3000A Series

Precision Multi Product Calibrator

Calibration Manual

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Preparing For Calibration

Introduction

The recommended calibration period for the 3000A series calibrators is 12 months. Extended specifications for 6, 12 and 24 month re-calibration periods are available from the 3000A extended specifications

Calibration can be achieved using one of two methods:
1. Manual calibration via the front panel controls.
2. Automated closed-loop calibration using ProCal calibration software

In both instances the calibrator should be switched on and allowed to warm up for the required period as stated in the operator's manual. Calibration should be performed in a stable environment where the temperature is stable to within +/- 1ºC during the calibration.

Equipment Required

To calibrate the 3000A series calibrators the following equipment is required:

1. High Accuracy precision Multimeter (example Transmille 8081 / Agilent 3458A opt 002 / Fluke 8508A)
2. LCR Bridge (example Agilent
3. DC Voltage Source (example Transmille 3000 series multiproduct calibrator, Fluke 55xx series multiproduct calibrator
4. High Accuracy Frequency Counter / GPS Frequency Reference / Off-Air Frequency Reference

Between these four pieces of equipment it is possible to calibrate all basic functions of the 3000 series calibrators. For units fitted with additional options additional equipment is required

Optional Equipment

To perform a full calibration of a 3000A series multiproduct calibrator additional equipment may be required dependent upon the capabilities of the multimeter being used

For multimeters such as the Agilent 3458A with limited maximum current, a selection of current shunts are required. These current shunts should be suitable for both DC and AC current up to 10kHz (5kHz for 2A Range, 1kHz for 30A range) Suggested current shunt values are listed below, along with the current range they will be used for :

0.1 Ohm – 2.02A to 30A AC/DC
1 Ohm – 202mA to 2A AC/DC
10 Ohm – 20.2mA to 200mA AC/DC
100 Ohm – 2.02mA to 20mA AC/DC

These shunts are also used for multimeters with insufficient current accuracy for low current calibration.

Equipment required for Oscilloscope (SCPXXX) option calibration

To calibrate the Oscilloscope output function of the 3000A series, the following equipment is required

1. High Accuracy precision Multimeter
2. Frequency Counter / GPS Frequency Standard / Off-air Frequency Standard
3. 600MHz – 1GHz Oscilloscope (example Agilent Xfinity Series Oscilloscope)

Equipment required for Power (PWR50, PWRSINE, PWRDDS) option calibration

To calibrate the Power output function of the 3000A series, the following equipment is required

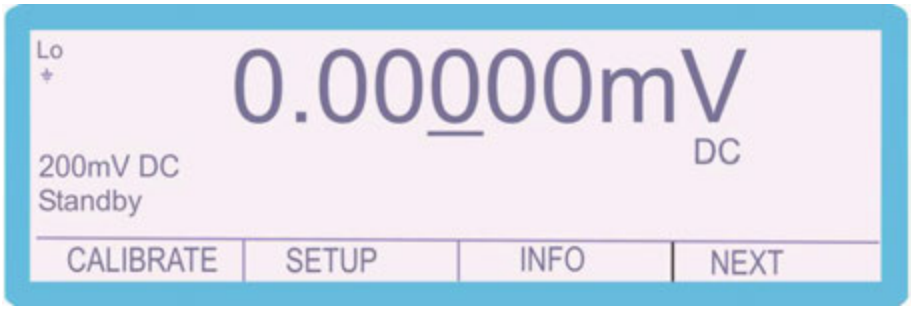
1. High Accuracy precision Multimeter
2. Phase Meter / Oscilloscope
3. Distortion Meter / Distortion Analyser (PWRDDS option only)

Calibration Password

Changing the Calibration Password

To navigate to the 'Calibration Password' screen follow the procedure in the section: 'Manual Calibration' to step 3 where the following screen appears:

1. Select **SETUP** using the soft key

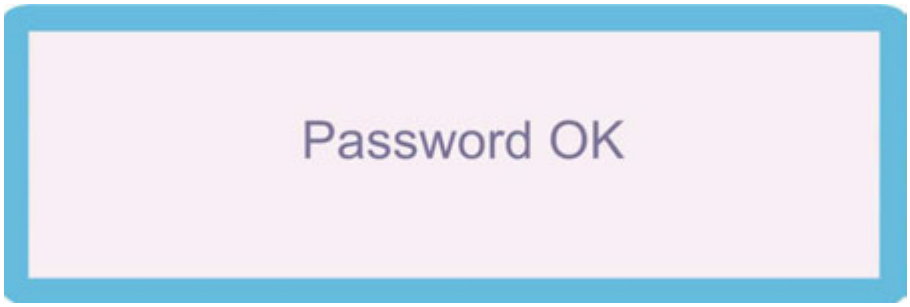


2. Use the 'Digital Control' or the 'Arrow Keys' to highlight 'Password' and then press **SELECT** soft key

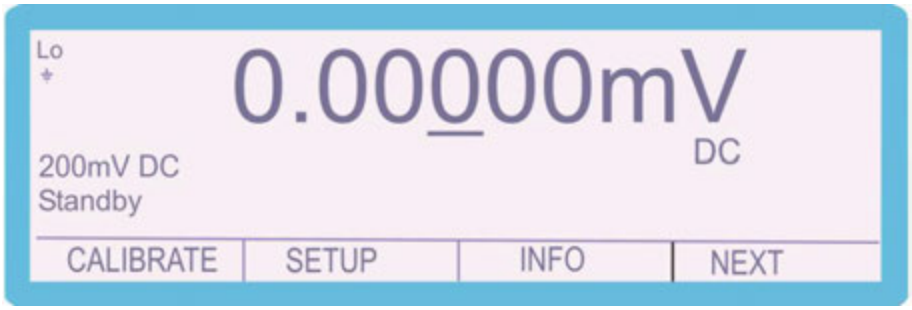
3. Press **SELECT** soft key

4. Enter the calibration password (default 0324)

The following screen is displayed for approximately 2 seconds:



and then reverts to:



The instrument is now ready to be calibrated and the password can be changed.

Set New Password

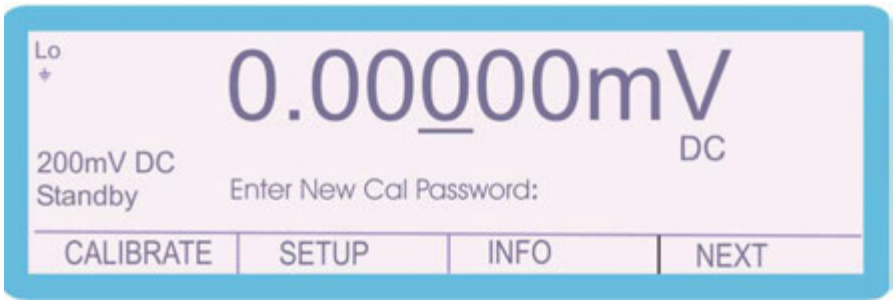
To change the password, complete the following procedure:

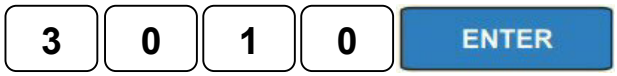
1. Select **SETUP** using the soft key

2. Use the 'Digital Control' or the 'Arrow Keys' to highlight 'Password' and then press **SELECT** soft key

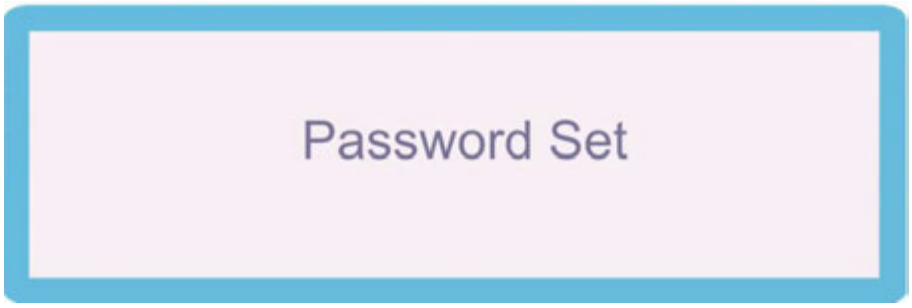
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight 'Set' and then press **SELECT** soft key

3. 'Enter New Cal Password' using function control keys, followed by the ENTER key
e.g. 3010

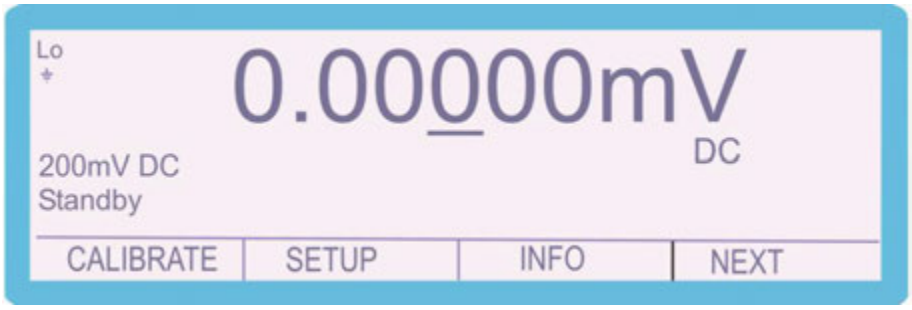




The following screen is displayed for approximately 2 seconds:



and then reverts to:

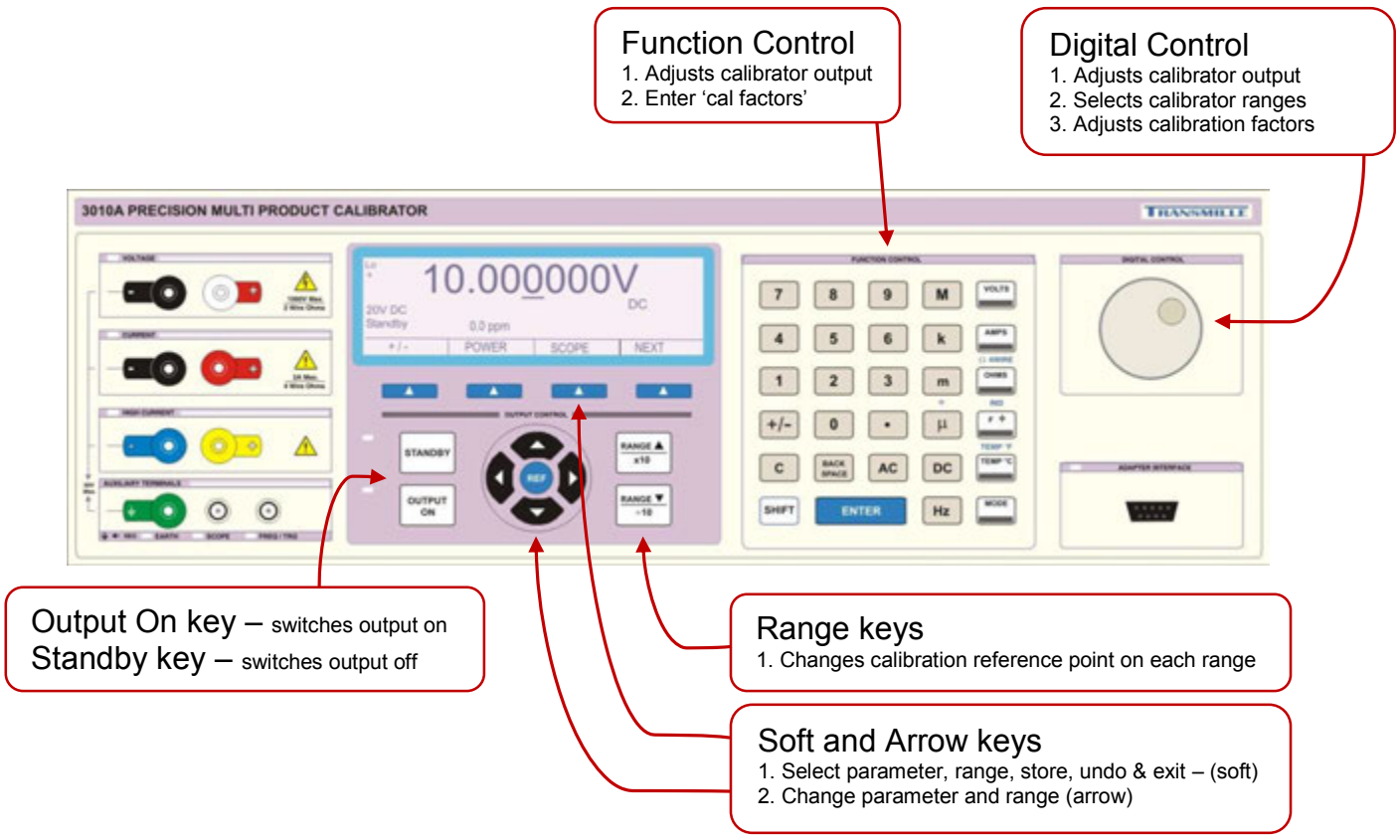


The password has now been changed.

Manual Calibration

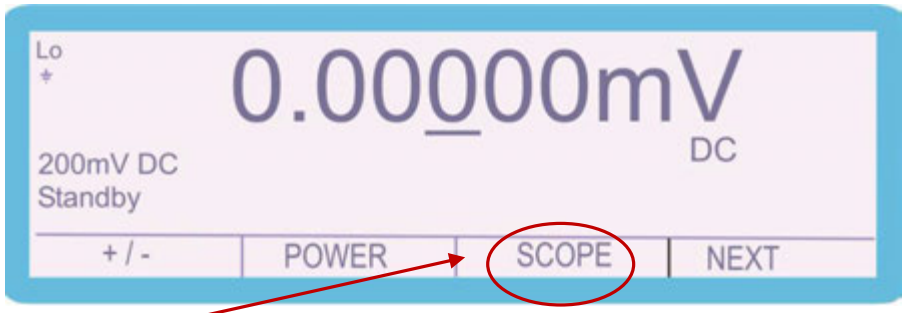
Manual Calibration is achieved using the front panel control:

1. Digital control
2. Function control
3. Soft and Arrow keys
4. Range up and Down keys
5. Output On and Standby keys

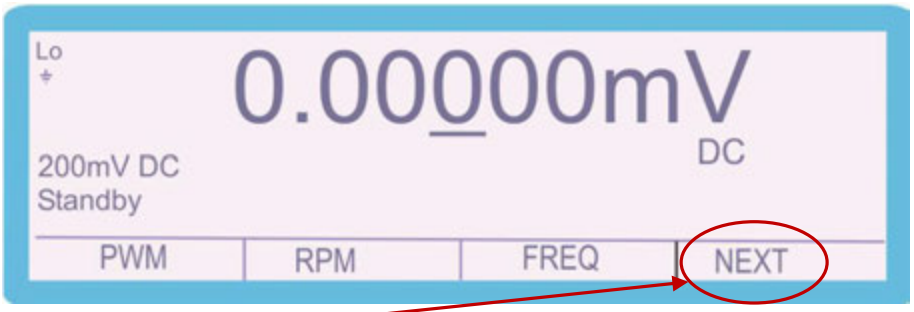


Entering Calibration Mode

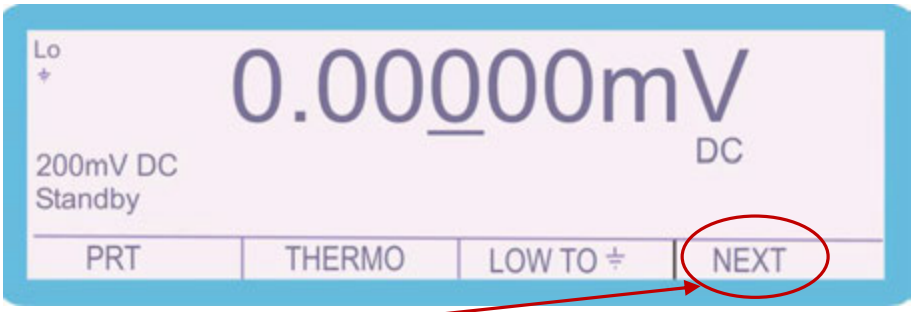
To navigate to the calibration control screen, complete the following procedure:



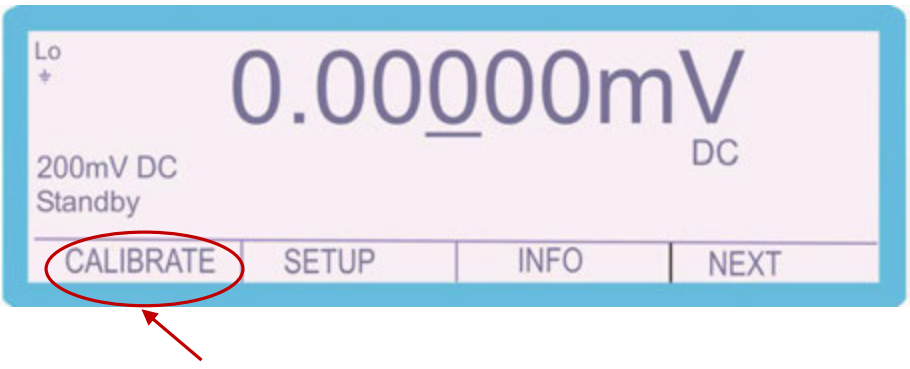
1. Select **NEXT** using the soft key



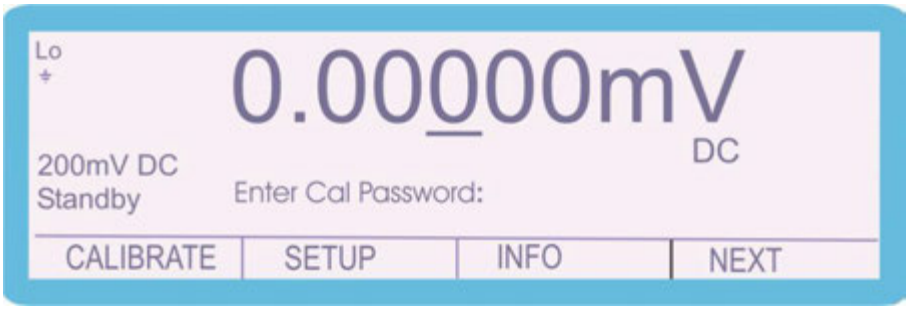
2. Select **NEXT** using the soft key



3. Select **NEXT** using the soft key



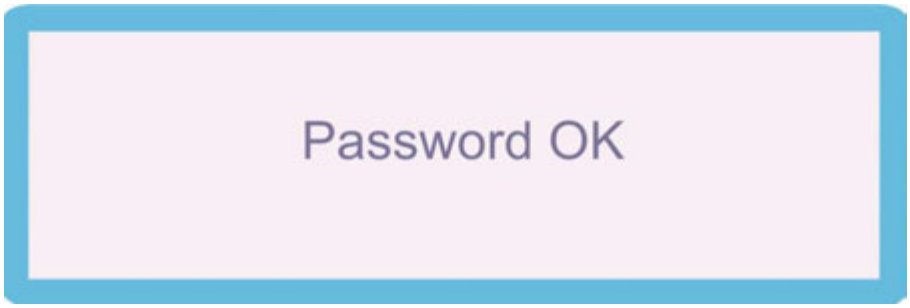
4. Select **CALIBRATE** using the soft key



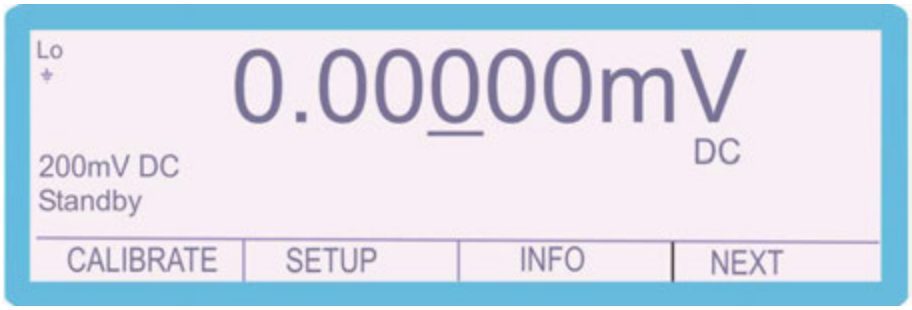
5. 'Enter Cal Password' using function control keys

(0324 is the default password) followed by 

The following screen is displayed for approximately 2 seconds:

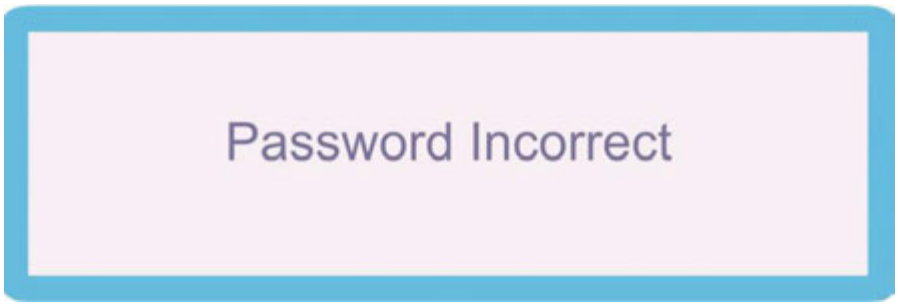


and then reverts to:

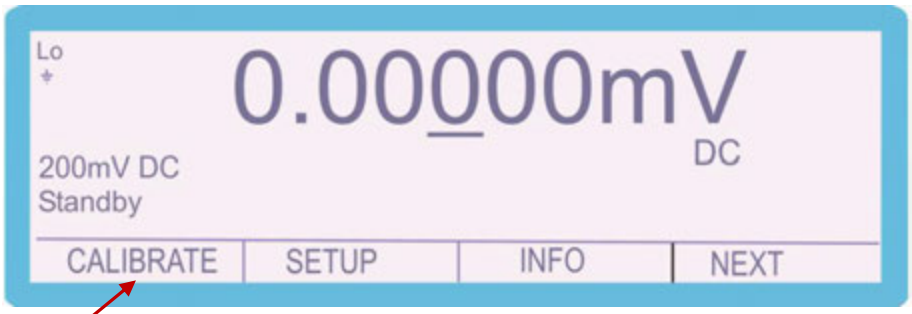


The instrument is now ready to be calibrated.

Should the password be entered incorrectly the screen will display



for approximately 2 seconds and then reverts to:



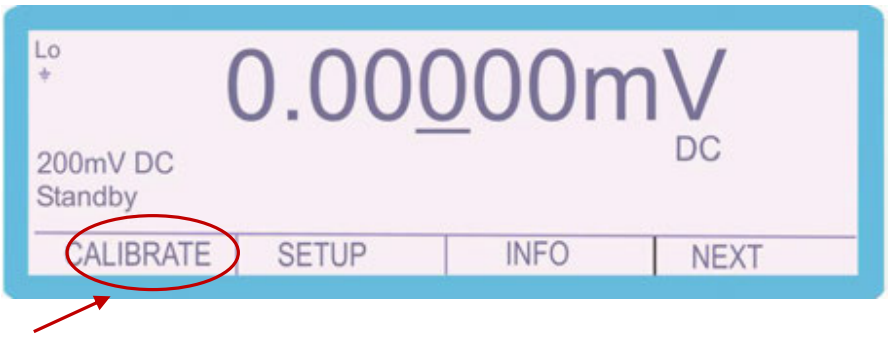
Select **CALIBRATE** using the soft key to navigate back to 'Enter Cal Password' screen and re-enter the password.

Exiting Calibration Mode

After calibration of the 3000A series is complete the calibration program should be ended to avoid any unauthorised or mistaken adjustment of the calibrator.

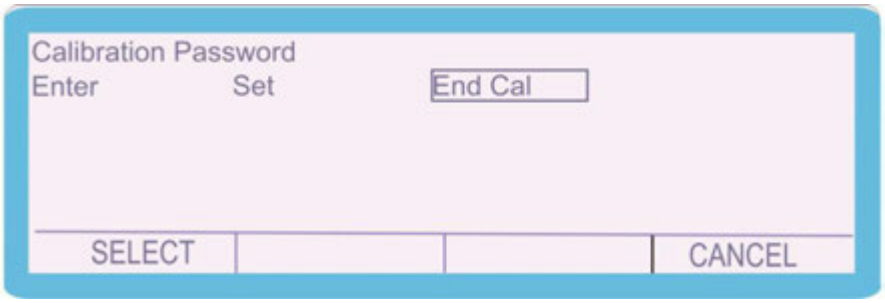
The following procedure should be completed.

1. Select **SETUP** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight 'Password' and then press **SELECT** soft key

3. Use the 'Digital Control' or the 'Arrow Keys' to highlight 'End Cal' and then press **SELECT** soft key



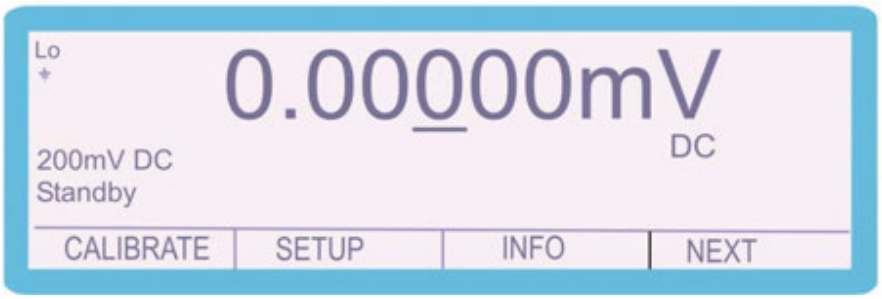
The calibrator returns to the normal screen.

Calibration Parameters

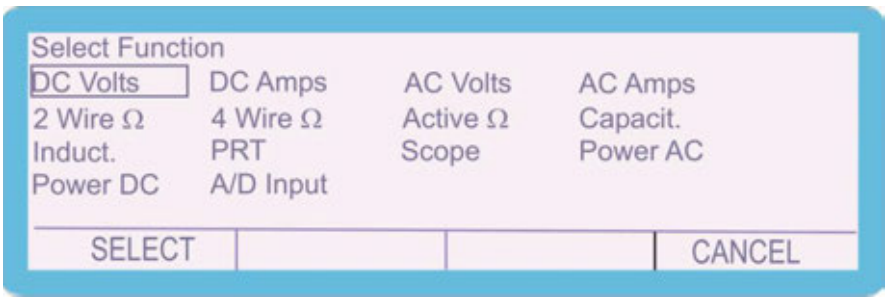
With the calibration password entered the different parameters of the instrument can be calibrated:

To enter the different parameters, complete the following procedure:

1. Select **CALIBRATE** using the soft key



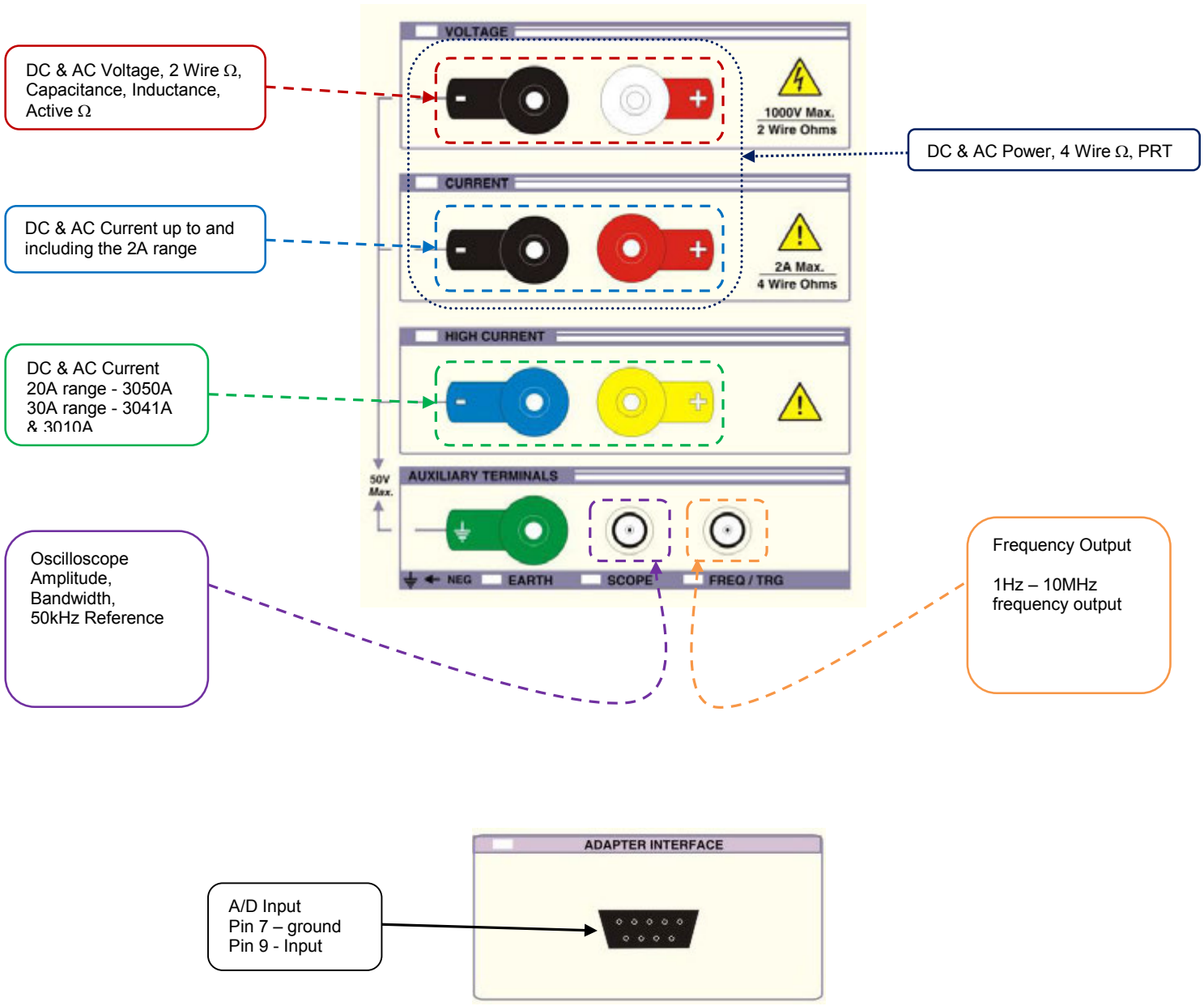
2. Use the ‘Digital Control’ or the ‘Arrow Keys’ to highlight the required parameter e.g. ‘DC Volts’ and then press **SELECT** soft key



Depending upon the model and options fitted the available functions will vary

Connections

The output of the 3000A series calibrator should be connected to the precision multimeter as below :



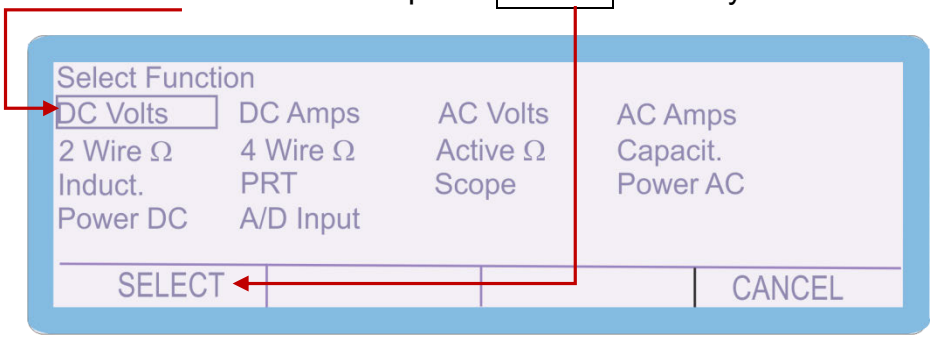
Calibration of Ranges

D.C. Voltage

To calibrate the D.C. Voltage parameter, complete the procedure as follows:

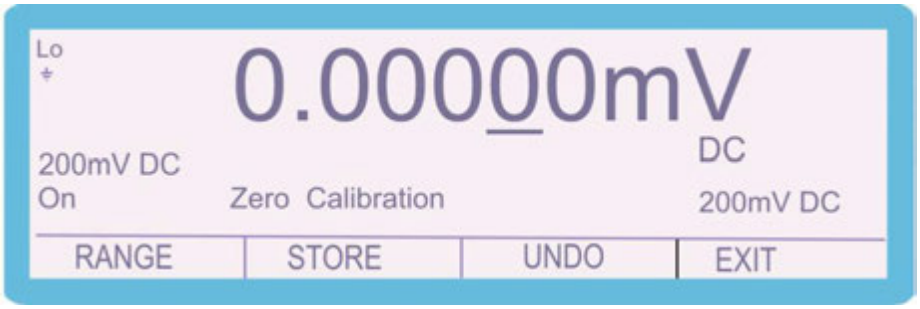
1. Select **CALIBRATE** using the soft key

2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'DC Volts' and then press **SELECT** soft key

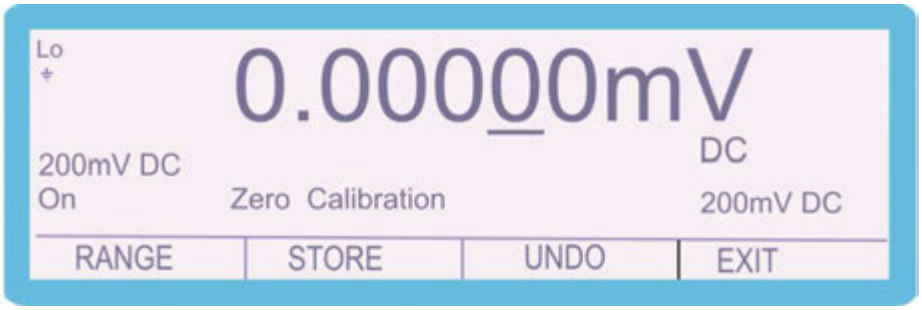


3. Connect the calibrator output voltage terminals to the precision Multimeter. Ensure that the Multimeter has been zeroed as a system by shorting out the leads and pressing the null button.

4. Use the 'range up' and 'range down' keys to change the calibration point to 'Zero Calibration'.



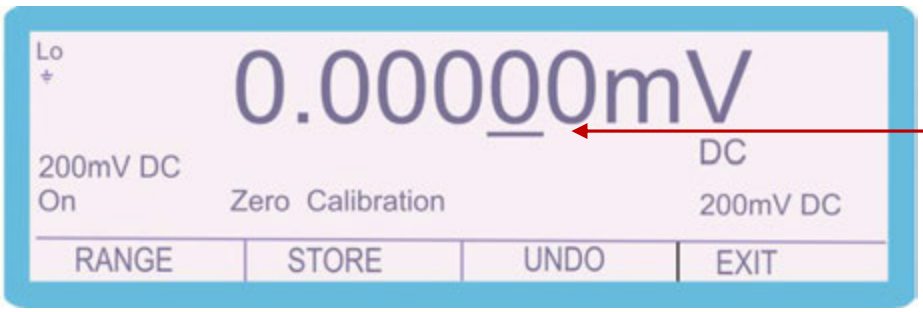
5. Press **OUTPUT ON** and measure the output 'Zero Calibration'.



6. To adjust the output, type in the measured value using the keyboard, followed by the 'ENTER' key i.e. 0.00028mV

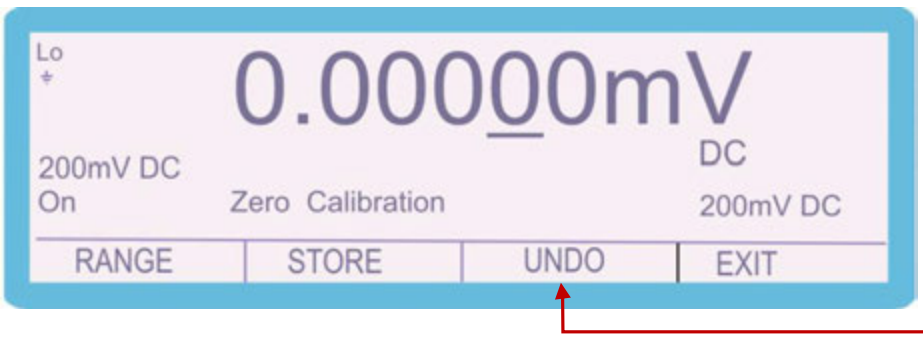
0 **•** **0** **0** **0** **2** **8** **ENTER**

7. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



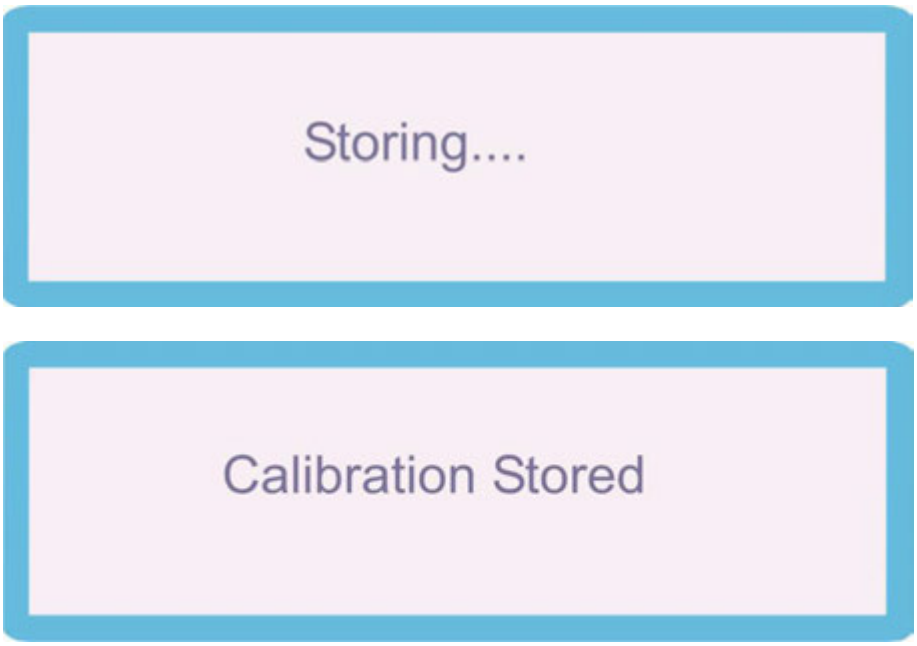
8. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored. **SHIFT**

9. To undo the adjustment before storing the changes, press the UNDO soft key. This will remove any changes that have been made to the output of the calibrator.



10. Once the output has been adjusted to within specification, the changes can be stored to long term memory. To store the changes permanently, press the **STORE** soft key

The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

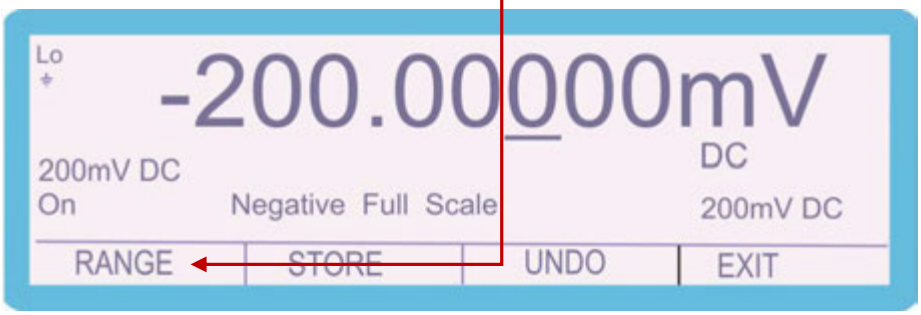
11. Using the 'RANGE UP' and 'RANGE DOWN' keys, change the output to 'Positive Full Scale'

12. Measure the output, and adjust as required using the process described in steps **6 - 10**

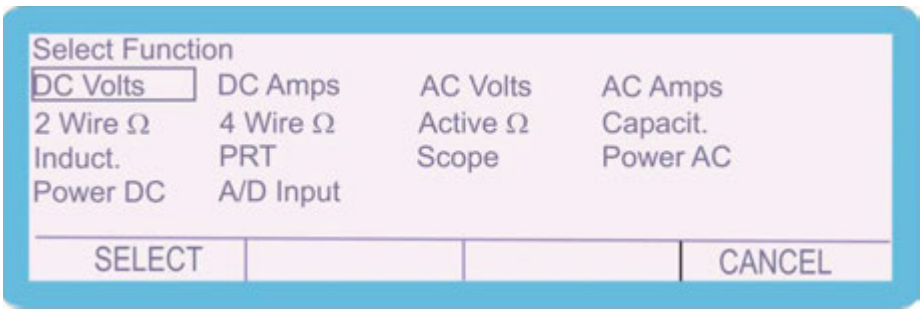
13. Use the ‘range up’ and ‘range down’ keys to change the calibration point to ‘Negative Full Scale’.

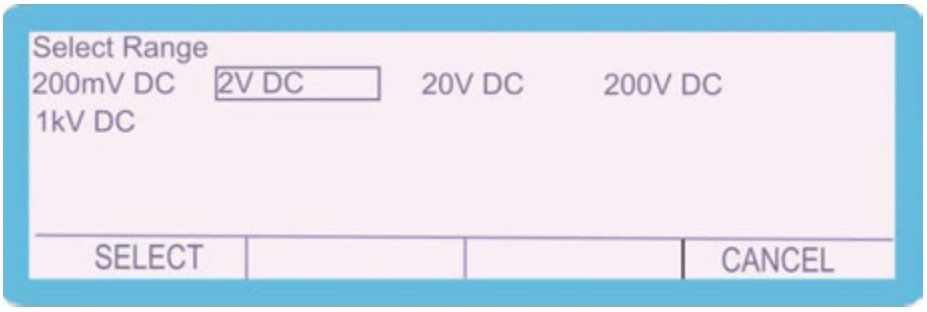
14. Measure the output, and adjust as required using the process described in steps **6 - 10**

15. When calibration of this range is complete press the **RANGE** soft key



16. To continue adjusting other ranges in the DC Voltage function, select ‘DC Volts’ and select the required range





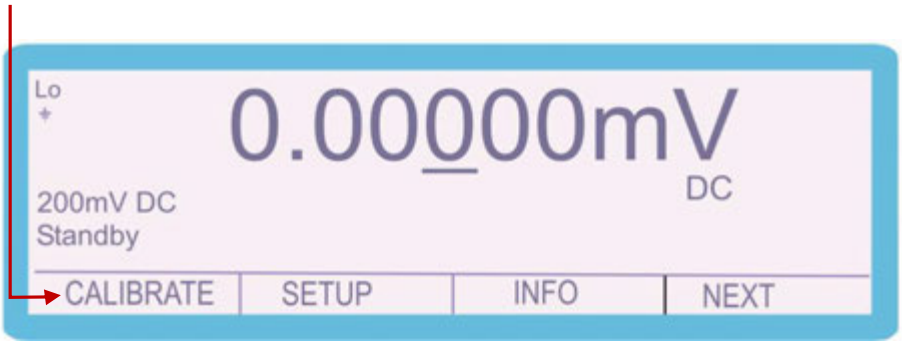
17. The ‘2V DC’, ’20V DC’, ‘200V DC’ and ‘1kV DC’ ranges are calibrated in the same manner.

NOTE : The ‘Zero Calibration’ points for both the 200V DC and 1kV DC Ranges do not occur at 0V. They take place at 5V and 50V respectively.

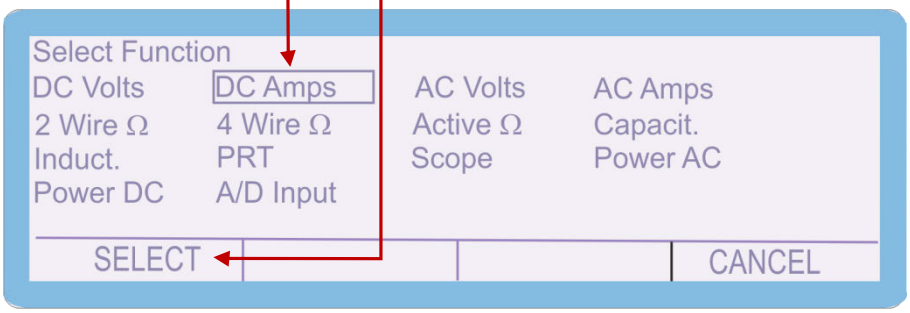
D.C. Current

To calibrate the D.C. Current parameter, complete the procedure as follows:

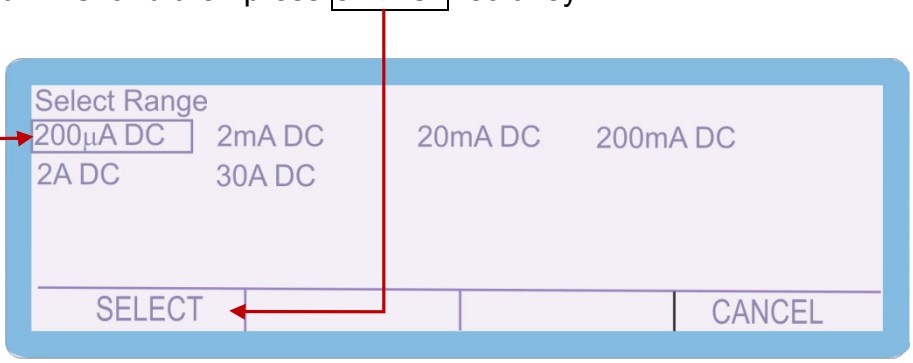
1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'DC Amps' and then press **SELECT** soft key

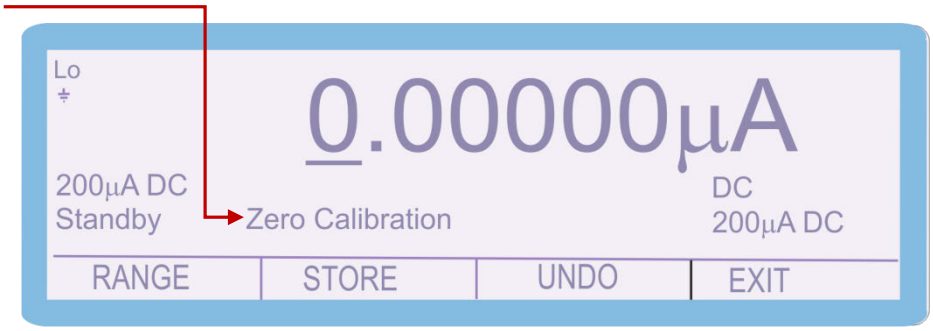


3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '200uA DC' and then press **SELECT** soft key



4. Connect the calibrator 2A current terminals to the precision Multimeter. Ensure that the Multimeter has been nulled with the leads disconnected

5. Use the ‘range up’ and ‘range down’ keys to change the calibration point to ‘Zero Calibration’ adjustment point

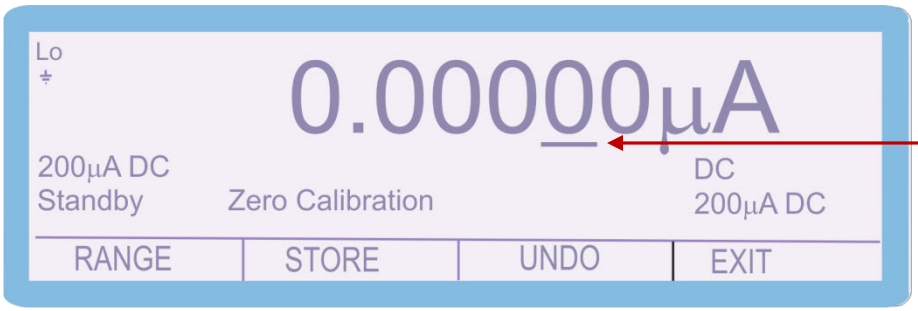


6. Press **OUTPUT ON** and measure the output ‘’Zero Calibration’.

7. To adjust the output, type in the measured value using the keyboard, followed by the ‘ENTER’ key i.e. 0.00028uA

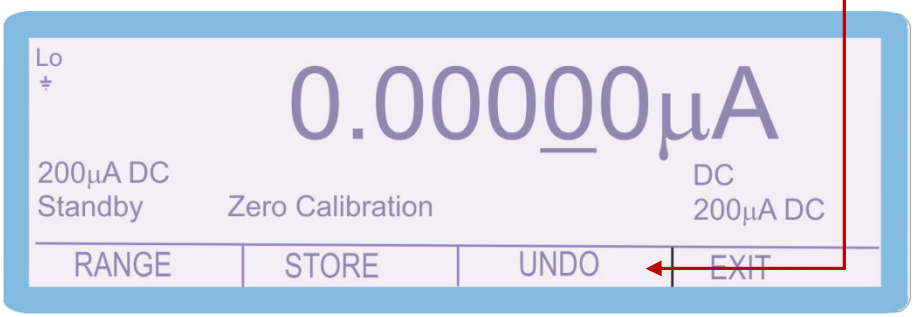
0 **•** **0** **0** **0** **2** **8** **ENTER**

8. The output can also be adjusted by moving the ‘cursor’ to the required digit and adjusting the output using the up / down arrows or the digital control



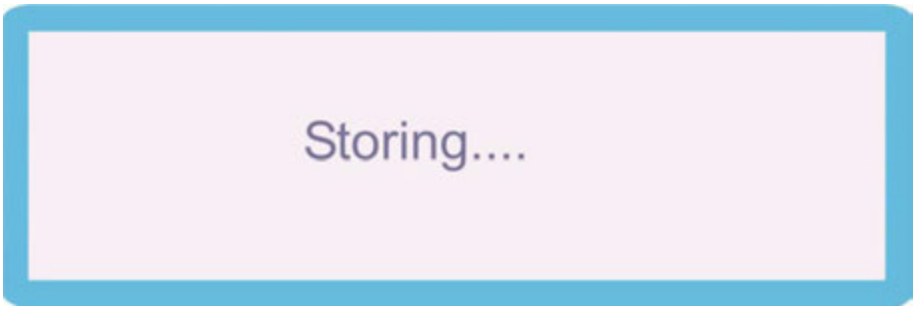
9. The ‘SHIFT’ key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored. **SHIFT**

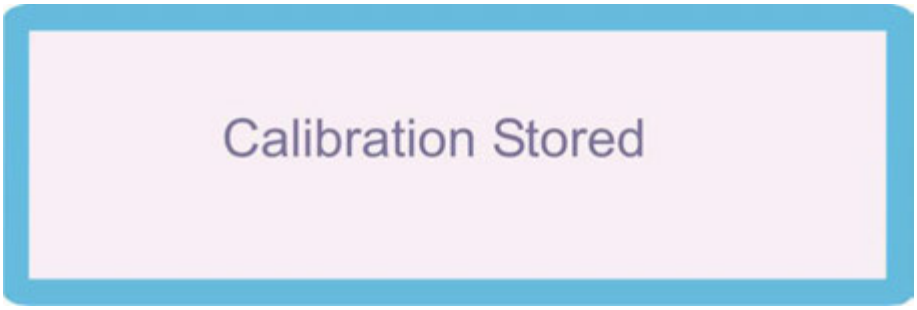
10. To undo the adjustment before storing the changes, press the **UNDO** soft key



This will remove any changes that have been made to the output of the calibrator.

11. Once the output has been adjusted to within specification, the changes can be stored to long term memory. To store the changes permanently, press the **STORE** soft key. The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



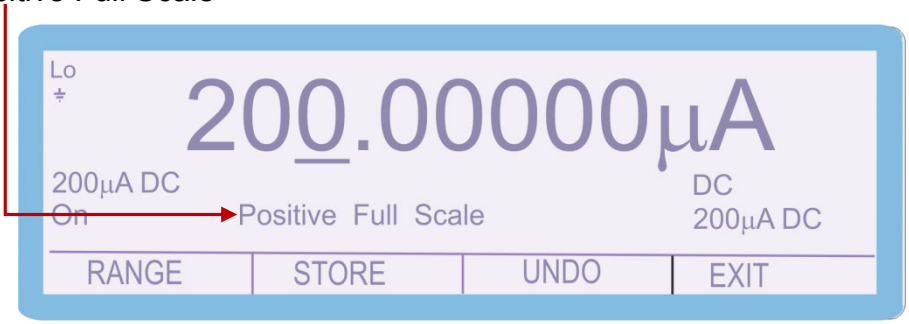


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

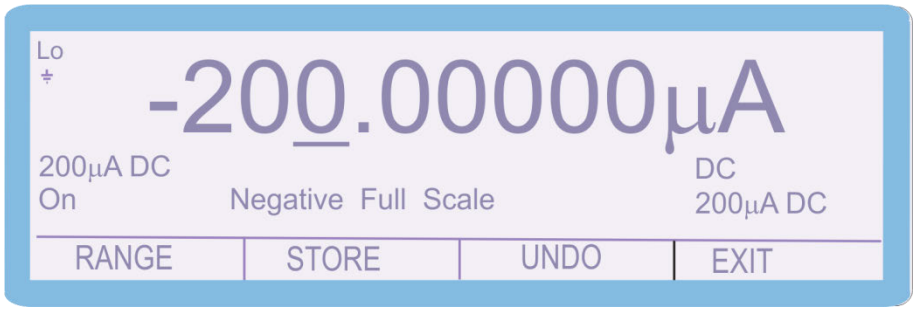
Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

12. Using the 'RANGE UP' and 'RANGE DOWN' keys, change the output to 'Positive Full Scale'



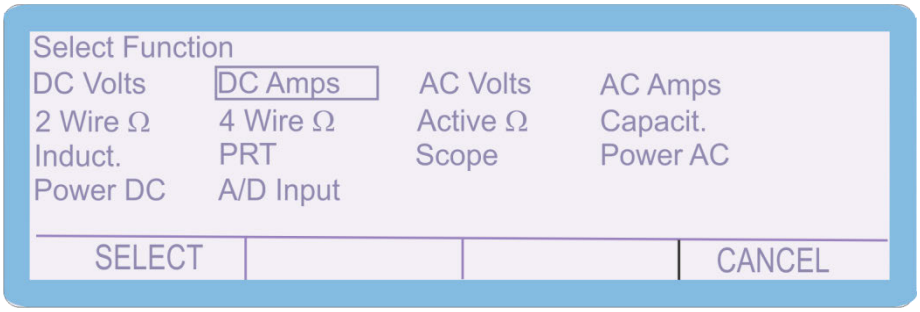
13. Measure the output, and adjust as required using the process described in steps **7 – 11**

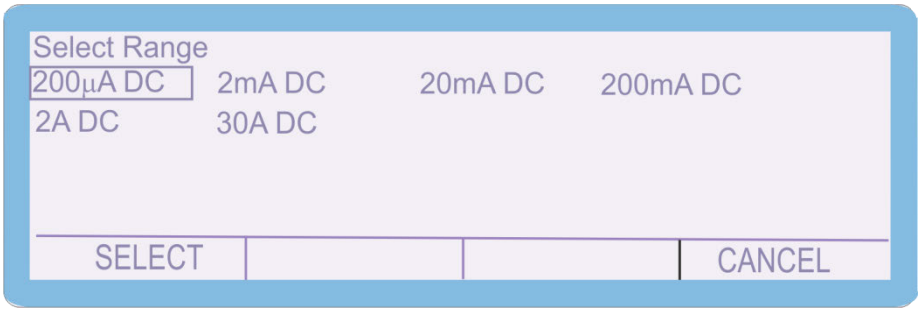
14. Use the ‘range up’ and ‘range down’ keys to change the calibration point to ‘Negative Full Scale’.



15. Measure the output, and adjust as required using the process described in steps **7 – 11**

16. To continue adjusting other ranges in the DC Current function, select ‘DC Amps’ and select the required range



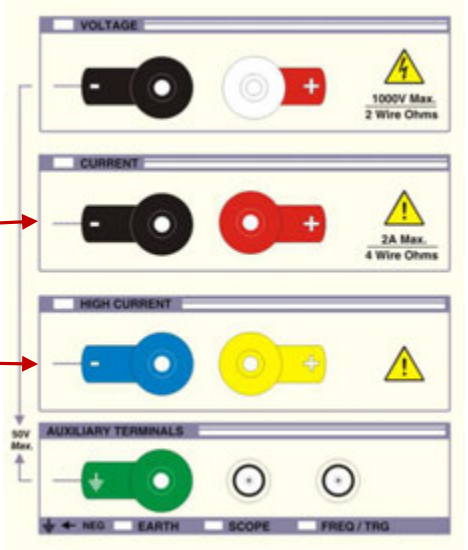


17. The ‘2mA DC’, ‘20mA DC’, ‘200mA DC’, ‘2A DC’ and ‘30A DC’ ranges are calibrated in the same manner.

Remember to change the connections when calibrating the 30A range

Current connections - 200μA, 2mA, 20mA, 200mA and 2A ranges

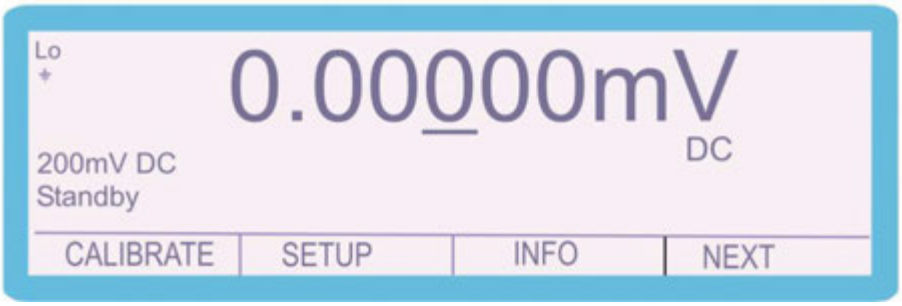
High current connections 30A range



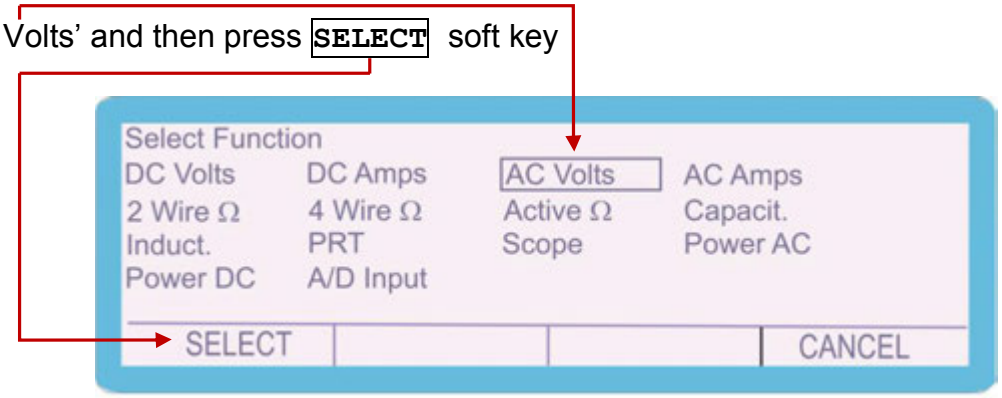
A.C. Voltage

To calibrate the A.C. Voltage parameter, complete the procedure as follows:

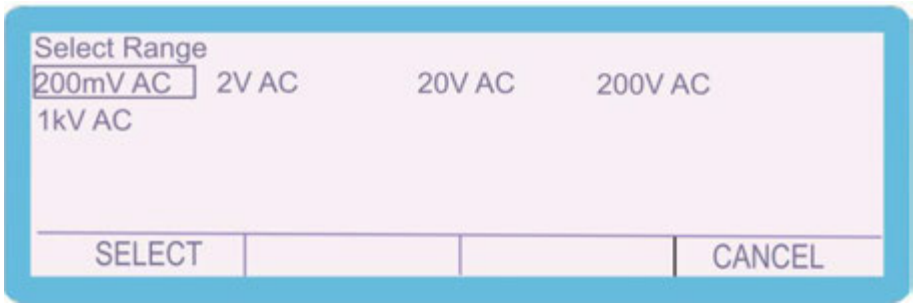
1. Select **CALIBRATE** using the soft key



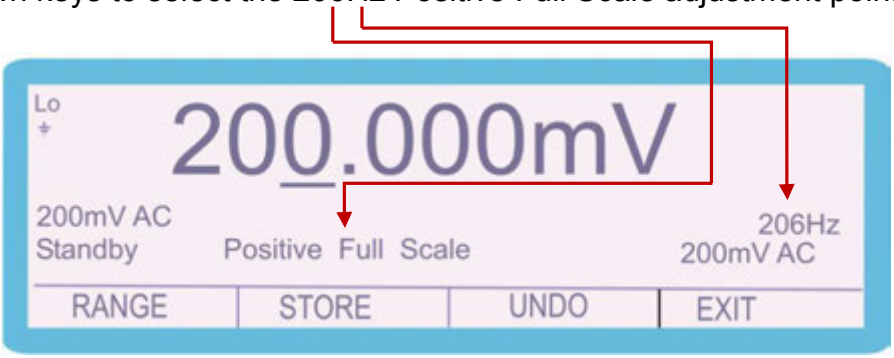
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'AC Volts' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '200mV AC' and then press **SELECT** soft key



3. The Calibrator will now change to the 200mV AC range. Use the Range Up / Range Down keys to select the 206Hz Positive Full Scale adjustment point



4. Connect the calibrator output voltage terminals to the precision multimeter. Ensure that the multimeter is in AC Voltage on the appropriate range.

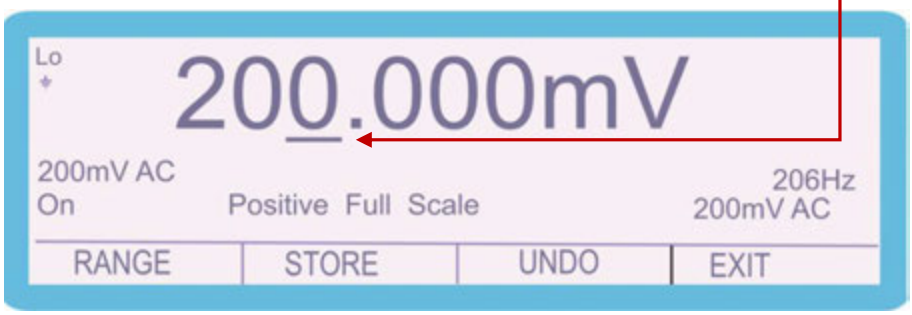
5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 199.990 mV, use the function control keys

1 **9** **9** **•** **9** **9** **0** **ENTER**

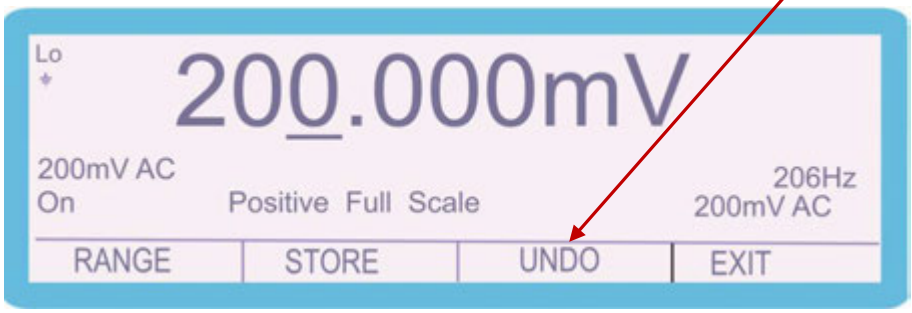
5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

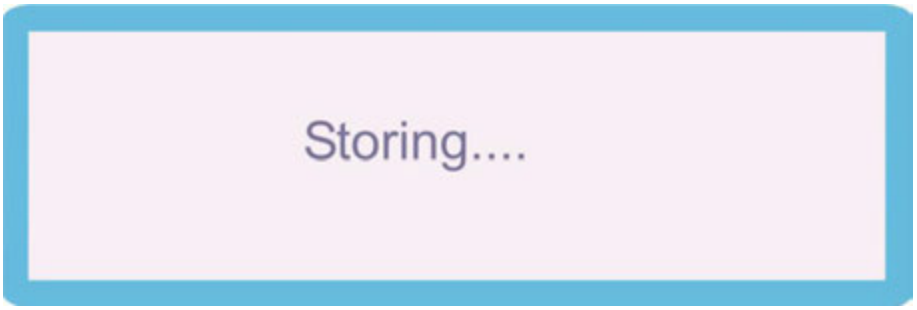
SHIFT

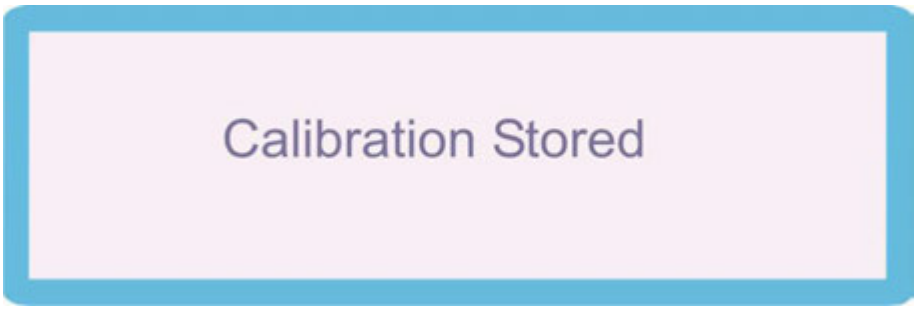
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



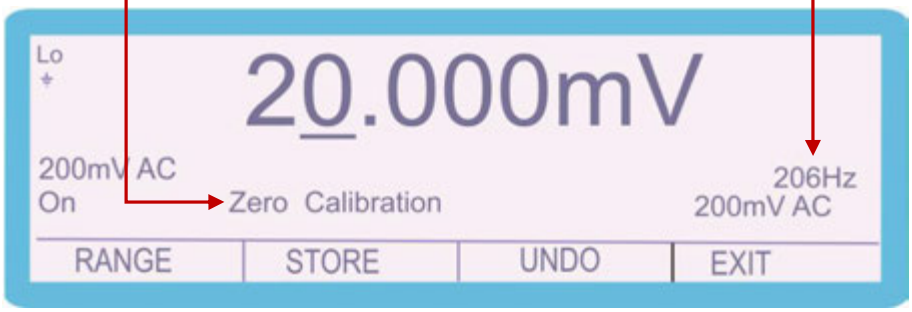


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

8. Use the ‘range up’ and ‘range down’ keys to change the calibration point to 206Hz ‘Zero Calibration’.

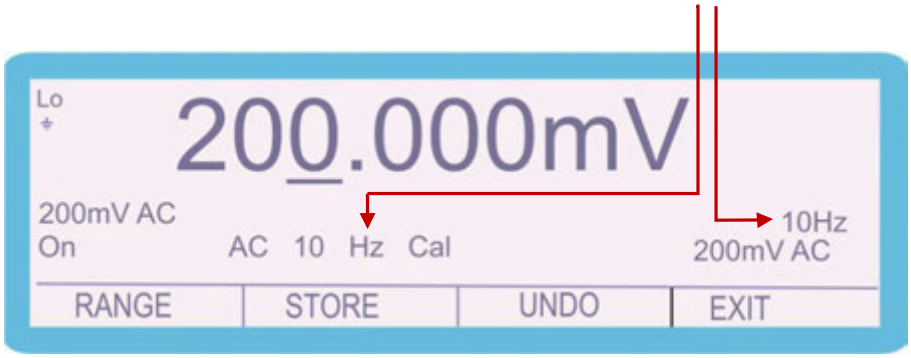


NOTE : The ‘Zero Calibration’ of the AC Voltage ranges is performed at **20% of full scale**

9. Measure the output as before; if necessary adjust as previously described above.

10. The AC Voltage frequency response is only adjusted at the Full Scale points at different frequencies. A List of the frequencies that each model is adjusted at can be found at the end of the calibration manual.

Use the range up / range down keys to select the AC 10Hz Calibration Point.

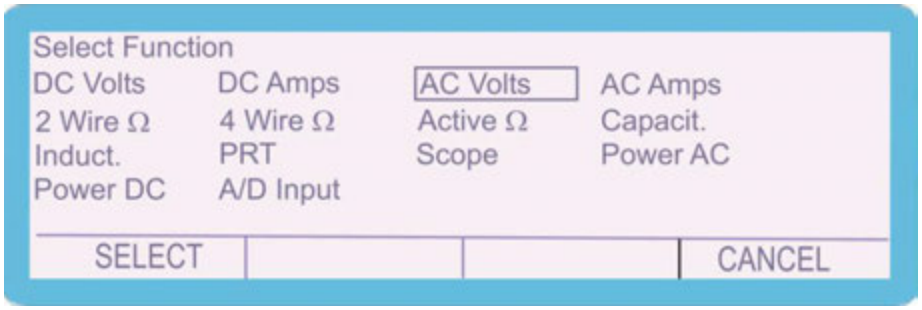


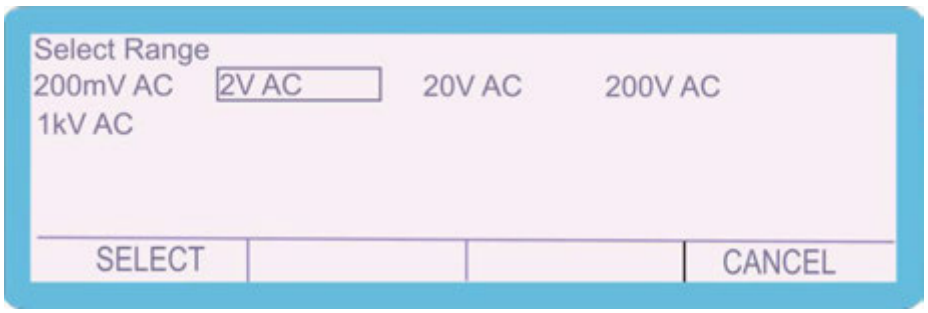
NOTE : In many cases only the 206Hz full scale and zero calibration points require adjustment. The Frequency Response of the 3000A series calibrator may not change.

11. Measure the output as before; if necessary adjust as previously described above.

12. Using the range up / range down keys, measure and adjust (if required) all available frequency points for each range. Depending upon the Range selected and the model of 3000A the available frequency points will differ. For a list of available frequency adjustment points, please refer to the section at the end of this manual.

56. When calibration of this range is complete press the **RANGE** soft key
Select ‘AC Volts’ and then ‘2V AC’ and proceed with this range as described above.





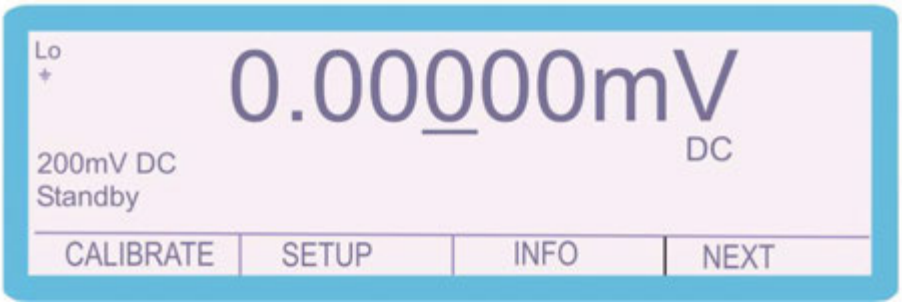
57. The ’20V AC’, ‘200V AC’ and ‘1kV AC’ ranges are calibrated in the same manner.

Note: The number of frequency (Hz) calibration points will depend upon model of calibrator (3010A, 3041A or 3050A).

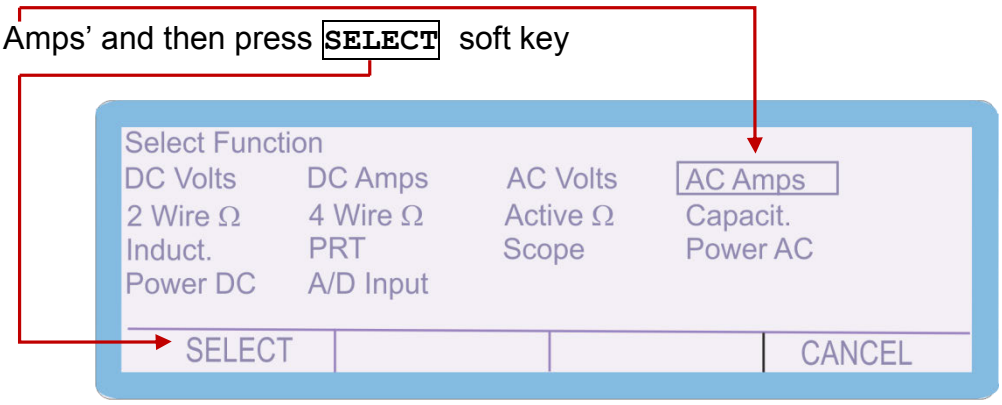
A.C. Current

To calibrate the A.C. Current parameter, complete the procedure as follows:

1. Select **CALIBRATE** using the soft key

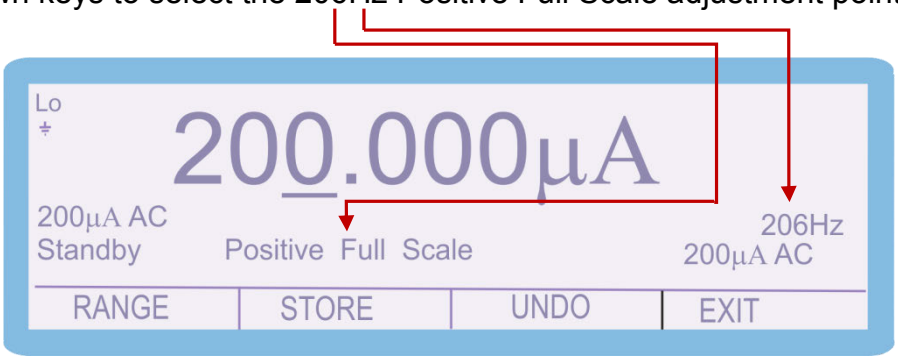


2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'AC Amps' and then press **SELECT** soft key



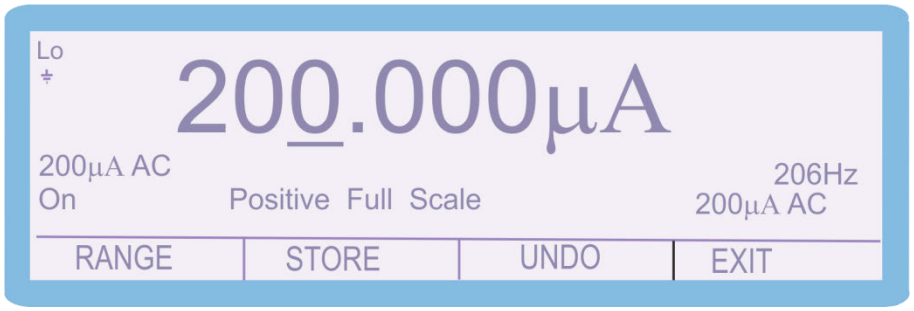
3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '200uA' and then press **SELECT** soft key

3. The Calibrator will now change to the 200uA AC range. Use the Range Up / Range Down keys to select the 206Hz Positive Full Scale adjustment point



4. Connect the calibrator output voltage terminals to the precision multimeter. Ensure that the multimeter is in AC Current on the appropriate range. Ensure that the correct terminals / current shunt is used for the various current outputs. The 3000A calibrators can output up to 30A AC current, which can blow the fuse / cause damage if the incorrect input is used

5. Press **OUTPUT ON** and measure the output.

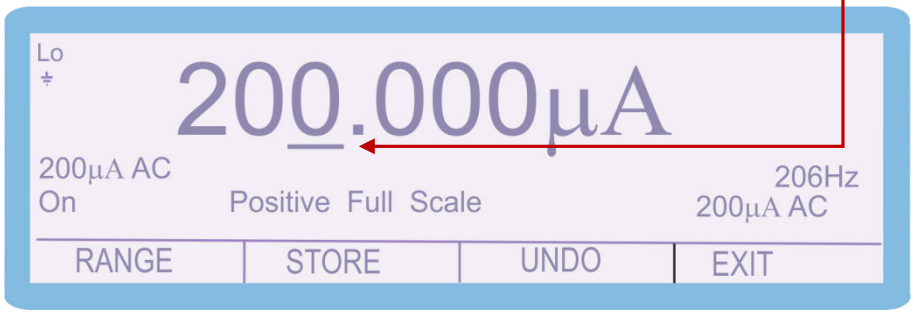


6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 199.990 uA, use the function control keys

1 **9** **9** **•** **9** **9** **0** **ENTER**

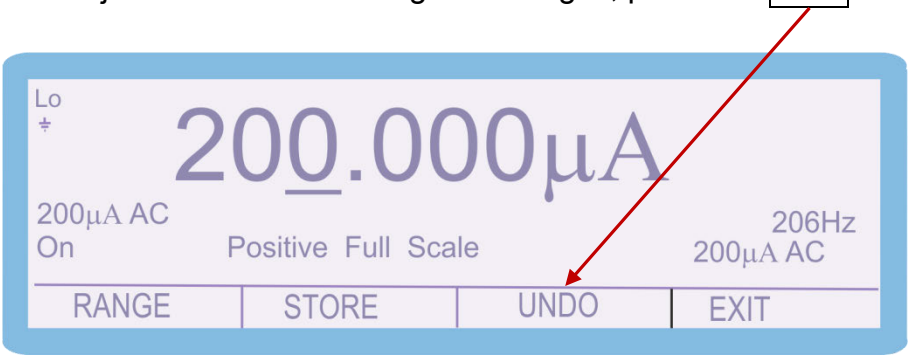
5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

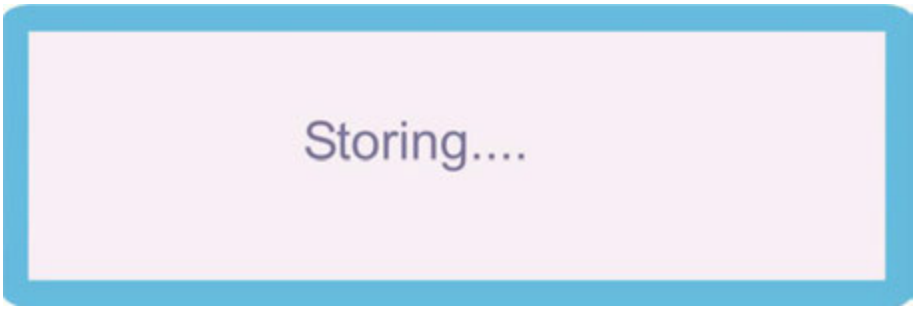
SHIFT

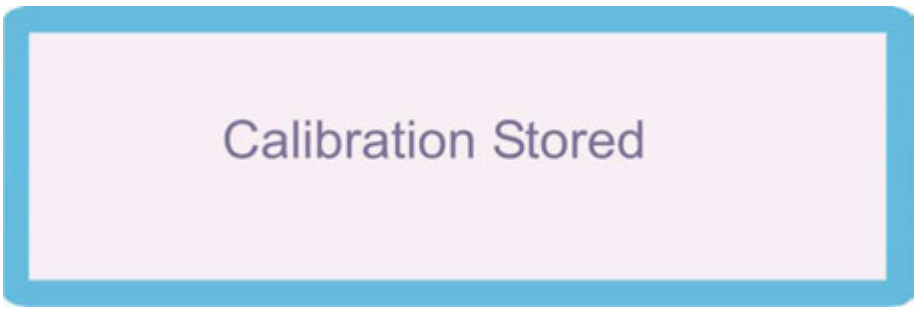
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



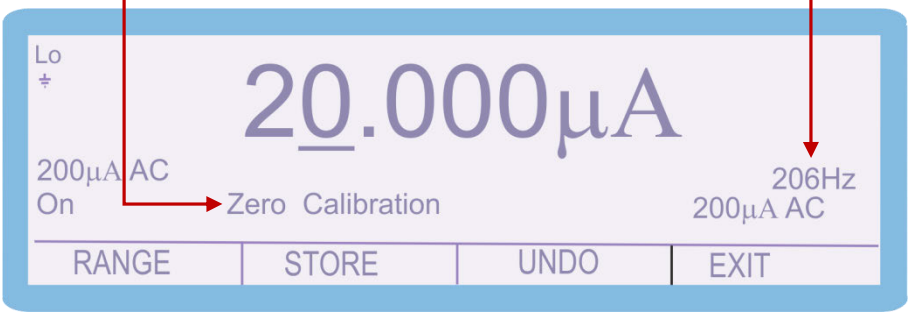


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

8. Use the ‘range up’ and ‘range down’ keys to change the calibration point to 206Hz ‘Zero Calibration’.

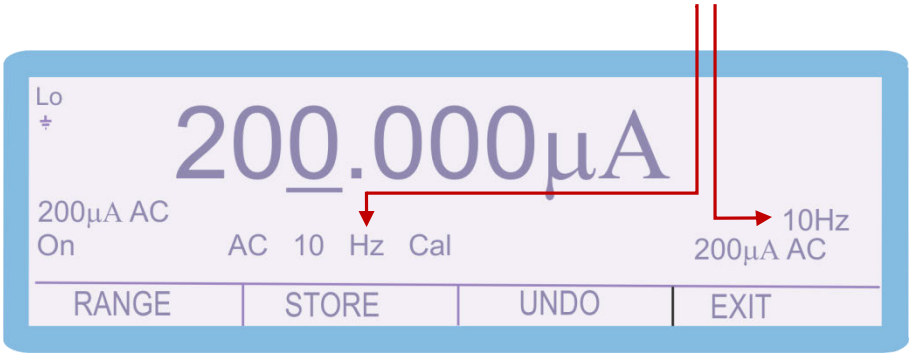


NOTE : The ‘Zero Calibration’ of the AC Current ranges is performed at **20% of full scale**

9. Measure the output as before; if necessary adjust as previously described above.

10. The AC Current frequency response is only adjusted at the Full Scale points at different frequencies. A List of the frequencies that each model is adjusted at can be found at the end of the calibration manual.

Use the range up / range down keys to select the AC 10Hz Calibration Point.

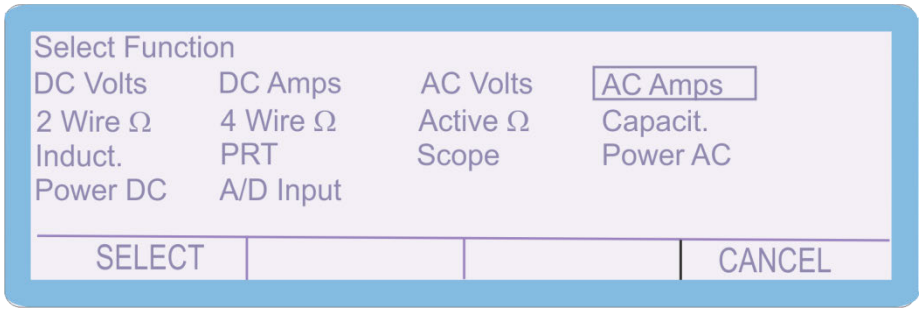


NOTE : In many cases only the 206Hz full scale and zero calibration points require adjustment. The Frequency Response of the 3000A series calibrator may not change.

11. Measure the output as before; if necessary adjust as previously described above.

12. Using the range up / range down keys, measure and adjust (if required) all available frequency points for each range. Depending upon the Range selected and the model of 3000A the available frequency points will differ. For a list of available frequency adjustment points, please refer to the section at the end of this manual.

56. When calibration of this range is complete press the **RANGE** soft key
Select 'AC Amps' and then '2mA AC' and proceed with this range as described above.



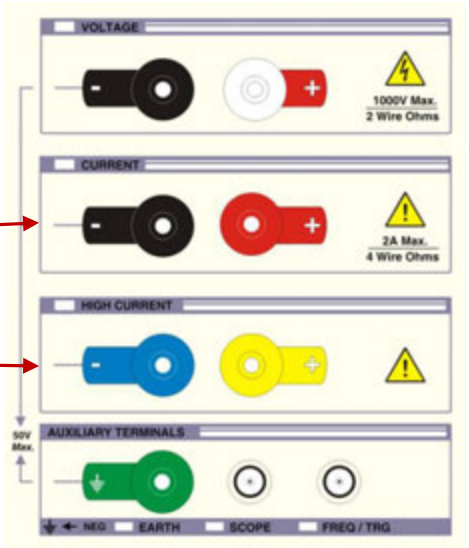
57. The '2mA AC', '20mA AC','200mA AC', '2A AC' and '30A AC' ranges are calibrated in the same manner.

Note: The number of frequency (Hz) calibration points will depend upon model of calibrator (3010A, 3041A or 3050A).

Remember to change the connections when calibrating the 30A range

Current connections - 200µA, 2mA, 20mA, 200mA and 2A ranges

High current connections 30A range



2Wire Ω

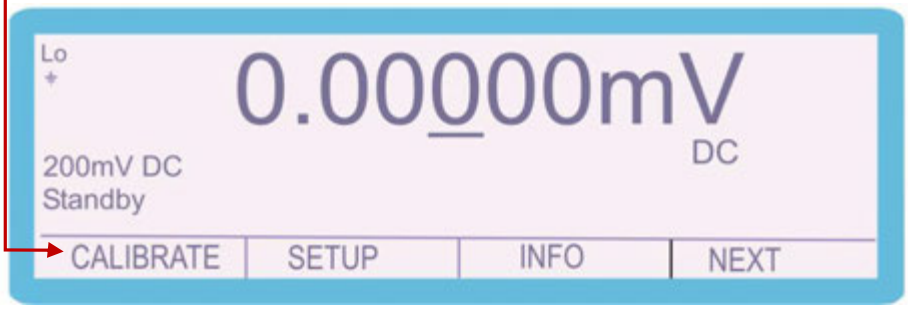
To calibrate the 2Wire Ω parameter, complete the procedure as follows:

NOTE : The 2Wire Ω output from the 3000A series calibrator is a passive output. This means that the value on the display is the resistance value generated at the terminals.

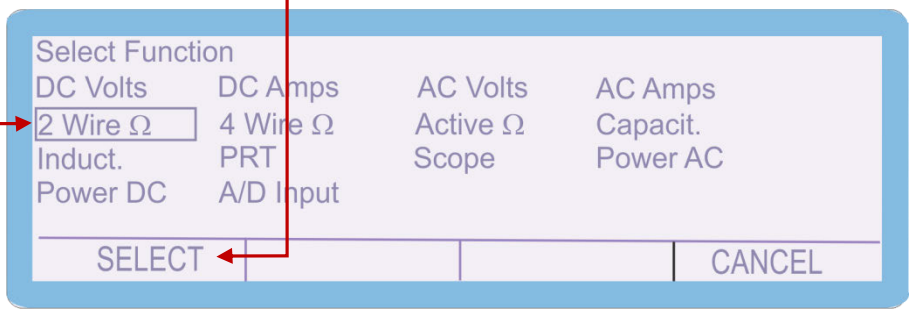
The resistance cannot be 'altered' to a different output, the value stored is simply the value of the resistor and the connections to the terminal.

For a variable resistance output, the Simulated Resistance output must be used.

1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter '2 Wire Ω' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '10 Ω ' and then press **SELECT** soft key

3. The Calibrator will now change to the 10 Ω 2 Wire range.

4. Connect the calibrator Voltage (2 Wire output) terminals to the precision multimeter. To ensure an accurate measurement connect as a 4 wire measurement, with both positive leads connected together. Ensure that the multimeter is nulled as a system, including the leads.

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 10.00045 Ω, use the function control keys

1 **0** **•** **0** **0** **0** **4** **5** **ENTER**

5. The output can also be adjusted by moving the ‘cursor’ to the required digit and adjusting the output using the up / down arrows or the digital control

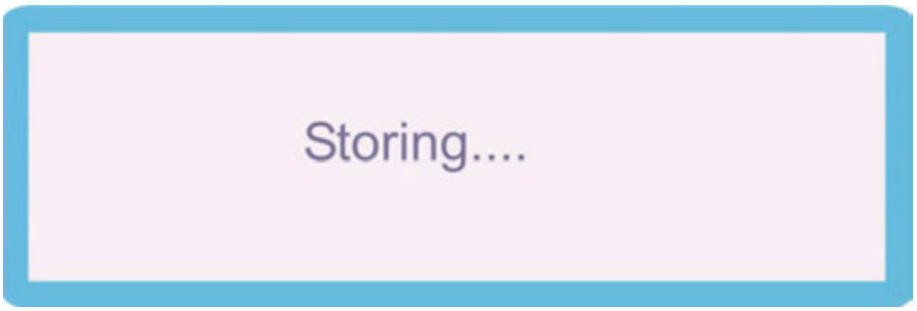
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

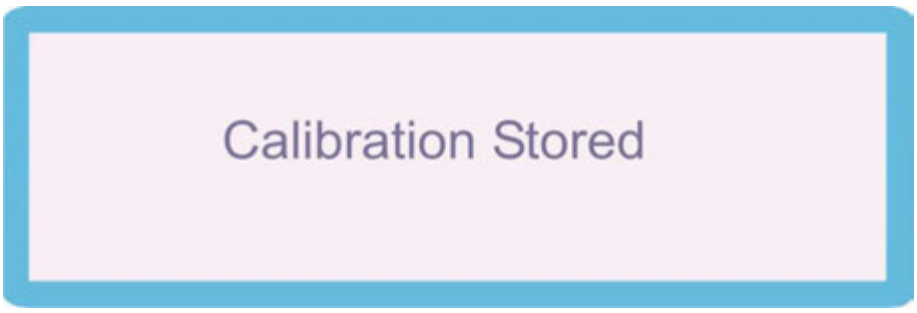
SHIFT

7. To undo the adjustment before storing the changes, press the UNDO soft key

This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



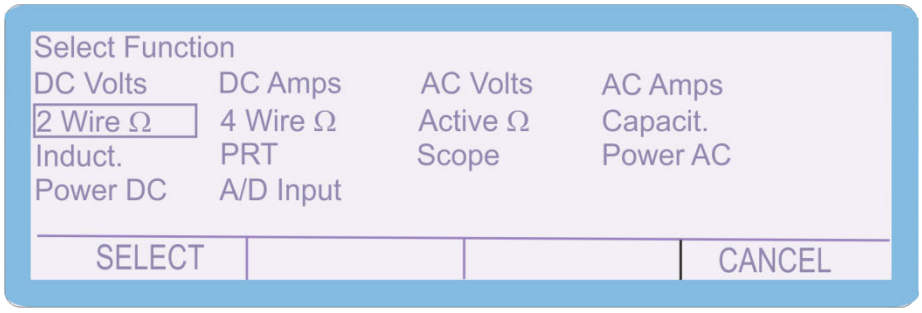


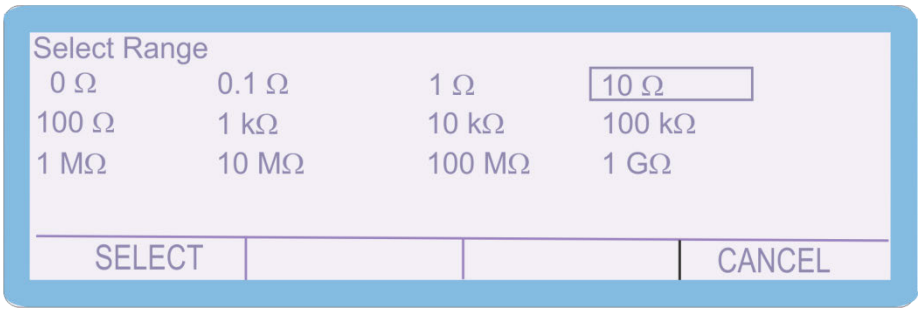
After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

56. When calibration of this range is complete press the **RANGE** soft key, Select '2 Wire Ω', and then select the required range.





57. The '0 mΩ', '100 mΩ,'1Ω', '10Ω', '1 kΩ', '10 kΩ', '100 kΩ', '1 MΩ', '10 MΩ', '100 MΩ' and '1 GΩ' ranges are calibrated in the same manner.

4Wire Ω

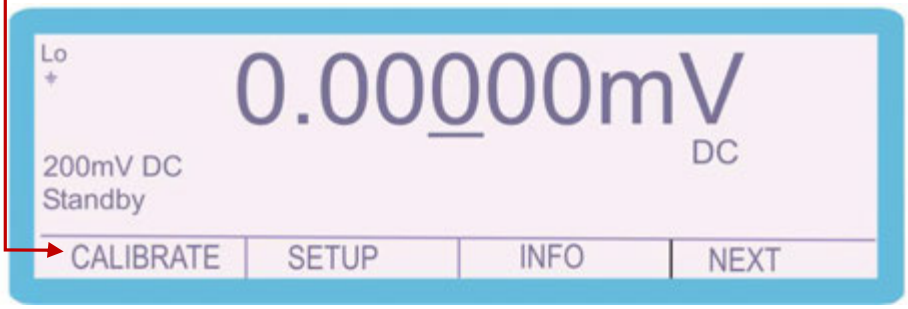
To calibrate the 4Wire Ω parameter, complete the procedure as follows:

NOTE : The 4Wire Ω output from the 3000A series calibrator is a passive output. This means that the value on the display is the resistance value generated at the terminals.

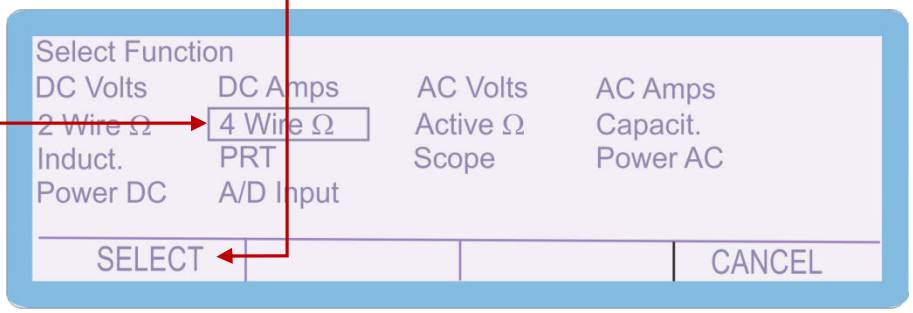
The resistance cannot be 'altered' to a different output; the value stored is simply the value of the resistor and the connections to the terminal.

For a variable resistance output, the Active Resistance output must be used.

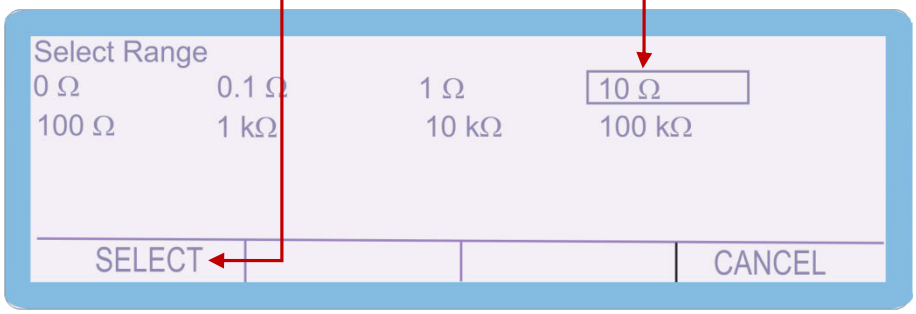
1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter '4 Wire Ω' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '10 Ω ' and then press **SELECT** soft key



3. The Calibrator will now change to the 10 Ω 4 Wire range.

4. Connect the calibrator Voltage and Low current output terminals (4 wire resistance) to the precision multimeter. Ensure that the multimeter is nulled with the calibrator set to the 0R range. The 4 wire resistance output is measured relative to the calibrator zero output value

Note that it is typical that the 4 Wire value will be lower than the corresponding 2 Wire value. This is due to the 4 Wire measurement value compensating for errors in the internal connections inside the calibrator

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 9.99997 Ω, use the function control keys

9 **•** **9** **9** **9** **9** **7** **ENTER**

5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control

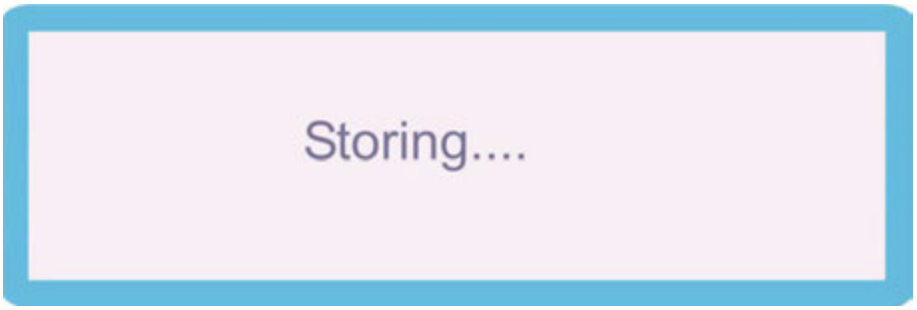
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

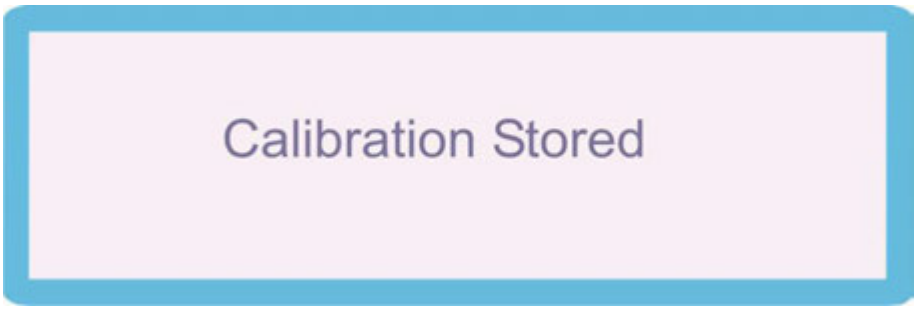
SHIFT

7. To undo the adjustment before storing the changes, press the UNDO soft key

This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



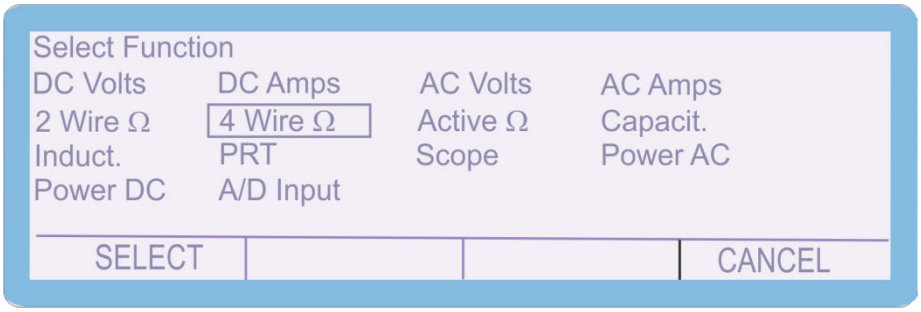


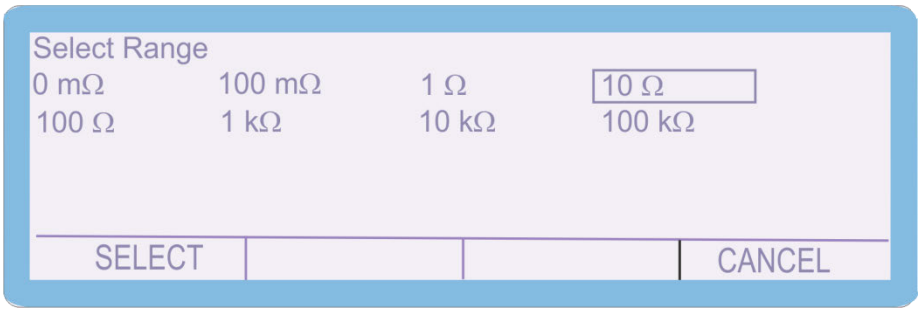
After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

56. When calibration of this range is complete press the **RANGE** soft key, Select '4 Wire Ω', and then select the required range.





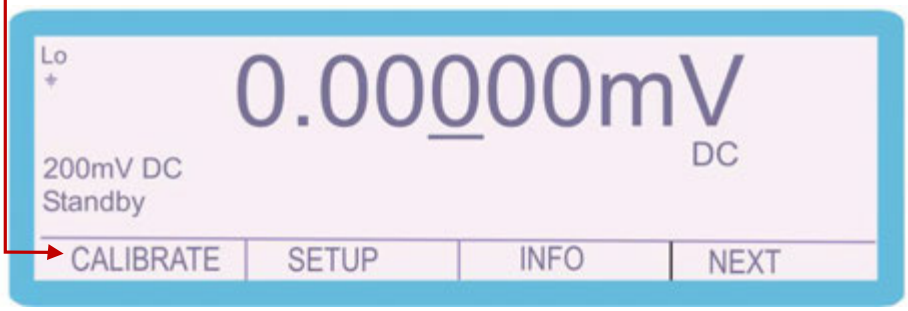
57. The '0 mΩ', '100 mΩ,'1Ω', '10Ω', '1 kΩ', '10 kΩ' and '100 kΩ' ranges are calibrated in the same manner.

Active Ω

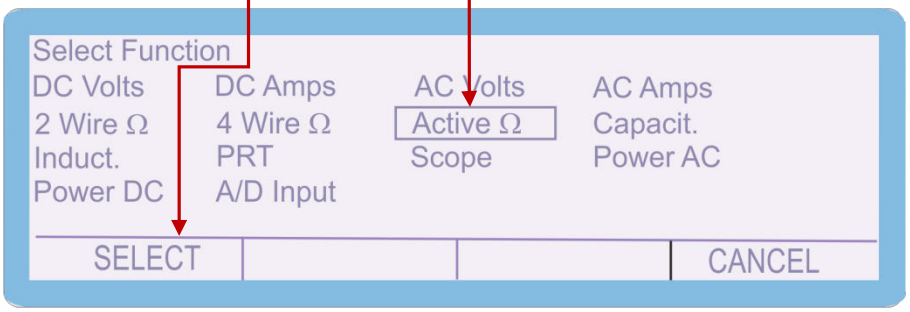
To calibrate the Active Ω parameter, complete the procedure as follows:

The Active Ω output of the 3000A series is available as a 2 Wire output only, however the output can be varied to any output

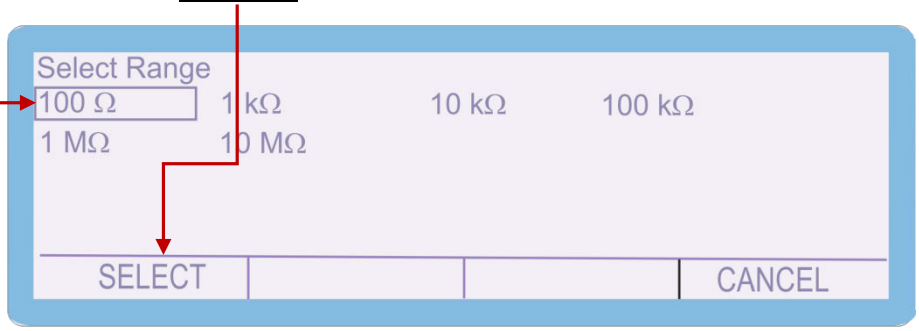
1. Select **CALIBRATE** using the soft key



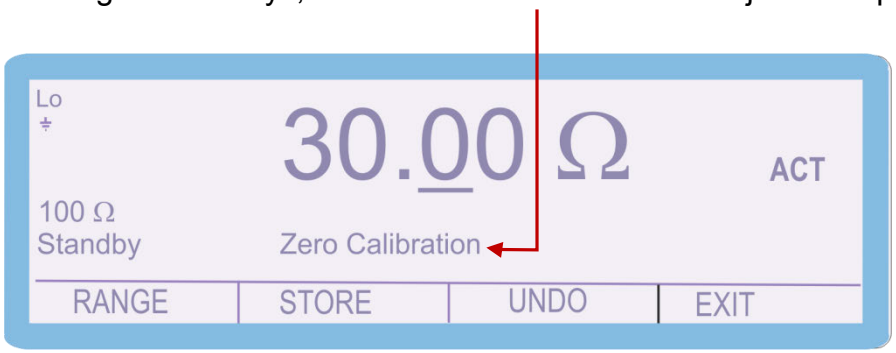
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter '4 Wire Ω' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '10 Ω ' and then press **SELECT** soft key



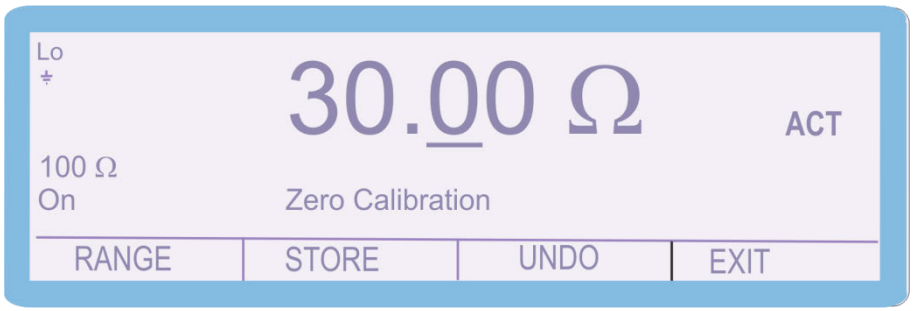
3. The Calibrator will now change to the 100 Ω Active Resistance range. Using the Range up / Range Down keys, select the 'Zero Calibration' adjustment point



4. Connect the calibrator Voltage output terminals (Active Resistance output)

Ensure that the multimeter has been zeroed with the leads shorted. If applicable use low current resistance (Low I) measurement modes. This is because active resistance is a lower accuracy output typically used for calibration of 3 ½ and 4 ½ digit multimeters that use lower measurement currents.

5. Press **OUTPUT ON** and measure the output.

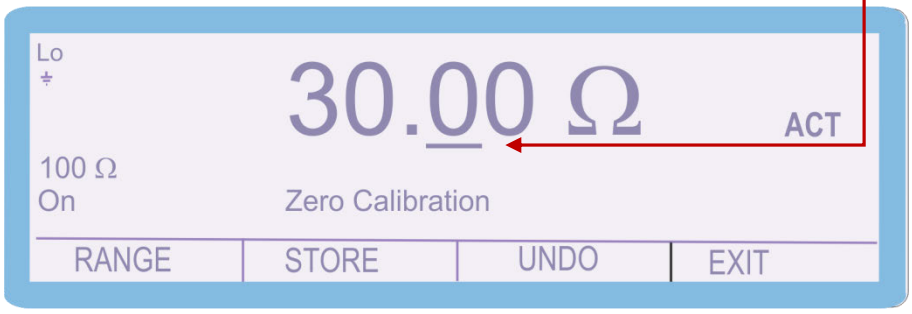


6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 29.95 Ω, use the function control keys

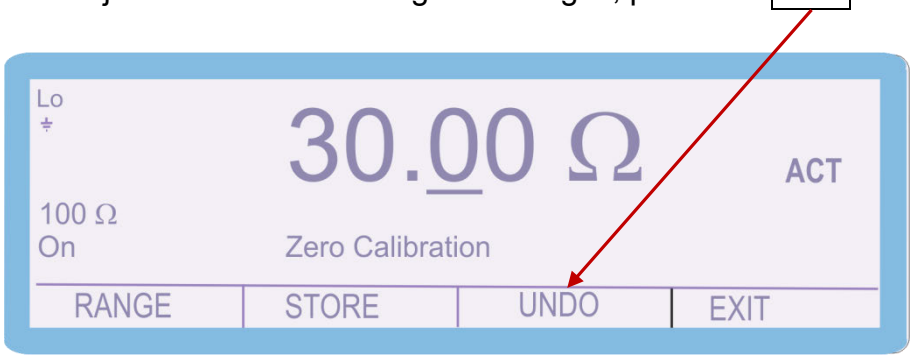
2 **9** **•** **9** **5** **ENTER**

5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



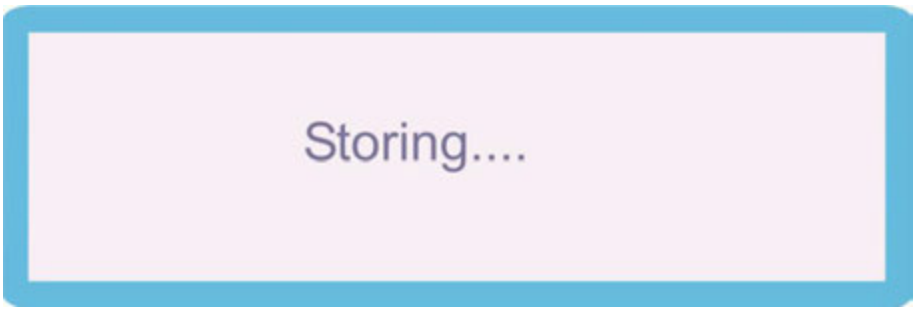
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

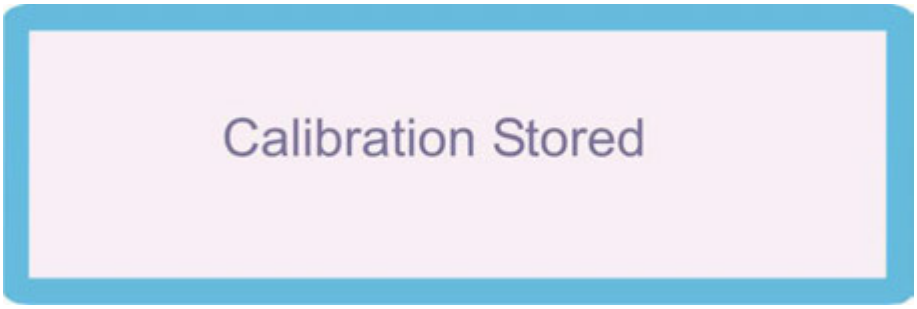
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.





After displaying these messages, the shift key will also cease to be illuminated

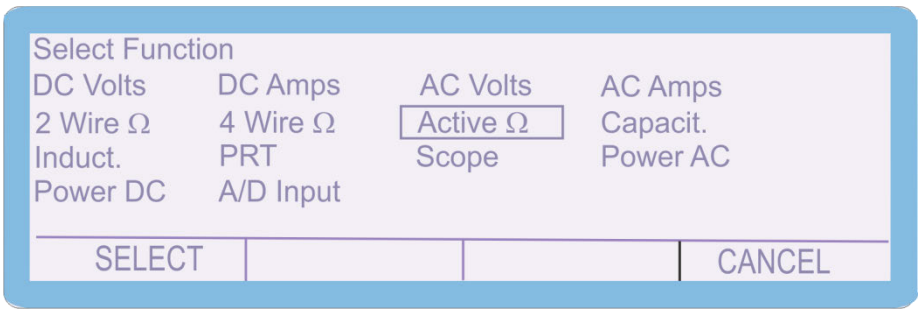
Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

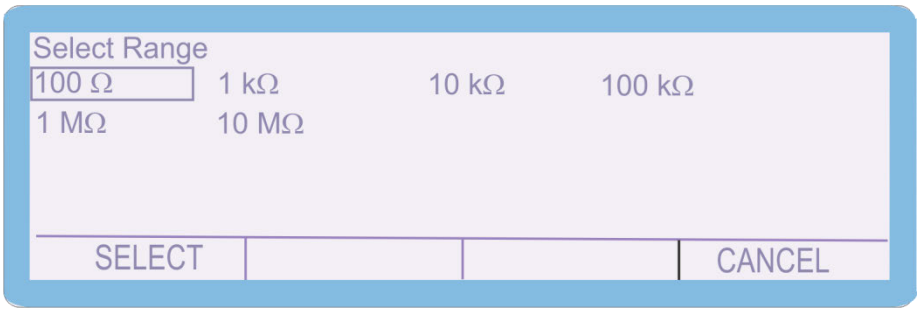
Press the Range Up / Range Down keys until ‘Full Scale Calibration’ is displayed

Measure the output, and adjust as required using the steps previously described.

If the ‘Full Scale Calibration’ has been adjusted, ensure that the ‘Zero Calibration’ point is still in calibration. It may require more than one cycle of adjusting the Zero and Full Scale calibration points to bring both points into specification.

56. When calibration of this range is complete press the **RANGE** soft key, Select ‘Active Ω’, and then select the required range.





57. The ’10 Ω’, ‘100 Ω,‘1 kΩ’, ’10 kΩ’, ‘100 kΩ’, ’1 MΩ’ and ‘10 MΩ’ ranges are calibrated in the same manner.

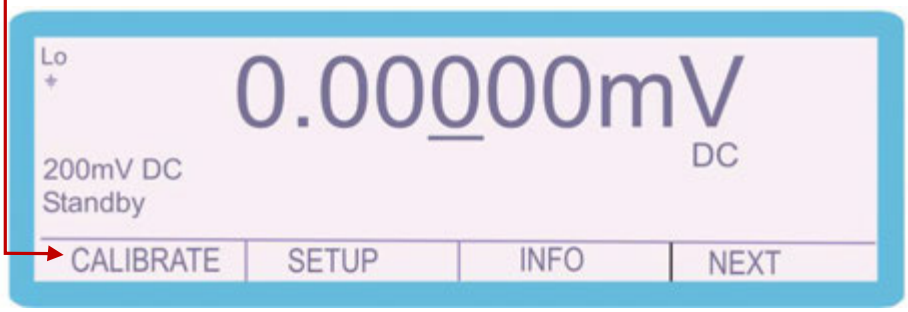
Capacitance

To calibrate the Capacitance parameter, complete the procedure as follows:

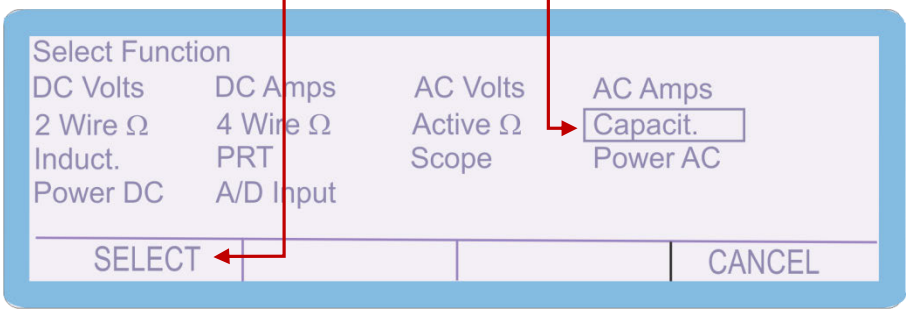
NOTE : The Capacitance output from the 3000A series calibrator is a passive output. This means that the value on the display is the capacitance value generated at the terminals.

The capacitance cannot be 'altered' to a different output, the value stored is simply the value of the capacitor and the connections to the terminal.

1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Capacit.' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. '1uF ' and then press **SELECT** soft key

3. The Calibrator will now change to the 1uF Capacitance range.

4. Connect the calibrator Voltage (Capacitance) terminals to the LCR Bridge. To ensure an accurate measurement connect as a 4 wire measurement, with both positive leads connected together. Ensure that the LCR Bridge is nulled before connecting to the Calibrator

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 1.0016 uF, use the function control keys

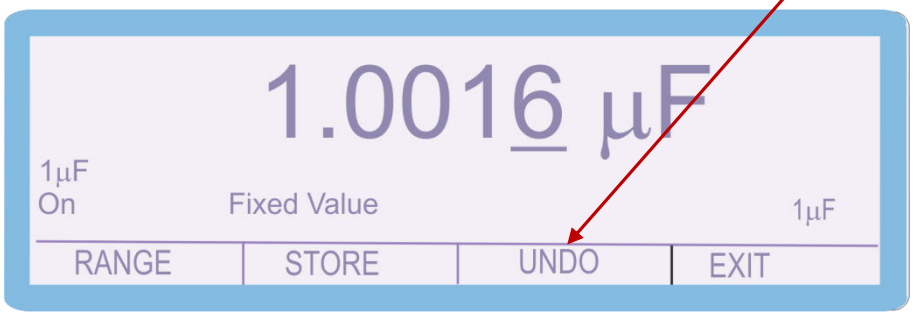
1 **•** **0** **0** **1** **6** **ENTER**

5. The output can also be adjusted by moving the ‘cursor’ to the required digit and adjusting the output using the up / down arrows or the digital control

6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

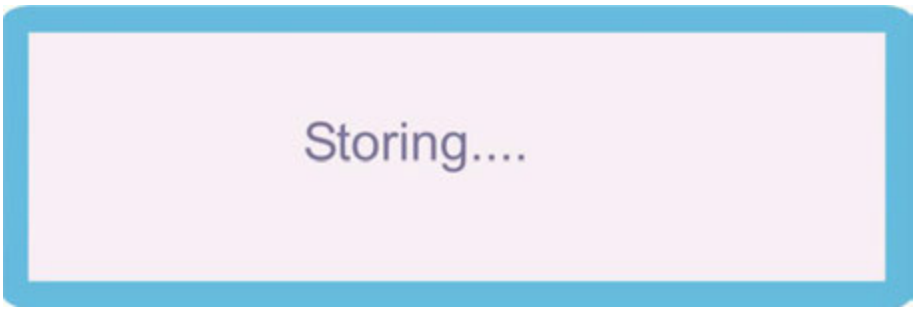
SHIFT

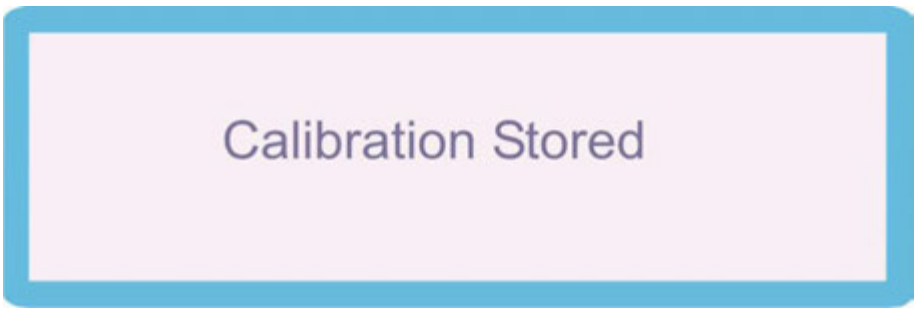
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



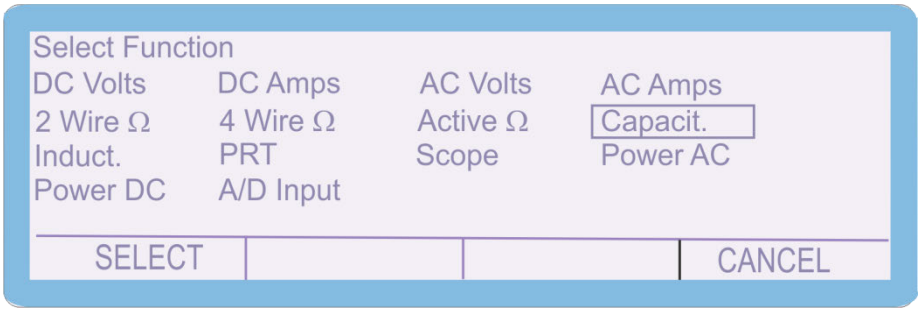


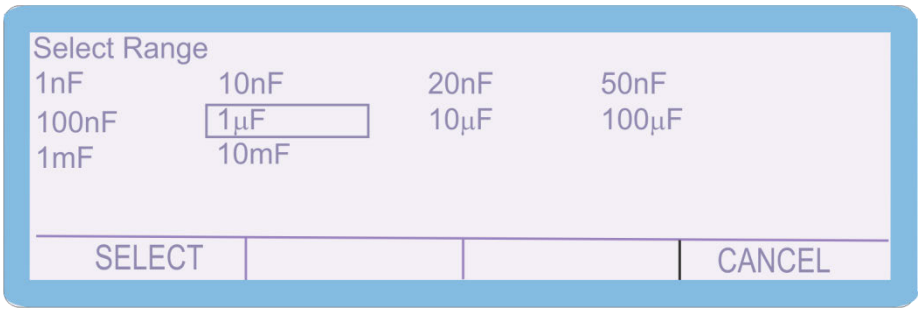
After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

56. When calibration of this range is complete press the **RANGE** soft key, Select '2 Wire Ω', and then select the required range.





57. The '1nF', '10nF', '20nF', '50nF', '100nF', '10uF' and '100uF' ranges are calibrated in the same manner.

The 1mF and 10mF ranges are simulated

Frequency Output

Information to be added in next revision of Calibration manual.

Please note that there is no adjustment of the frequency output available from the front panel, this is adjusted manually on the top board of the calibrator.

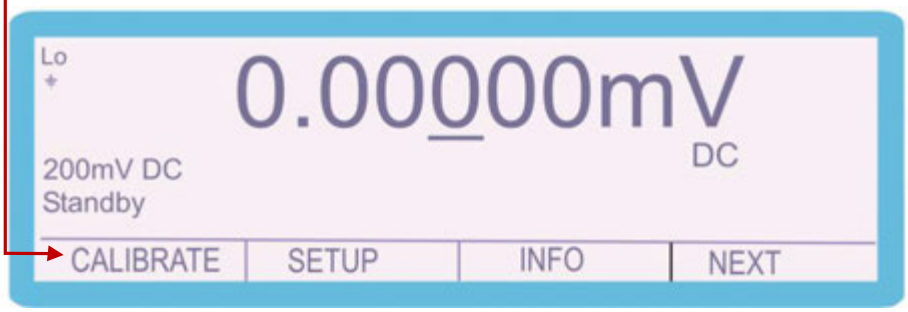
Inductance

To calibrate the Capacitance parameter, complete the procedure as follows:

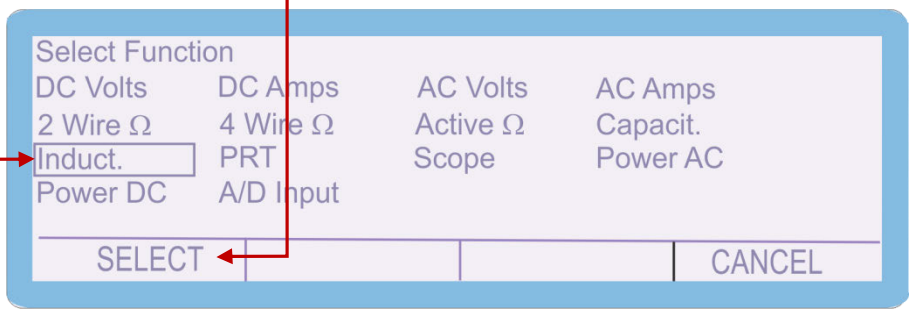
NOTE : The Inductance output from the 3000A series calibrator is a passive output. This means that the value on the display is the Inductance value generated at the terminals.

The Inductance cannot be ‘altered’ to a different output, the value stored is simply the value of the inductor and the connections to the terminal.

1. Select **CALIBRATE** using the soft key

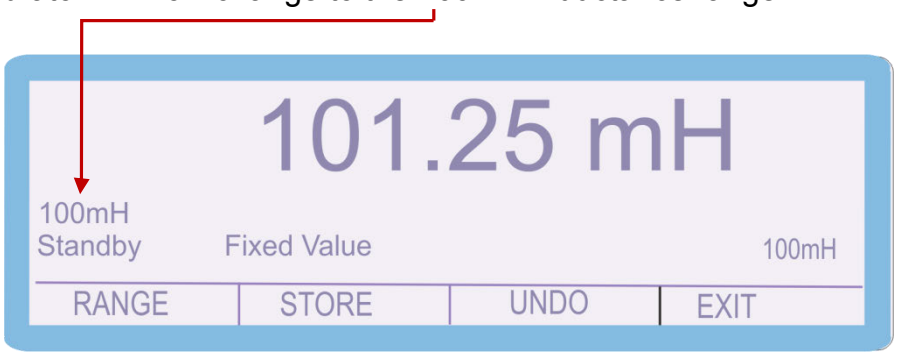


2. Use the ‘Digital Control’ or the ‘Arrow Keys’ to highlight the required parameter ‘Capacit.’ and then press **SELECT** soft key



3. Use the ‘Digital Control’ or the ‘Arrow Keys’ to highlight the required range e.g. ’100mH ’ and then press **SELECT** soft key

3. The Calibrator will now change to the 100mH Inductance range.



4. Connect the calibrator Voltage (Inductance) terminals to the LCR Bridge. To ensure an accurate measurement connect as a 4 wire measurement, with both positive leads connected together. Ensure that the LCR Bridge is nulled before connecting to the Calibrator

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 100.65 mH, use the function control keys

1 **0** 0 • **6** **5** **ENTER**

5. The output can also be adjusted by moving the ‘cursor’ to the required digit and adjusting the output using the up / down arrows or the digital control

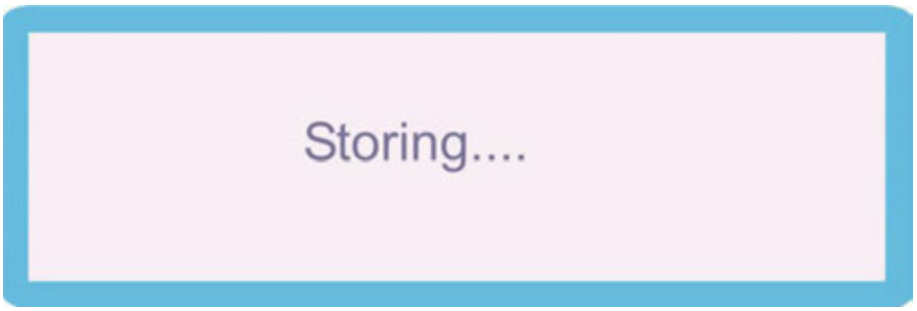
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

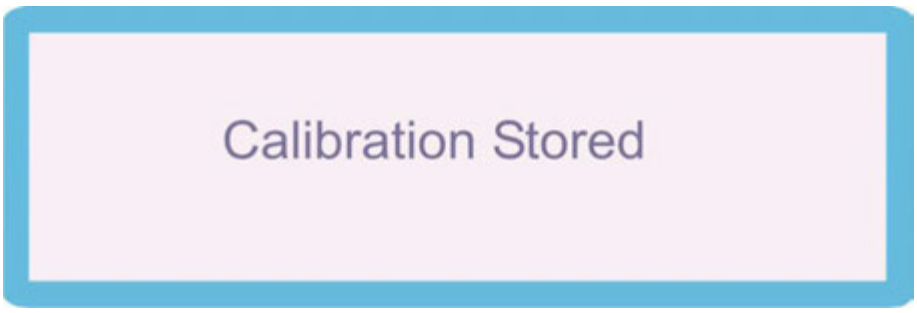
SHIFT

7. To undo the adjustment before storing the changes, press the UNDO soft key

This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



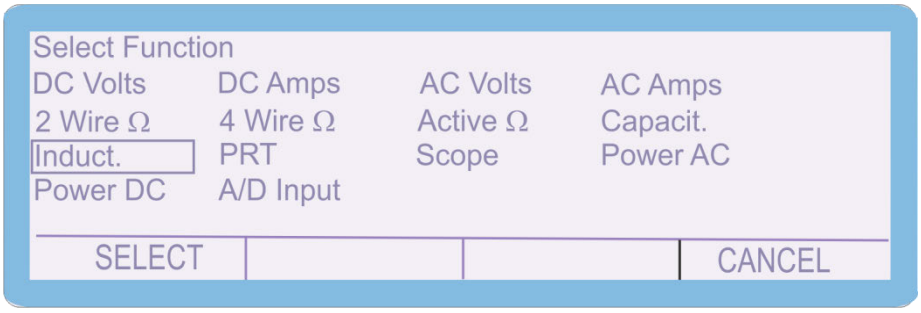


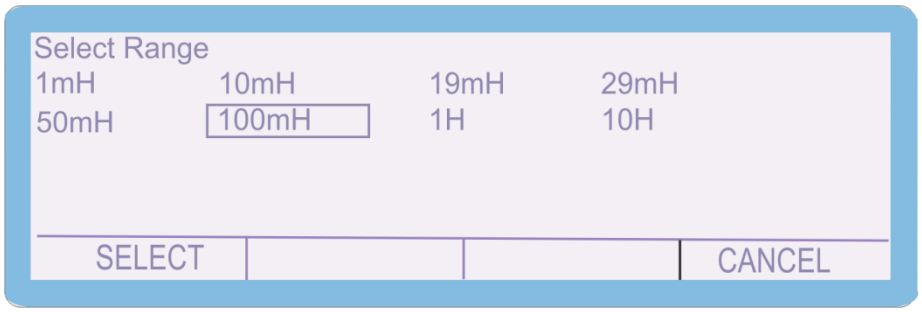
After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

56. When calibration of this range is complete press the **RANGE** soft key, Select '2 Wire Ω', and then select the required range.





57. The '1mH', '10mH','19mH','29mH','50mH', '1H' and '10H' ranges are calibrated in the same manner.

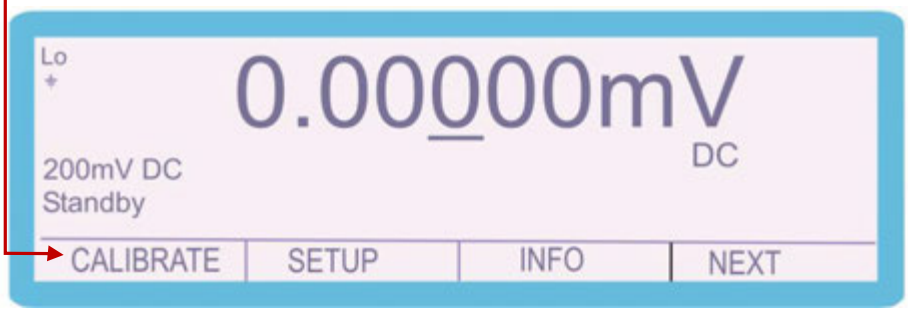
PRT

To calibrate the Capacitance parameter, complete the procedure as follows:

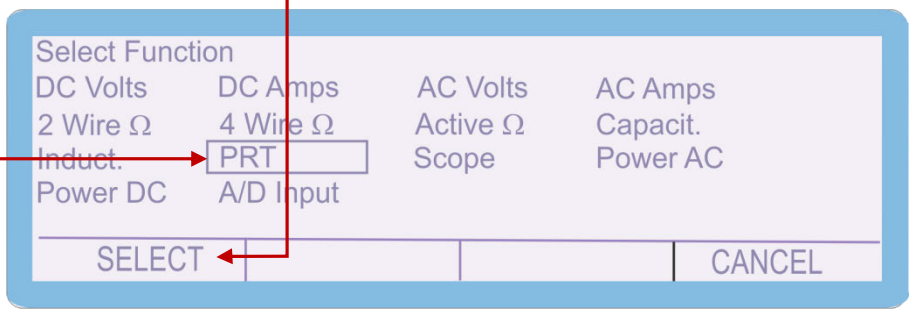
NOTE : The PRT output from the 3000A series calibrator is a passive output. This means that the value on the display is the Temperature (Based on R0=100) value generated at the terminals.

The Temperature value cannot be 'altered' to a different output, the value stored is simply the value of the resistor and the connections to the terminal.

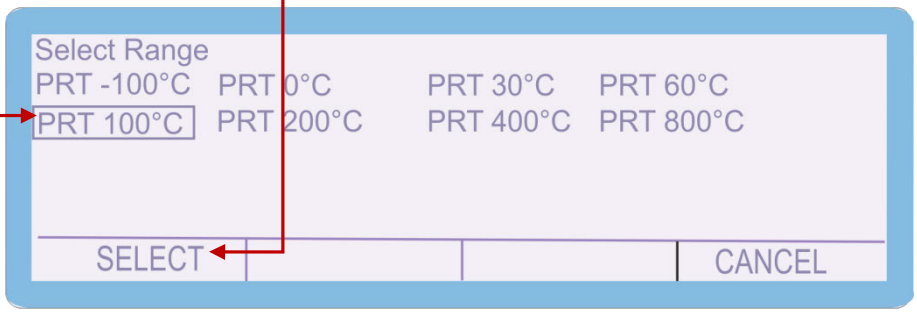
1. Select **CALIBRATE** using the soft key



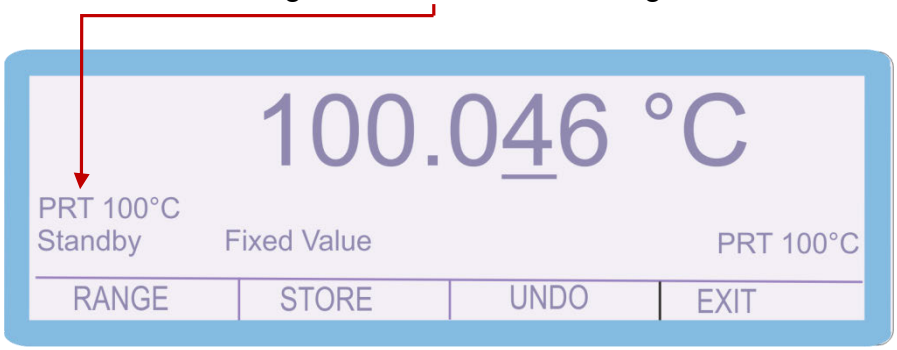
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'PRT' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required range e.g. 'PRT 100 °C ' and then press **SELECT** soft key



3. The Calibrator will now change to the 100 °C PRT range.



4. Connect the calibrator Voltage and Current terminals to the precision Multimeter using 4 wire connection methods. If available, set the reference multimeter to Temperature mode, otherwise use lookup tables to convert the indicated resistance to temperature.

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 100.013 °C, use the function control keys

1 **0** 0 • **0** **1** **3** **ENTER**

5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control

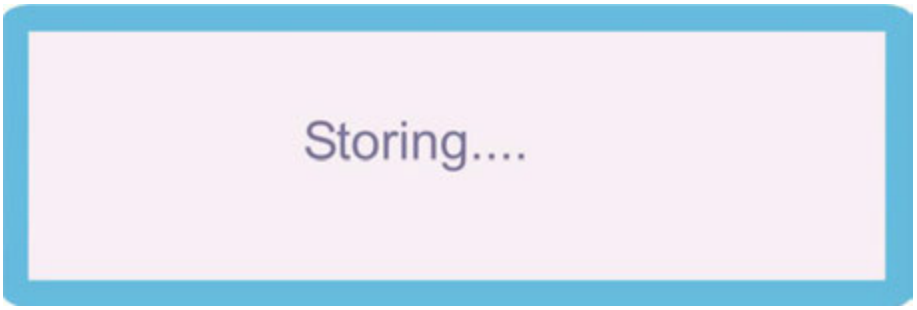
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

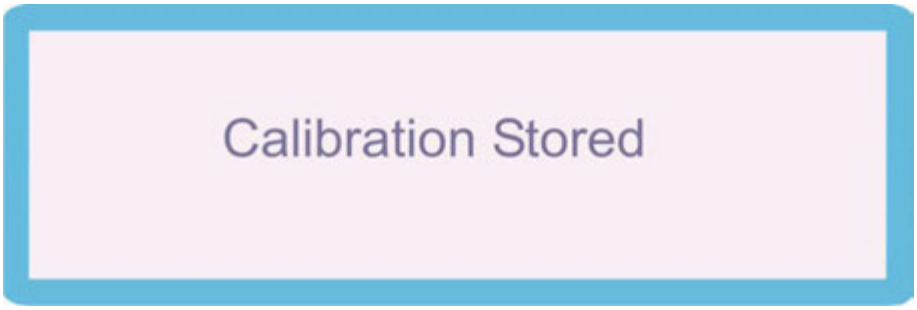
SHIFT

7. To undo the adjustment before storing the changes, press the UNDO soft key

This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



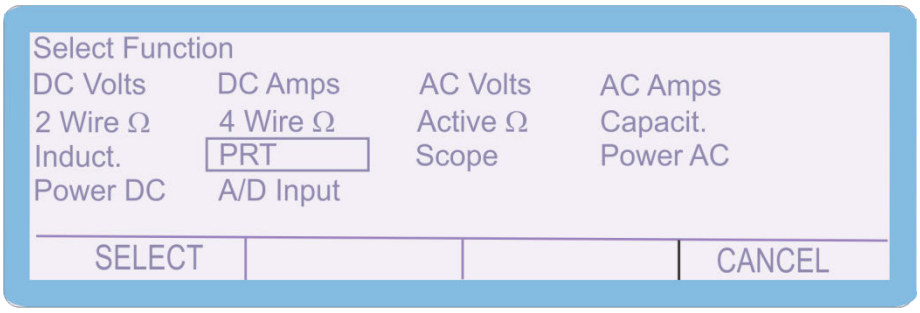


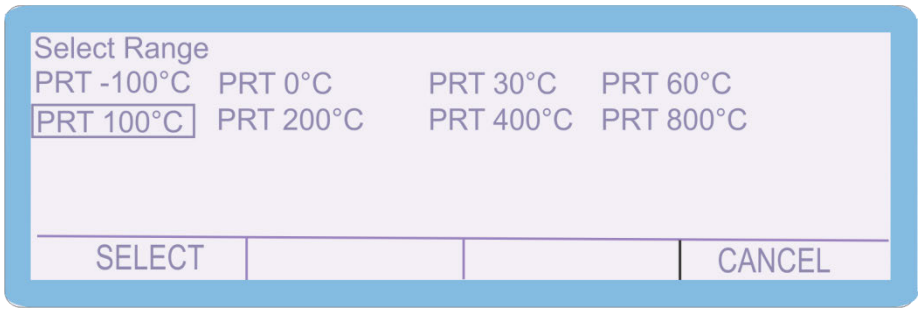
After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

56. When calibration of this range is complete press the **RANGE** soft key, Select ‘2 Wire Ω’, and then select the required range.

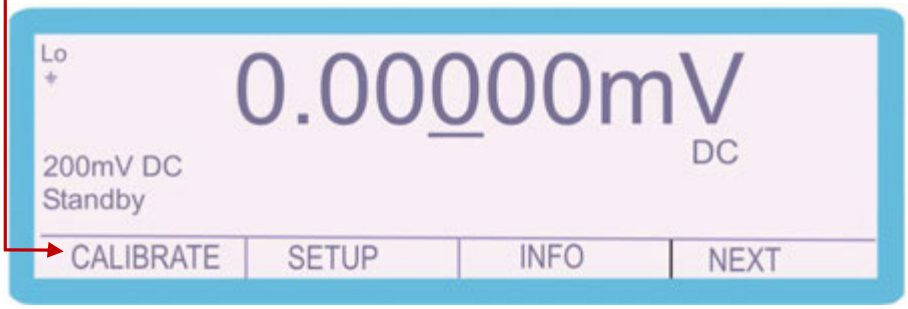




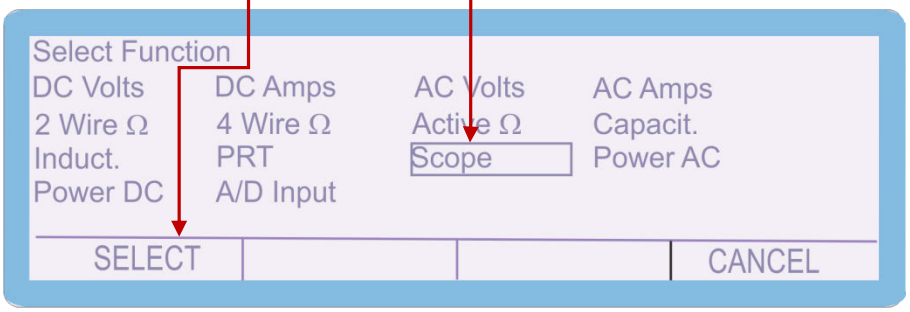
57. The ‘PRT -100 °C’, ‘PRT 0°C’,’PRT 30°C’, ’PRT 60°C’, ’PRT 200°C’, ‘PRT 400°C’ and ‘PRT 800°C’ ranges are calibrated in the same manner.

Oscilloscope – Amplitude

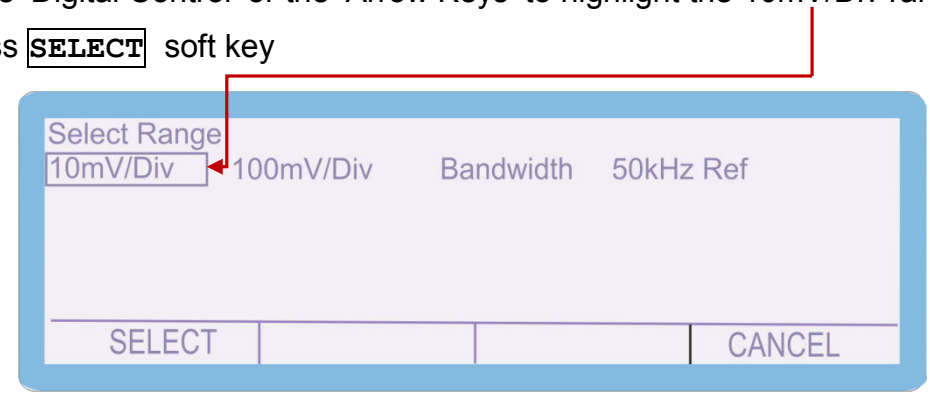
1. Select **CALIBRATE** using the soft key



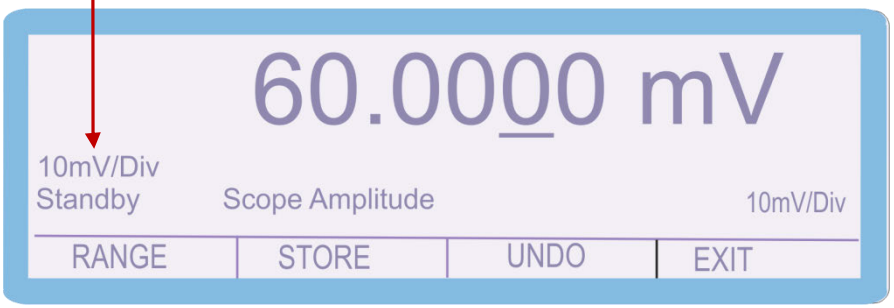
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Scope' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the 10mV/Div range and then press **SELECT** soft key

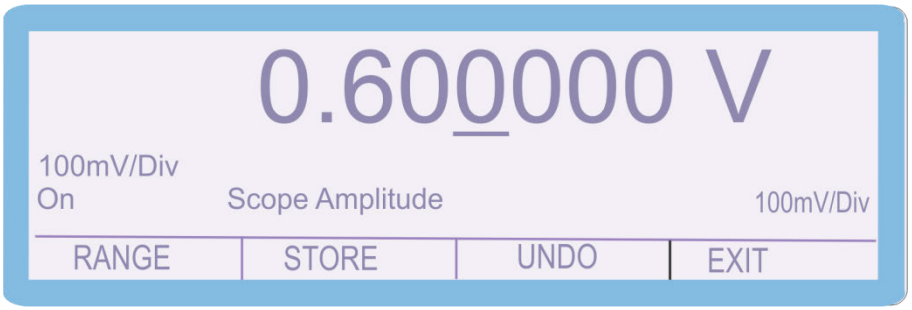


3. The Calibrator will now change to the 10mV/Division Oscilloscope Amplitude range.



4. Connect the calibrator Oscilloscope output to the precision digital multimeter. Set the 100mV DC voltage range. Normally the Oscilloscope Amplitude output is a levelled square AC Voltage output, however in the calibration mode this is set to a levelled DC waveform. This allows more accurate measurement than low level AC Voltage measurements

5. Press **OUTPUT ON** and measure the output.

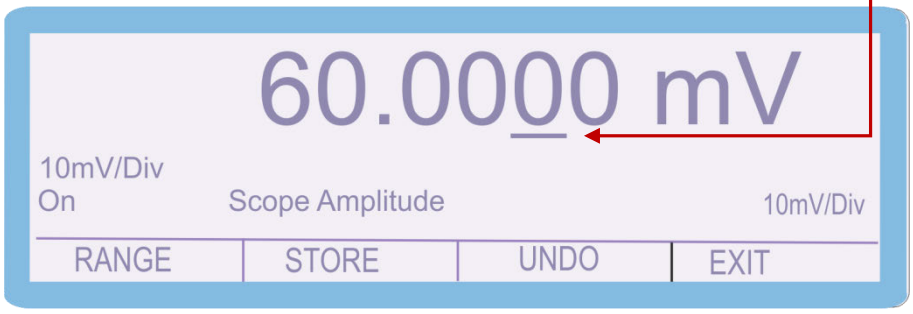


6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 59.9985 mV, use the function control keys

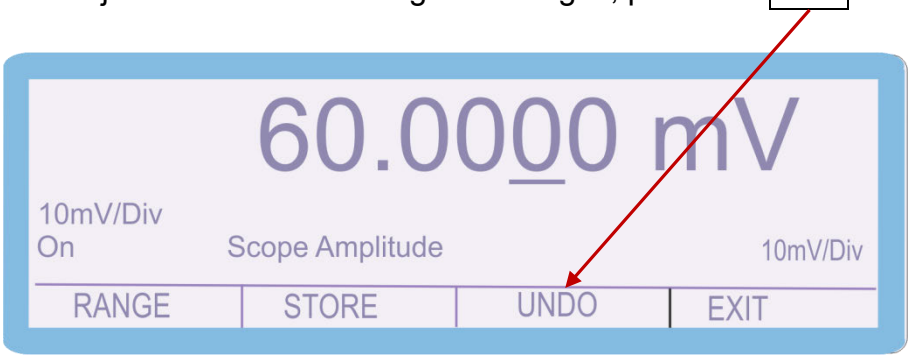
5 **9** **.** **9** **9** **8** **5** **ENTER**

5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



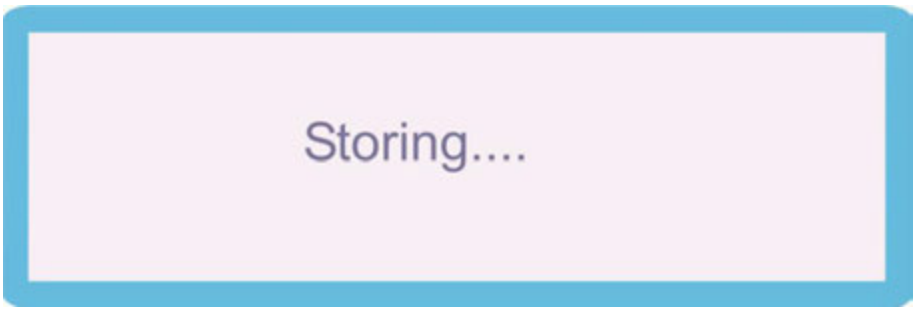
6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

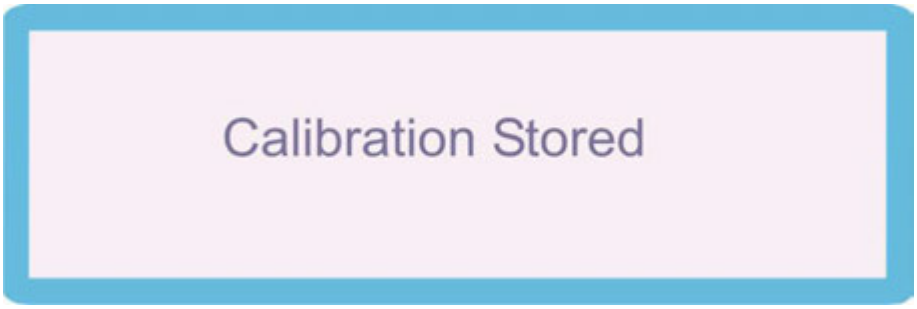
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.





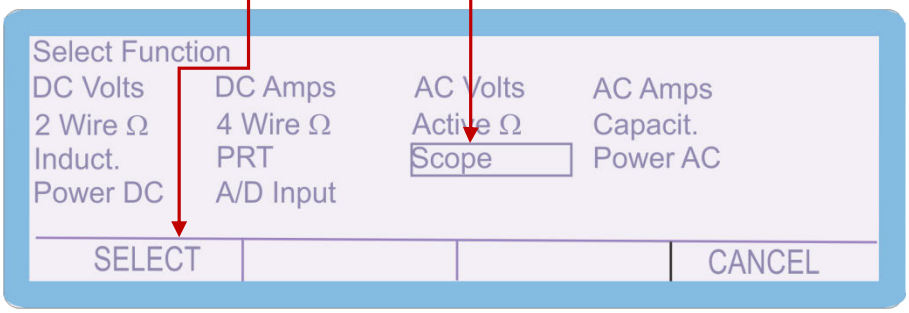
After displaying these messages, the shift key will also cease to be illuminated

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

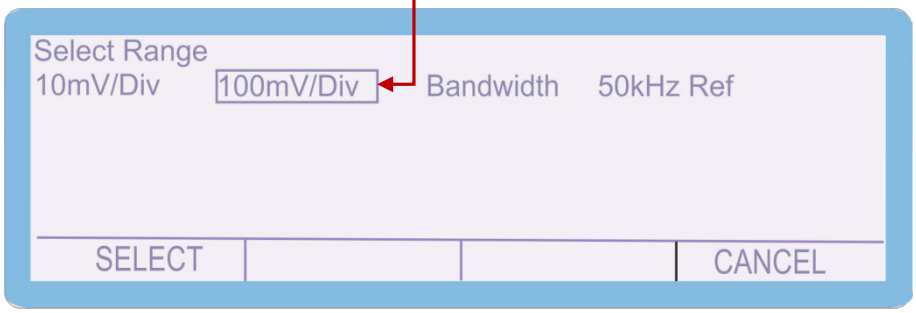
When calibration of this range is complete press the **RANGE** soft key,

The Oscilloscope Amplitude output has two calibration points to be adjusted, the 10mV/Div output and the 100mV/Div output.

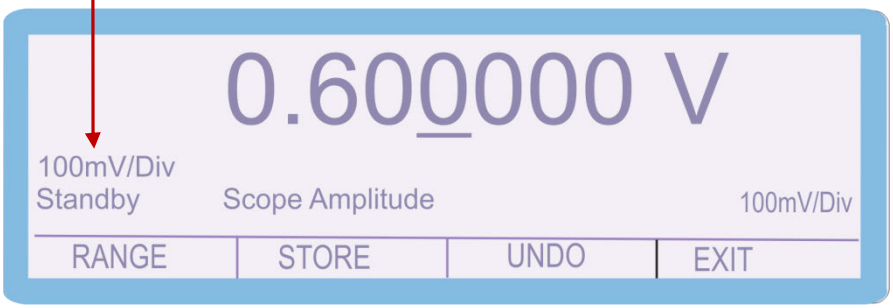
2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Scope' and then press **SELECT** soft key



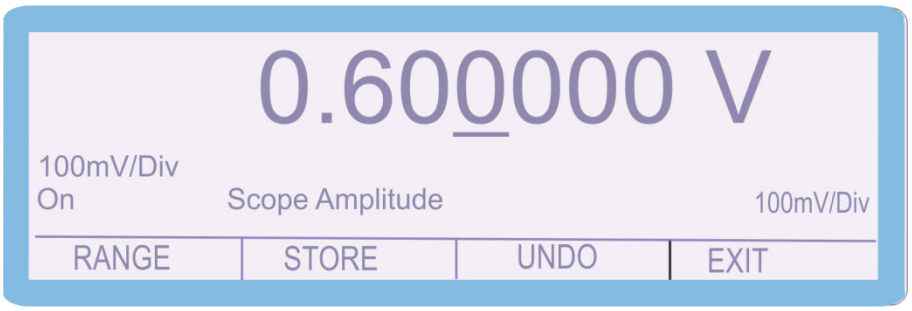
3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the 100mV/Div range and then press **SELECT** soft key



3. The Calibrator will now change to the 100mV/Division Oscilloscope Amplitude range.



5. Press **OUTPUT ON** and measure the output.

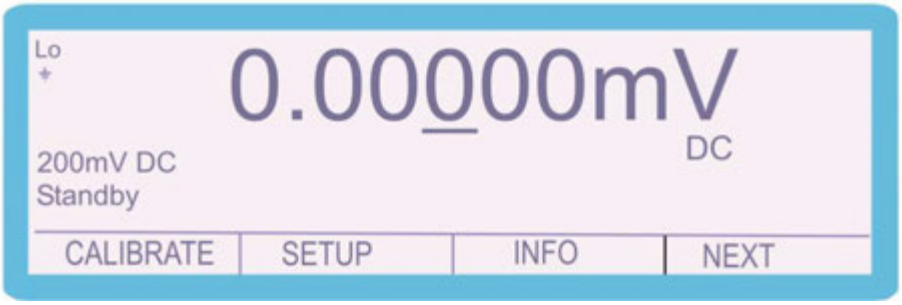


If required, adjust the output as previously described, either typing in the measured value or deviating the output of the calibrator using the cursor and the arrow keys / digital control.

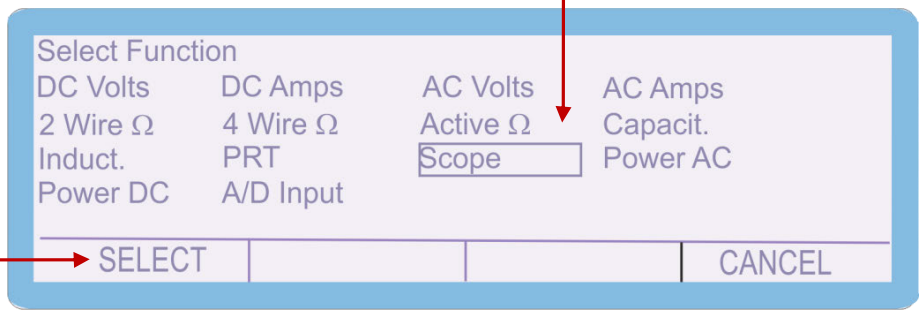
To complete the calibration, press the **STORE** key

Oscilloscope – Bandwidth

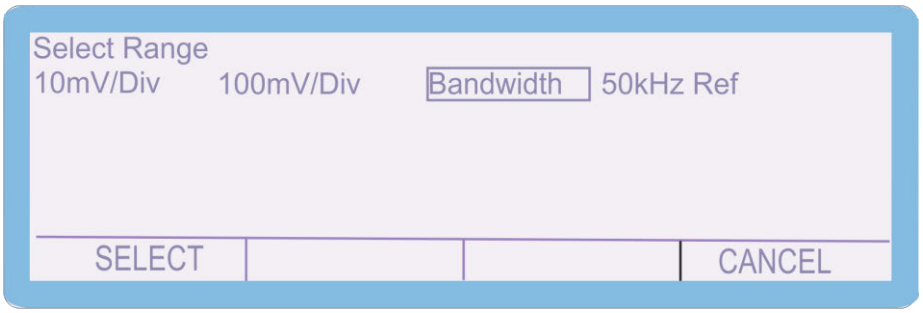
1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Scope' and then press **SELECT** soft key



3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Bandwidth' and then press **SELECT** soft key



3. The Calibrator will now change to the Scope Bandwidth Function. Use the Range Up / Range Down keys to select the required Scope Bandwidth adjustment point

The currently selected adjustment point is displayed on the screen above the soft key menu

4. Connect oscilloscope to the SCOPE terminal on the front panel. Ensure that the oscilloscope is set to 50 Ohm input impedance

5. Set the oscilloscope to 100mV/Division

5. Press **OUTPUT ON** and measure the output.

6. To adjust the output enter the value as measured on the oscilloscope

E.g. measured output = 610.00 mV, use the function control keys

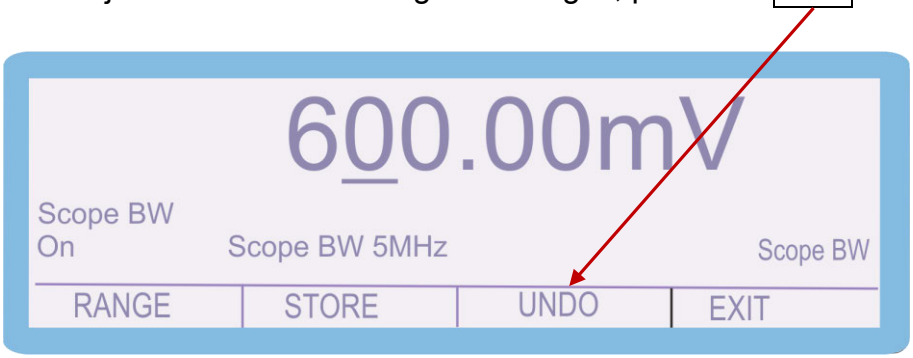
6 **1** **0** **•** **0** **0** **ENTER**

5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control

6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

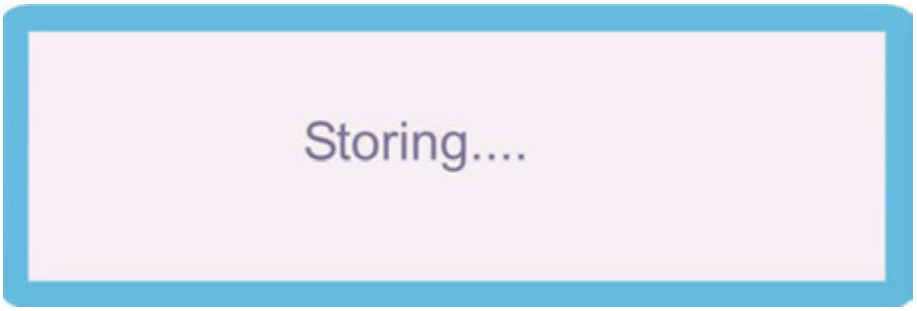
SHIFT

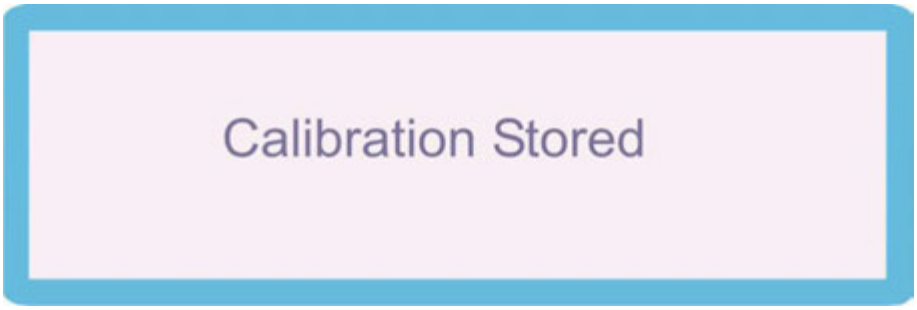
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



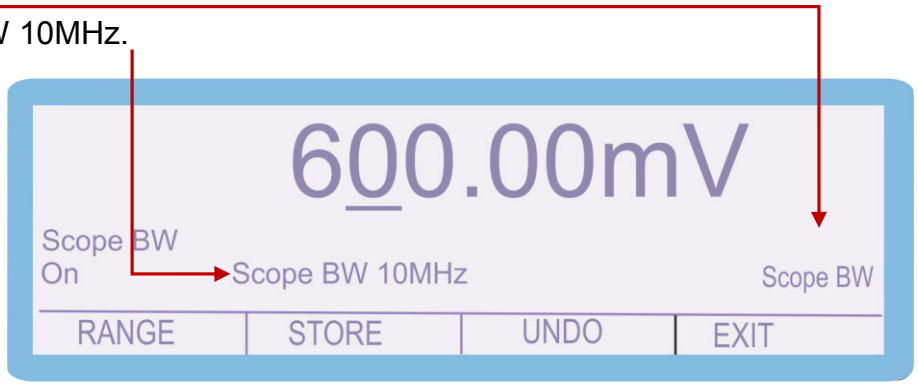


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

8. Use the ‘range up’ and ‘range down’ keys to change the calibration point to Scope BW 10MHz.



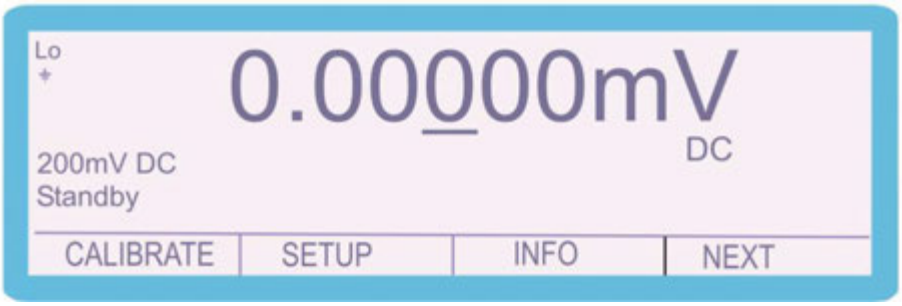
10. Adjust as steps **ASJDASJDASDJ.**

11. Continue adjustment until 260MHZ (SCP250) / 360MHz (SCP350) / 620MHz (SCP600) point has been adjusted

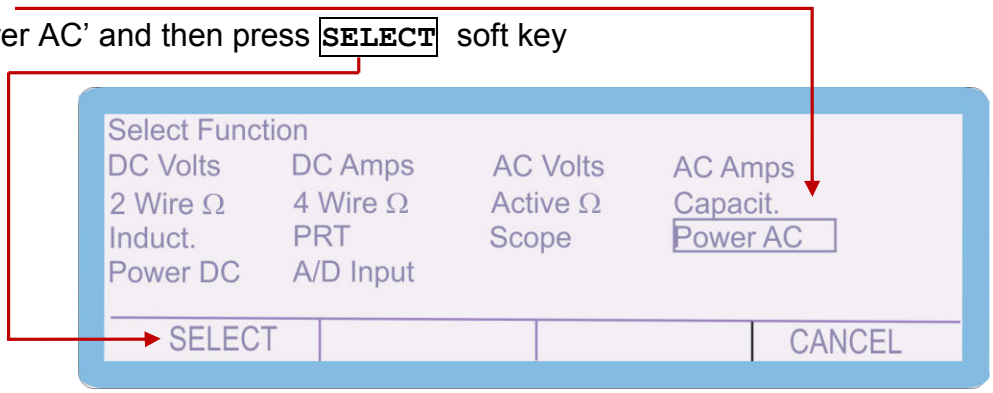
12. Verify Bandwidth Output flatness by performing a sweep of the full frequency range, ensuring that flatness is achieved across the full range of the oscilloscope function.

AC Power (Current Output)

1. Select **CALIBRATE** using the soft key

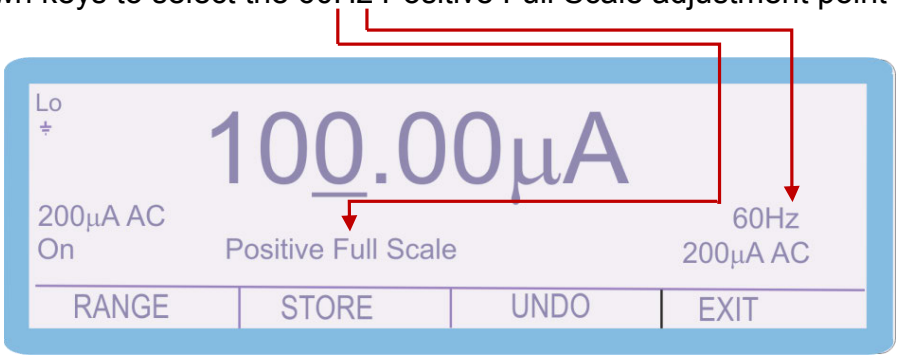


2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Power AC' and then press **SELECT** soft key



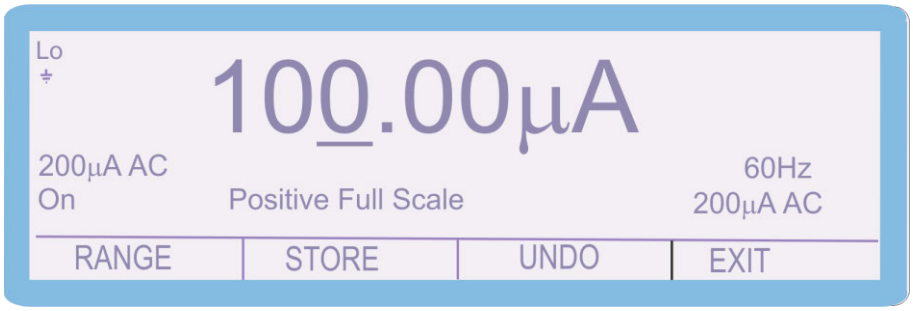
3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter '200uA AC' and then press **SELECT** soft key

3. The Calibrator will now change to the 200uA AC range. Use the Range Up / Range Down keys to select the 60Hz Positive Full Scale adjustment point



4. Connect the calibrator output voltage terminals to the precision multimeter. Ensure that the multimeter is in AC Current on the appropriate range. Ensure that the correct terminals / current shunt is used for the various current outputs. The 3000A calibrators can output up to 30A AC current, which can blow the fuse / cause damage if the incorrect input is used

5. Press **OUTPUT ON** and measure the output.

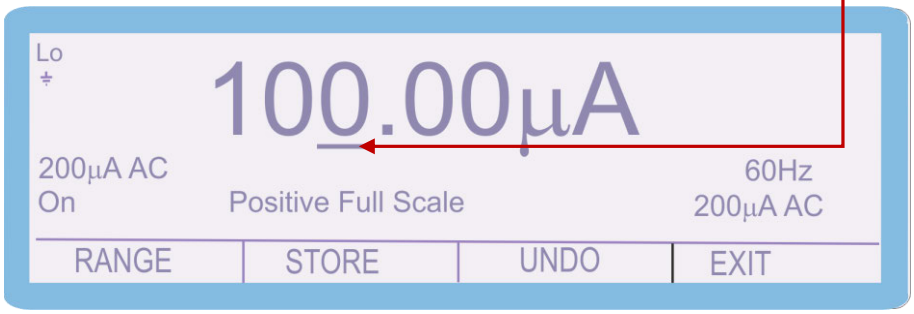


6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 99.90 uA, use the function control keys

9 **9** **•** **9** **0** **ENTER**

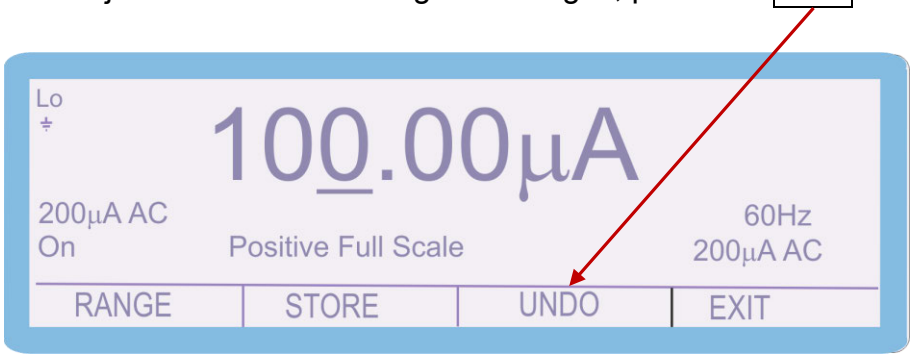
5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

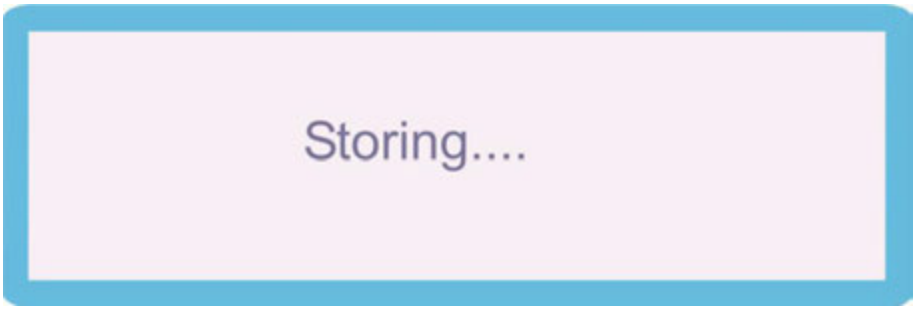
SHIFT

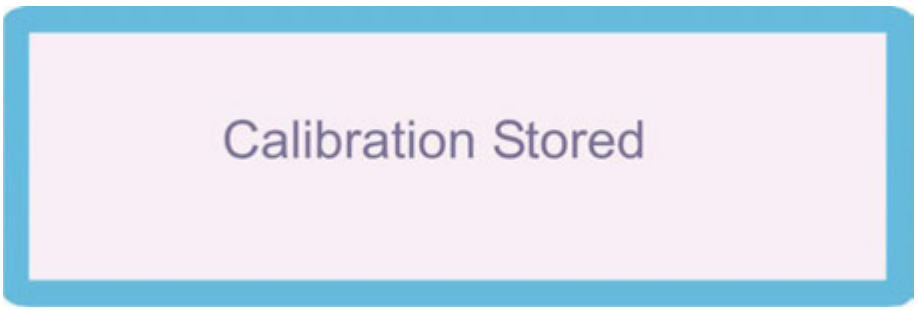
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



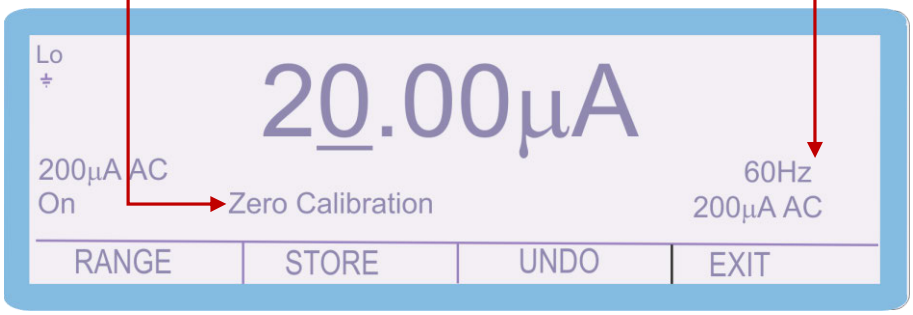


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

8. Use the ‘range up’ and ‘range down’ keys to change the calibration point to 60Hz ‘Zero Calibration’.

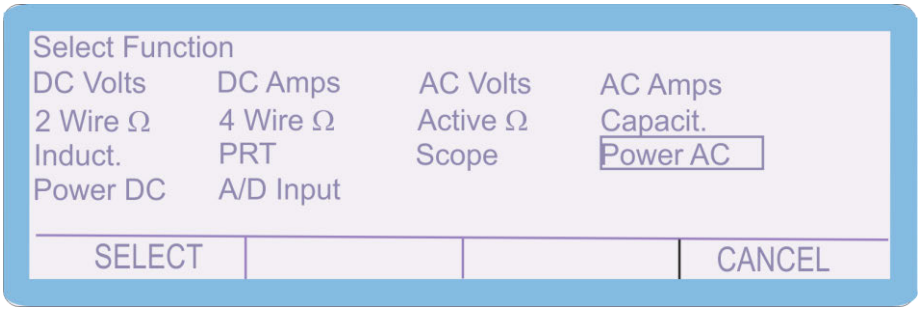


NOTE : The ‘Zero Calibration’ of the AC Current ranges is performed at **20% of full scale**

9. Measure the output as before; if necessary adjust as previously described above.

11. Measure the output as before; if necessary adjust as previously described above.

56. When calibration of this range is complete press the **RANGE** soft key
Select ‘AC Current’ and then ‘2mA AC’ and proceed with this range as described above.

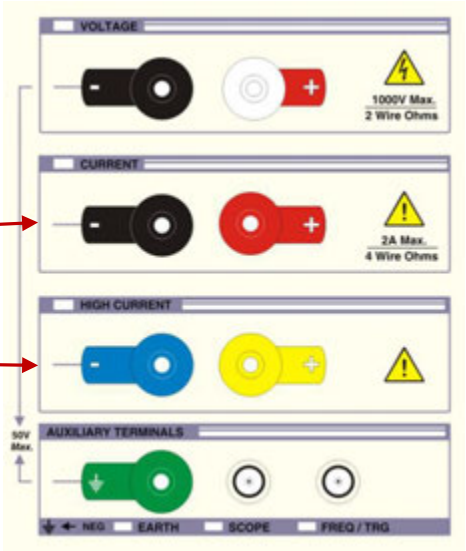


57. The ’2mA AC’, ‘20mA AC’,‘200mA AC’, ‘2A AC’ and ‘30A AC’ ranges are calibrated in the same manner.

Remember to change the connections when calibrating the 30A range

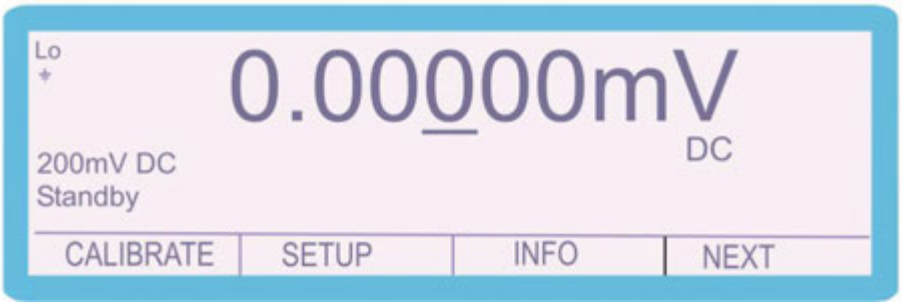
Current connections - 200μA, 2mA, 20mA, 200mA and 2A ranges

High current connections 30A range

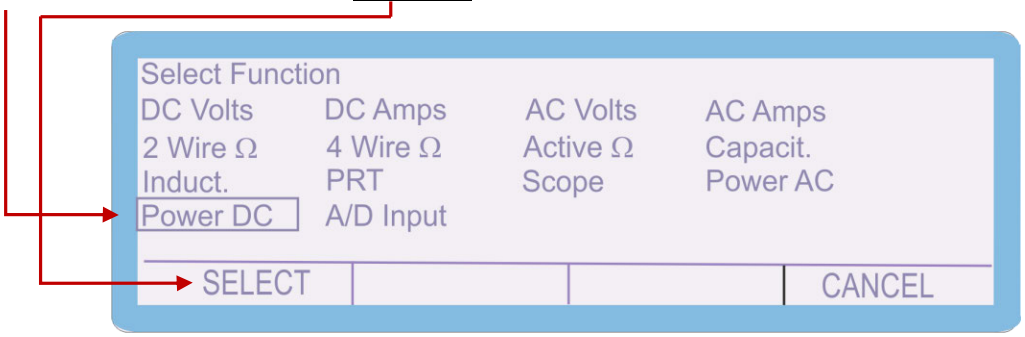


DC Power (Current Output)

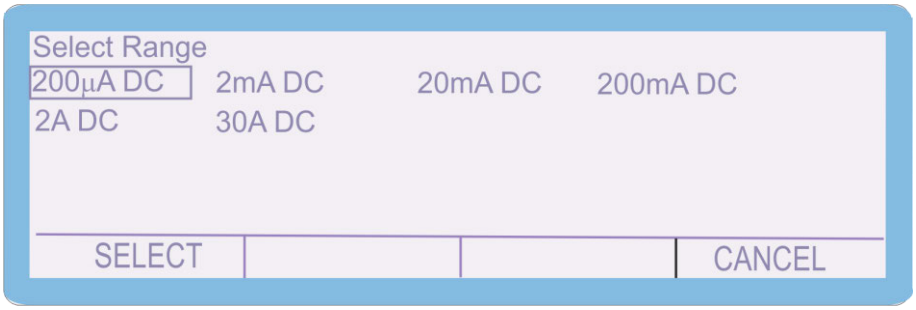
1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'Power DC' and then press **SELECT** soft key



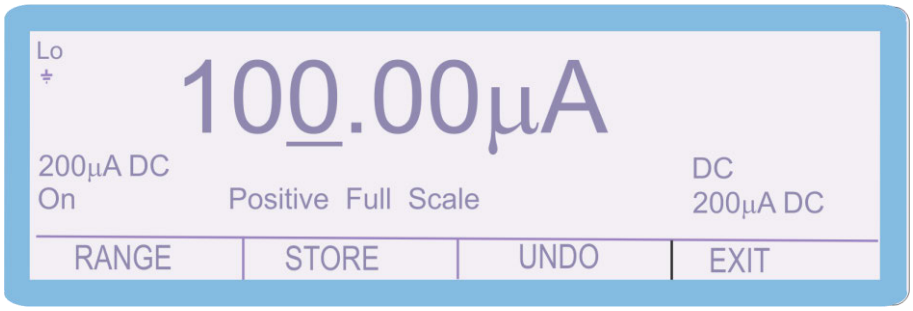
3. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter '200uA DC' and then press **SELECT** soft key



3. The Calibrator will now change to the 200uA DC range. Use the Range Up / Range Down keys to select the Positive Full Scale adjustment point

4. Connect the calibrator output voltage terminals to the precision multimeter. Ensure that the multimeter is in DC Current on the appropriate range. Ensure that the correct terminals / current shunt is used for the various current outputs. The 3000A calibrators can output up to 30A AC current, which can blow the fuse / cause damage if the incorrect input is used

5. Press **OUTPUT ON** and measure the output.

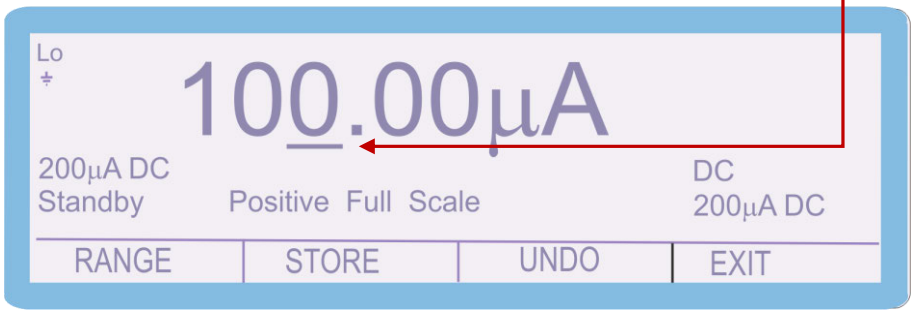


6. To adjust the output enter the value as measured on the multimeter

E.g. measured output = 99.90 uA, use the function control keys

9 **9** **•** **9** **0** **ENTER**

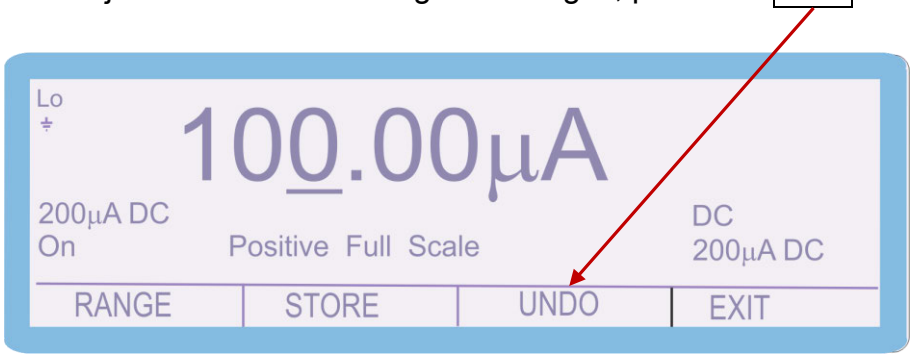
5. The output can also be adjusted by moving the 'cursor' to the required digit and adjusting the output using the up / down arrows or the digital control



6. The 'SHIFT' key will illuminate to indicate that a change has been made to the calibration of the instrument, however has not yet been stored.

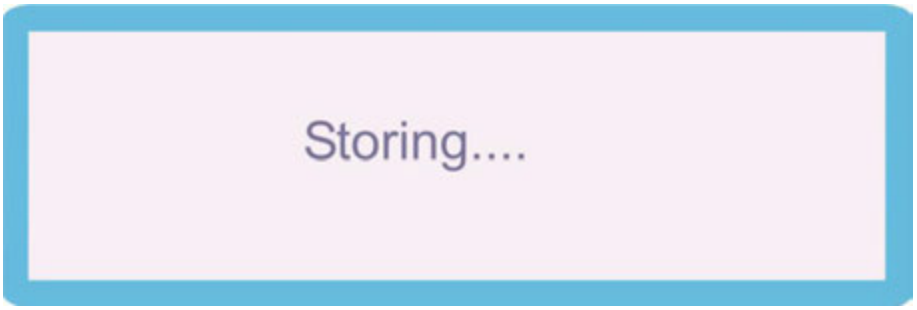
SHIFT

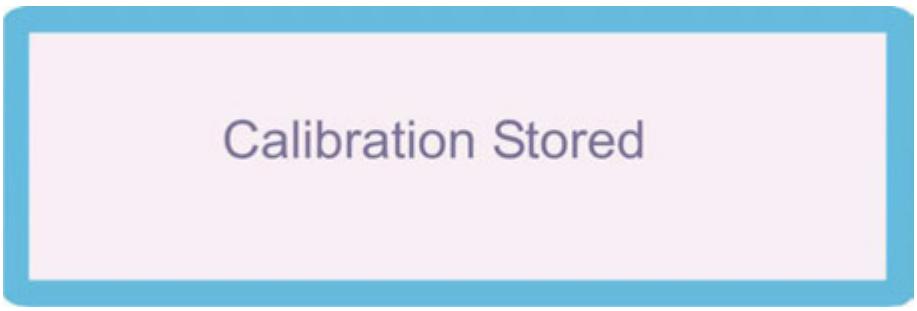
7. To undo the adjustment before storing the changes, press the UNDO soft key



This will remove any changes that have been made to the output of the calibrator.

7. Measure and check the output again and then press STORE soft key
The following 2 screens are displayed briefly to confirm that the calibration factors have been saved.



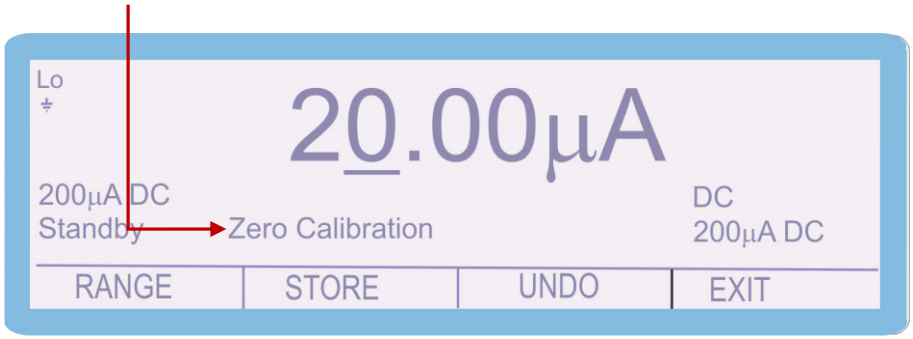


After displaying these messages, the shift key will also cease to be illuminated

SHIFT

Note: All the calibration points can be adjusted prior to storing the calibration factors (STORE), however if the calibration routine is ended or there is a power failure the new calibration factors will not be saved if STORE has not been pressed.

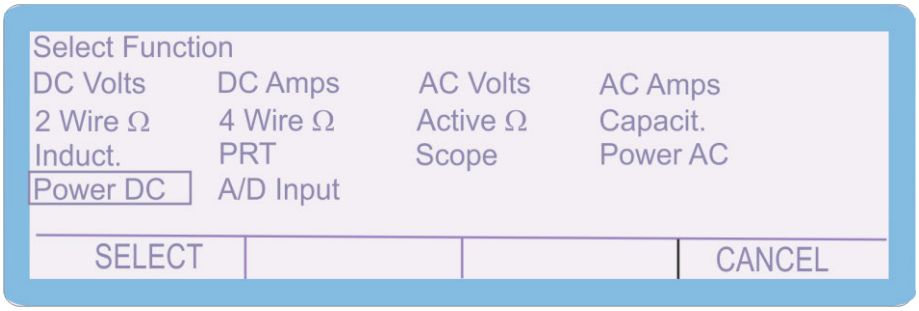
8. Use the ‘range up’ and ‘range down’ keys to change the calibration point to ‘Zero Calibration’.

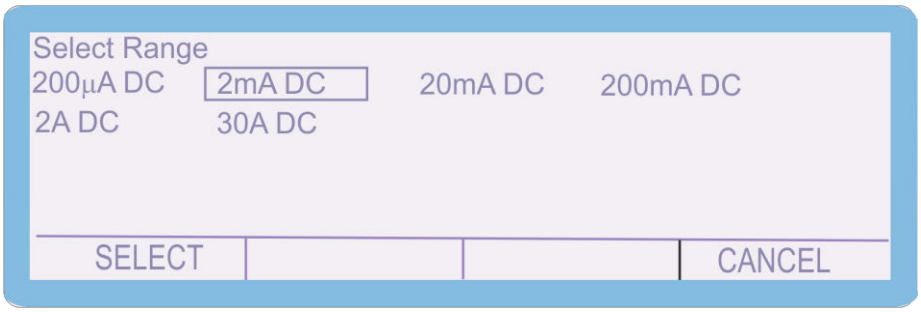


9. Measure the output as before; if necessary adjust as previously described above.

11. Measure the output as before; if necessary adjust as previously described above.

56. When calibration of this range is complete press the **RANGE** soft key
Select ‘DC Current’ and then ‘2mA ’ and proceed with this range as described above.



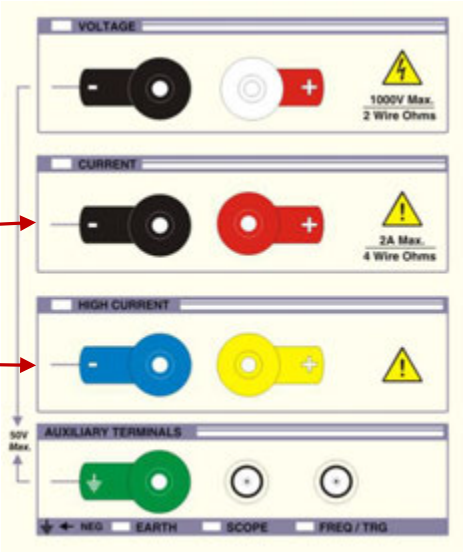


57. The ’2mA DC’, ‘20mA DC’,‘200mA DC’, ‘2A DC’ and ‘30DC’ ranges are calibrated in the same manner.

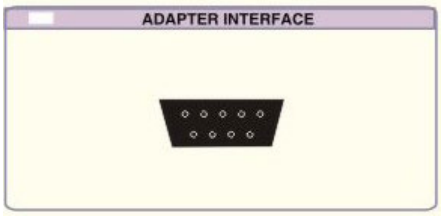
Remember to change the connections when calibrating the 30A range

Current connections - 200μA, 2mA, 20mA, 200mA and 2A ranges

High current connections 30A range

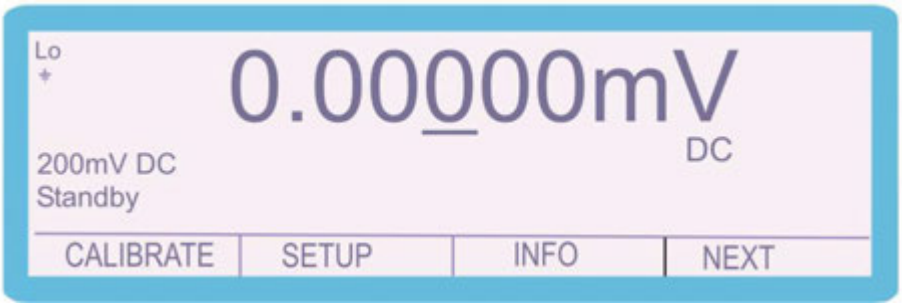


A/D Input

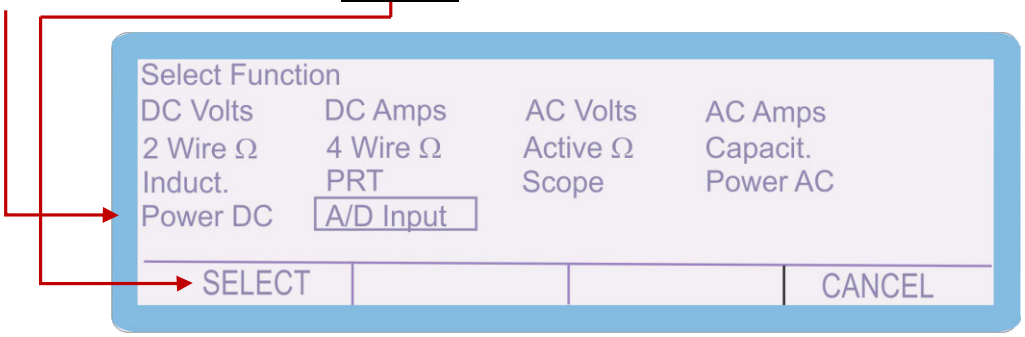


Injecting voltage between Pins 7 (Ground) and 9 (Input), the 3000A series calibrator can measure voltage. This is used for adapters with readback (such as EA001A, EA015 etc) as well as Pressure and Torque Modules

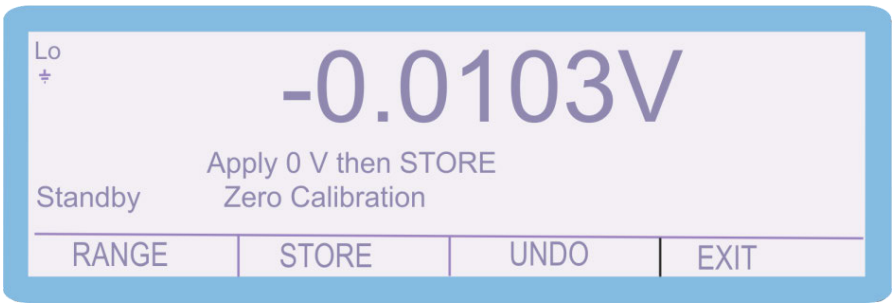
1. Select **CALIBRATE** using the soft key



2. Use the 'Digital Control' or the 'Arrow Keys' to highlight the required parameter 'A/D Input' and then press **SELECT** soft key

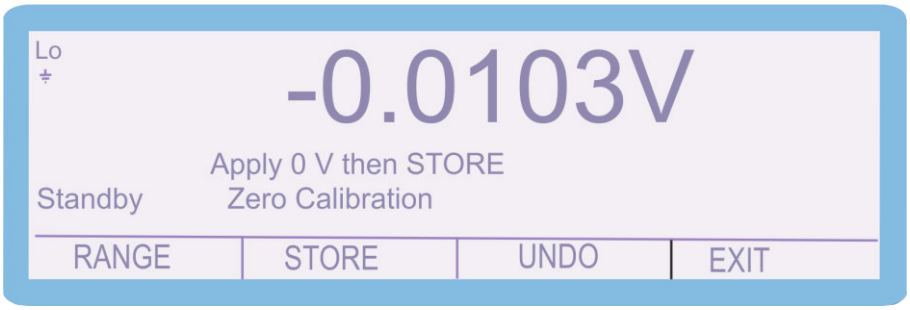


3. The Calibrator will now change to the A/D Input Screen. Use the Range Up / Range Down keys to select the Zero Calibration adjustment point

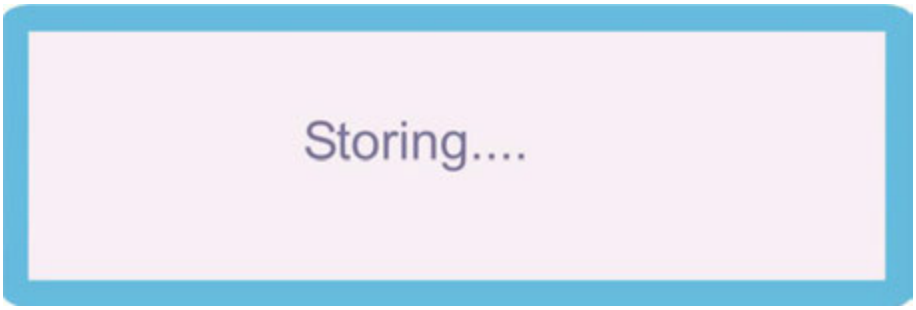


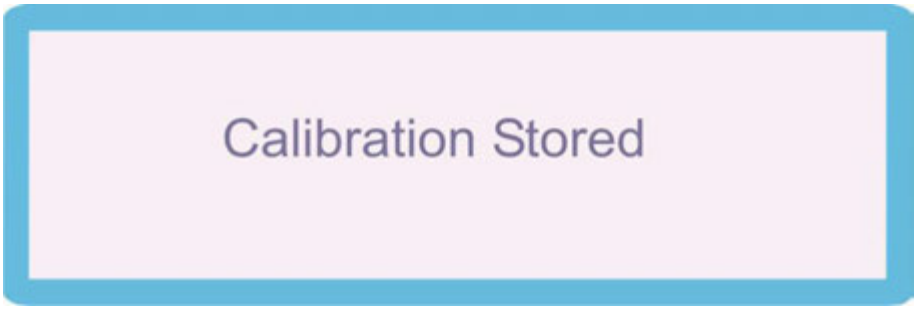
4. Apply an output of 0V from your voltage source to the adapter interface, using Pin 7 as the Ground or Negative connection, and Pin 9 as the Signal or Positive connection.

5. Wait for the reading to stabilise on the screen of the 3000A. After achieving a stable reading, press the ‘Store’ button.

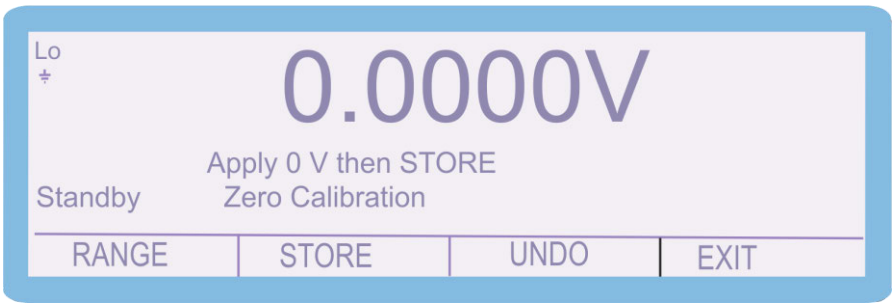


7. The following 2 screens are displayed briefly to confirm that the calibration has been saved.





The screen of the 3000A will now display 0V. If the reading is different, repeat the previous stages

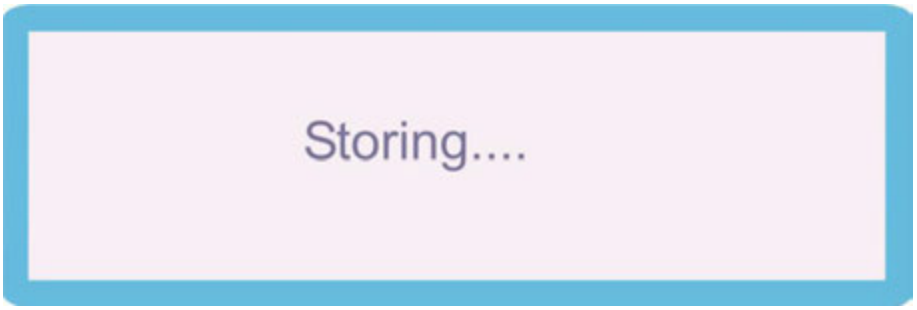


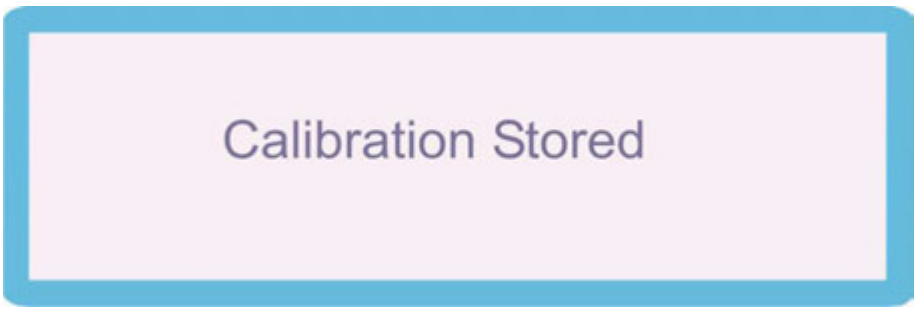
3. Using the Range Up / Range Down keys to select the Positive Full Scale adjustment point

4. Apply an output of 10V from your voltage source to the adapter interface, using Pin 7 as the Ground or Negative connection, and Pin 9 as the Signal or Positive connection.

5. Wait for the reading to stabilise on the screen of the 3000A. After achieving a stable reading, press the ‘Store’ button.

7. The following 2 screens are displayed briefly to confirm that the calibration has been saved.





The screen of the 3000A will now display 10V. If the reading is different, repeat the previous stages

3. Using the Range Up / Range Down keys, select the Negative Full Scale point, and repeat the