Interface 9310

Hand Held
Digital Load Cell/Pressure Meter
Operation and Instruction Manual

Table of Contents

1 Introduction

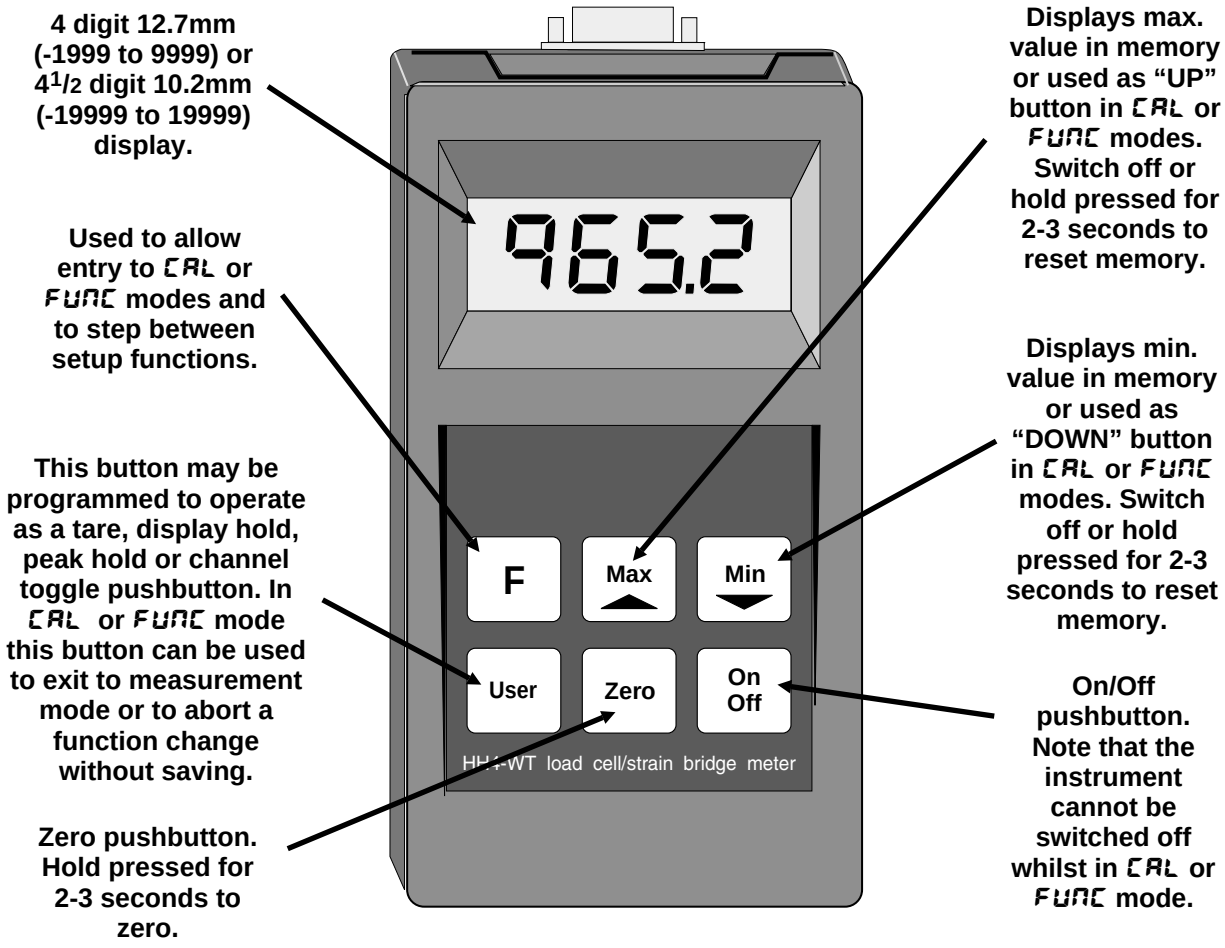
This manual contains information for the operation of the 9310 hand held load cell monitor. The 9310 is a high accuracy meter with the capability of high speed sampling. Sample rate is programmable in steps from 5 to 100 samples per second. The instrument has a full scale range of 0.5mV/V to 100mV/V. Up to 3 separate calibration values can be stored internally allowing switching between 3 load cells, or 3 scaling ranges, without the need to recalibrate each time.

When used with external memory options the 9310 can “read” the calibration scaling values stored in memory in the load cell connector shell. The instrument can then display the correct scaling value for each individual load cell which uses a memory device without the need for re-calibration.

The 9310 is supplied with RS232 communications as standard but by default this is disabled. See “Serial communications” chapter for DIP switch settings required for enabling the serial communications.

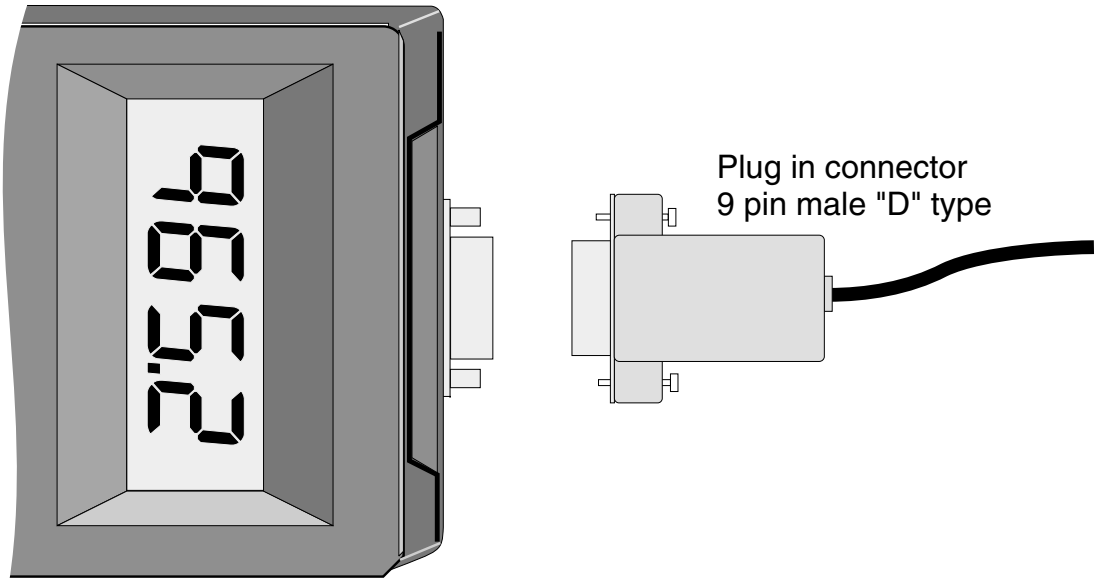
The 9310 has various calibration method options. It may be calibrated by applying two know weights to the load cell or by entering the mV/V value for the load cell or via a single offset value.

The 9310 is suitable for measuring weight, pressure, force, torque etc. from a 4 wire mV output transducer. Calibration, and set up functions are easily achieved via front pushbuttons.

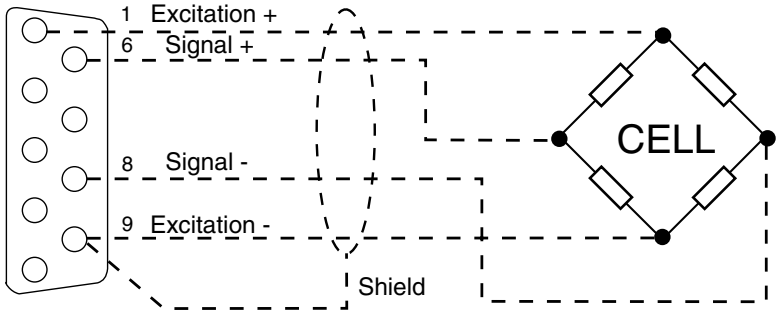


2 Electrical Connections

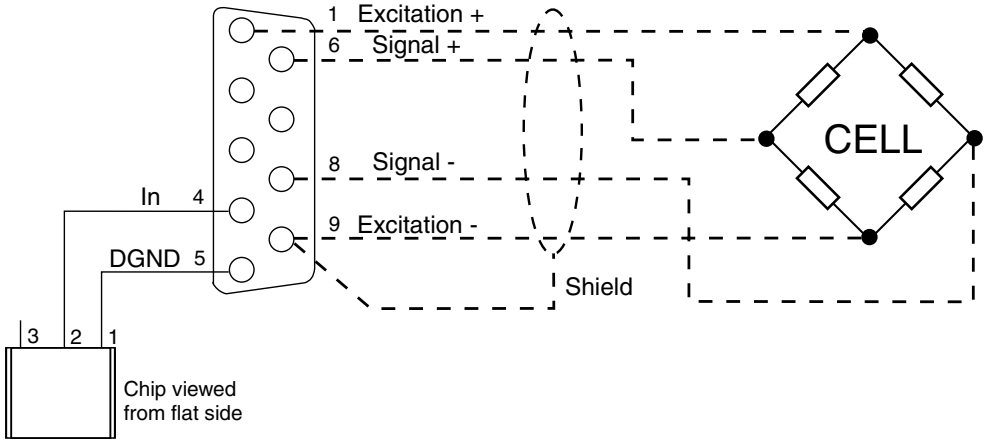
Power for the 9310 is provided by a 9VDC (216) battery. The battery cover is located at the underside of the case. External connections to the 9310 are as shown below.



Plug in connector
9 pin male "D" type



Connection with optional memory chip.



3 Explanation of Functions

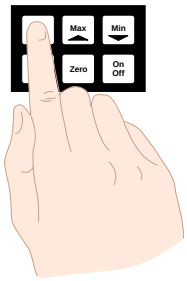
The 9310 setup and calibration functions are configured through a push button sequence. Two levels of access are provided for setting up and calibrating:-

FUNC mode (simple push button sequence) allows access to calibration channel selection, display rounding, decimal point and digital filter settings only.

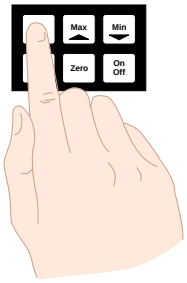
CAL mode (power up sequence plus push button sequence) allows access to all functions including calibration parameters.

Once CAL or FUNC mode has been entered you can step through the functions, by pressing and releasing the F push button, until the required function is reached. Changes to functions are made by pressing the ▲ or ▼ push button (in some cases both simultaneously) when the required function is reached. Any changes to a function will not be saved until the F button is pressed to accept the change.

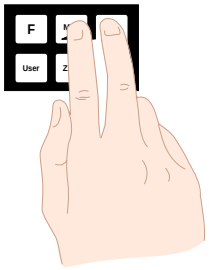
Entering CAL Mode



1. Switch off the instrument. Hold in the F button and switch on. The display will indicate CAL as part of the "wake up messages" when the CAL message is seen you can release the button.

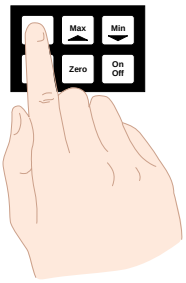


2. When the "wake up" messages have finished and the display has settled down to its normal reading press then release the F button.

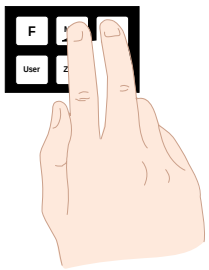


3. Within 2 seconds of releasing the F button press then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Entering FUNC Mode



1. Switch on the instrument. When the "wake up" messages have finished and the display has settled down to its normal reading press then release the F button.



2. Within 2 seconds of releasing the F button press then release the ▲ and ▼ buttons together. The display will now indicate FUNC followed by the first function.

Function	Description
CHNL	Cell calibration selection - selects one of the three possible calibration channels (CH 1, CH2, CH3, also CH.A 1 if the optional external memory chip is used - see "External memory" chapter). The CHNL function allows the instrument to be calibrated to up to 3 different load cells and hold the calibration values in internal memory. Alternatively 3 different calibration scaling values may be entered for a single cell, allowing the same cell to display in different units e.g. Kilonewtons, Kilograms & Tonnes. The user may select the load cell to be used via this CHNL function or via the "User" pushbutton if the pushbutton has been programmed for this purpose (see USER function). To scale any of these independent calibration memories you may use either the CAL 1/SCL 1 & CAL2/SCL2 methods or the ECAL/ESCL method. Simply select the required cell number prior to scaling then scale using whichever calibration method best suits the application. The channel selected will always default to CH 1 (or CH.A 1 if external memory is used) at switch on. In addition to independent calibration scalings for each channel selected each channel can be assigned different decimal point (dCPt), digital filter (FLtr), mV/V input range (rnGE) and sample rate (rAtE) settings.
drnd	Display rounding - displays and sets the display rounding value. This value may be set to 1 - 5000 displayed units. Display rounding is useful for reducing the instrument resolution without loss of accuracy in applications where it is undesirable to display to a fine tolerance. (example: if set to 0.5 the instrument will display in multiples of 0.5 i.e. 0, 0.5, 1.5 . 2.0 etc.).
Unit	Unit address - this function is used to display or set a unit address to one or more optional external memory devices. For identification purposes each device should be allocated an address if more than one external memory is used. When a sensor with a memory chip is plugged in the Unit function can be used to view the address of the memory device. The address can be set from 1 to 250. If address 255 is seen this indicates that the device has not had yet had an address set. If a memory device has had an address set then the address can be viewed or altered at this function. The procedure for setting or altering an address is as follows. **1.** The CHNL function must be set to either CH.A 1 i.e. a memory device must be connected. **2.** With the external memory device connected enter function mode and step through to the Unit function. **3.** Use the ▲ or ▼ arrow to select the required address for that chip then press F to accept the change. The address selected will now be stored in that memory device. The same address can be allocated to more than one memory device and the address of a device can be changed at any time by following steps 1, 2 & 3 above.
dCPt	Decimal point selection - displays and sets the decimal point. By pressing the ▲ or ▼ pushbuttons the decimal point position may be set. The display will indicate as follows: 0 (no decimal point), 0. 1 (1 decimal point place), 0.02 (2 decimal point places) or 0.003 (3 decimal point places). 3 decimal places is the maximum for both 4 & 4 1/2 digit displays.
FLtr	Digital filter - displays and sets the digital filter value. Digital filtering is used for reducing susceptibility to short term interference. The digital filter range is selectable from 0 to 8, where 0 = none and 8 = most filtering. A typical value for the digital filter would be 3. The digital filter uses a weighted averaging method of filtering which will increase the display update time at higher settings.
CAL mode functions Entry via CAL mode (see first page of this chapter) must be made in order to view and adjust the functions which follow.	

<table>
<tr><td>rnGE</td><td>Full scale mV/V output of transducer - displays and sets the full scale mV/V range to suit the load cell transducer usable range and is selected in steps as follows:
0.5, 1.0, 2.5, 5.0, 10, 20, 40 and 80
If there is no exact match to your transducer choose the next highest setting e.g. if your load cell has a 2mV/V output then choose 2.5 as the range setting. Choosing a setting higher than required will result in a loss of resolution. Choosing a setting lower than required may result in the overload display "----"</td></tr>
<tr><td>rAtE</td><td>Sample rate - displays and sets the ADC sample rate from 5 to 100 samples per second and may be selected in steps as follows:
5, 10, 15, 20, 30, 40, 50, 60, 80 and 100
For best resolution choose the lowest acceptable sample rate. A resolution table can be found in the Specifications chapter.</td></tr>
<tr><td>USEr</td><td>User pushbutton function - in normal measurement mode the User push button can be programmed to operate in one of the modes described below. In CAL or FUNC modes pressing the User button will cause the instrument to immediately return to normal measurement mode. Any changes to the function selected when the button was pressed will not be saved.
Displays and sets the user pushbutton function. This function may be set to any one of the following shown in the table below:
<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>nonE</td><td>No function</td></tr>
<tr><td>tArE</td><td>Push button tare - the pushbutton must be pressed for 2-3 seconds to perform a tare operation. When tare is selected you can toggle between the nett, tare and gross displays via the User pushbutton. The message grOS.nEtt or tArE will precede the measurement value.</td></tr>
<tr><td>d.HLd</td><td>Display hold - Press the User button momentarily to hold the display the message HOLd will flash every few seconds. Press the F button to reset back to normal display. If the User button is held pressed for 2-3 seconds the held value in memory will be reset and a the current value will be held. The display will automatically reset to normal measurement after 20 seconds.</td></tr>
<tr><td>P.HLd</td><td>Peak hold - Press the User button momentarily to hold the peak value display the message P.HLd will flash every few seconds. Press the F button to reset back to normal display. If the User button is held pressed for 2-3 seconds the peak value in memory will be reset and a the current value will be become the new peak value. The display will automatically return to normal measurement after 20 seconds.</td></tr>
<tr><td>CHnL</td><td>Change calibration channel - Allows toggling between input readings for calibration channels CH.A 1 (if memory device fitted) CH 1.CH2&CH3. If switched off then the instrument automatically reverts to CH 1 (or CH.A 1) when switched on again.</td></tr>
<tr><td>Prnt</td><td>This function is not used with standard 9310 instruments.</td></tr>
</table></td></tr>
</table>

CAL 1 & CAL2

2 point calibration scaling - this is an alternative calibration method to the ECAL method of scaling, note that only one method needs to be used (See "Use of ECAL and ESCL as reference values" if using CAL 1 & CAL2). The CAL 1 & CAL2 functions are used to set two independent calibration/scaling points of the input to the display. This method uses two different live input values to scale the instrument. The method is as follows:

1. Enter the setup functions via CAL mode and choose the required channel number at the CHNL function. The channel number selected will be the channel for which this calibration scaling operation applies.

2. Step through the functions by pressing and releasing the F button until the display indicates CAL 1.

3. Press then release, the ▲ and ▼ buttons simultaneously to enter the calibration functions.

4. The display will now indicate CAL 1 (1st calibration point) followed by a "live" reading.

5. Apply a known input to the instrument of nominally 0% (this value is not critical and may be anywhere within the measuring range of the instrument). For example you could arrange that the load or pressure is zero at this time. When the live reading has stabilised press the F button.

6. The display will indicate SCL 1 (scale 1) followed by the scale value in memory.

7. Use the ▲ or ▼ button to obtain the required scale value.

8. Press the F button, the display will now indicate CAL End (indicating that calibration of the first point is complete).

9. The display will now indicate CAL2 (2nd calibration point). If you do not wish to enter the second point at this stage then press and release the F button until the FUNC End message is seen. If you wish to enter the second point at this stage press the ▲ and ▼ buttons simultaneously.

10. The display will now indicate CAL2 (2nd calibration point) followed by a "live" reading.

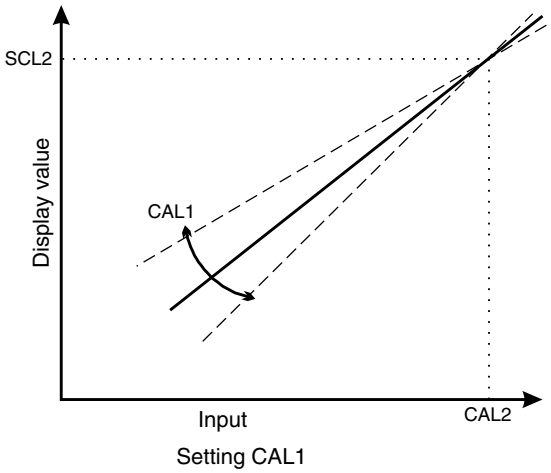
11. Apply an input of 100% (again this value is not critical, but there must be at least 10% of rated capacity difference between CAL 1 and CAL2 inputs. For best accuracy the difference between CAL 1 and CAL2 inputs should be as large as possible).

12. When the reading has stabilised, press the F button, the display will now read SCL2 (scale 2) followed by the second scale value in memory.

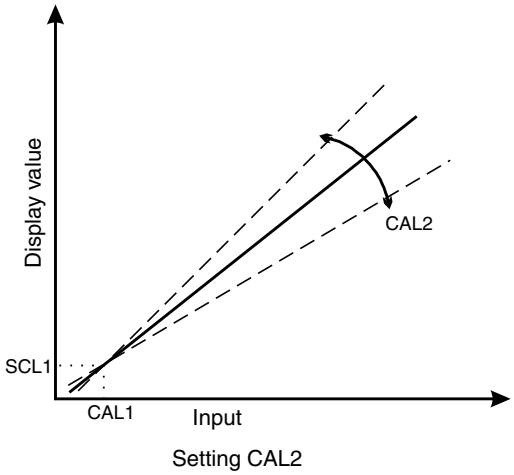
13. Use the ▲ or ▼ button to obtain the required scale value.

14. Press the F button, the display will now read CAL End (indicating that calibration of the second point is complete). The display will now move to the next function.

2 Point calibration graphs



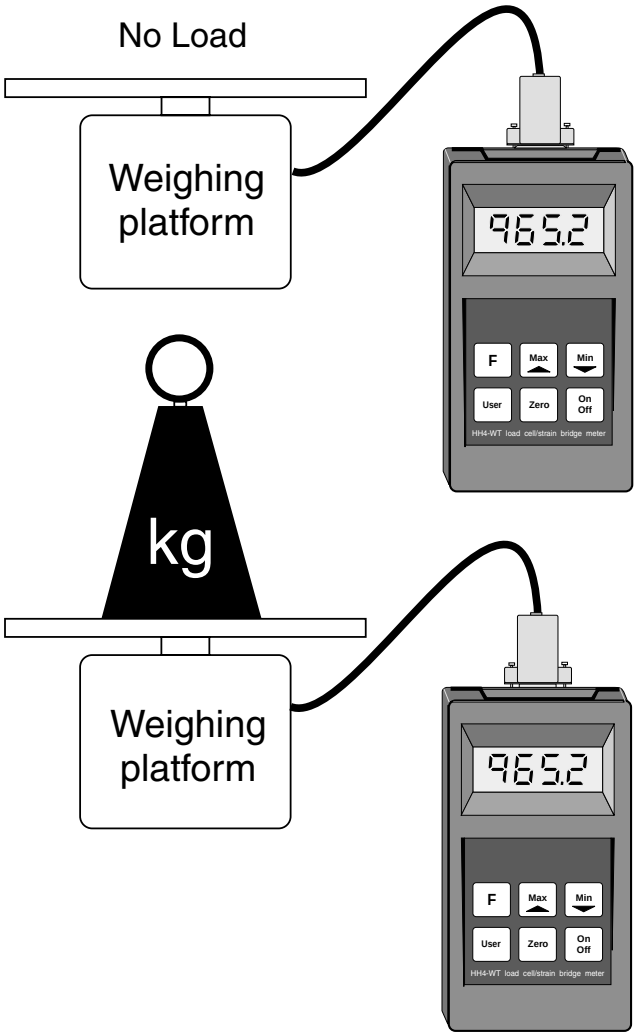
Setting CAL1



Setting CAL2

CAL 1 & CAL2 cont.

Example - 2 point calibration



Perform CAL 1 and SCL 1 operation with no load or low load.

Perform CAL2 and SCL2 operation with load. The load must be significantly different to the CAL 1 load (at least 10% of capacity difference).

ECAL	mV/V calibration - this is an alternative calibration method to the CAL 1&CAL2 method of scaling, note that only one of these methods should be used. The ECAL method allows the known rated mV/V value of the load cell to be entered followed by the maximum capacity of the load cell in whatever measuring units are required. The mV/V value is entered to 3 decimal places (3 decimal places will automatically appear up when you enter ECAL). Maximum ECAL value is 9.999 for a 4 digit display or 19.999 for a 4.5 digit display. If an the mV/V figure is greater than the 9310 allows you can divide the ECAL and ESCL values by the same amount to give the correct scaling e.g. for a 4 digit display with an 18.000mV/V input with a full scale reading of 1000 you could enter the ECAL value as 9.000 and the ESCL value as 500. Note: Steps 1. to 6. which follow can be completed with or without a load cell being connected, step 7 requires the load cell to be connected. The ECAL/ESCL procedure is as follows: **1.** At the ECAL function press then release ▲ and ▼ simultaneously to enter the ECAL mode. **2.** The display will show the previous mV/V value (or the mV/V value calculated by the 9310 if its last scaling was via CAL 1&CAL2). Use the ▲ or ▼ pushbutton to enter the known rated mV/V value of your load cell. **3.** Press F to store this mV/V value in memory. **4.** The display will now show ESCL followed by the previous scale value. **5.** Use the ▲ or ▼ pushbutton to enter the full scale value of your load cell in the measuring units you are using e.g. kilograms, tonnes etc. **6.** Press F to accept this new value. Note: it is important that the actual full scale value for the cell, i.e. maximum rated load, is entered and not simply the maximum load it will be used to in your application. **7.** Once the ESCL value has been entered connect the cell to the instrument. With zero load on the cell use either the SEt ZERO function or operate the Zero button. This operation is required to give a zero load reference point to the instrument to eliminate any zero offsets present in the lad cell. **Use of ECAL and ESCL as reference values.** If using the two point calibration method (CAL 1 & CAL2) the mV/V value and scale is automatically calculated and stored at the ECAL and ESCL functions. After calibration using CAL 1 & CAL2 the ECAL and ESCL values may be viewed and a note taken of their value, ensure that you do not change either the ECAL or ESCL values whilst they are being viewed. If the instrument is accidentally recalibrated incorrectly the ECAL and ESCL values recorded can be re-entered to scale the instrument back to the same load cell. Note that the mV/V reference value stored at the ECAL function will only match the manufacturers rated mV/V value for the load cell if CAL 1 and CAL2 were carried out at exactly 0% and 100% of rated load. For example if the manufacturer states that the load cell has a 2.000mV/V output and CAL 1 & CAL 2 were carried out at 0% and 50% of rated load then the ECAL reference value you would expect to see would be approximately half of the rated mV/V i.e. approximately 1.000 mV/V.
CAL OFSt	Offset calibration - allows the instrument calibration to be offset by a single point value. This value is added or subtracted across equally the range of the instrument. This scaling method is used to correct for a constant error in the reading. The procedure is as follows: **1.** Press then release ▲ and ▼ simultaneously to enter the CAL OFSt function. The display will show the current display value. **2.** Press the F button. The display will show SCLE followed by the previous scale value. **3.** Use the ▲ or ▼ button to alter this scale value to the required reading for the current input load. **4.** Press F to accept the new scale value. The display will show OFSt End to indicate that the offset calibration scaling has been completed.

ZERO RNGE	Zero range - the zero range function is expressed as a percentage of full range (0.0 to 100.0%). The full range input is calculated by the SCL2 figure minus the SCL 1 figure for 2 point calibration or the ESCL figure if ECAL calibration is used. If the display value (as a percentage of range) is greater than the percentage selected in the ZERO RNGE function then any attempt to zero the display will be aborted and a ZERO RNGE Err message will be seen, the beeper will also sound repeatedly. If the zero operation is successful then the instrument will beep once and the ZERO message will be seen prior to the display value going to 0. A zero range setting of 0.0 will mean that no zero operation is possible, a zero range setting of 100.0 will mean that the display can be zeroed at any time no matter what the display value at the time. Example: A load cell is calibrated using 2 point calibration the SCL 1 figure is 10 and the SCL2 figure is 70. If the ZERO RNGE function is set to 30.0 (30.0 percent) then the display can only be zeroed if the display is below approximately 18. This is calculated by (SCL2 - SCL 1 x 30%) i.e. (70 - 10) x 0.3 = 18. Note that the zero operation is cumulative i.e. the zero operations are added in memory. For example if the display is scaled to read from 0 to 1000 and the zero range is set at 20.0% then the 9310 will allow multiple zero operations up until a total 200 (20% of 1000 = 200) units have been zeroed off. So, for example if the 9310 will allow a zero with a reading of 50, a second zero with a display reading of 100 but a third zero with a display reading of 70 will not be allowed since 50 + 100 + 70 = 220 which is over the limit of 200 set by the 20.0% zero range selection. The best solution to allow zeroing beyond this is to set a new calibration zero reference point via the CAL ZERO function, alternatively the ZERO RNGE setting can be increased.
CAL ZERO	Zero reference - this function allows the user to select a zero position anywhere within the input range. The CAL ZERO function is provided to allow a zero reference for the ZERO RNGE function only and does not form part of the calibration scaling i.e. display values are not affected by a CAL ZERO operation. Press the ▲ and ▼ buttons simultaneously to execute this function, a live reading will be seen. Press the F button to enter this as the new zero reference. The message ZERO End will be seen to confirm that the operation has been completed. The zero range memory will now be cleared.
SET ZERO	Set zero - used to set the load cell system to display reading of zero. The set zero point is entered when the load cell is installed and in a no weight condition. To operate the set zero function press, then release, ▲ and ▼ simultaneously, a live reading will be seen. Press the F button to zero the display. The message ZERO End will be seen to confirm that the operation has been completed. If the zero point set by this function is lost due to subsequent front pushbutton zero operations then it can be recovered via the CLR ZERO function (see below). The SET ZERO function operates in the same manner as the **Zero** pushbutton on the instrument. The input at the time of the SET ZERO operation will now show as a zero display but the calibration scaling slope is not affected.
CLR ZERO	Clear zero - the clear zero function allows the zero point to be set back to the position programmed at the SET ZERO function. Press the ▲ and ▼ buttons simultaneously to execute this function. The message End will be seen to confirm that the operation has been completed.
P.OFF	Power off time - selects the automatic power off time in minutes. This function allows the instrument to conserve battery power by automatically powering down if a button has not been pressed for the number of minutes selected. Selections allow range from 0 to 300 minutes. If 0 minutes is selected then the instrument will not automatically power down and must be switched off via the “On Off” pushbutton.
P.dLY	This function is not used with standard 9310 instruments.
bAud RAtE. PrtY O.Put Addr	See “Serial communications” chapter.

3 .1 Error messages

"----" This message indicates that the mV input is higher than the 9310 is expecting. This could be due to an incorrect **rnGE** function setting or an incorrectly wired or faulty load cell.

"-or-" This message indicates that the 9310 is being asked to display a number which is too large e.g. a number greater than 9999 on a 4 digit display. Check that the instrument has been correctly calibrated and that the display range required is not greater than the number of digits on the display.

"**2Er0 rnGE Err**" This message means that the **2Er0 rnGE** function setting has stopped the zero operation. If you wish to proceed with the zero operation then you will find that either the **2Er0 rnGE** value needs to be changed or a **CAL 2Er0** operation carried out.

"**Adc GAIn Err**" This message indicates that the **ECAL** value selected is higher than the **rnGE** setting. Check the settings and adjust either the **ECAL** or **rnGE** setting as required.

"**SPAn Err**" This message indicates that the change in load between **CAL 1** and **CAL2** was not enough. The change must be a minimum of 10% of rated capacity of the load cell/pressure sensor to allow calibration.

"**LobAtt**" This message indicates a low battery voltage. Fit a new battery. The **P.OFF** function can be used to automatically switch the instrument off after a selected time of no operation to extend the life of the battery.

"**P.OFF**" This message indicates that the instrument is about to automatically power down, see **P.OFF** function.

"**Auto Err**" This message indicates that a memory chip has been detected but that an error has occurred usually due to a unit address not being assigned to the chip. Check that the memory chip has been assigned an address - see **Unit** function for procedure. It may be necessary to manually change the **CHnL** function to **CH.A 1** to be able to view and change the **Unit** function.

4 Function Table

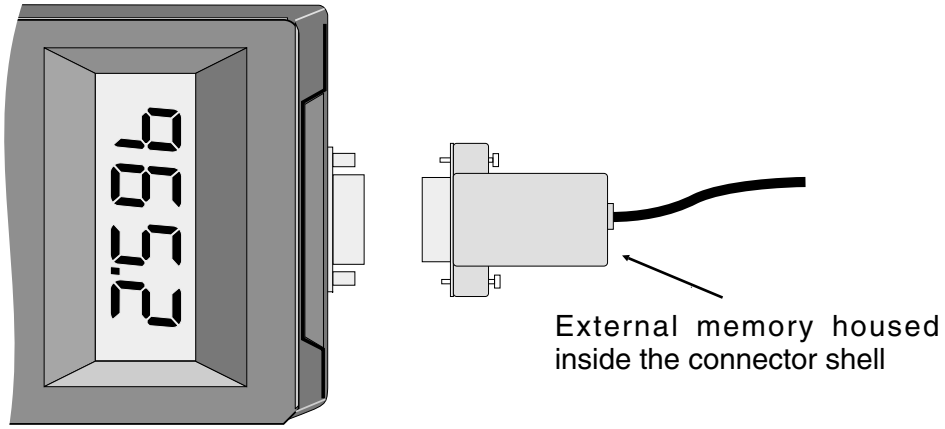
Initial display	Meaning of display	Next display	Default Setting	Record Your Settings
CHNL	Cell number selection	CH 1, CH 2 or CH 3 (and CH.A 1 if external memory used)	CH 1	
drnd	Display rounding selects resolution	Value in memory	1	
Unit	Unit address for external memory	1 to 255	255	
dCPt	Display decimal point	Decimal pt position (0.0.1, 0.02 or 0.003)	0	
FLtr	Digital filter range 0 to 8	0 to 8 (8 = most filtering)	2	
Functions below are accessible only via CAL mode				
rnGE	Full scale mV/V range	0.5, 1.0, 2.5, 5.0, 10, 20, 40, or 80	5.0	
rAtE	Sample rate (samples per second)	5, 10, 15, 20, 30, 40, 50, 60, 80 or 100	10	
USEr	"User" pushbutton function	nONE, tArE, P.HLd, d.HLd, CHNL or Prnt	nONE	
CAL 1	Calibration standard two point	See "Explanation of functions" chapter	n/a	
CAL2	Calibration standard two point	See "Explanation of functions" chapter	n/a	
ECAL	Calibration by entering mV/V value	See "Explanation of functions" chapter	n/a	
CAL OFSt	Offset calibration	See "Explanation of functions" chapter	n/a	
2Er0 rnGE	Allowable % reading for zero operation	0.0 to 100.0	10	
CAL 2Er0	Calibration zero	See "Explanation of functions" chapter	n/a	
SEt 2Er0	Set zero	See "Explanation of functions" chapter	n/a	
CLr 2Er0	Clear zero	See "Explanation of functions" chapter	n/a	
P.OFF	Auto power off time (minutes)	0 to 300	10	
P.dLY	Not used with standard 9310 instruments			
The functions below relate to serial communications - see "Serial communications" chapter.				
bAud rAtE	Baud rate	300, 600, 1200, 2400, 4800, 9600, 19.2, 38.4	9600	
PrtY	Parity	nONE, EUEn or Odd	nONE	
O.PUt	Output mode	di SP, Cont or POLL	Cont	
Addr	Unit address	0 to 31	0	

5 External memory

An external memory option is available for the 9310. This external memory will normally be housed inside the 9 pin “D” connector shell connected to the load cell.

Note: the optional external memory each memory device should be allocated a unit address, see **Unit** function. Valid addresses are 1 to 250. If the **Unit** function indicates an address of **255** then this indicates that the memory device has not been given an address. The same address can be allocated to more than one memory device and the address of a device can be changed at any time.

See “Electrical connections” chapter for details of electrical wiring for the memory device.



Calibration and setup with external memory

The calibration and setup procedures are identical those described in the “Explanation of functions” chapter. If connected to a load cell with an external memory device then you simply need to ensure that the channel you wish to calibrate (**CH.A 1**) is selected prior to any calibration or setup.

Taking readings with external memory

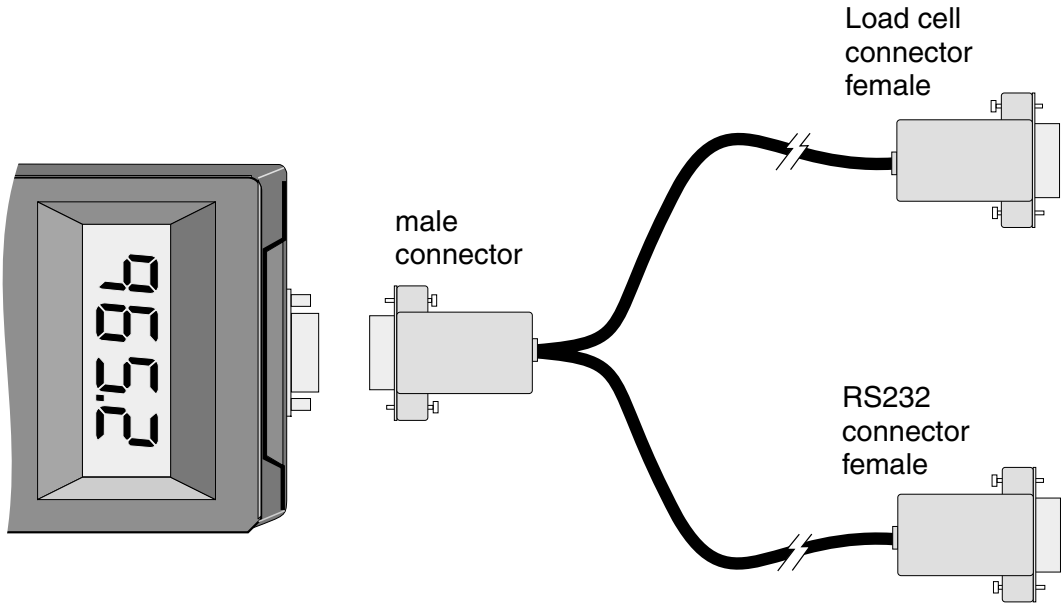
Once the load cell with external memory is connected to the 9310 the instrument will automatically display the calibrated scaling figures for that load cell. Simply ensure that the required channel (**CH.A 1**) is selected prior to taking a reading, the **CH.A 1** channel should automatically be selected when the 9310 detects that a memory device is connected.

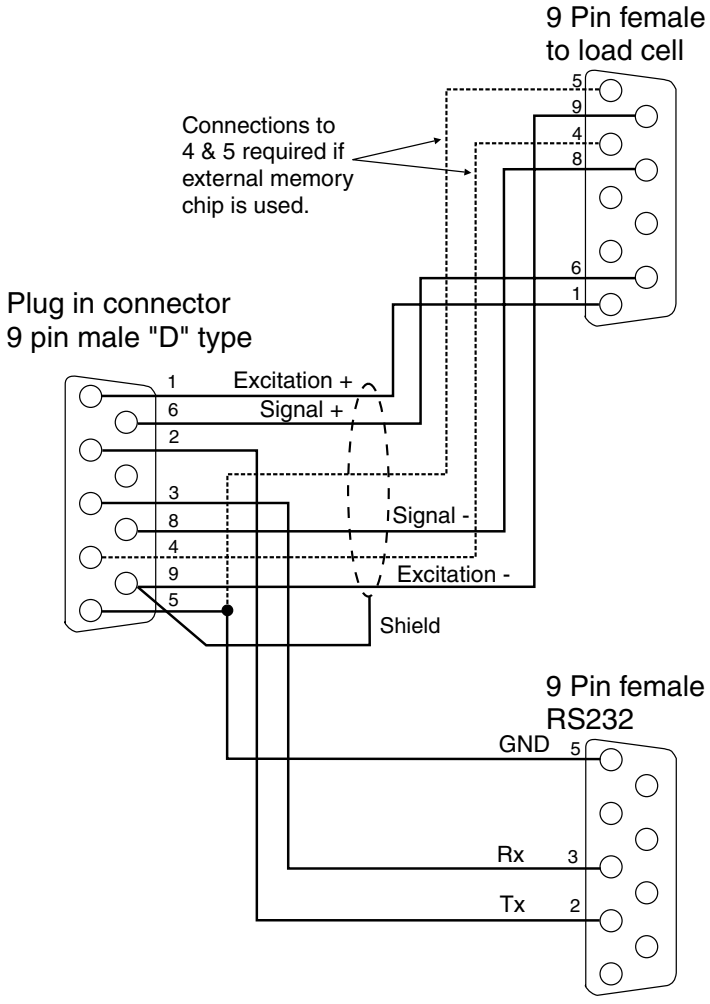
6 Serial communications

RS232 communications allowing continuous or polled downloading of the display data is possible on the 9310 instrument.

Electrical connections.

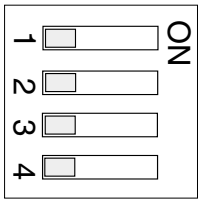
The diagram below shows the electrical connections for a 9310 with both serial and load cell connectors. This dual lead arrangement allows for a convenient connection to the load cell and serial port. Note: an adaptor may be required to allow connection directly to a serial port.





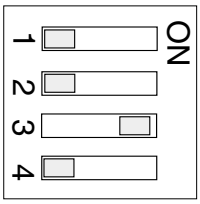
DIP switch settings.

The RS232 communications can be enabled or disabled via a DIP switch SW7 located at the display end of the 9310 circuit board. Switch 3 of this DIP switch is used to switch the communications facility on or off as detailed below. To gain access to the DIP switch remove the four screws at the rear of the 9310 case and remove the back. The back is connected to the circuit board via a ribbon cable, there is no need to unplug this cable. Once the back is removed SW7 should be visible at the top edge of the circuit board.



SW7

Switch 3 off.
Communications disabled.



SW7

Switch 3 on.
Communications enabled.

With the communications enabled the following extra functions will be seen:

bAudrAtE (set baud rate)

Select from 300. 600. 1200. 2400. 4800. 9600. 19.2 or 38.4 baud.

PrtY (set parity)

Select parity check bit to either nONE, EUEn or odd.

O.PUt (set RS232/485 interface mode)

Select di SP, Cont or POLL

Allows user to select the RS232/485 interface operation as follows:-

di SP	Sends image data from the display without conversion to ASCII. This mode is intended for use only when the 9310 is used to transmit data to a compatible display.
Cont	Sends ASCII form of display data every time display is updated.
POLL	Controlled by computer or PLC as host. Host sends command via RS232 and the instrument responds as requested in ASCII form. See “Poll commands” section which follows.

Addr (set unit address for polled (POLL) mode (0 to 31)).

Allows an individual address to be assigned to a number of 9310 instruments. The instrument will respond with its address proceeding the display reading.

The unit address ranges from 0 to 31 (DEC) but is offset by 32 (DEC) to avoid clashing with ASCII special function characters (such as <STX> and <CR>). Therefore 32 (DEC) or 20 (HEX) or SPACE (ASCII) is address 0 whilst 42 (DEC) or 2A (HEX) or * (ASCII) is address 10.

If the host computer or PLC etc. uses address 0 when polling then the 9310 connected to the host will always respond no matter what the Addr function setting. If the host uses any other address then only instruments with the same address will respond to a polling command.

Poll commands - *Host Controlled Transmit Mode:*

This mode requires a host computer or PLC to poll the instrument to obtain display or other information or reset various setpoint parameters. Communications software often known as a “terminal” program is required when using Poll mode.

When polling the 9310 it is essential that the command characters are sent with less than a 10mS delay between them. This means that each command line must be sent as a whole string e.g. <STX>PA<CR> is sent as one string rather than <STX> on one line followed by P etc. If testing using “Telix” or other software this is normally achieved by allocating a command string to a function key. Whenever the function key is operated the whole string is sent.

The format used is ASCII (8 data bits + 1 stop bit) so, for instance, if address 1 is used then the string <STX>PA<CR> would typically be put into the terminal program as:

^BP!^M

where: ^B is the ASCII character for STX

P is the command line to transmit the primary display value

! is the ASCII character for address 1 (33 Dec of 21 Hex)

^M is the ASCII character for CR

A typical format for the host command is as follows:-

<STX>CA<CR> (Standard read)

Where:	<STX>	is Start of Text Character (2 Dec, 02 Hex, ^B ASCII)
	C	is the command character (see following commands)
	A	is the unit address (Range: 32 to 63 Dec, 20 to 3F Hex, "SPACE" to ? ASCII, the address is offset by 32 Dec, 20 Hex)
	<CR>	is Carriage Return (13 Dec, 0D Hex, ^M ASCII)

The POLL commands available and instrument responses are as follows:

1. Transmit Primary Display Value: <STX>PA<CR>

e.g. ^BP!^M in the terminal program (address 1).

Instructs unit to return the primary display value. The primary value is the main display reading e.g. load or pressure. Format of returned data is:-

<ACK>PAXYYYY<CR>

Where:	<ACK>	is Acknowledge (6 Dec, 06 Hex)
	P	echo command received 'P' (80 Dec, 50 Hex)
	A	is the responding unit's address
	X	SPACE for positive and '-' for negative
	YYYY	is the display value in ASCII
	<CR>	is a Carriage Return (13 Dec, 0D Hex)

The number of display characters returned depends on the number of display digits present. If the decimal point is non zero then it will be sent in the appropriate place as '.' (46 Dec, 2E Hex).

2. Transmit Secondary Display Value: <STX>SA<CR>

e.g. ^BS!^M in the terminal program (address 1).

Instructs the unit to send the secondary display value. The value will equal the primary display value if the USER function is set to NONE. If the USER function is set to tARE, d.HLd, P.HLd or CHNL the value for the selected operation will be returned . Format of returned data is:

<ACK>SAYYYY<CR> or
<ACK>SAYYYY,YYYY<CR> in the case of HiLo

Where:	<ACK>	is Acknowledge (6 Dec, 06 Hex)
	S	echo command received 'S' (83 Dec, 53 Hex)
	A	is the responding unit's address
	YYYY	is the secondary display value in ASCII
	<CR>	is a Carriage Return (13 Dec, 0D Hex)

For NONE the primary and secondary display values will be identical.

If tARE is used then the primary display value transmitted will be the live input value i.e. the gross value. The secondary display value transmitted will be the tared value i.e the nett value.

For d.HLd and P.HLd the secondary display will be the held value and the primary display the live input value.

For CHNL the secondary display returned data will be the channel number i.e. 1, 2 or 3.

3. Transmit Instrument Model and Version: <STX>IA<CR>

e.g. ^BI!^M in the terminal program (address 1)

Instructs unit to return the model and version number of the instrument.

Format of returned data is:-

<ACK>IACCX.X<CR>

Where:	<ACK>	is Acknowledge (6 Dec, 06 Hex)
	I	is echo command received 'I' (73 Dec, 49 Hex)
	A	is the responding unit's address
	CC	a 2 character model identifier ("Ht" for the 9310)
	X.X	is the version number (e.g.: "0.1")
	<CR>	is a Carriage Return (13 Dec, 0D Hex)

4. Invalid Command

If the command received from the host is not valid then the unit may return the following:-

<ACK>?A<CR>

Where:	<ACK>	is Acknowledge (6 Dec, 06 Hex)
	?	is the character '?' (63 Dec, 3F Hex)
	A	is the responding unit's address
	<CR>	is a Carriage Return (13 Dec, 0D Hex)

If the address received from the host does not match the units address then the unit will not respond at all.

7 Specifications

Technical Specifications

Input:	Ratiometric 4 wire strain gauge
Input sensitivity:	0.5mV/V to 100mV/V selectable
Bridge compatibility:	80Ω to > 2000Ω
Excitation:	5VDC
Accuracy:	Up to 0.005% of full scale dependant upon sample rate selection
Sample rate:	5 to 100 per sec selectable
ADC resolution:	Up to 22 bits, see table and uV calculations below
ADC conversion:	Sigma Delta
Microprocessor:	MC68HC11 CMOS
Ambient temperature:	0 to 50°C
Humidity:	5 to 95% non condensing
Display:	Model 9310-4C 4 digit 12.7mm (-1999 to 9999) or model 9310-5C 4 1/2 digit 10.2mm (-19999 to 19999)
Power supply:	Battery 9VDC type 216 (alkaline recommended)
Communications:	Inbuilt RS232 communications
Low battery warning:	Lo bAtt message + beeper

Options

External memory:	Memory chip, 9 pin D connector & shell

Physical Characteristics

Dimensions:	80mm (w) x 145mm (l) x 32 to 39mm (d)
Connections:	9 Pin “D” connector, female at instrument end
Weight:	250 gms. including battery

Effective Resolution (Bits) 9310 Over Full Scale							
	mV/V Input						
Samples/ Second	0.5mV/V	1mV/V	2.5mV/V	5mV/V	10mV/V	25mV/V	50mV/V or 100mV/V
5	15.5	16.5	17.5	18.5	19.5	20.5	20.5
10	15.5	16.5	17.5	18.5	19.0	19.0	19.0
15	15.5	16.5	17.5	18.5	18.5	19.0	19.0
20	15.5	16.5	17.5	18.0	18.5	18.5	18.5
30	15.5	16.5	17.5	18.0	18.5	18.5	18.5
50	15.0	16.0	16.5	17.0	17.5	17.5	17.5
100	14.0	14.0	14.5	14.5	15.0	15.0	14.5

Note: Figures in the table above apply when the digital filter setting is 0. Add 0.5 bits effective resolution for each step on the digital filter setting e.g. if the digital filter is set at 4 add 2 bits of effective resolution to each of the figures in the table above.

Resolution in uV can be calculated using the resolution in bits figures above. These uV resolution values are calculated by the following method:

Resolution (uV) = full signal input voltage range / number of divisions of resolution.

e.g. for 2.5mV/V range full signal input voltage is 2.5mV x 5V excitation = 12.5mV.

For 14.5 bits (100 samples/sec, zero filter) the number of divisions is $2^{14.5}$ which equals 23170 divisions. For 21.5 bits (5 to 30 samples/sec, filter setting of 8) the number of divisions is 2965820 ($2^{21.5}$).

Resolution (uV) at 14.5 bits = (2.5 mV x 5) / 23170 = 0.54uV

Resolution (uV) at 21.5 bits = (2.5 mV x 5) / 2965820 = 0.0042uV

8 Guarantee and Service

The product supplied with this manual is guaranteed against faulty workmanship for a period of 2 years from the date of dispatch.

Our obligation assumed under this guarantee is limited to the replacement of parts which, by our examination, are proved to be defective and have not been misused, carelessly handled, defaced or damaged due to incorrect installation. This guarantee is VOID where the unit has been opened, tampered with or if repairs have been made or attempted by anyone except an authorised representative of the manufacturing company.

Products for attention under guarantee (unless otherwise agreed) **must be returned to the Interface Inc. freight paid** and, if accepted for free repair, will be returned to the customers address in Australia free of charge.

When returning the product for service or repair a full description of the fault and the mode of operation used when the product failed must be given.

In any event the manufacturer has no other obligation or liability beyond replacement or repair of this product.

Modifications may be made to any existing or future models of the unit as it may deem necessary without incurring any obligation to incorporate such modifications in units previously sold or to which this guarantee may relate.