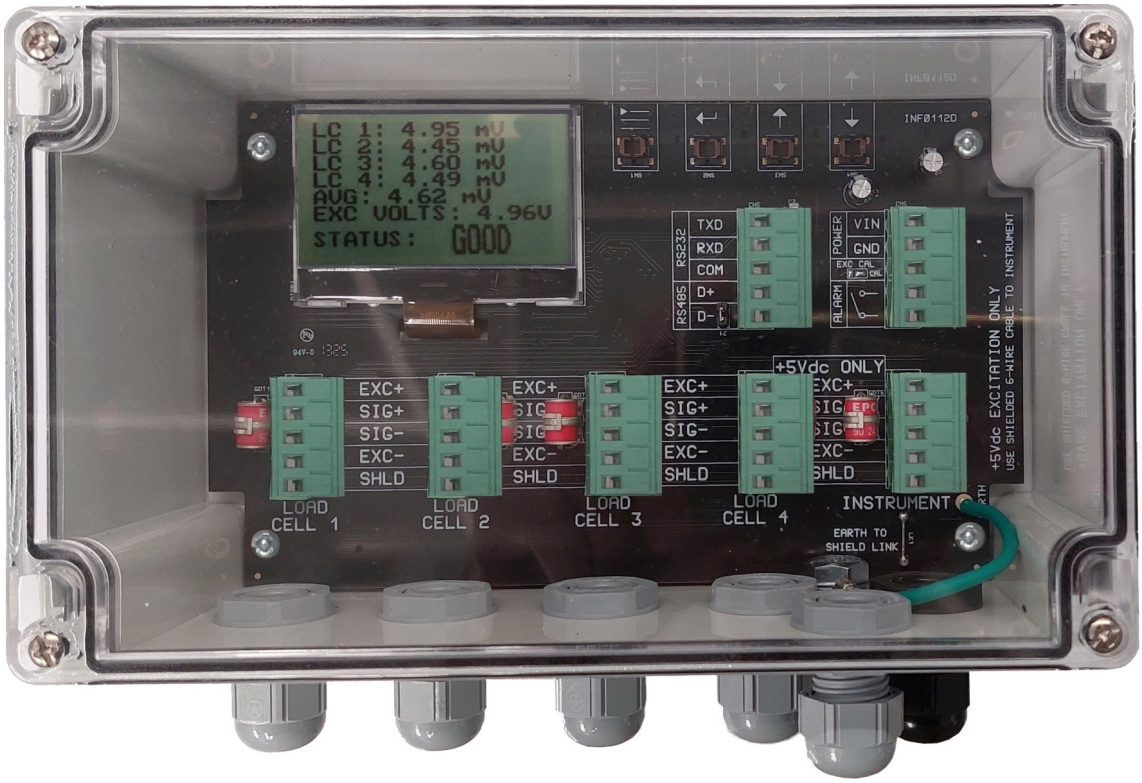
NCS580

SMART Load Cell Junction / Summation box with Fault Monitoring

Manual – English 2.01



Introduction

The SMART load cell junction / summation box allows for easy connection / summation of 1 to 4 load cells to be connected in parallel to the host load cell instrumentation. The smart junction box continuously monitors each individual load cell as well the excitation voltage. A relay output is de-energised if any of the listed below alarm conditions are met or if power to the SMART junction box is off.

The SMART junction box can be powered from the host weighing instruments excitation voltage or by an external power supply.

The SMART junction box can detect an error if any of the following occurs:
- An open or short circuit on any of the load cells or connectors
- Any of the load cells are open circuit or any load cell has exceed 3.5mV/V
- Any load cell exceeds the user set low or high mV range
- Any of the load cells is out of balance with the user set error band
- The excitation voltage is above or below the user set limits.

The SMART junction box immediately detects fault conditions and prevents incorrect weighing and product waste. The avoidance of production downtime and ease of installation makes the SMART junction box and invaluable tool.

1 Features

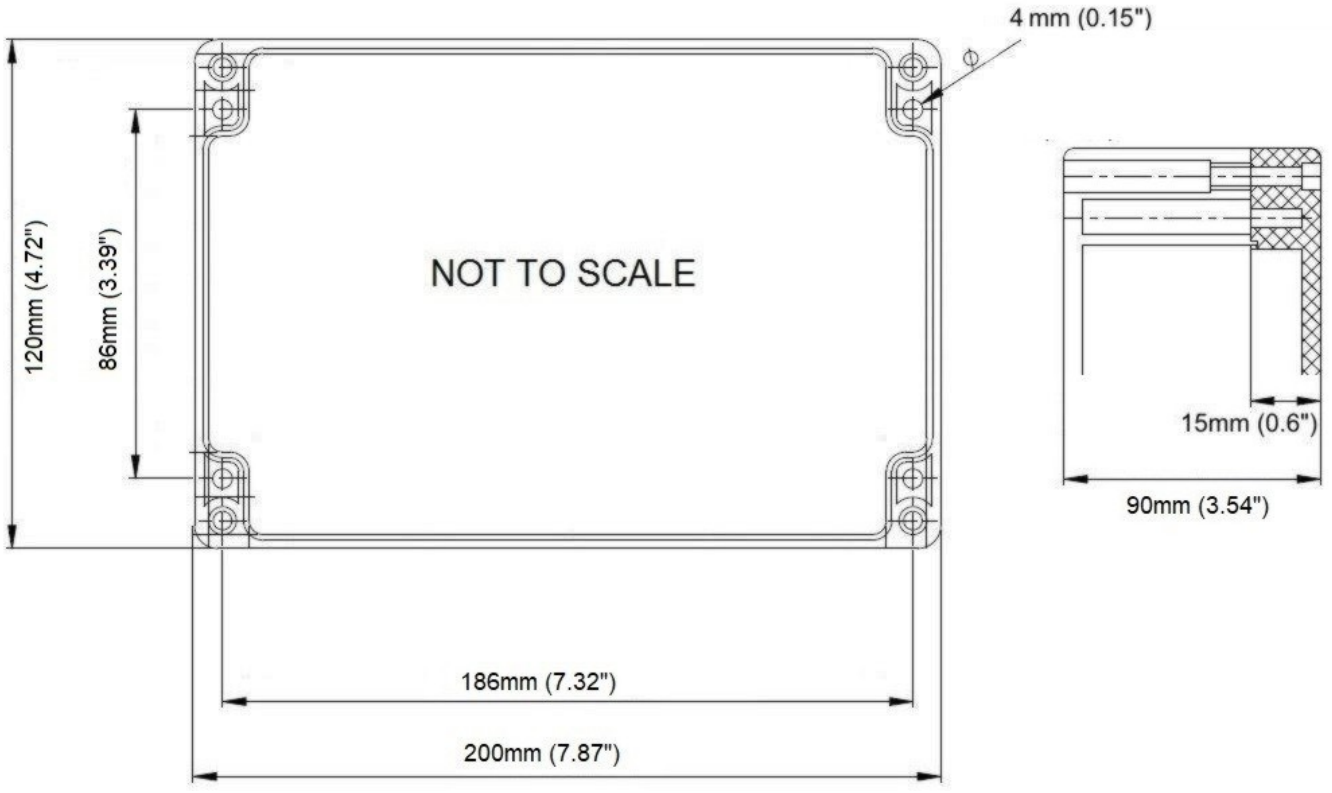
- **Easy connection / summation of 1 to 4 load cells in parallel**
- **Continuously monitors the state of the connected load cells**
- **Continuously monitors the excitation voltage**
- **Displays the individual mV value of each connected load cell**
- **Displays the average of the connected load cells**
- **Displays the alarm / status condition**
- **Provides a relay which is de-energised when a fault is detected or power to the smart junction box is off.**
- **Host excitation or self powered mode**
- **Includes Gas Discharge Tubes for surge protection**
- **Prevents incorrect weighing and wastage of product**
- **Eases load cell installation**
- **Removable connectors for easy fault finding**
- **1 year limited warranty**

2 Specifications

General:	
LCD Display	128x64 Full graphic sunlight readable monochrome display
LCD Backlight	Yellow/Green, User on/off control (Increase in power supply excitation current when on). Off by default.
Keypad	4 keys total
Warm up time	15 minutes
Environmental:	
Operating temperature	-10°C to 50°C (14°F to 122°F)
Storage temperature	-40°C to 80°C (-40°F to 176°F)
Operating and storage humidity	<85% RH non-condensing
Enclosure:	
Dimensions	200x120x90mm (7.87x4.72x3.54”)
Enclosure Sealing	Tongue and groove with Neoprene seal
Enclosure Material	Polycarbonate (grey base, clear lid)
Connectors Ratings	5 Way plug-in terminal blocks for load cells
Wire range	0.2-2.5mm2
Wire stripping length	7mm
Gland Clamping/sealing range	4-8mm (0.157-0.314”) Diameter wire
Electrical:	
Power Requirements:	
Power supply voltage (from host instrument excitation supply)	+5Vdc
Power supply current (from host instrument excitation supply) Excluding any connected load cells	75mA @ 5V (Backlight On) 50mA @ 5V (Backlight Off)
Power supply voltage (In excitation self powered mode, not using host instrument excitation supply)	+8Vdc to +13Vdc Reverse and over voltage protected
Power supply current (In excitation self powered mode, not using host instrument excitation supply)	75mA @ 12V (Backlight On) 50mA @ 12V (Backlight Off)
Alarm:	
Relay	Solid State Relay (SSR)
Contact rating	150mA @ 60V (DC)
Type	1-Form-B (Normally closed) (Relay is open when not in alarm condition) Relay is always energized.
Load Cell Input:	
Number of load cells (User Selectable)	1 to 4 (Software enabled)
ADC Resolution	24 bit Delta-sigma, Ratiometric
Input range	+-3.5mV/V
Conversion rate	80 updates/second, 20 updates/second per load cell
Input Impedance	>100MΩ
CMRR	>-110dB
Linearity	<0.01% of full scale
Accuracy	0.05% of full scale
Load cell connection	4 wire connection + shield
Cable compensation	Ratiometric

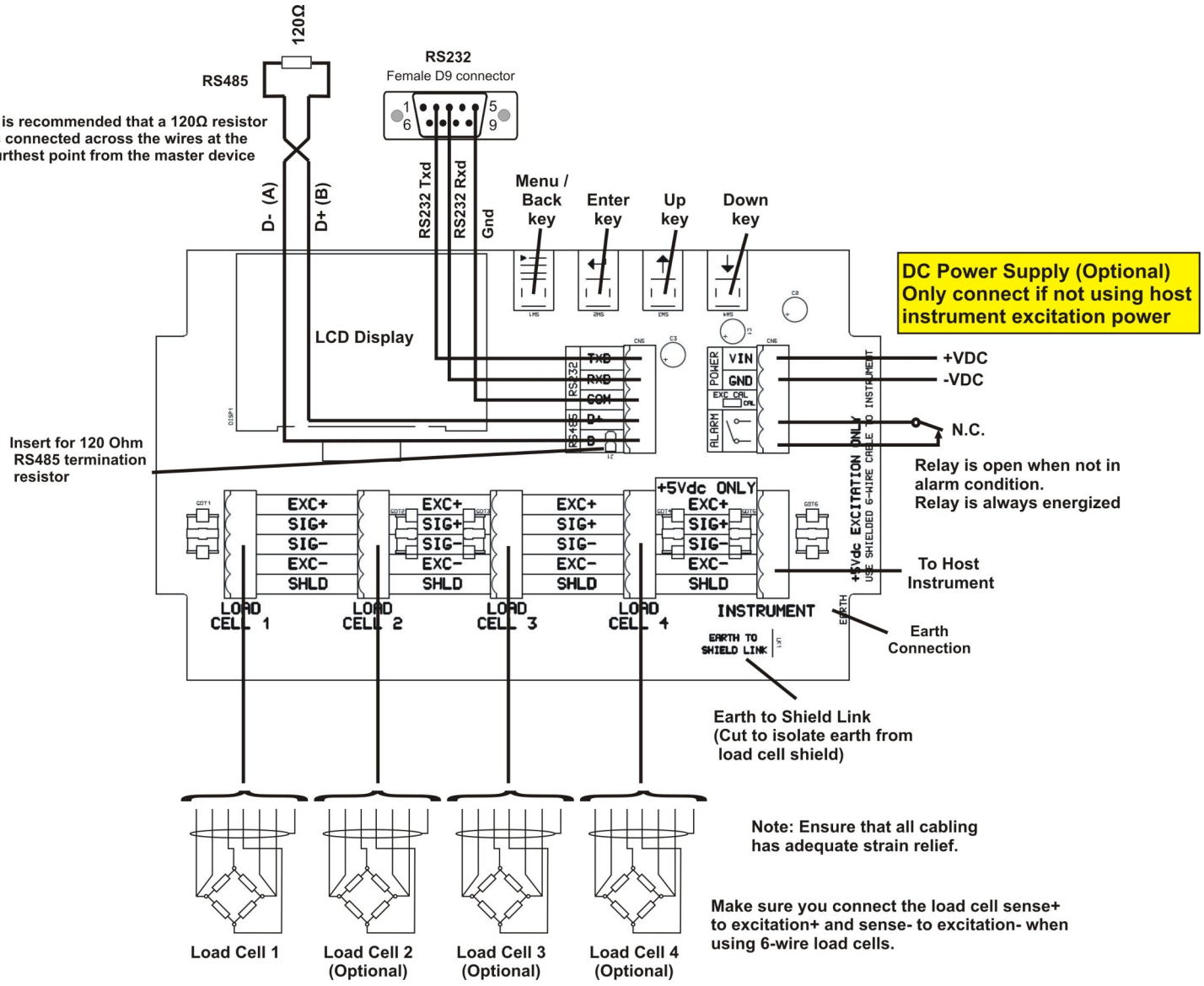
Output load (Host input impedance)	1M Ohm
Load Cell Excitation:	
Maximum excitation voltage (From instrument host)	5Vdc
Excitation Voltage (In excitation self powered mode, not using host instrument excitation supply)	+5Vdc Fixed
Protection:	
Gas Discharge Tube clamping voltage	+-90V
Main earth connection	External M8 Stud
Communications:	
Protocol	Modbus RTU Modbus ASCII
RS232 Communications	Baud rate: 1200,2400,4800,9600,19200,38400,57600,115200 Data bits: 7 or 8 bits Parity: Odd, Even or None Stop bits: 1 or 2 stop bits
RS485 Communications	Baud rate: 1200,2400,4800,9600,19200,38400,57600,115200 Data bits: 7 or 8 bits Parity: Odd, Even or None Stop bits: 1 or 2 stop bits Internal 120Ω field jumper selectable termination resistor Max 32 instruments per line

3 Dimension & Template Drawing



4 Installation

4.1 Connection Diagram



Note: Install with cable glands facing downwards and with cable drip loops

4.2 Load Cell Connection

Connect load cells “LOAD CELL 1” to “LOAD CELL 4” noting the load cells correct wiring positions (Use the grey glands). Connect a suitable shielded 6 wire cable from the load cell instrumentation to the smart junction box connector marked “INSTRUMENT” (Use the black gland). Connect the instrumentation cable wires sense+ to excitation+ and sense- to excitation- on the smart junction box instrument connector.

When making connection to the load cell make sure you use screened cable connected to a ground point at one side only. Avoid running cables in the same trunking as high current/voltage cables and cables supplying DC motors or contactors etc.

When connecting less than four load cells, start at Load Cell 1 and fill the remaining channels in numerical order. Set the number of “LOAD CELLS” in the Load Cell setup menu to correspond.

Make sure you connect the load cell sense+ to excitation+ and sense- to excitation- when using 6-wire load cells.

Notes:

- Tighten the gland nut until the rubber touches the cable completely and then tighten the nut with ½ turn (180 degrees)
- For unused glands either replace the glands with blank glands or insert a small off cut of wire to represent a “Dummy load cell” to block the hole.
- Install the junction / summation box with the cable glands pointing downwards with cable drip loops (If the cables and junction box is exposed to water then bend a short downward loop in all cables near the cord grips so any water draining down the cables will drip off before reaching the junction box.

Surge Protection

The SMART junction box needs to be earthed for the protection circuitry to function correctly. Connect the external M8 stud to the equipment earth with the minimum length of cable as possible.

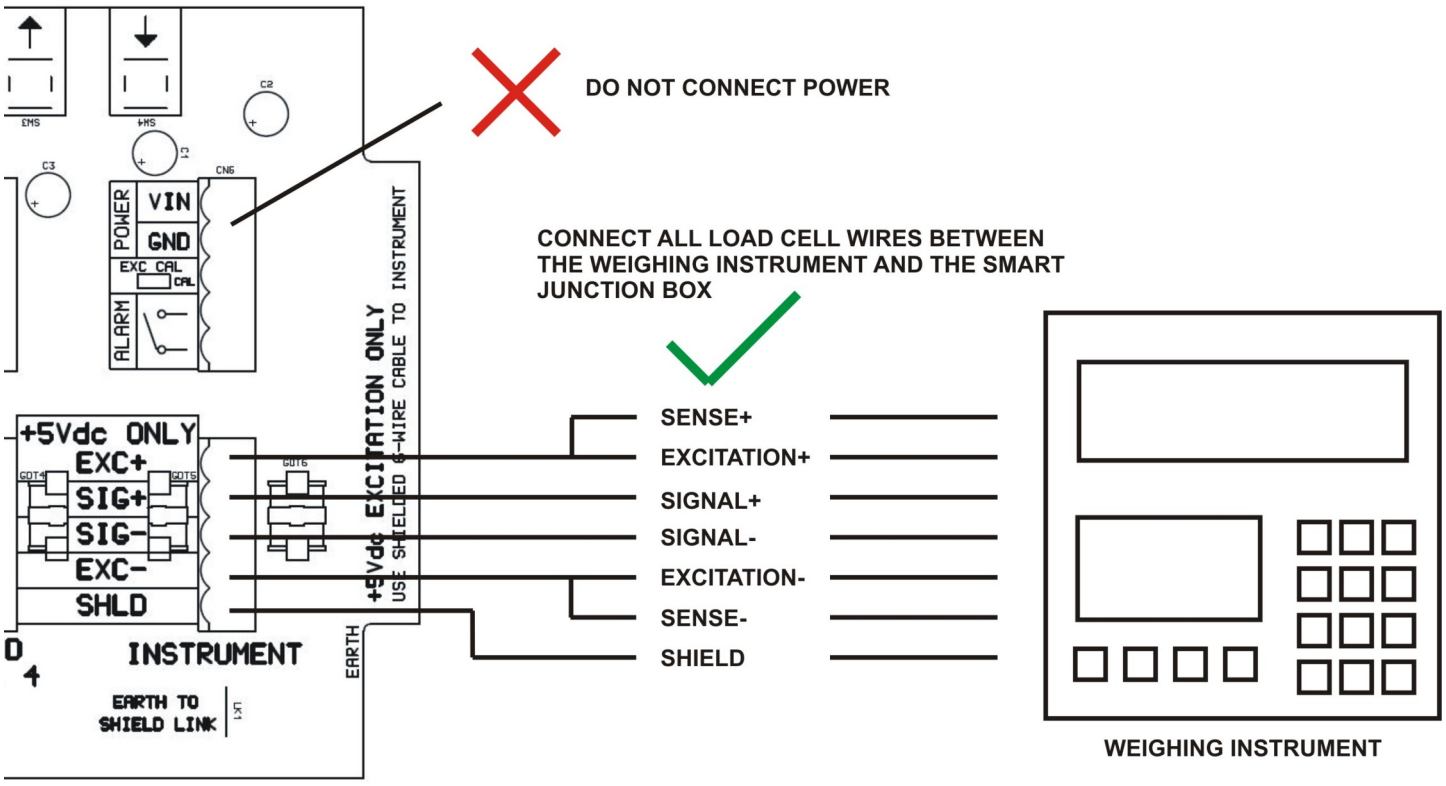
The SMART junction box provides both a screened earth and an isolated screen by cutting the shield to earth link on the PCB.

4.3 Powering the Smart Junction box

The SMART junction box can be powered either by the host instruments excitation voltage or by using an external power supply.

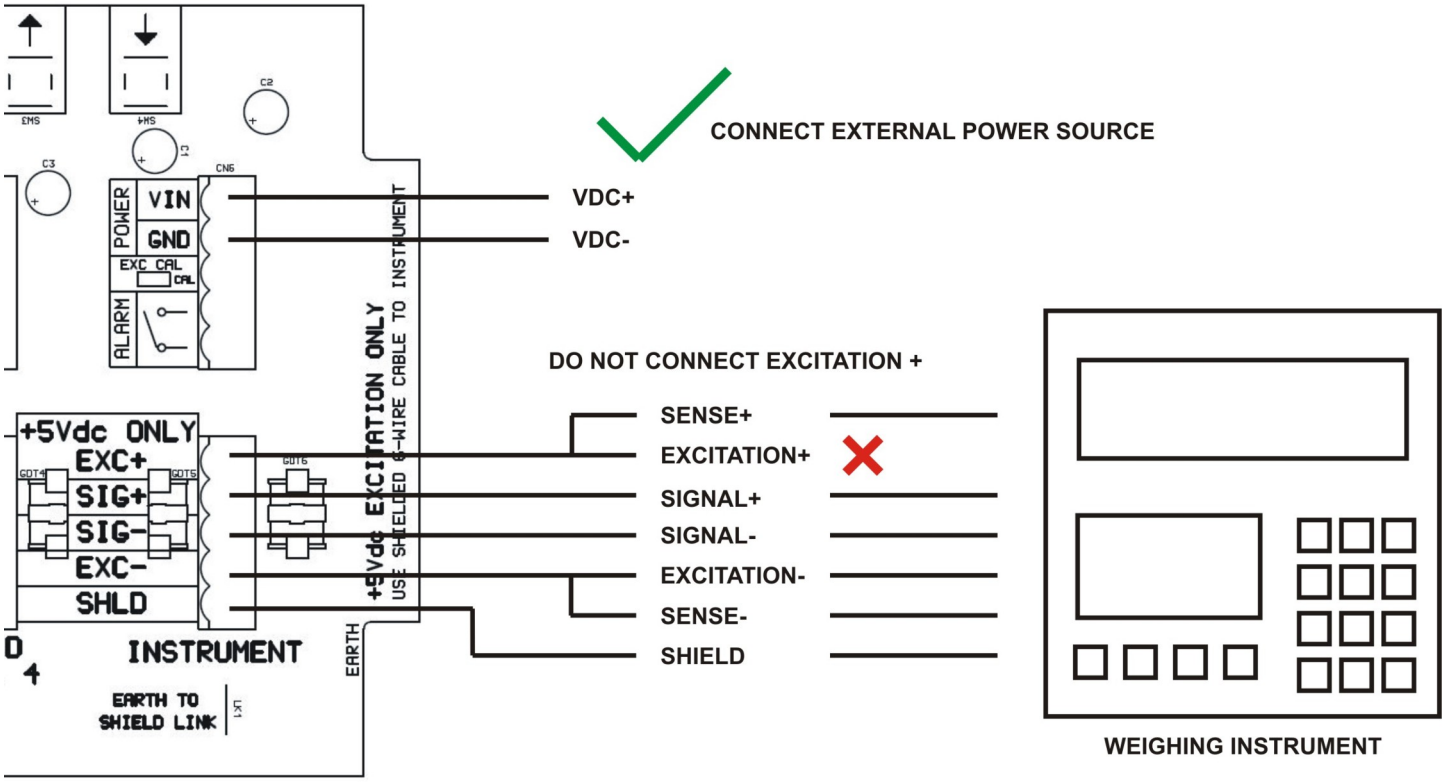
4.3.1 Host Instrument Powered

The host weighing instruments excitation voltage has to be +5Vdc and must be able to supply a working current (Excluding load cell current) of 80mA. **DO NOT CONNECT ANY POWER TO THE SMART JUNCTION BOX POWER INPUT.** Connect the SMART junction box as in the diagram below.



4.3.2 Self Powered (not using host instruments excitation supply)

Connect an external power supply of 8 to 15Vdc to the SMART Junction box power input. **Do not connect the excitation+ load cell wire to the host weighing instrument**. Connect the SMART junction box as in the diagram below.



4.4 RS232 Communication

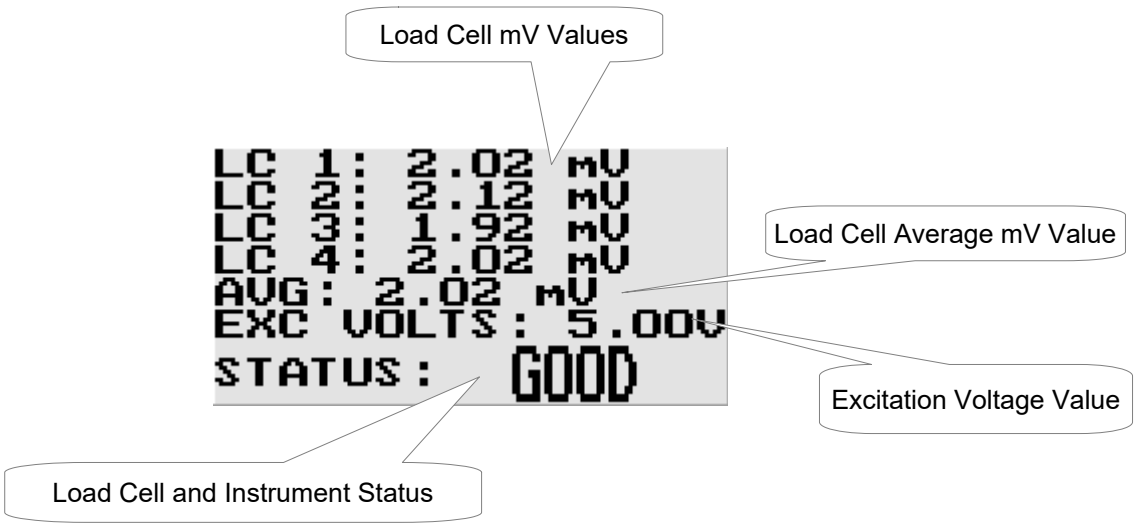
The RS232 port is used for firmware upgrades and communication.

4.5 RS485 Communication

The SMART junction box includes an on-board termination resistor which can be selected by linking J1 on the circuit board. The termination resistor is 120 Ohms.

5 Main Display

5.1 Main Display



5.2 Status Messages

The Load Cell system is functioning correctly and **NO ERRORS** are detected.

The load cell balance has exceeded the user set balance band. **CHECK WIRING, BALANCE BAND SETTING, LOAD CELL MOUNTING.**

The Excitation Voltage is below the user set limit. **CHECK WIRING, EXCITATION MIN SETTING.**

The Excitation Voltage is above the user set limit. **CHECK WIRING, EXCITATION MAX SETTING.**

Load Cell 1 is open/short circuit or has exceeded +-3.5mV/V (+-17.5mV). **CHECK WIRING AND POWER SUPPLY.**

Load Cell 2 is open/short circuit or has exceeded +-3.5mV/V (+-17.5mV). **CHECK WIRING AND POWER SUPPLY.**

Load Cell 3 is open/short circuit or has exceeded +-3.5mV/V (+-17.5mV). **CHECK WIRING AND POWER SUPPLY.**

Load Cell 4 is open/short circuit or has exceeded +-3.5mV/V (+-17.5mV). **CHECK WIRING AND POWER SUPPLY.**

Load Cell 1 has exceeded the user set load cell minimum setting. **CHECK WIRING, LC MIN SETTING, LOAD CELL MOUNTING.**

Load Cell 2 has exceeded the user set load cell minimum setting. **CHECK WIRING, LC MIN SETTING, LOAD CELL MOUNTING.**

Load Cell 3 has exceeded the user set load cell minimum setting. **CHECK WIRING, LC MIN SETTING, LOAD CELL MOUNTING.**

Load Cell 4 has exceeded the user set load cell minimum setting. **CHECK WIRING, LC MIN SETTING, LOAD CELL MOUNTING.**

Load Cell 1 has exceeded the user set load cell maximum setting. **CHECK WIRING, LC MAX SETTING, LOAD CELL MOUNTING.**

Load Cell 2 has exceeded the user set load cell maximum setting. **CHECK WIRING, LC MAX SETTING, LOAD CELL MOUNTING.**

Load Cell 3 has exceeded the user set load cell maximum setting. **CHECK WIRING, LC MAX SETTING, LOAD CELL MOUNTING.**

Load Cell 4 has exceeded the user set load cell maximum setting. **CHECK WIRING, LC MAX SETTING, LOAD CELL MOUNTING.**

5.3 Keyboard Description

Use the keyboard to navigate through the menu system. Press and hold the up or down keys to speed up the incrementing or decrementing of a value.

6 Menu System

6.1 Main Menu

Enter the menu system by pressing by the menu key. The following menu items will be displayed.

Load Cell configuration setup menu

Press the down key to proceed to the next menu option

Alarm configuration setup menu

RS232 and RS485 communication setup menu

Miscellaneous items setup menu

Back to the start of the main menu

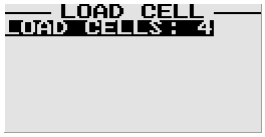
6.1.1 Exiting the menu system

Press the menu key when the main menu items are showing to exit the menu system. All the settings are saved and the instrument will then return to the normal display mode.

> **Note:** The menu system has a 2 minute program timeout. If no key has been pressed within this period then the instrument will save all settings and return to the normal display mode.

6.2 Load Cell Configuration Menu

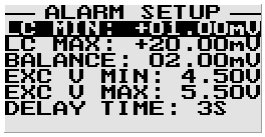
This menu configures the load cell parameters.



Select the number of load cells connected to the SMART junction box. The individual load cell dip switches must also be selected to match the number of load cells.

6.3 Alarm Configuration Menu

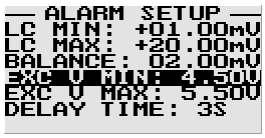
This menu configures the alarm parameters.



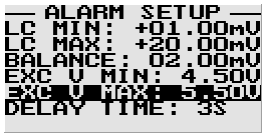
This is the lowest operating level (in mV) of any connected load cell. The alarm will activate if any load cell falls below this value.

This is the highest operating level (in mV) of any connected load cell. The alarm will activate if any load cell exceeds this value.

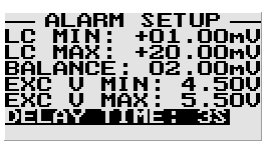
This is the allowable difference (in mV) between any 2 load cells. The alarm will activate if this value is exceeded.



This is the lowest operating level (in V) of the excitation voltage. The alarm will activate if the excitation voltage falls below this value.



This is the highest operating level (in V) of the excitation voltage. The alarm will activate if the excitation voltage exceeds this value.



Time in seconds an error condition must persist to when the error message is displayed and the relay is activated.

6.4 Communication Configuration Menu

This menu configures the RS232 and RS485 serial port parameters.

The SMART junction box has 2 built in communication protocols:

1) MODBUS RTU
2) MODBUS ASCII

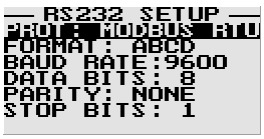
Please see below for the MODBUS registers.

Enter the communication address of the instrument. If more then one instrument is connected via a multidrop network then the address of each instrument must be unique. A unique address allows commands to be sent to an individual instrument as well as it also prevents all the instruments on the bus replying simultaneously. The Modbus address range is 001 to 247.

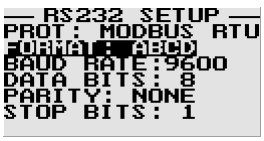
RS232 Communication setup menu.

RS485 Communication setup menu.

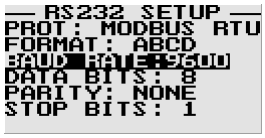
The RS232 Communication setup menu is shown below. The setup for the RS485 communication setup is identical.



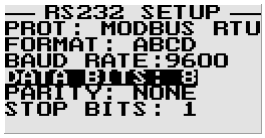
Select the communication protocol. The communication protocol can be set to Modbus RTU or to Modbus ASCII.



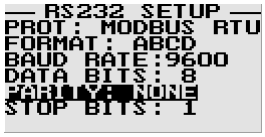
Select the float format of the Modbus variables.



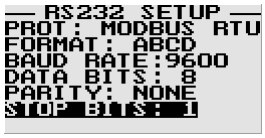
Select the communication baud rate.



Select the communication data bits.



Select the communication parity bit.



Select the communication stop bit.

Back to the start of the RS232 or RS485 configuration menu

6.4.1 The Modbus Protocol

Both Modbus RTU and Modbus ASCII protocols are supported.

6.4.2 Modbus Commands

The instrument supports the following Modbus commands:

FC03 (0x03) – Read Holding Registers
FC05 (0x05) – Write Single Coil
FC06 (0x06) – Write Single Holding Register

Note: Broadcast read commands are ignored by the indicator, only broadcast write commands are processed.

Supported Modbus Error Messages:

Error Code	Error Description
0x01	Illegal function code
0x02	Illegal register address
0x03	Illegal data value or data length

6.4.3 Modbus Register Addresses

Read Holding Register (FC03), Write Single Holding Register (FC06):

Referenced to 4XXXX.

Address	Data Type	Operation	Description
0	32 bit unsigned	R	Serial Number High Word
1	32 bit unsigned	R	Serial Number Low Word
2	8 bit unsigned	R	Model Number
3	16 bit unsigned	R	Firmware Version
20	32 bit signed	R/W	Load Cell Minimum Value High Word
21	32 bit signed	R/W	Load Cell Minimum Value Low Word
22	32 bit signed	R/W	Load Cell Maximum Value High Word
23	32 bit signed	R/W	Load Cell Maximum Value Low Word
24	32 bit signed	R/W	Load Cell Balance High Word
25	32 bit signed	R/W	Load Cell Balance Low Word
26	32 bit unsigned	R/W	Excitation Voltage Minimum High Word
27	32 bit unsigned	R/W	Excitation Voltage Minimum Low Word
28	32 bit unsigned	R/W	Excitation Voltage Maximum High Word
29	32 bit unsigned	R/W	Excitation Voltage Maximum Low Word
30	8 bit unsigned	R/W	Alarm Delay in Seconds
40	8 bit unsigned	R/W	COM Address
41	8 bit unsigned	R/W	COM 1 (RS232) Protocol 0: Modbus RTU 1: Modbus ASCII
42	8 bit unsigned	R/W	COM 1 (RS232) Modbus Float format 0: ABCD 1: CDAB 2: BADC 3: DCBA
43	8 bit unsigned	R/W	COM 1 (RS232) Baud 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
44	8 bit unsigned	R/W	COM 1 (RS232) Data Bits 0: 7 Bits 1: 8 Bits
45	8 bit unsigned	R/W	COM 1 (RS232) Parity

			0: None 1: Even 2: Odd
46	8 bit unsigned	R/W	COM 1 (RS232) Stop bits 0: 1 Stop Bit 1: 2 Stop Bits
50	8 bit unsigned	R/W	COM 2 (RS485) Protocol 0: Modbus RTU 1: Modbus ASCII
51	8 bit unsigned	R/W	COM 2 (RS485) Modbus Float format 0: ABCD 1: CDAB 2: BADC 3: DCBA
52	8 bit unsigned	R/W	COM 2 (RS485) Baud 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200
53	8 bit unsigned	R/W	COM 2 (RS485) Data Bits 0: 7 Bits 1: 8 Bits
54	8 bit unsigned	R/W	COM 2 (RS485) Parity 0: None 1: Even 2: Odd
55	8 bit unsigned	R/W	COM 2 (RS485) Stop bits 0: 1 Stop Bit 1: 2 Stop Bits
60	8 bit unsigned	R/W	LCD Contrast
61	8 bit unsigned	R/W	Backilight 0: Off 1: On
62	8 bit unsigned	R/W	Security 0: Off 1: On
63	16 bit unsigned	R/W	Security Code
100	8 bit unsigned	R/W	Number of Load Cells
101	Float	R	Load Cell 1 mV value
102	Float	R	Load Cell 1 mV value
103	Float	R	Load Cell 2 mV value
104	Float	R	Load Cell 2 mV value
105	Float	R	Load Cell 3 mV value

106	Float	R	Load Cell 3 mV value
107	Float	R	Load Cell 4 mV value
108	Float	R	Load Cell 4 mV value
109	Float	R	Load Cell Average value
110	Float	R	Load Cell Average value
111	Float	R	Excitation Voltage
112	Float	R	Excitation Voltage
113	32 bit unsigned	R	Alarm Status High Word (Bit pattern) 0x00000000: Status Good 0x00000001: Excitation Low 0x00000002: Excitation High 0x00000004: Load Cell 1 Minimum alarm 0x00000008: Load Cell 1 Maximum alarm 0x00000010: Load Cell 2 Minimum alarm 0x00000020: Load Cell 2 Maximum alarm 0x00000040: Load Cell 3 Minimum alarm 0x00000080: Load Cell 3 Maximum alarm 0x00000100: Load Cell 4 Minimum alarm 0x00000200: Load Cell 4 Maximum alarm 0x00000400: Load Cell 1 Wire alarm 0x00000800: Load Cell 2 Wire alarm 0x00001000: Load Cell 3 Wire alarm 0x00002000: Load Cell 4 Wire alarm 0x00004000: Load Cell 1 High alarm 0x00008000: Load Cell 2 High alarm 0x00010000: Load Cell 3 High alarm 0x00020000: Load Cell 4 High alarm 0x00040000: Load Cell Balance alarm 0x00080000: Load Cell 1 Under range alarm 0x00100000: Load Cell 2 Under range alarm 0x00200000: Load Cell 3 Under range alarm 0x00400000: Load Cell 4 Under range alarm 0x00800000: Load Cell 1 Over range alarm 0x01000000: Load Cell 2 Over range alarm 0x02000000: Load Cell 3 Over range alarm 0x04000000: Load Cell 4 Over range alarm
114	32 bit unsigned	R	Alarm Status Low Word

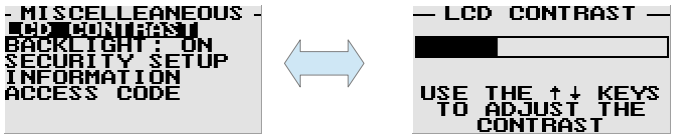
FC05: Write Single Coil

Referenced to 0XXXX. A value of 0xFF00 for the data will execute the function. An Echo of the original message will be returned.

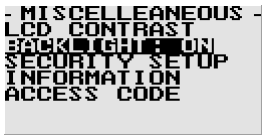
Address	Action Command
0	Instrument Reset
1	Load Default Settings
2	Save instrument settings

6.5 Miscellaneous Configuration Menu

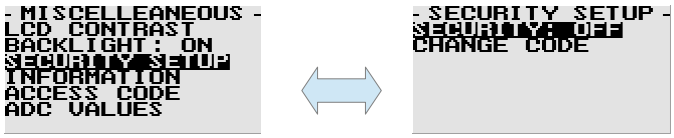
This menu configures the miscellaneous functions of the instrument.



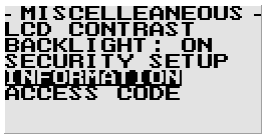
Select this menu option to adjust the LCD display contrast.



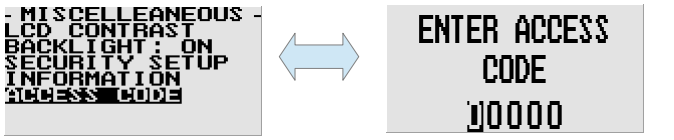
Select this menu option to turn the LCD backlight on/off or to automatic. If “AUTO” has been selected and no key has been pressed within 30 seconds then the backlight will automatically turn off. Excitation current increases when turned on. The LCD backlight is set to auto by default.



Select this menu option if you want to password protect the menu system.



This menu option shows the system information.



This menu option allows access to technical functions such as input signal calibration. These functions are accessed by the factory during the calibration of the instrument. Please consult the factory for more information.

Back to the start of the miscellaneous configuration menu

7 Loading Default Settings

Default settings can be loaded by simultaneously pressing the Enter, Up and Down keys at power up. The words “LOADING DEFAULT SETTINGS” will briefly appear on the LCD display. All settings will revert back to the factory defaults.

8 Cleaning

The unit should not be cleaned with any abrasive substances. The instrument is very sensitive to certain cleaning materials and should only be cleaned using a clean, damp cloth.

9 Notice

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The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Infiniteq for any damages resulting from such improper use or sale.

10 Warranty

This product carries a warranty for a period of one year from date of purchase against faulty workmanship or defective materials, provided there is no evidence that the unit has been mishandled or misused. Warranty is limited to the replacement of faulty components and includes the cost of labor. Shipping costs are for the account of the purchaser.

Note: Product warranty excludes damages caused by unprotected, unsuitable or incorrectly wired electrical supplies and or sensors, and damage caused by inductive loads.