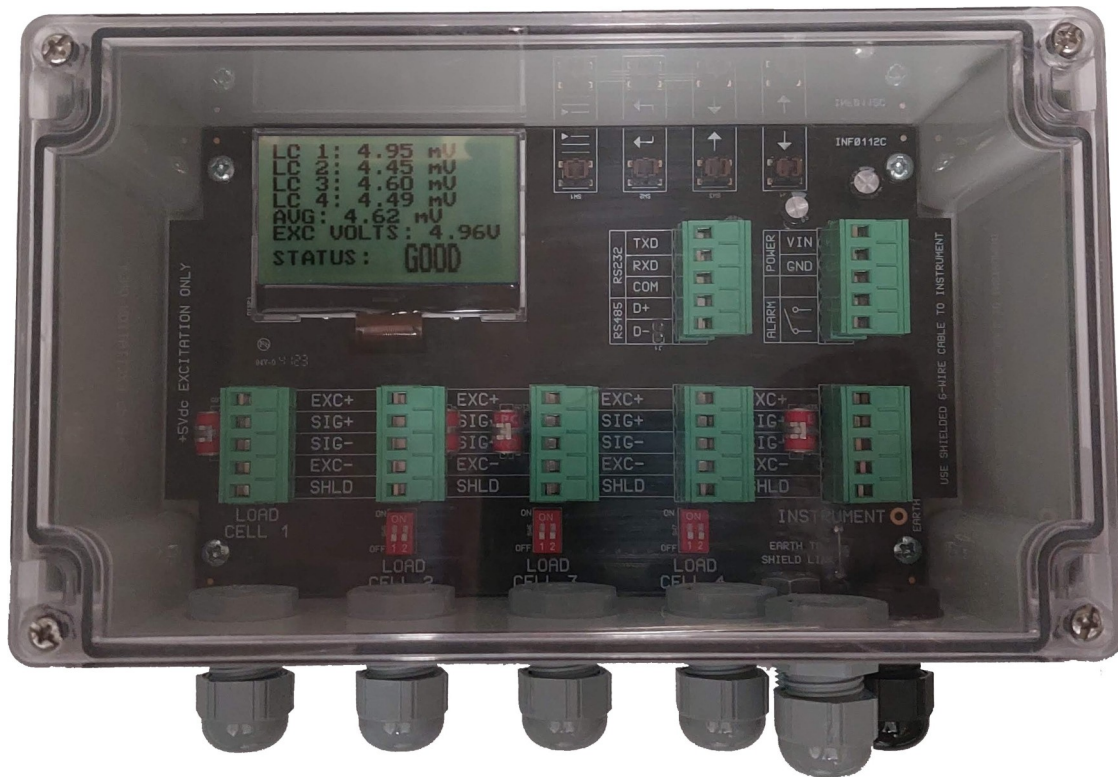# IQ620

SMART Load Cell Junction / Summation box with Fault Monitoring

Manual – English 1.00

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.
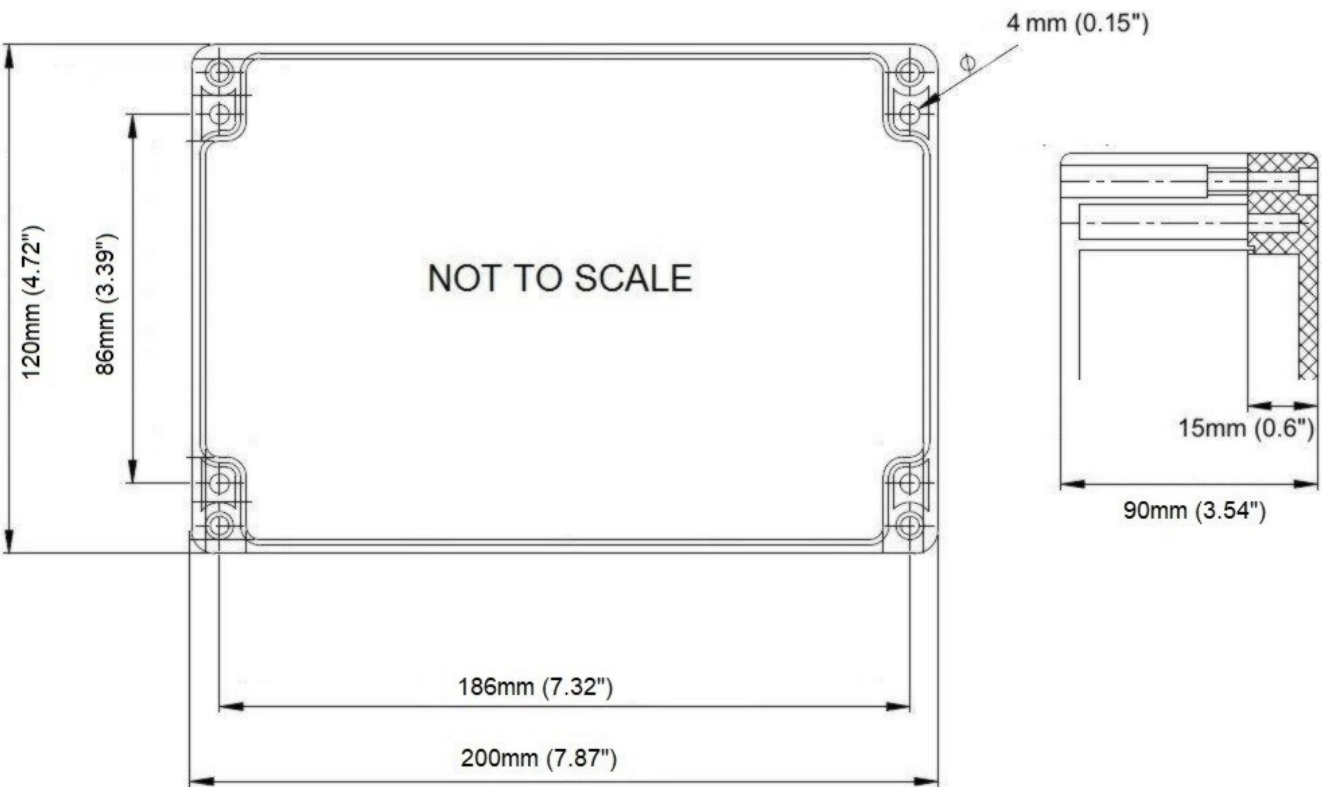
1 Features

- **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)	+8 to 15Vdc input 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 (Dip switch & 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

120Ω

RS485

RS232
Female D9 connector

1   5
6   9

It is recommended that a 120Ω resistor is connected across the wires at the furthest point from the master device

D- (A)
D+ (B)

RS232 Txd
RS232 Rxd
Gnd

Menu / Back key
Enter key
Up key
Down key

LCD Display

DC Power Supply (Optional)
Only connect if not using host instrument excitation power

+VDC
-VDC

TXD
RXD
COM
D+
D-

POWER VIN
GND

ALARM

N.C.

Insert for 120 Ohm RS485 termination resistor

Relay is open when not in alarm condition.
Relay is always energized

+5vdc EXCITATION ONLY

CUTOUT

EXC+
SIG+
SIG-
EXC-
SHLD

EXC+
SIG+
SIG-
EXC-
SHLD

EXC+
SIG+
SIG-
EXC-
SHLD

EXC+
SIG+
SIG-
EXC-
SHLD

USE SHIELDED 6-WIRE CABLE TO INSTRUMENT

To Host Instrument

LOAD CELL 1
LOAD CELL 2
LOAD CELL 3
LOAD CELL 4

INSTRUMENT

EARTH TO SHIELD LINK

Earth Connection

Load Cell 2 On / Off
Load Cell 3 On / Off
Load Cell 4 On / Off

Earth to Shield Link
(Cut to isolate earth from load cell shield)

Load Cell 1
Load Cell 2 (Optional)
Load Cell 3 (Optional)
Load Cell 4 (Optional)

Note: Ensure that all cabling has adequate strain relief.

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

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. Also switch the corresponding load cell dip switches to "ON".

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.
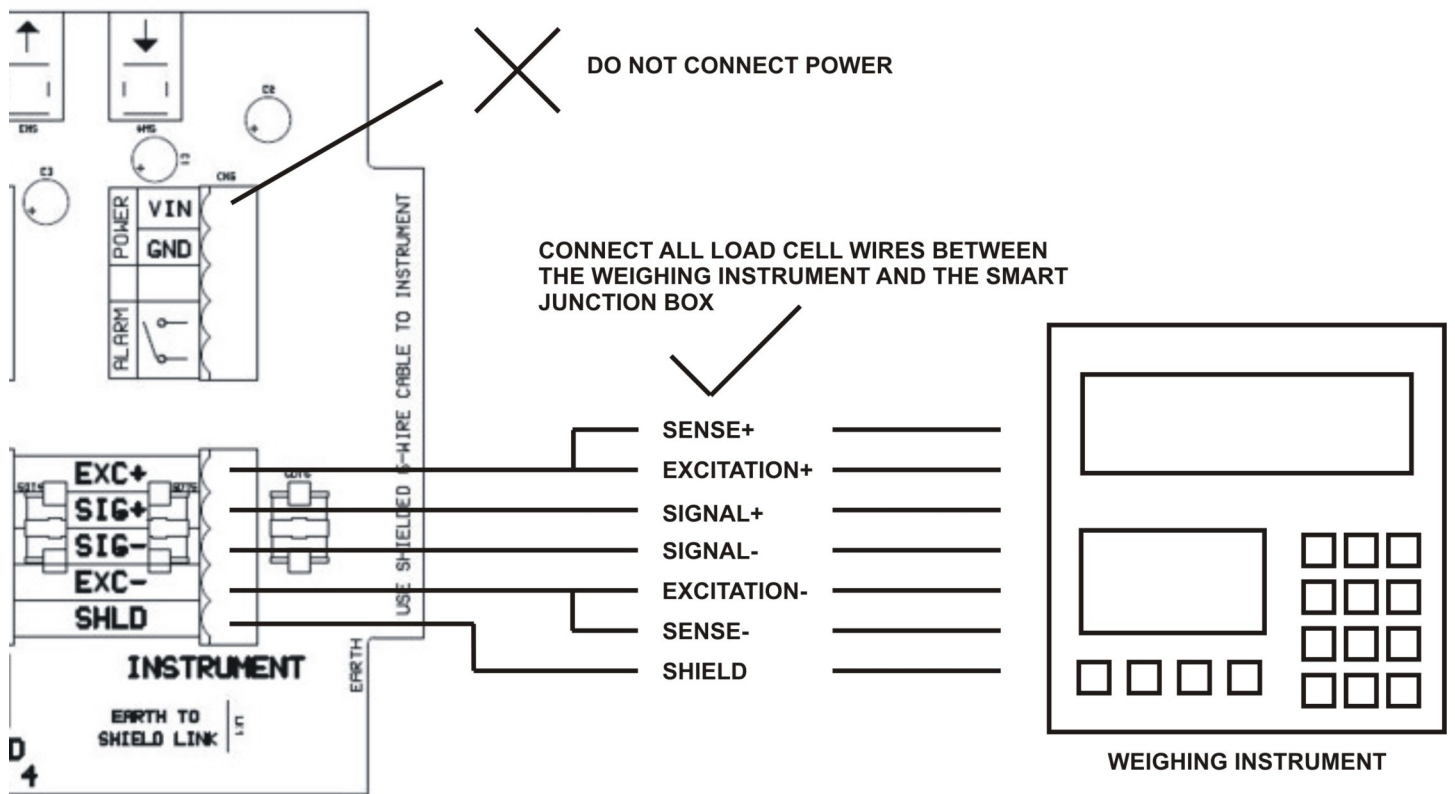
4.3.2 Self Powered (not using host instruments excitation supply)

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.
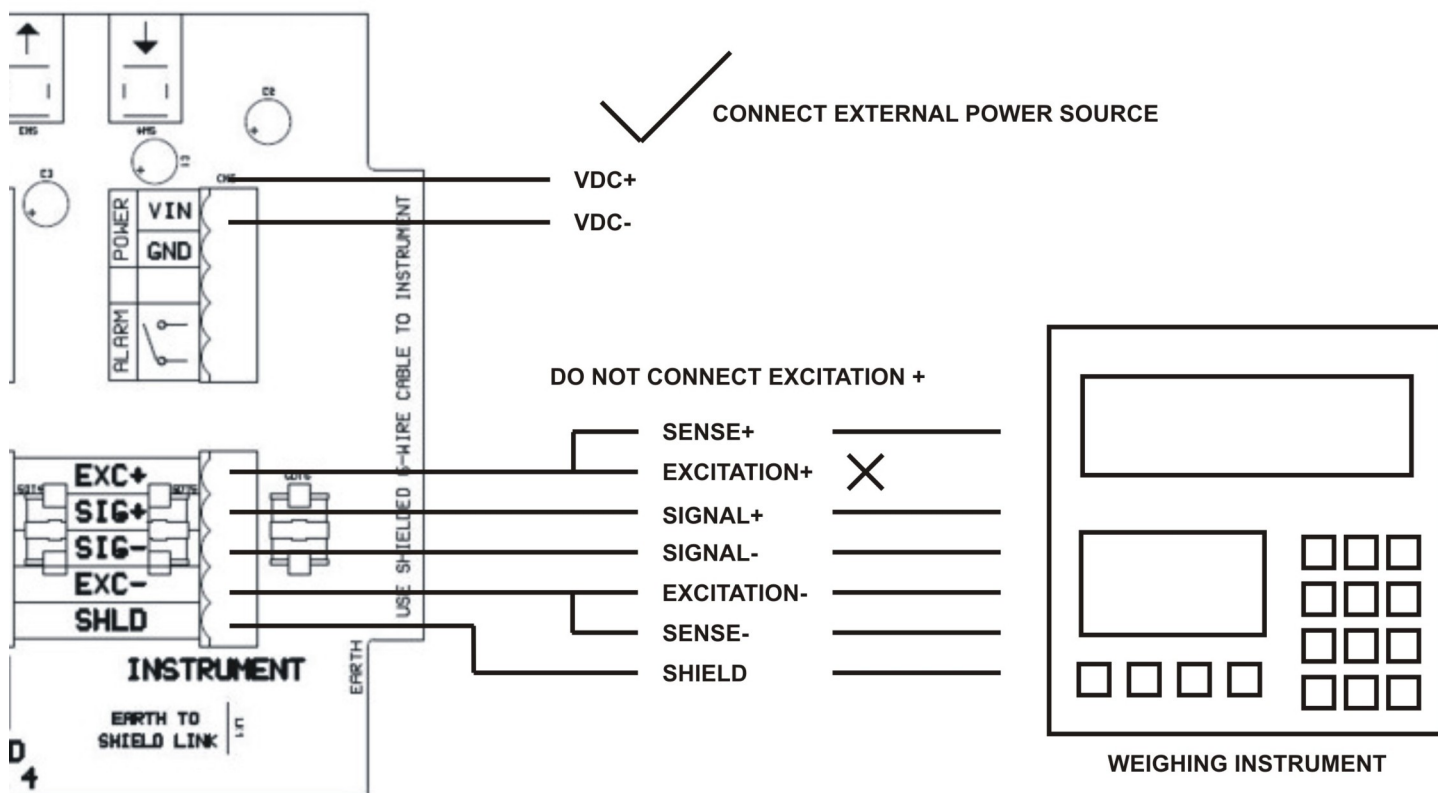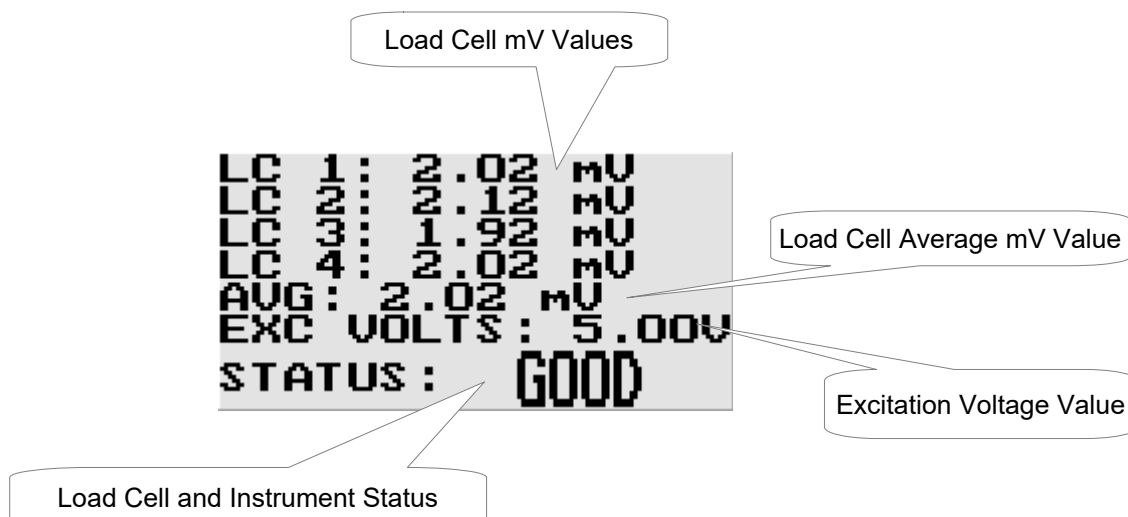

4.4 RS232 Communication

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

Load Cell mV Values

```
LC 1: 2.02 mV
LC 2: 2.12 mV
LC 3: 1.92 mV
LC 4: 2.02 mV
AVG: 2.02 mV
EXC VOLTS: 5.00V
STATUS:    GOOD
```

Load Cell Average mV Value

Excitation Voltage Value

Load Cell and Instrument Status

5.2 Status Messages

STATUS: GOOD

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

STATUS: BALANCE

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

STATUS: EXC LOW

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

STATUS: EXC HIGH

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

STATUS: LC1 WIRE

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

STATUS: LC2 WIRE

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

STATUS: LC3 WIRE

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

STATUS: LC4 WIRE

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

STATUS : LC1 LOW

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

STATUS : LC2 LOW

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

STATUS : LC3 LOW

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

STATUS : LC4 LOW

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

STATUS : LC1 HIGH

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

STATUS : LC2 HIGH

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

STATUS : LC3 HIGH

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

STATUS : LC4 HIGH

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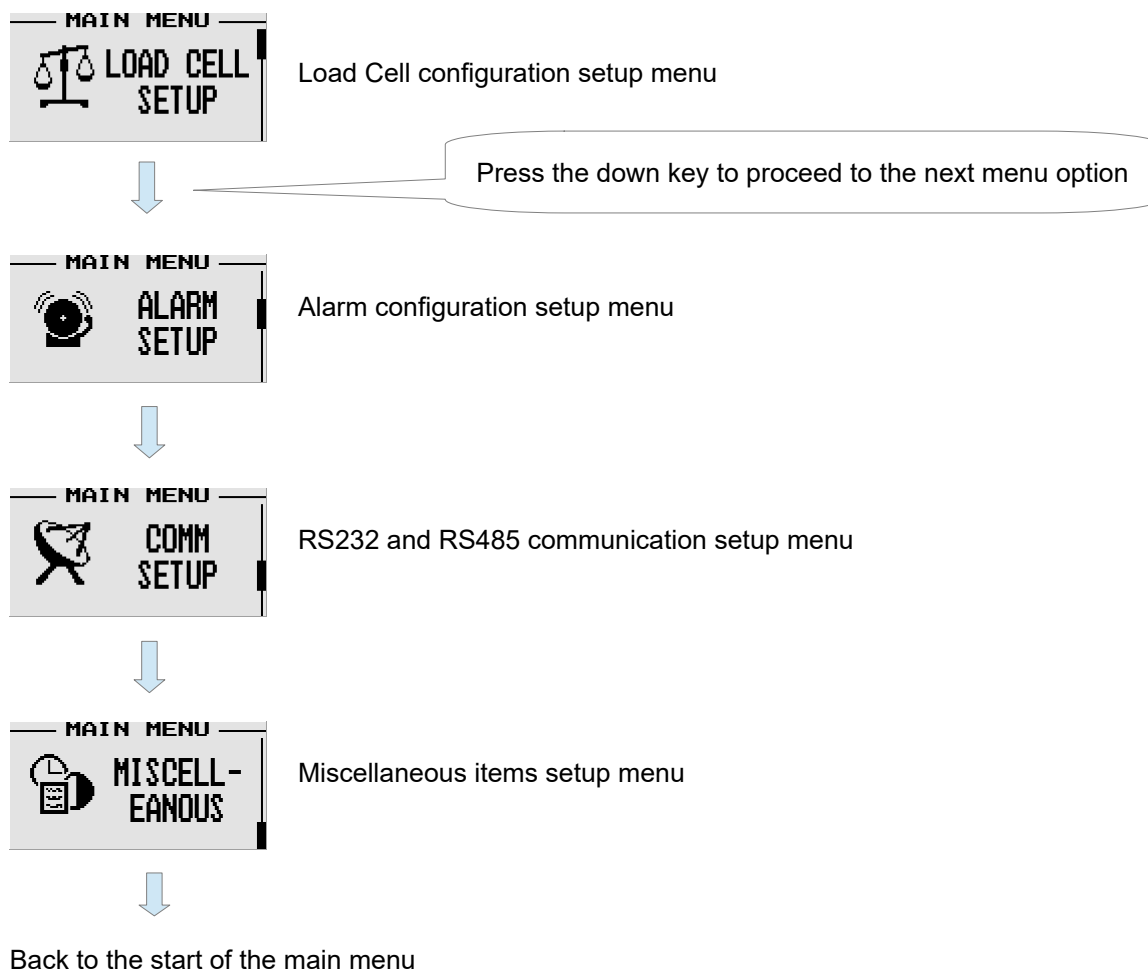
5.3 Keyboard Description

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

```
——— MAIN MENU ———
⚖ LOAD CELL
     SETUP
```

This menu configures the load cell parameters.

```
——— LOAD CELL ———
LOAD CELLS: 4
```
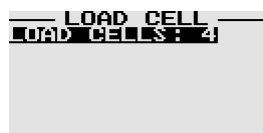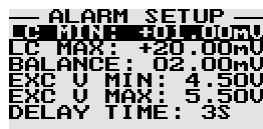
Select the number of load cells connected to the SMART junction box. The individual load cell dip switches must also be selected to match the number of load cells.

6.3 Alarm Configuration Menu

```
——— MAIN MENU ———
🔔 ALARM
    SETUP
```

This menu configures the alarm parameters.

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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.

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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

```
—— ALARM SETUP ——
LC MIN: +01.00mV
LC MAX: +20.00mV
BALANCE: 02.00mV
EXC V MIN: 4.50V
EXC V MAX: 5.50V
DELAY TIME: 3S
```

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.
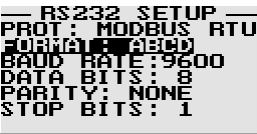
RS232 Communication setup menu.

RS485 Communication setup menu.

The RS232 Communication setup menu is shown below. The setup for the RS485 communication setup is identical.
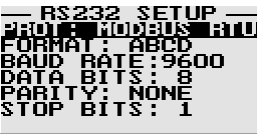
Select the communication protocol. The communication protocol can be set to Modbus RTU or to Modbus ASCII.

Select the float format of the Modbus variables.

```
— RS232 SETUP —
PROT: MODBUS RTU
FORMAT: ABCD
BAUD RATE:9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
```
Select the communication baud rate.

```
— RS232 SETUP —
PROT: MODBUS RTU
FORMAT: ABCD
BAUD RATE:9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
```
Select the communication data bits.

```
— RS232 SETUP —
PROT: MODBUS RTU
FORMAT: ABCD
BAUD RATE:9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
```
Select the communication parity bit.

```
— RS232 SETUP —
PROT: MODBUS RTU
FORMAT: ABCD
BAUD RATE:9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
```
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
10	8 bit unsigned	R/W	Number of Load Cells
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	Float	R	Load Cell 1 mV value
101	Float	R	Load Cell 1 mV value
102	Float	R	Load Cell 2 mV value
103	Float	R	Load Cell 2 mV value

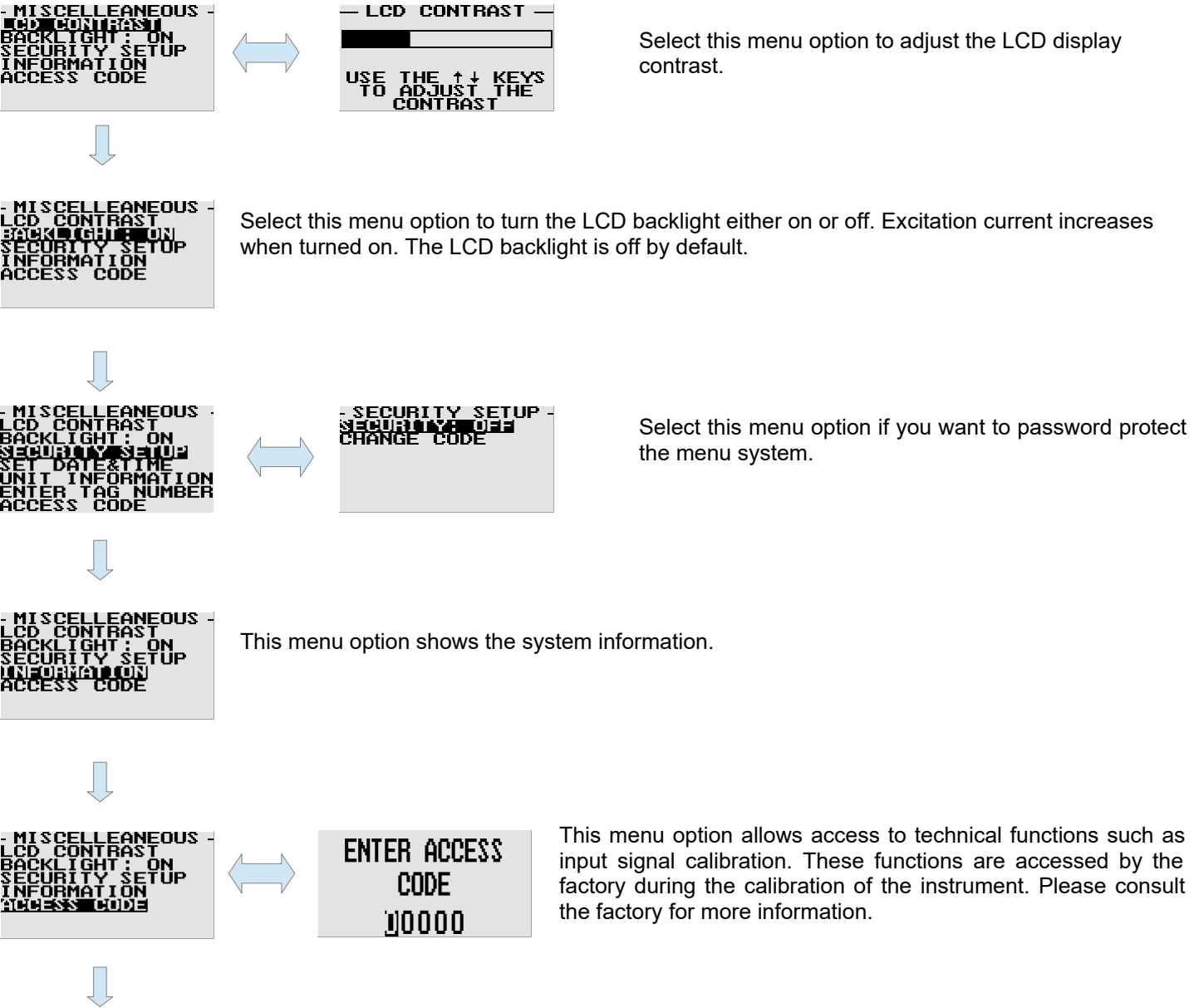| 104	Float	R	Load Cell 3 mV value
105	Float	R	Load Cell 3 mV value
106	Float	R	Load Cell 4 mV value
107	Float	R	Load Cell 4 mV value
108	Float	R	Load Cell Average value
109	Float	R	Load Cell Average value
110	Float	R	Excitation Voltage
111	Float	R	Excitation Voltage
112	32 bit unsigned	R	Alarm Status High Word (Bit pattern) 0x0000: Status Good 0x0001: Excitation Low 0x0002: Excitation High 0x0004: Load Cell 1 Minimum alarm 0x0008: Load Cell 1 Maximum alarm 0x0010: Load Cell 2 Minimum alarm 0x0020: Load Cell 2 Maximum alarm 0x0040: Load Cell 3 Minimum alarm 0x0080: Load Cell 3 Maximum alarm 0x0100: Load Cell 4 Minimum alarm 0x0200: Load Cell 4 Maximum alarm 0x0400: Load Cell 1 Under/Over range alarm 0x0800: Load Cell 2 Under/Over range alarm 0x1000: Load Cell 3 Under/Over range alarm 0x2000: Load Cell 4 Under/Over range alarm 0x4000: Load Cell 1 High alarm 0x8000: Load Cell 2 High alarm 0x10000: Load Cell 3 High alarm 0x20000: Load Cell 4 High alarm 0x40000: Load Cell Balance alarm
113	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 either on or off. Excitation current increases when turned on. The LCD backlight is off 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

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

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