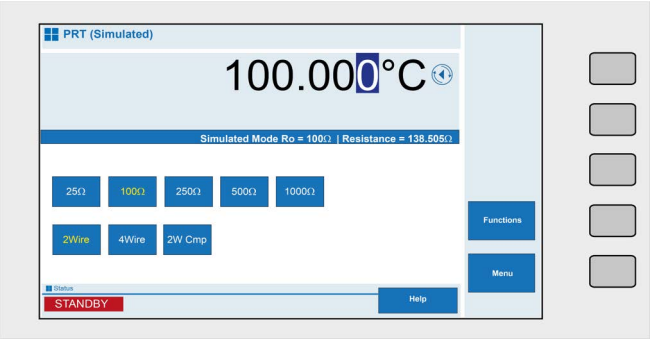


Figure 5-38 : PRT (Simulated)

The calibrator can simulate PRT temperature values for RTD types 25Ω,100Ω, 250Ω, 500Ω and 1000Ω in the range -200°C to 800°C, the different RTD types are selected by the touchscreen directly.
Complete the following procedure to select a 100Ω RTD and set to 0°C in simulated PRT mode. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the meter under test to the 4610M calibrator as required (For a 2 Wire connection, see "Resistance - 2 Wire Passive / 2 Wire Simulated Variable / 2 Wire Simulated Variable PRT" on page 54 or "Resistance - 2 Wire Compensated Simulated" on page 55. For a 4 Wire connection see "Resistance - 4 Wire Passive / 4 Wire Simulated" on page 55).
- Ensure the UUT / DUT has been set to measure the correct input on the desired range.
- On the 4610M, Press the MODE key
- Select PRT / RTD from the menu
- Input the following example sequence to set the temperature value:

  0 TEMP °C ENTER

- Press the OUTPUT ON key to activate the calibrator output

To change the required temperature from the nominal value, use the deviation function. This is controlled by using the left and right arrow keys to select the digit to be incremented. To increase or decrease the highlighted digit, use the up and down of the cursor keys or use the digital control potentiometer.

The PRT (Simulated) mode can output as 2 Wire, 4 Wire and 2 Wire Compensated resistance. To change the mode, press the desired mode from the second row of on screen buttons

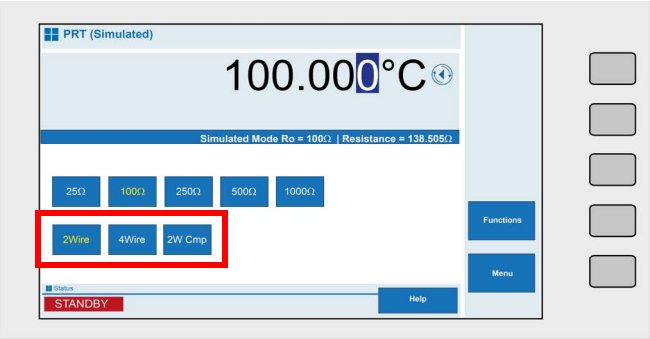


Figure 5-39 : PRT (Simulated) - Ohms Mode Highlighted

5.23 Setting DC Current Output using EA002 Coil

To access the Current Coil Active function, go to the 'Function Menu' as described in "Function Menu" on page 26, use the digital control to highlight the 'Current' function and then press the ENTER key or use the touchscreen directly to highlight the function.

From the Current Menu use the digital control to highlight the 'DC Current [2/10/50 Turn Coil Active]' function and then press the ENTER key or use the touchscreen directly to highlight the function.

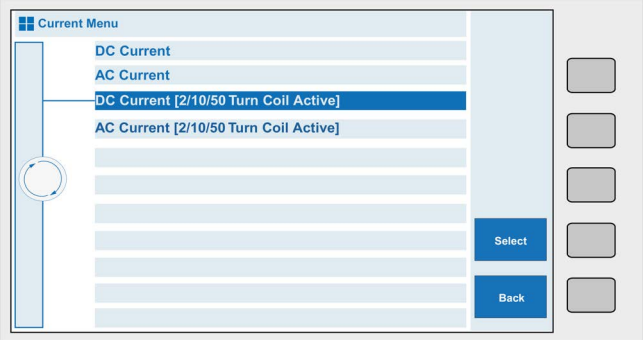


Figure 5-40 : Current Menu - DC Current Coil Selected

The following screen will be displayed

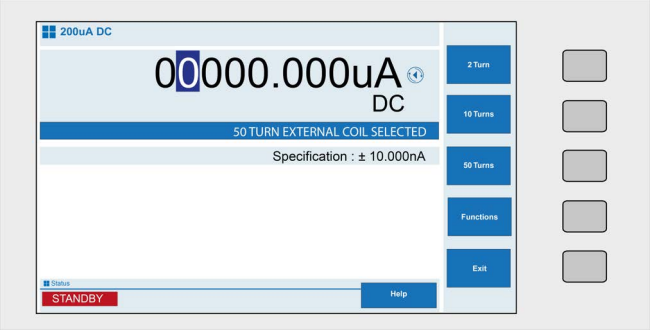


Figure 5-41 : Main Screen - 50 Turn Coil Active

The 4610M calibrator can be used with the optional current coil EA002 (2, 10 and 50 turn coil) or any other current coil that does not exceed the burden voltage limits.

This enables DC currents up to 1500A (50 turn coil), 150A (10 turn coil) and 60A (2 turn coil) to be simulated for the calibration of current clamp meters.

The current from the calibrator is connected the appropriate coil connections. The current output from the calibrator is then multiplied by the number of turns in that coil producing a higher current for the clamp to measure.

Complete the following procedure to select 500A DC using the 50-turn coil, i.e. 50 turns x 10A = 500A. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the 50 Turn connections of the EA002 to the High Current terminals of the 4610M
- Ensure the UUT / DUT has been set to measure the correct input on the desired range, and connect around the 50 turn post of the EA002. Ensure that the jaws are central to the post using the alignment platform for repeatable measurements
- On the 4610M, Press the MODE key
- Select "Current" from the menu
- Select "DC Current [2/10/50 Turn Coil Active"
- Input the following example sequence to set the current output:

5 0 0 AMPS ENTER

- Press the OUTPUT ON key to activate the calibrator output

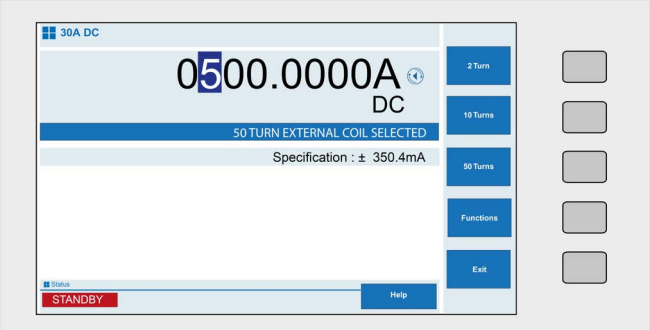


Figure 5-42 : DC Current (50 Turn Coil, 500A DC Set)

To change the required current from the nominal value, use the deviation function. This is controlled by using the left and right arrow keys to select the digit to be incremented. To increase or decrease the highlighted digit, use the up and down of the cursor keys or use the digital control

To change the coil turns / multiplier, use the soft keys on the right hand side of the screen. Note that the following maximums apply :

2 Turn Coil - Maximum current 60 A (2 x 30A)
10 Turn Coil - Maximum current 300A (10 x 30A)

50 Turn Coil - Maximum current 1500A (50 x 30A)

5.24 Setting AC Current Output using EA002 Coil

To access the Current Coil Active function, go to the 'Function Menu' as described in "Function Menu" on page 26, use the digital control to highlight the 'Current' function and then press the ENTER key or use the touchscreen directly to highlight the function.

From the Current Menu use the digital control to highlight the 'AC Current [2/10/50 Turn Coil Active]' function and then press the ENTER key or use the touchscreen directly to highlight the function.

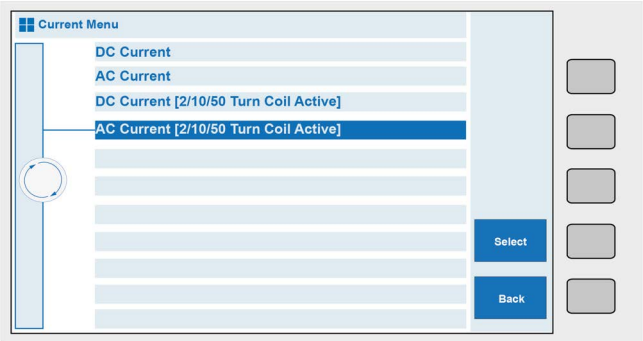


Figure 5-43 : Current Menu - AC Current Coil Selected

The following screen will be displayed

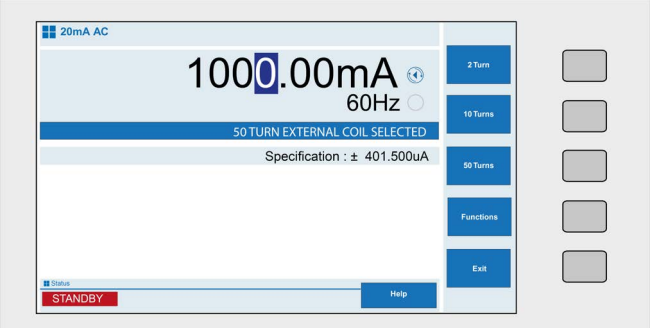


Figure 5-44 : Main Screen - 50 Turn Coil Active

The 4610M calibrator can be used with the optional current coil EA002 (2, 10 and 50 turn coil) or any other current coil that does not exceed the burden voltage limits.

This enables AC currents up to 1500A (50 turn coil), 150A (10 turn coil) and 60A (2 turn coil) to be simulated for the calibration of current clamp meters. The frequency limit varies depending

upon the number of turns used as well as the inductance of the Clamp Meter Itself. Typically the maximum frequency is 400Hz at 500A (10A * 50 Turns), and 100Hz at 1500A

The current from the calibrator is connected the appropriate coil connections. The current output from the calibrator is then multiplied by the number of turns in that coil producing a higher current for the clamp to measure.

Complete the following procedure to select 500A AC, 55 Hz using the 50-turn coil, i.e. 50 turns x 10A = 500A. If an entry error is made, use the 'backspace' or 'C' (clear) soft keys to edit and delete the entry.

- Reset the calibrator using the SHIFT key, followed by the C key
- Connect the 50 Turn connections of the EA002 to the High Current terminals of the 4610M
- Ensure the UUT / DUT has been set to measure the correct input on the desired range, and connect around the 50 turn post of the EA002. Ensure that the jaws are central to the post using the alignment platform for repeatable measurements
- On the 4610M, Press the MODE key
- Select "Current" from the menu
- Select "AC Current [2/10/50 Turn Coil Active"
- Input the following example sequence to set the temperature value:

5 0 0 AMPS 5 5 Hz ENTER

- Press the OUTPUT ON key to activate the calibrator output

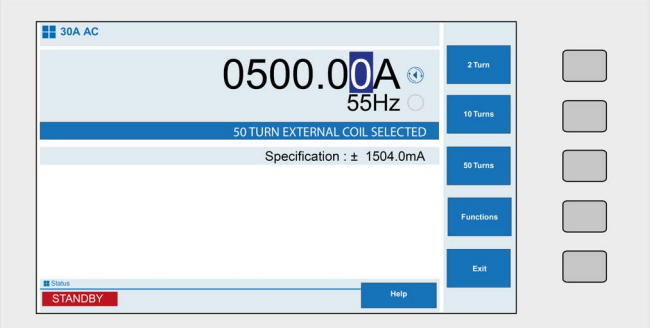


Figure 5-45 : AC Current (50 Turn Coil, 500A 55Hz AC Set)

To change the required current from the nominal value, use the deviation function. This is controlled by using the left and right arrow keys to select the digit to be incremented. To increase or decrease the highlighted digit, use the up and down of the cursor keys or use the digital control

To change the coil turns / multiplier, use the soft keys on the right hand side of the screen. Note that the following maximums apply :

2 Turn Coil - Maximum current 60 A (2 x 30A)
10 Turn Coil - Maximum current 300A (10 x 30A)
50 Turn Coil - Maximum current 1500A (50 x 30A)

6 Guarantee and Service

Transmille Ltd. guarantees this instrument to be free from defects under normal use and service for a period of 1 year from purchase. This guarantee applies only to the original purchaser and does not cover fuses, or any instrument which, in Transmille's opinion, has been modified, misused or subjected to abnormal handling or operating conditions.

Transmille's obligation under this guarantee is limited to replacement or repair of an instrument which is returned to Transmille within the warranty period. If Transmille determines that the fault has been caused by the purchaser, Transmille will contact the purchaser before proceeding with any repair.

To obtain repair under this guarantee the purchaser must return the instrument in its original packaging (carriage prepaid) and a description of the fault to Transmille in either the UK or the USA. The instrument will be repaired at the factory and returned to the purchaser; carriage prepaid.

TRANSMILLE ASSUMES NO RESPONSIBILITY FOR DAMAGE IN TRANSIT

THIS GUARANTEE IS THE PURCHASER'S SOLE AND EXCLUSIVE GUARANTEE AND IS IN LEIU OF ANY OTHER GUARANTEE, EXPRESSED OR IMPLIED. TRANSMILLE SHALL NOT BE LIABLE FOR ANY INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS.

Transmille Ltd.
Unit 4, Select Business Centre
Lodge Road
Staplehurst
Kent
TN12 0QW
United Kingdom
Tel:+44 0 1580 890700
Email:sales@transmille.com
Web:www.transmille.com