



# NCS920

## Belt Weigher Indicator

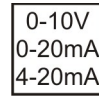
Operating Manual – English 2.04



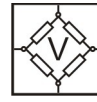
7 Segment  
LED Display



128x64  
Pixels Graphic LCD  
Display



0-10V  
0-20mA  
4-20mA Analog  
Re-Transmission



5VDC  
Excitation



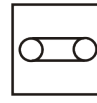
High Resolution  
ADC



High Resolution  
DAC



Modbus™  
Communications



Dynamic  
Calibration



Field upgradeable  
Firmware



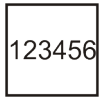
Dynamic  
Tare



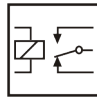
Advanced  
Digital Filtering



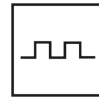
Real Time  
Clock



Resettable Totaliser  
Non-Resettable Totaliser



4 Alarm  
Setpoints



Encoder /  
Tacho-Generator  
Input



RS232  
RS485  
Ethernet

## Introduction

The NCS920 Belt Weigher indicator is a precision digital indicator for belt weighing applications. The NCS920 takes the weight and speed information from a belt conveyor system to accurately calculate rate and total material transferred.

The high bright 6-digit 7-segment 20mm LED displays and the sunlight readable graphic LCD display make for easy setup and readability. A simple menu system allows for easy configuration of display and belt weighing settings.

The load cell calibration can be done directly from the load cell calibration certificate or by using dynamic calibration of the belt conveyor system. The NCS920 also provides an internal jumper selectable power supply for powering an encoder / tachogenerator and a pulse counting digital input to measure the speed of the belt conveyor system.

A universal mains switch mode power supply (85-264VAC) is provided as standard but an optional low voltage (10-30VDC) can be installed.

The NCS920 contains precision front end circuitry for high accuracy and stability. The ratiometric ADC circuitry automatically compensates for temperature drift and excitation voltage variances due to cable loss. The load cell excitation voltage is 5VDC and can interface with both 4 wire and 6 wire load cells. The NCS920 can power up to 6x350Ω load cells.

RS232 and RS485 communications is supplied as standard with the MODBUS RTU and MODBUS ASCII protocol. A simple ASCII out protocol is also provided for serial printing and communicating to large displays. Ethernet communications optional. Both Modbus TCP/IP and Modbus RTU over TCP/IP supported.

The NCS920 also has analog out circuitry to generate a precision 0/4-20mA or 0-10V analog output signal.

The NCS920 also includes advanced features such as a resettable and non-resettable totaliser, dynamic tare function, auto-zero tracking, user input linearisation, max recording, programmable front push buttons, programmable digital inputs, security menu lockout, dead band adjustment, advanced digital filtering, dynamic calibration, pulse output plus many more to provide an all in one precision belt weighing indicator.

# 1 Features

- 4 or 6 wire load cell / strain gauge input
- Can power up to 6x350Ω load cells at +5Vdc excitation voltage
- Dynamic tare function
- Dynamic calibration function
- Dead band adjustment to determine the minimum rate at which the instrument will cease to totalise
- A resettable and non-resettable totaliser
- Encoder / Tacho-generator pulse counting Input with jumper selectable power supply
- High precision 24bit ADC front end circuitry
- -199999 to +999999 display counts
- High bright 6-digit 7-segment 20mm LED displays
- 128x64 pixel backlit sunlight readable graphic LCD display for easy setup and calibration
- Easy calibration either from the load cell calibration certificate or by using known weights
- Material calibration feature
- RS232 and RS485 communications (MODBUS RTU / ASCII and a serial ASCII out protocol)
- Ethernet communications optional (Supports TCP Client, TCP Server, UDP Client, UDP Server)
- Both Modbus TCP/IP and Modbus RTU over TCP/IP supported
- 180x180x60mm flame retardant ABS enclosure
- Universal mains switch mode power supply (85-264VAC) standard with built in EMI and fuse protection
- 4x Mechanical (FORM-C) relays
- 5x Programmable digital inputs (2x digital inputs are opto-isolated)
- 16 Point lineariser
- Auto-zero tracking
- PI Control function
- High precision 16bit Analog output (0/4-20mA, 0-10V)
- Selectable / adjustable advanced digital filtering
- 8 front panel LED indicators for alarm set point status, rate display, total display, dead range and print
- Pulse output function
- Full alpha-numeric keypad
- Front programmable function keys (Rate, Total, Print, Dynamic tare and Alarm latch reset)
- Max value recording (weight, speed & rate)
- RTC (Real Time Clock) for time and date stamping
- Cage clamp wire connectors for easy installation
- Field upgradable firmware via the RS232 interface
- 1 Year Warranty

Additional hardware options include:

- Up to 4 solid state (FORM-A) relays
- Low voltage 10-30VDC Isolated power supply
- Ethernet communication module



This instrument is marked with the international hazard symbol. It is important to read this manual before installing or commissioning your wall mount indicator as it contains important information relating to safety and Electromagnetic Compatibility EMC.

**ENSURE THAT ALL POWER IS SWITCHED OFF TO THE INSTRUMENT BEFORE INSTALLING OR DOING MAINTENANCE WORK.**

- **Do not place signal and power supply wiring in the same loom.**
- **Make sure that all anti-static precautions are adhered to when handling the circuit boards.**
- **Use screened cable for all signal inputs and attach to earth at one point only.**
- **Use ferrules with all input connections for greater reliability.**



The instrument contains a battery for data retention purposes. The battery should be disposed of correctly. Please contact your supplier or local council if in doubt.

## 2 Specifications

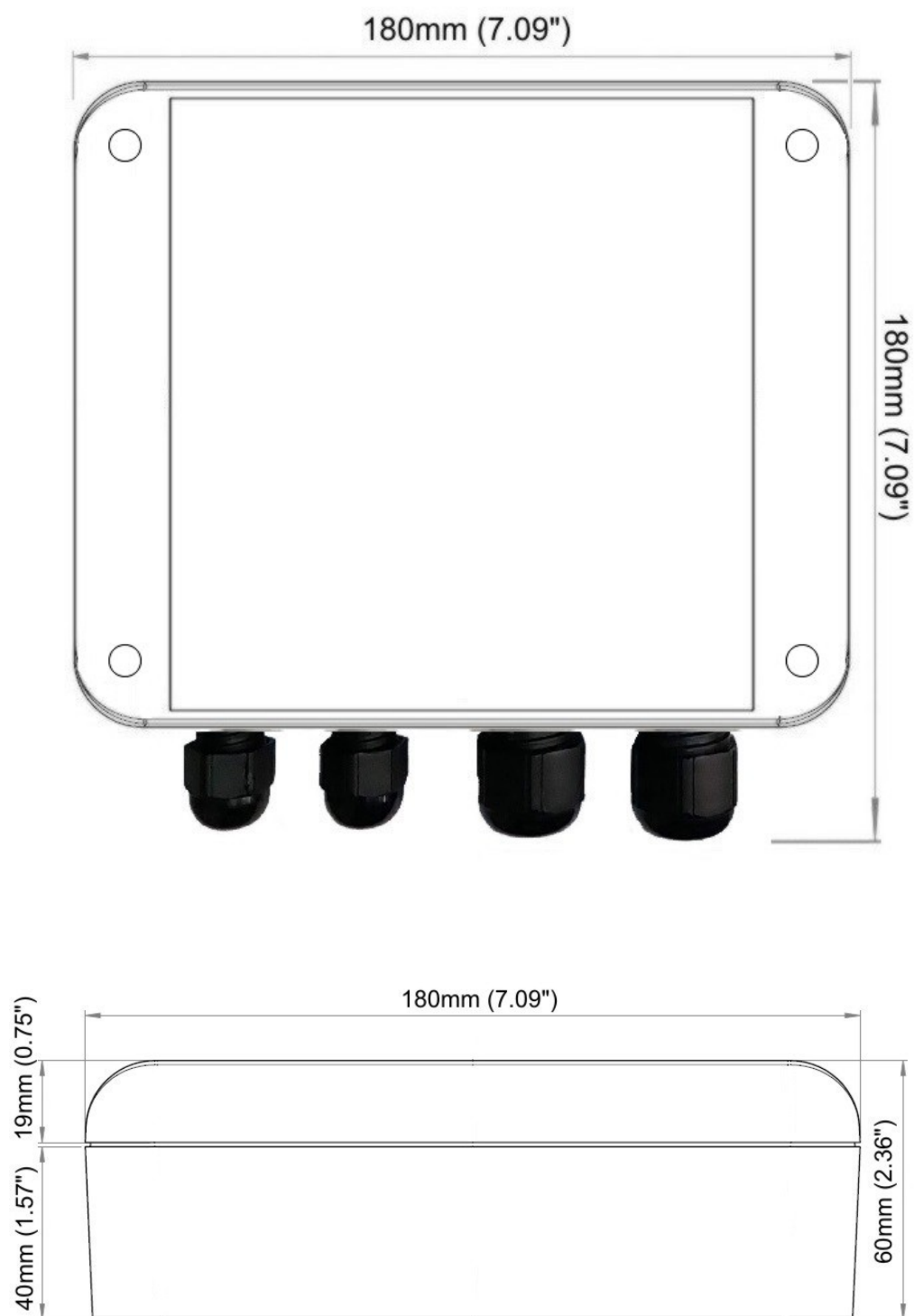
<b>General:</b>	
<b>LED Display</b>	6-Digit, 20mm (0.8") 7 segment high brightness red LED
<b>LCD Display</b>	128x64 Full graphic sunlight readable monochrome display
<b>LCD Backlight</b>	Yellow/Green, User defined on/off control
<b>Display range</b>	-199999 to +999999
<b>Display decimal point</b>	x to x.xxxxx
<b>Status LEDs</b>	8 LEDs total (SP1, SP2, SP3, SP4, Rate, Total, Dead Range & Print)
<b>Digital Inputs</b>	<p>4 / 5 Programmable digital inputs</p> <p><b>Digital Inputs 1, 2 &amp; 3</b> Built in hysteresis, filter and input over voltage protection Maximum input voltage &lt;30VDC</p> <p>Active/Non-Active input trigger: &lt;2V Non-Active/Active input trigger: &gt;2.5V</p> <p><b>Digital Input 4 &amp; 5</b> Opto-isolated PLC type input Supports NPN, PNP, Push-pull (Totem-Pole) sensors, switches and push buttons.</p>
<b>Keypad</b>	<p>Full 4x3 alpha-numeric keyboard</p> <p>4 Dedicated function keys (Rate, Total, Print, Tare)</p> <p>1 Dual function key (Alarm latch reset)</p>
<b>Memory storage</b>	Non-volatile EEPROM, 100000 write cycles minimum
<b>Warm up time</b>	15 minutes
<b>Power Requirements:</b>	
<b>AC Power Supply</b>	85-264VAC, 50/60Hz or 120-370VDC Isolation: 3000VAC/1min
<b>DC Power Supply, 10-30VDC (Optional)</b>	10-30VDC input Reverse and over voltage protected Isolation: >1000V/1min
<b>Power Consumption</b>	<10W
<b>Fuse (Built in)</b>	2A Slow Blow (Littlefuse part number 37212000431)
<b>Environmental:</b>	
<b>Operating temperature</b>	-10°C to 50°C (14°F to 122°F)
<b>Storage temperature</b>	-40°C to 80°C (-40°F to 176°F)
<b>Operating and storage humidity</b>	<85% RH non-condensing
<b>Enclosure:</b>	
<b>Overall Dimensions</b>	180x180x60mm (LxHxD) (7.09x7.09x2.36") (Height includes cable glands)
<b>Mounting Holes</b>	160x94mm (6.3x3.7")
<b>Enclosure Material</b>	ABS – Flame Retardant
<b>IP Rating</b>	IP65
<b>Gland Ratings:</b>	
<b>Clamping/sealing range (Small gland)</b>	4-8mm (0.157-0.314") Diameter wire
<b>Clamping/sealing range (Large gland)</b>	7-13mm (0.276"-0.512") Diameter wire
<b>Input:</b>	
<b>ADC Resolution</b>	24 bit Delta-sigma, Ratiometric
<b>Input range</b>	+/-3.5mV/V
<b>Conversion rate</b>	80 updates/second

<b>Filter</b>	Moving average digital filter with programmable input step detection
<b>Increment size</b>	1, 2, 5, 10, 20, 50, 100, 200
<b>Input Impedance</b>	>100M $\Omega$
<b>CMRR</b>	>-110dB
<b>Linearity</b>	<0.01% of full scale
<b>Accuracy</b>	0.05% of full scale
<b>Calibration method</b>	From the load cell calibration certificate or from using known weights
<b>Load cell connection</b>	4 or 6 wire connection + shield (Sense included)
<b>Load Cell Excitation:</b>	
<b>Excitation Voltage (Sense included)</b>	+5Vdc Fixed
<b>Excitation current</b>	Max. 90mA Up to 6x350 $\Omega$ load cells or 10x1000 $\Omega$ load cells
<b>Cable compensation</b>	Ratiometric
<b>Encoder / Tacho-generator Input: (Digital input 4)</b>	
<b>Range</b>	10KHz
<b>Measurement type</b>	<500Hz Period measurement >500Hz Pulse measurement
<b>Excitation</b>	Jumper selectable +12Vdc, 24Vdc
<b>Maximum excitation current</b>	100mA
<b>Digital Input 4</b>	Opto-isolated PLC type input Supports NPN, PNP, Push-pull (Totem-Pole) sensors, switches and push buttons.
<b>Analog Out:</b>	
<b>Ranges (Selectable through menu)</b>	0-20mA 4-20mA 0-10V
<b>DAC Resolution</b>	16 Bit
<b>Update rate</b>	12 updates/second
<b>Current output compliance (max load)</b>	500 $\Omega$ (Current is source, not sink)
<b>Voltage output compliance (min load)</b>	1k $\Omega$
<b>Current open loop detection</b>	LCD display flashes "Loop Error" error message
<b>Linearity</b>	<0.02% of full scale
<b>Accuracy</b>	0.05% of full scale
<b>Communications:</b>	
<b>Protocol</b>	Modbus RTU Modbus ASCII ASCII In ASCII Out (Various Protocols) - Output data rate 10 Hz
<b>RS232 Communications</b>	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 Non isolated
<b>RS485 Communications</b>	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 120 $\Omega$ field jumper selectable termination resistor Max 32 instruments per line
<b>Ethernet TCP/IP Communications</b>	
<b>Network Protocols</b>	TCP Client, TCP Server, UDP Client, UDP Server
<b>Modbus Support</b>	Supports Modbus TCP/IP and Modbus RTU over TCP/IP
<b>Interface</b>	8 pin RJ45
<b>Protection</b>	1.5KV electromagnetism isolation

<b>Rate</b>	10/100 Mbps auto-detection
<b>Access way to IP</b>	Static IP, DHCP
<b>SetPoints:</b>	
<b>Electro-mechanical Relays:</b>	
<b>Contact rating</b>	2A@240VAC or 30VDC (Resistive load)
<b>Isolation to input circuitry</b>	>1000Vrms for 1 minute
<b>Type</b>	FORM-C (Change over contact (NO/NC))
<b>Life expectancy</b>	>100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads
<b>Solid-State Relays (SSR): (Optional, Up to 4 can be fitted)</b>	
<b>Contact rating</b>	120mA@400VAC/DC
<b>Isolation to input circuitry</b>	>1000Vrms for 1 minute
<b>Type</b>	FORM-A (Normally open)
<b>RTC (Real Time Clock):</b>	
<b>Battery</b>	CR2032
<b>Accuracy</b>	Better then 2 seconds per day (Temperature dependent)

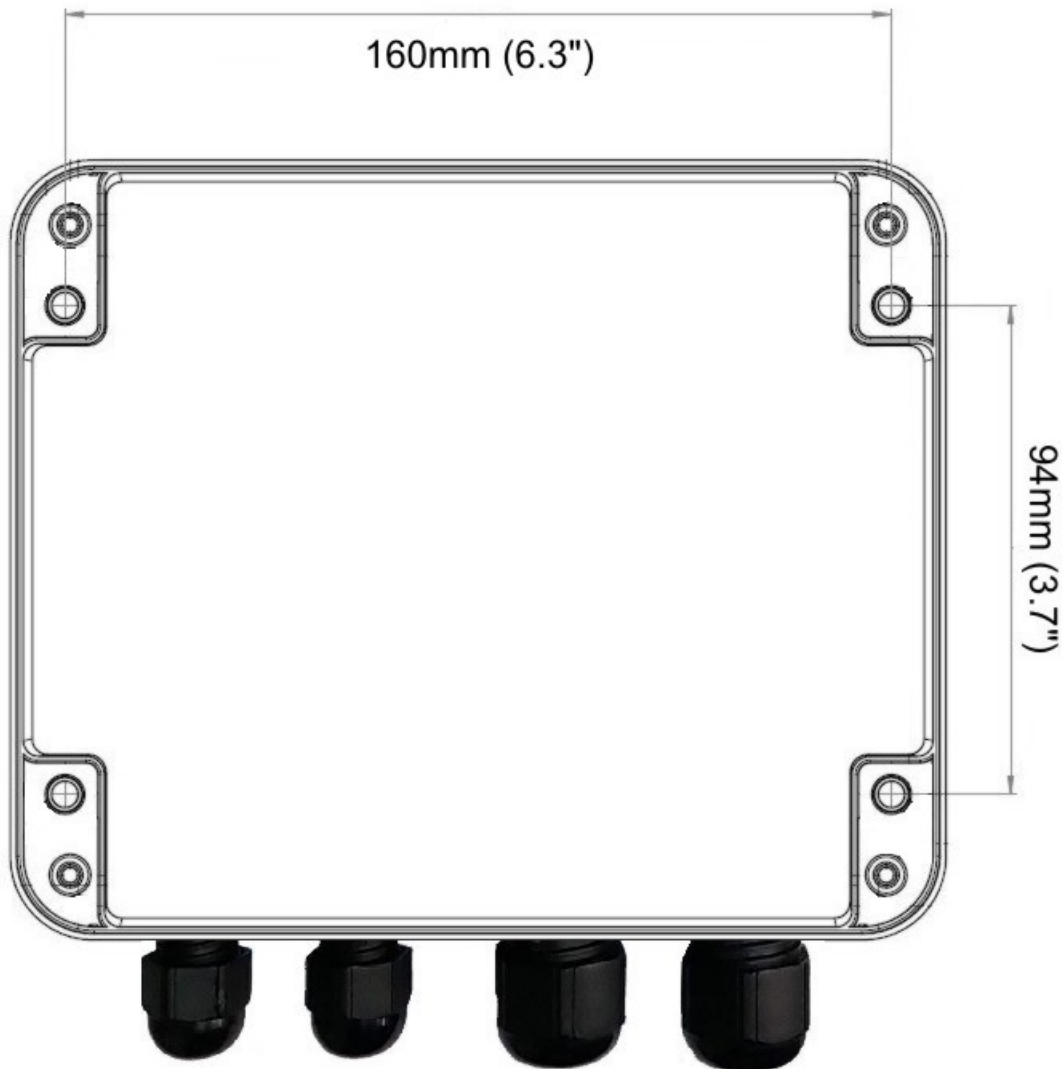
## 3 Installation

### 3.1 Enclosure Dimensions



## 3.2 Mounting Template

The below diagram shows the location of the enclosure mounting holes.



## 3.3 Opening the Unit

**Make sure power has been removed before opening the unit.**

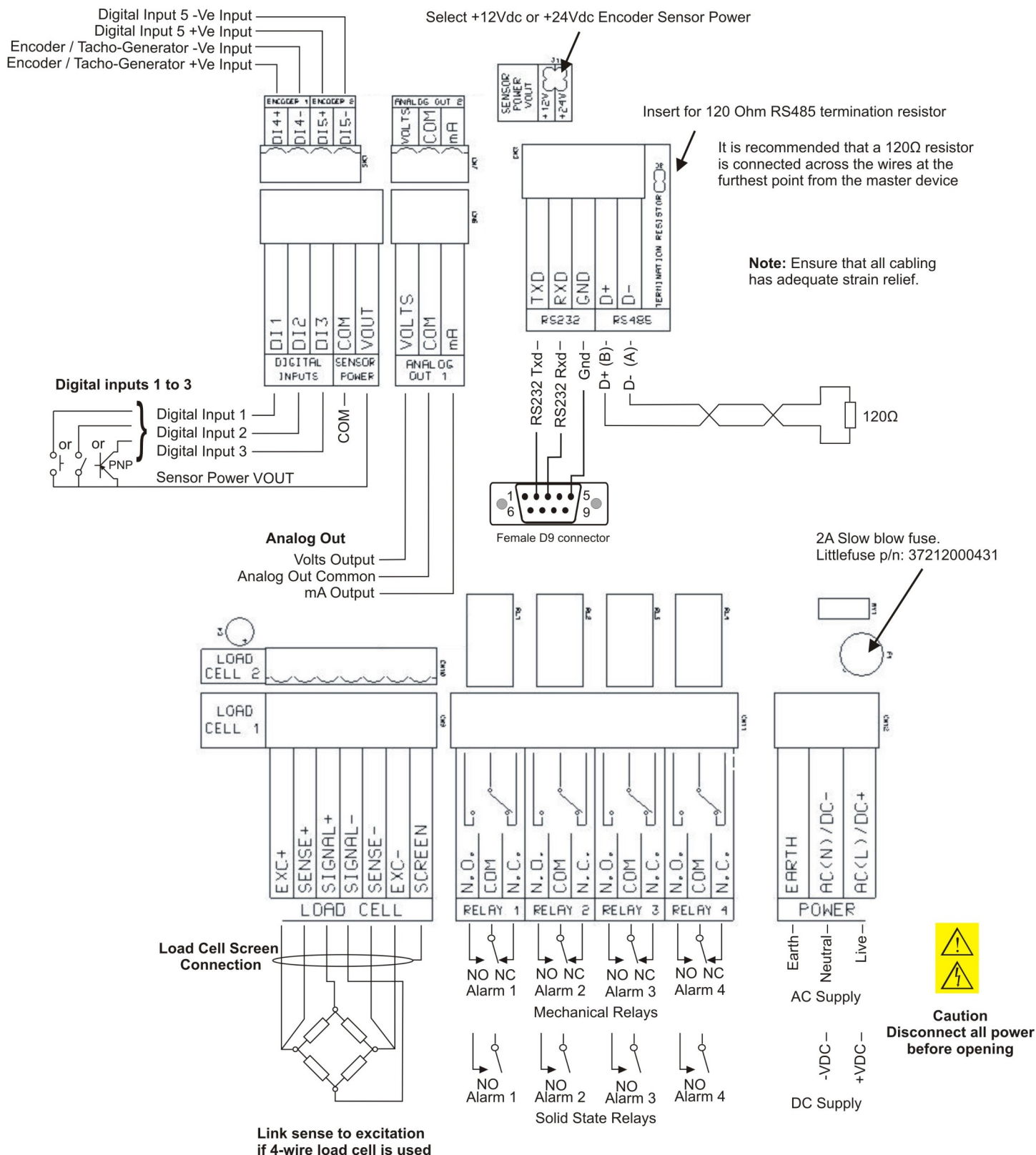
Simply unscrew the 4 screws on the sides of the lid to open the unit. Be careful when removing the lid as not to damage the ribbon cable connecting the lid to the base PCB.

**Make sure full anti-static precautions are adhered to when handling the circuit boards.**

**Do not apply power to the instrument until the instrument has been carefully reassembled back in to its enclosure.**

### 3.4 Hardware Connections, Jumpers and Fuse position

Below is an exploded view of the hardware connections and jumper locations of the main circuit board.



### 3.5 Power Supply Wiring

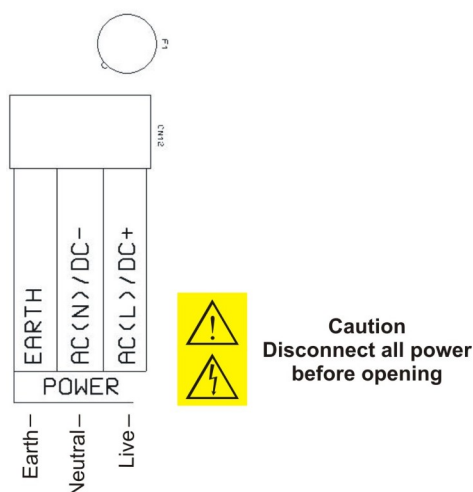
**There are 2 different power supply variants!** Please check which power supply is installed before connecting power by checking the sticker on the gland side of the instrument.

A universal mains switch mode power supply (85-264VAC) is provided as standard but an optional low voltage (10-30VDC) isolated power supply can be installed.

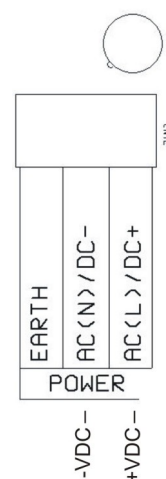
The instrument will consume a maximum of 10W with 6x350 ohm load cells, all relays on, mA analog output fully loaded, all led segments illuminated and the LCD backlight on.

**WARNING** - Access to power terminals should be restricted to authorised skilled personnel only. Application of supply voltages higher than those for which the instrument is intended may compromise safety and can cause permanent damage.

#### AC Power Supply

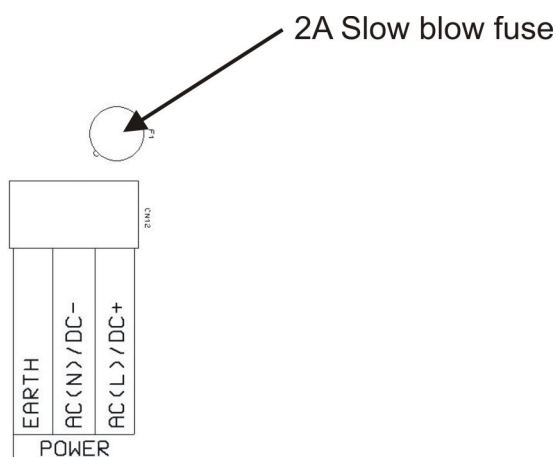


#### DC Power Supply



### 3.6 Fuse Replacement

The instrument contains a built in fuse. The fuse is a slow blow 2A Littlefuse part number 37212000431. The diagram below illustrates the position of the fuse on the main circuit board.



### 3.7 Load Cell Connection

The load cell should be connected to the instrument as in the diagrams below. 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.

It is recommended to use 6-wire load cells for the best results. When using 6-wire load cells make sure you connect the sense+ and sense- wires as close as possible to the load cell. The sense lines compensate for any voltage loss due to the wiring impedance.

If using 4-wire load cells then the sense+ must be connected to the excitation+ and the sense- must be connected to the excitation- as close as possible to the instrument.

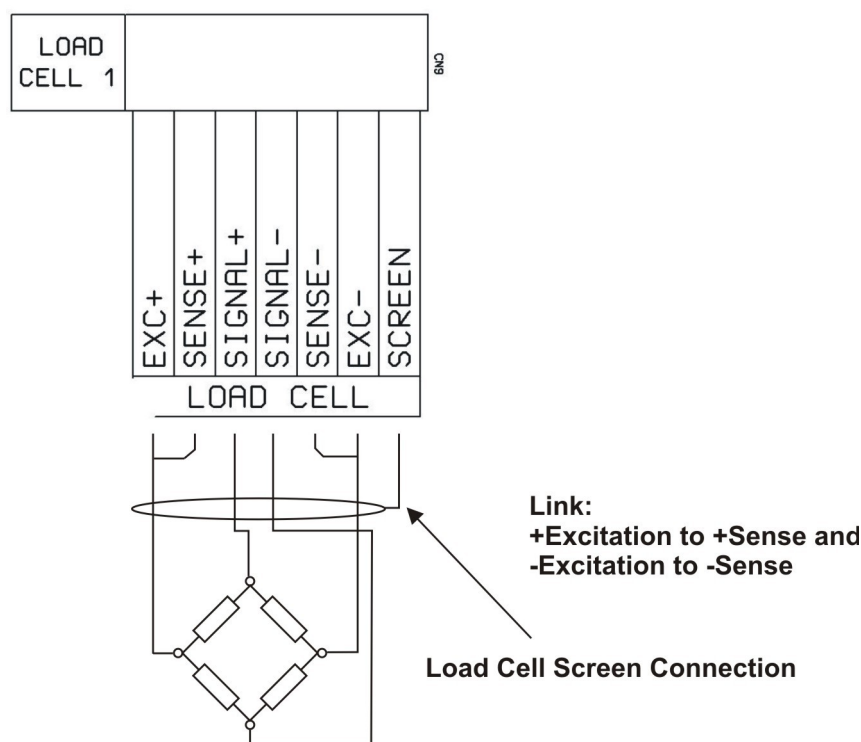
#### Automatic offset calibration

The instrument contains a unique feature in that it automatically does an offset calibration to cancel out any temperature effects in the electronics. This is to maintain optimum accuracy. The automatic offset calibration happens at power on as well as every few minutes. **Care must be taken to ensure that a load cell is connected before power is applied to the instrument otherwise an incorrect reading will be displayed until the next offset calibration takes place.**

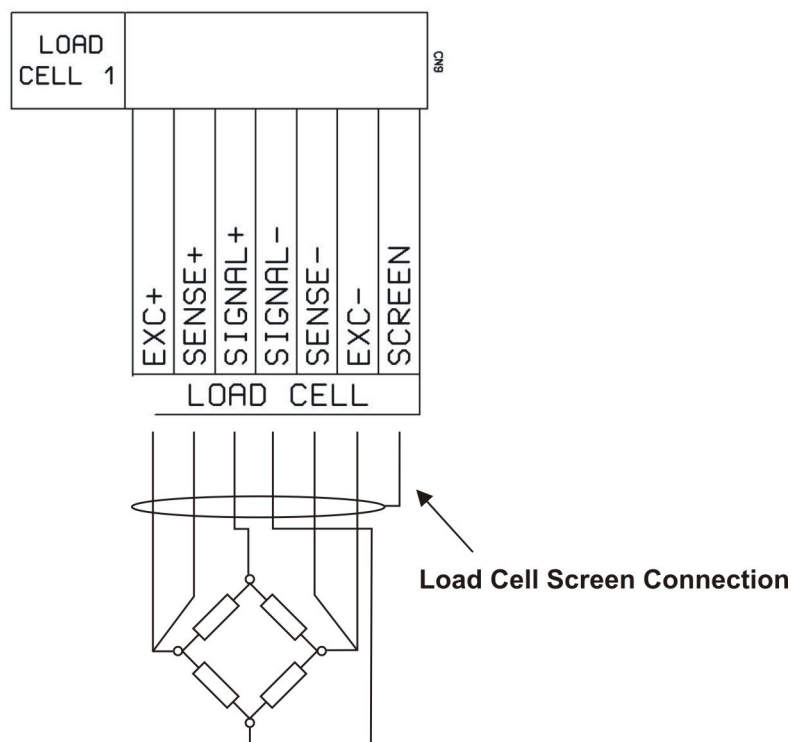
#### Load Cell Excitation Voltage

The instrument provides a stable built in +5VDC load cell excitation voltage. The instrument can power up to  $6 \times 350\Omega$  load cells using +5VDC excitation. Connect the sense+ to excitation+ and sense- to excitation- if using a 4-wire load cell.

#### 4-Wire Load Cell Connection

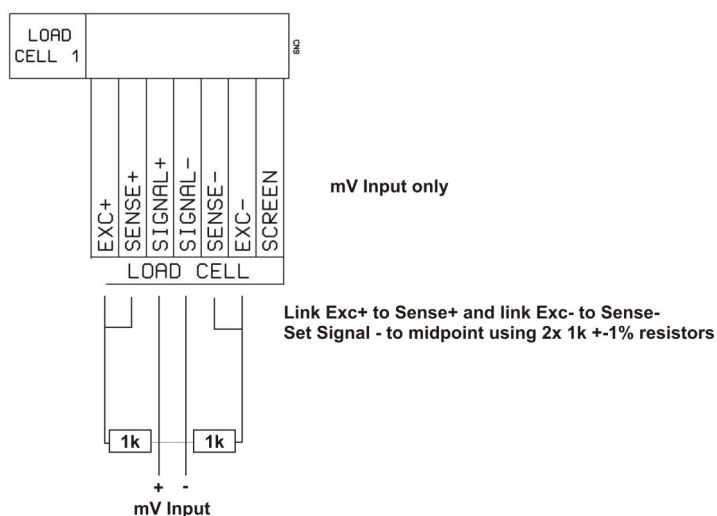


## 6-Wire Load Cell Connection



## Millivolt (mV) only input

If the instrument is used as a millivolt meter or if a true mV output calibrator is used then the input must be connected as in the diagram below. This is necessary to maintain the common mode voltage for the ratiometric ADC.



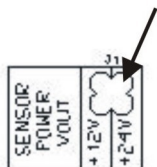
## ADC Ratiometric input

The instrument uses a ratiometric ADC (Analog to Digital Converter) to obtain its precision. This means it uses the sense lines as the reference to the ADC. If the excitation voltage to the load cells varies (i.e. due to cable length, temperature etc) then the output voltage of the load cell will vary in proportion to the excitation voltage. This form of measurement improves the accuracy of the instrument and is perfectly suited for bridge circuits such as load cells.

### 3.8 Sensor Power

The instrument provides a stable +12Vdc or +24Vdc to power sensors, encoders, switches & push buttons. The sensor power supply voltage is jumper selectable with a maximum current consumption of 100mA.

Select +12Vdc or +24Vdc Sensor Power



### 3.9 Digital Input Connection

The instrument has 5 programmable digital inputs. **Digital input 4 can be used as a programmable input if the belt speed is set to set.**

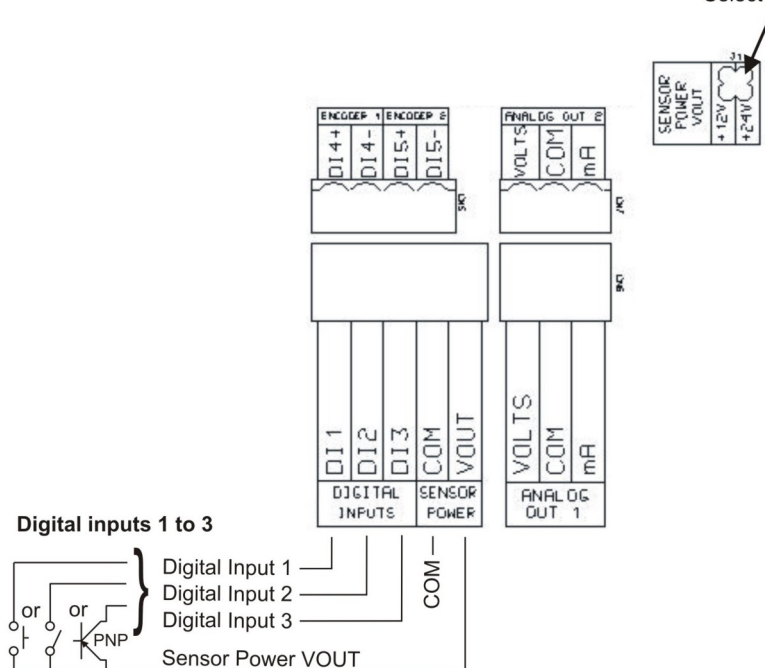
#### Digital Inputs 1, 2 and 3

Digital inputs 1, 2 and 3 require a voltage (Sensor Power VOUT on the instrument) to activate the digital input. Leaving the digital input floating / unconnected will deactivate the digital input. The instrument provides a stable +12Vdc or +24Vdc to power sensors, switches & push buttons. The sensor power supply voltage is jumper selectable with a maximum current consumption of 100mA. Digital inputs 1,2 & 3 have built in hysteresis, filter and input over voltage protection. Maximum input voltage <30VDC

Active/Non-Active input trigger: <2V

Non-Active/Active input trigger: >2.5V

Select +12Vdc or +24Vdc Sensor Power

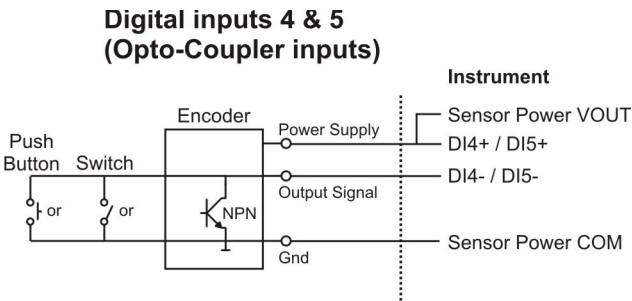


Digital Input 4 and 5

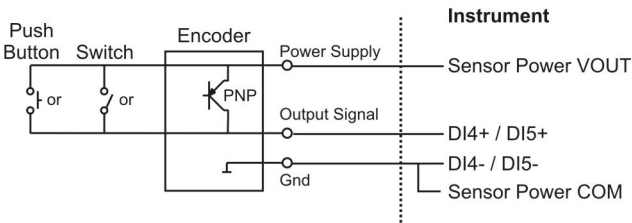
Digital input 4 and 5 are opto-isolated and are based on a PLC type input which can handle both NPN, Push-pull (Totem-Pole), PNP switches and push buttons.

The instrument provides a stable +12Vdc or +24Vdc to power sensors, switches & push buttons. The sensor power supply voltage is jumper selectable with a maximum current consumption of 100mA.

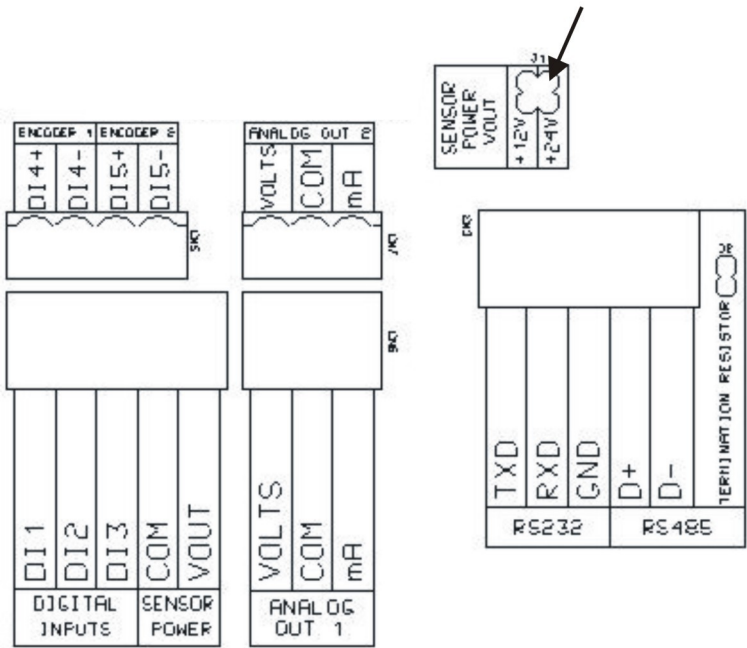
Please see the diagrams below on how to connect the digital inputs 4 and 5.



Digital inputs 4 & 5 can be wired either in a common ground or a common supply configuration



Select +12Vdc or +24Vdc Sensor Power

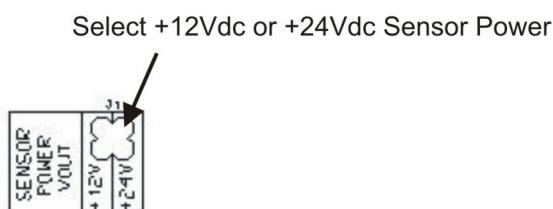


### 3.10 Encoder / Tacho-Generator Input Connection

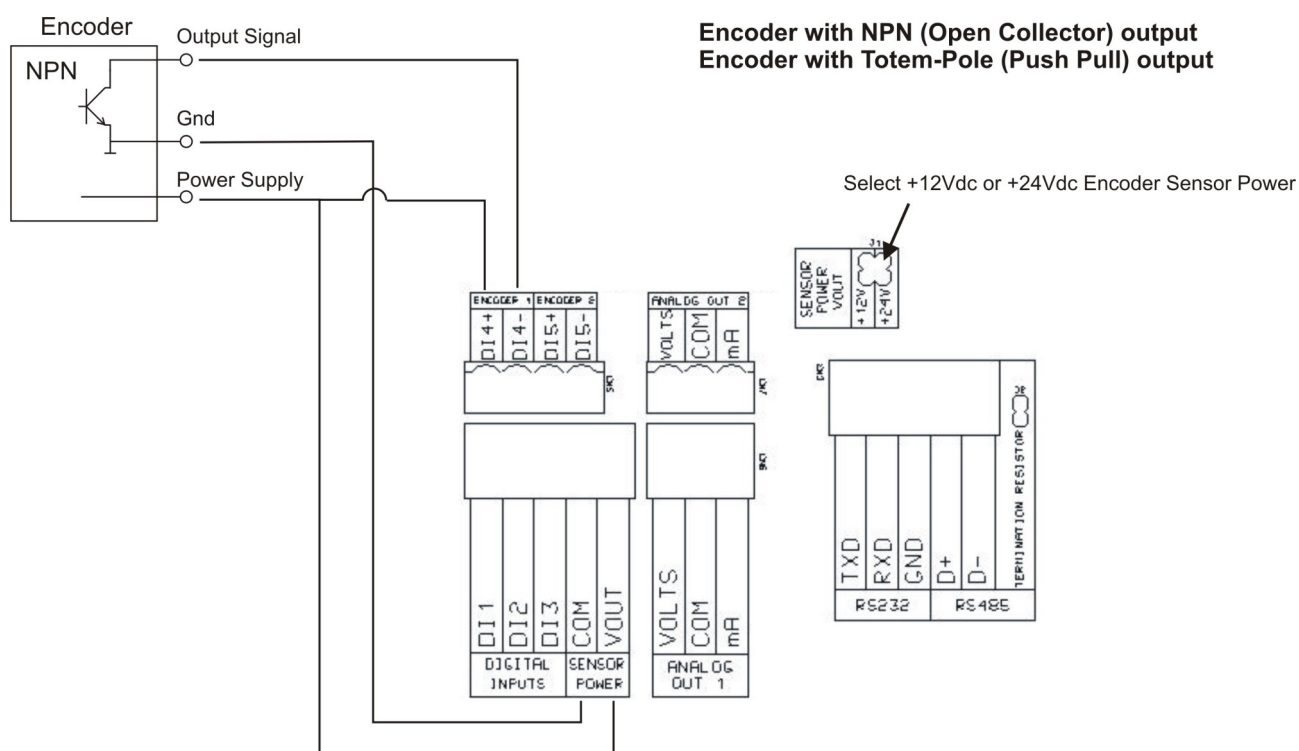
The instrument has a pulse counting digital input to measure speed pulses from an encoder / tachogenerator. The encoder input is opto-isolated and is based on a PLC type input which can handle both NPN, Push-pull (Totem-Pole) and PNP encoders / tachogenerators. The instruments can handle frequencies up to 10KHz.

The instrument also provides a stable +12Vdc or +24Vdc to power the encoder / tacho-generator. The encoder power supply voltage is jumper selectable with a maximum current consumption of 100mA.

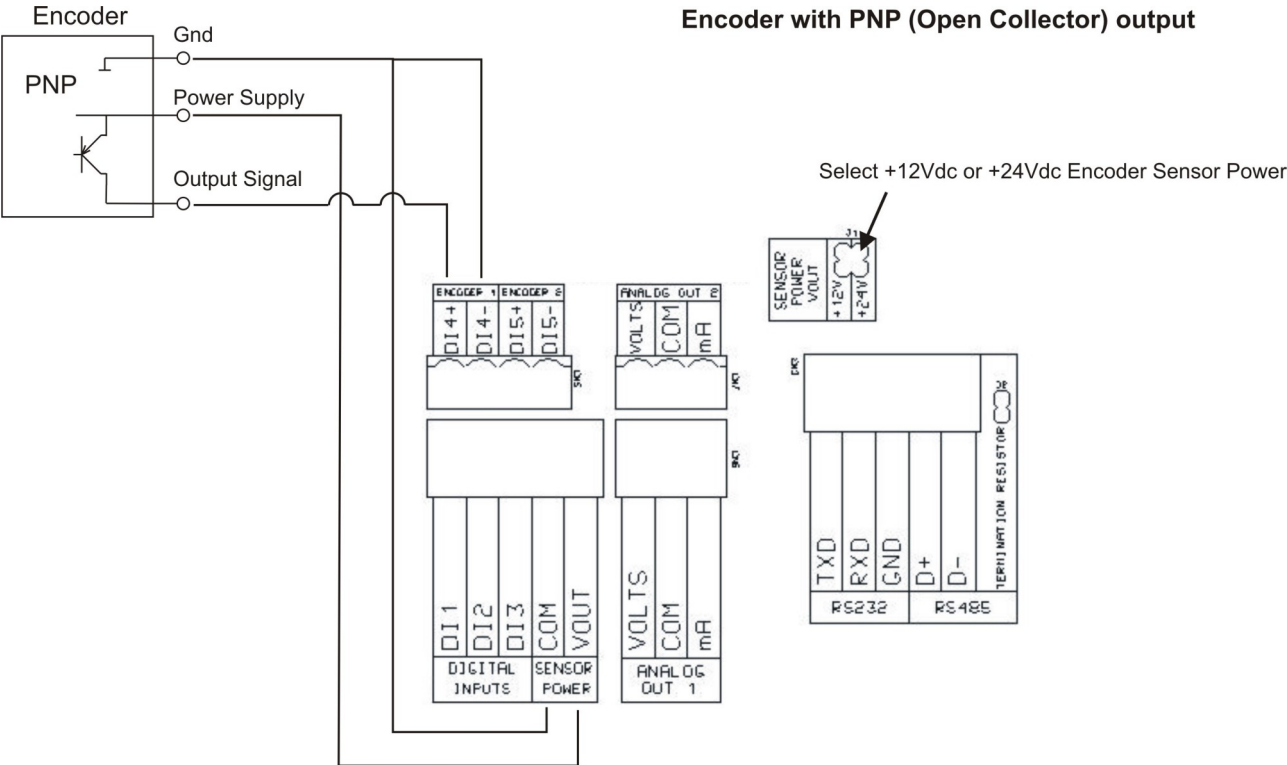
Please see the diagrams below on how to connect the different types of encoders / tacho-generators.



## Encoder with NPN (Open Collector) or Totem-Pole (Push Pull) output

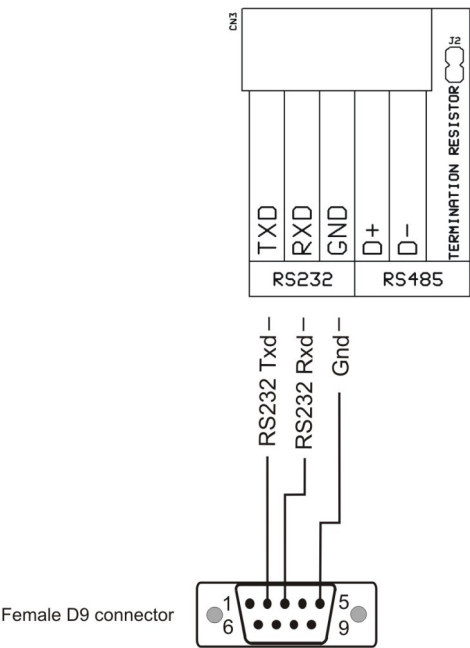


Encoder with PNP (Open Collector) output



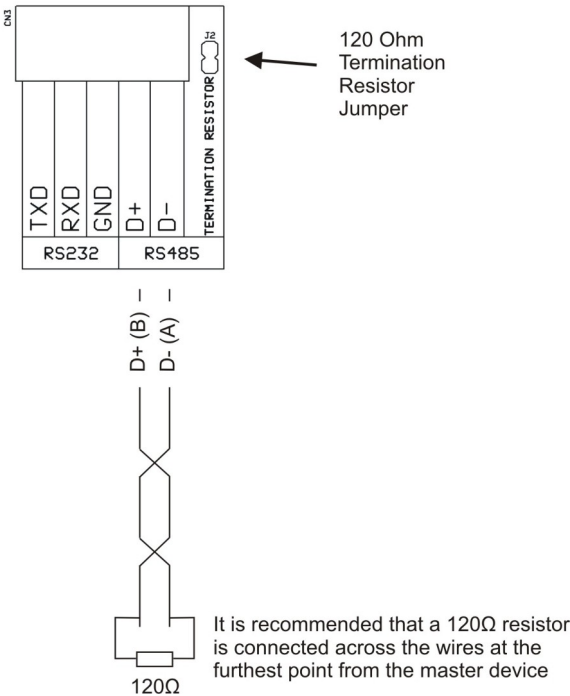
3.11 RS232 Communications

The RS232 protocol allows for a wired connection to be established as far as 100ft (30m). The RS232 port is also used for firmware upgrades.



3.12 RS485 Communications

The RS485 protocol allows for a wired connection to be established as far as 4000ft (1200m). RS232 only allows for a wired connection up to 100ft (30m). The instrument includes an on-board termination resistor which can be selected by linking J2 on the main circuit board. The termination resistor is 120 Ohms.



### 3.13 Ethernet Communications

A RJ45 port is provided for the ethernet network connection.

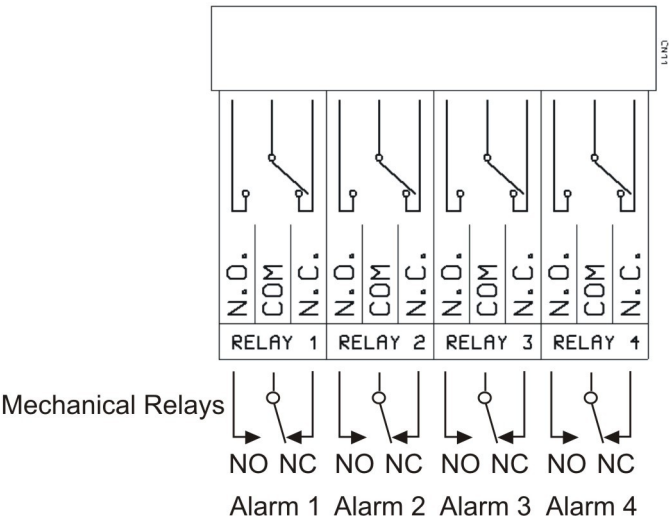
#### RJ45 cable installation Tip:

Remove the gland outer nut and rubber grommet from one of the big cable glands. Slip the RJ45 plug through the gland outer nut, through the rubber grommet and then through the gland. Click the RJ45 plug into the ethernet module and reassemble the cable gland.



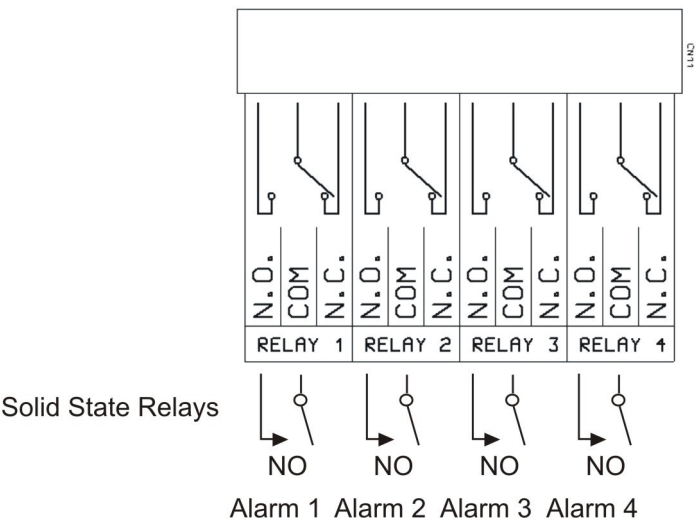
3.14 Mechanical Relays

4 Mechanical relays are provided as standard. Interposing relays are recommended for heavy duty applications. A R-C Snubber network or MOV maybe required for switching AC loads and a freewheeling diode or MOV maybe required for switching DC loads. An optional inductive load suppressor can be ordered and added to every relay output to suppress transient surges. Avoid running the alarm cables in the same trunking as the load cell cable.

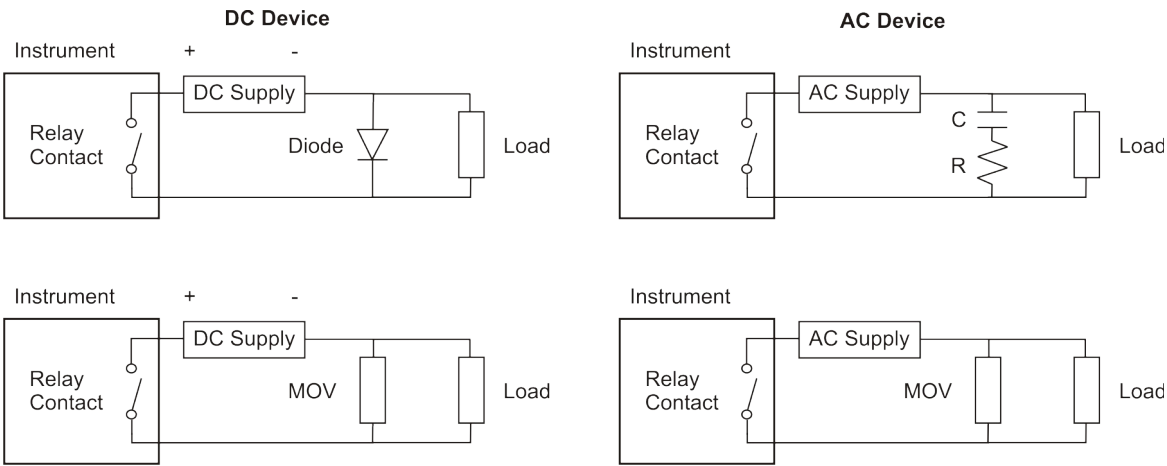


3.15 Solid-State Relays (Optional)

Up to 4 solid-state relays can be added as an option. **These are factory fitted and take the position of the equivalent mechanical relay.** Interposing relays are recommended for heavy duty applications. A R-C Snubber network or MOV maybe required for switching AC loads and a freewheeling diode or MOV maybe required for switching DC loads. An optional inductive load suppressor can be ordered and added to every relay output to suppress transient surges. Avoid running the alarm cables in the same trunking as the load cell cable.



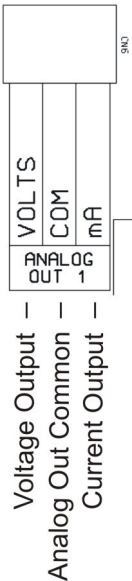
Noise suppression device for switching AC or DC devices



An optional noise suppression device can be ordered. Install these devices as close to the load as possible.

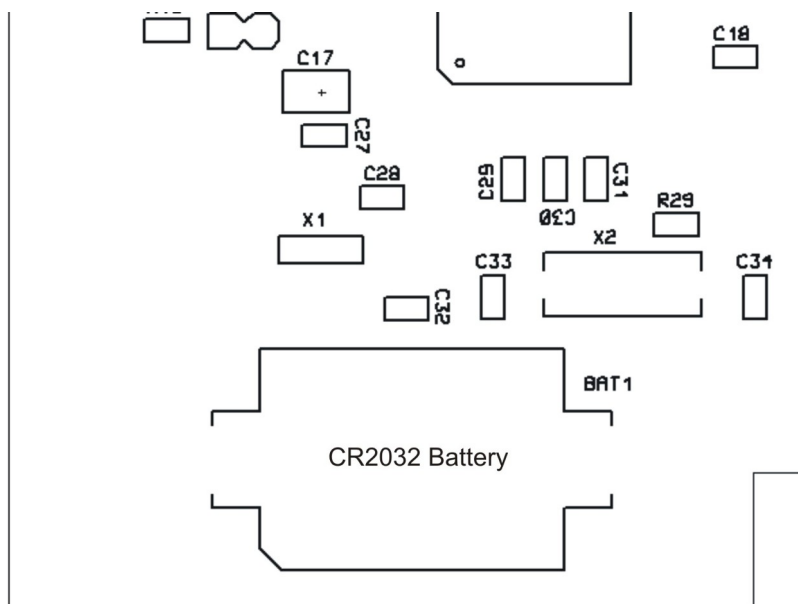
3.16 Analog Out

The Analog output uses a high precision 16 bit DAC (Digital to Analog converter) to provide analog ranges of 0-20mA, 4-20mA and 0-10V. The current output is source, not sink and can drive a maximum of 500Ω. The voltage output can drive a minimum load of 1kΩ. The current output also has a unique open loop detection feature. If the current loop is broken then the words “LOOP ERROR” will be briefly displayed on the LCD display. Connect the analog output as in the diagram below.



### 3.17 RTC Battery Replacement

The internal battery will have to be replaced if the instrument loses its time when the instrument is switched off and on. The battery is of type CR2032. The battery is located on the underside of the display circuit board. The diagram below shows the location of the battery.



#### MESSAGE

**REPLACE BATTERY  
OR SET CLOCK**

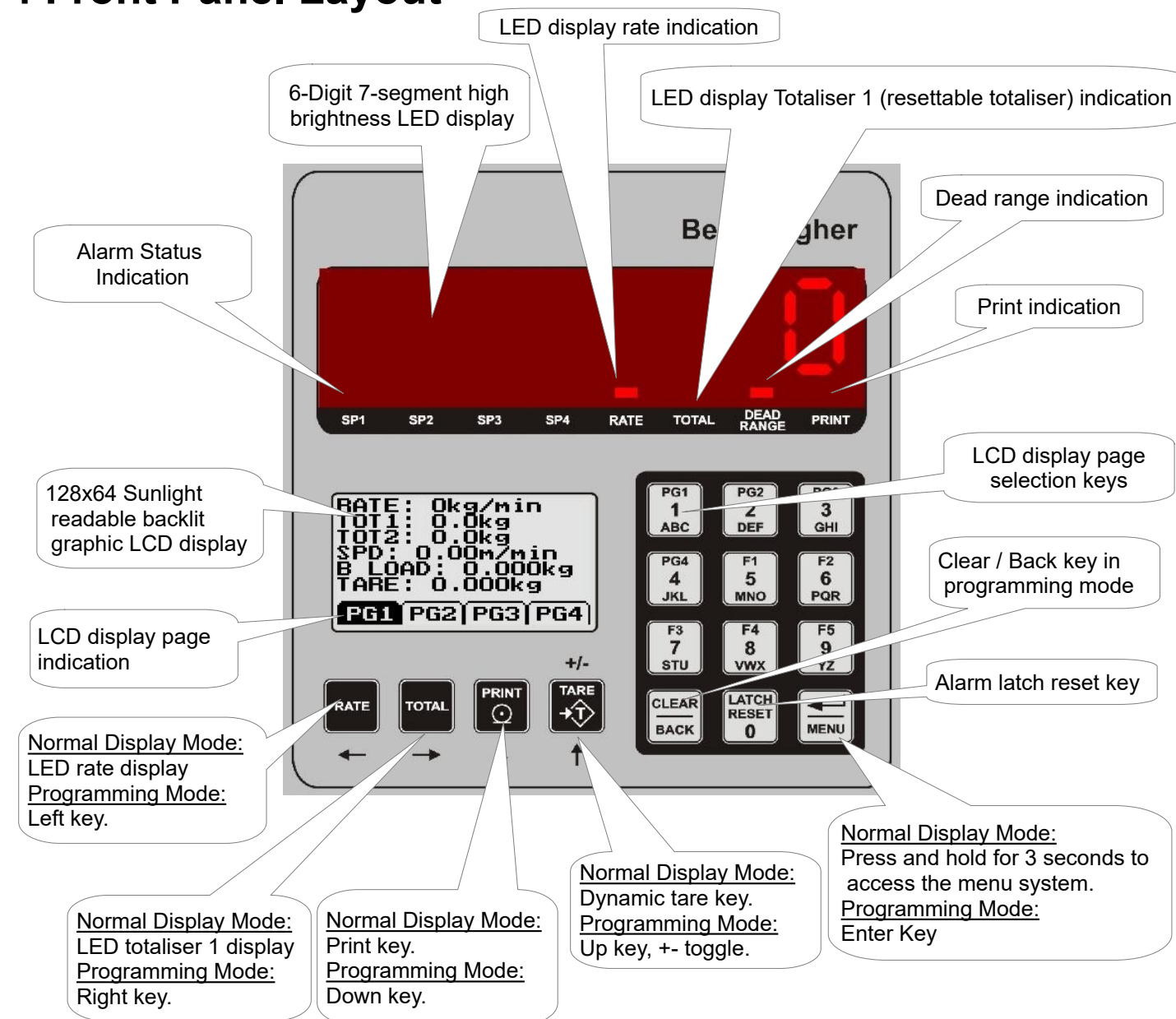
The internal CR2032 battery needs to be replaced or the clock needs to be set.

### 3.18 EMI Installation Guidelines

The instrument is designed with a high degree of immunity to EMI but the following guidelines will help in the successful installation of the instrument in the industrial environment. Cable length, routing and shielding can mean the difference between a successful or troublesome installation.

- Signal and control cables should be routed as far away as possible from contactors, DC motors etc.
- Never run signal or control cables in the same trunking as AC power lines or high current carrying conductors.
- Cables should be run in metal conduit that is grounded.
- Do not run cable near powerful radio transmitting devices eg. Two way radios.
- Keep cables as short as possible. Long cable runs are more susceptible to EMI than short run cables.
- Switching inductive loads cause high EMI. Use R-C Snubber networks or transient suppression devices across inductive loads.
- The instrument should be mounted in a grounded metal enclosure.
- Use shielded cables for all connections to the instrument. Some applications could require that one side of the screen is grounded.
- The use of external EMI suppression devices are recommended in high noise environments.

## 4 Front Panel Layout



### 4.1 LED Status Indicators



The SP1 to SP4 LED will illuminate when the corresponding alarm has been activated.



The rate LED will illuminate when the LED display is showing the rate value.



The total LED will illuminate when the LED display is showing the totaliser 1 (resettable totaliser) value.



The dead range LED will illuminate when the rate value is below the dead band setting. The rate value will not be added to the totalisers when the dead range LED is illuminated.



The Print LED will briefly flash when a successful print has been completed.

4.2 Keyboard Description

The instrument contains 4 dedicated function keys which can be enabled in the Function Key menu option. During normal display mode these are:

- RATE

This is the LED display rate push button. If enabled, this will switch the LED display to show the rate value.
- TOTAL

This is the LED display totaliser 1 (resettable totaliser) push button. If enabled, this will switch the LED display to show the totaliser 1 value.
- PRINT

This is the print push button. If enabled, this function key allows the user to print the assigned value via the RS232 or the RS485 interface. The print LED will briefly illuminate when the print push button is pressed. The print button will only work if either the RS232 or RS485 ASCII Out mode is selected.
- TARE

This is the dynamic tare push button. If enabled, this function key will start the dynamic tare function of the belt conveyor system.



←

→

↓

↑

These keys also serve as the up, down, left, right keys when navigating the menu system. The up key also changes the sign of a value when in editing a numeric value.

Keypad



The instrument contains a full alpha-numeric keypad for data entry in programming mode. During the normal display mode certain keys have alternate functions. These are:



These keys select page 1, page 2, page 3 or page 4 on the LCD display.

- LATCH RESET 0

This is the alarm latch push button. If enabled, this function key will reset any of the latched alarms when the alarm condition has been removed. This menu option is only displayed if any of the alarm latch functions have been enabled.

## 4.3 LCD Display Pages

### LCD Display Page 1

```

RATE: 0kg/min
TOT1: 0.0kg
TOT2: 0.0kg
SPD: 0.00m/min
B LOAD: 0.000kg
TARE: 0.000kg
PG1 PG2 PG3 PG4

```

```

FREQ: 0Hz
RPM: 0RPM
mA OUT: 4.00mA
PG1 PG2 PG3 PG4

```

This display page shows the following parameters: Rate, Totaliser 1 (resettable totaliser), Totaliser 2 (non-resettable totaliser), Speed, Belt Load (Weight) and the Tare value. Pressing the PG1 key again will display extended information such as frequency, RPM and the analog out value.

### LCD Display Page 2

```

----- TOTALS -----
TOT1: 0.0kg
TOT2: 0.0kg
PRESS CLEAR TO
RESET TOTAL 1
PG1 PG2 PG3 PG4

```

This display page shows the Totalisers. Totaliser 1 (resettable totaliser) and Totaliser 2 (non-resettable totaliser). Press the clear key to reset the Totaliser 1 value to zero.

### LCD Display Page 3

```

----- SETPOINTS -----
SP1: +001000
SP2: +001000
SP3: +001000
SP4: +001000
PG1 PG2 PG3 PG4

```

This display page shows the setpoints. This page also allows the editing of the setpoint values (If enabled in the security setup)

### LCD Display Page 4

```

----- MAX VALUES -----
RATE: 0kg/min
SPD: 0.00m/min
B LOAD: 0.000kg
CLEAR TO RESET
PG1 PG2 PG3 PG4

```

```

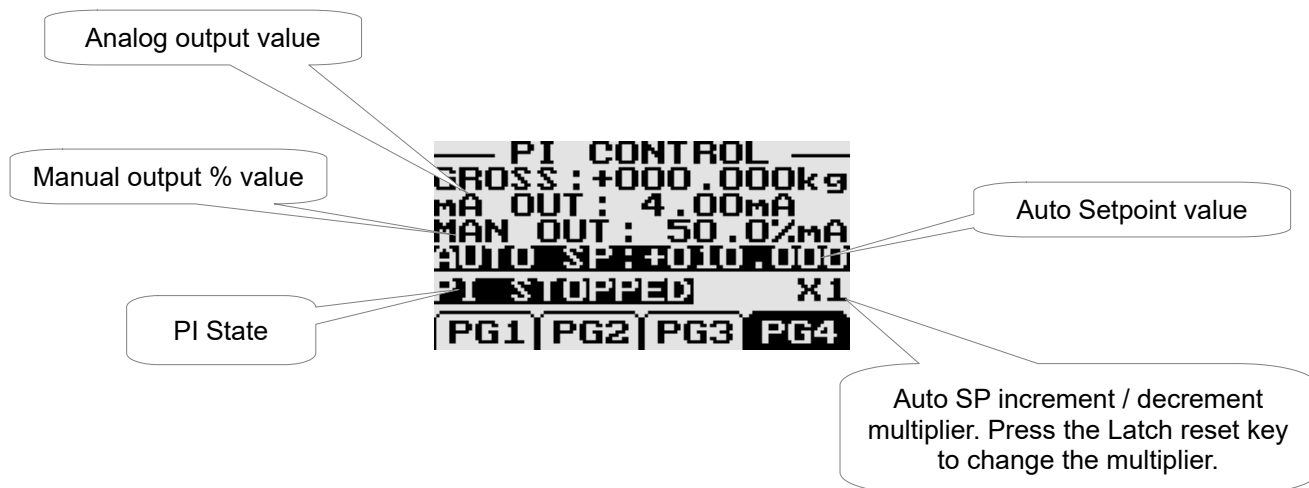
----- PI CONTROL -----
GROSS: +000.000kg
mA OUT: 4.00mA
MAN OUT: 50.0%mA
AUTO SP: +0010.000
PI STOPPED X1
PG1 PG2 PG3 PG4

```

This display page shows the max values and PI Control screen. Press the clear button to reset the max values to the current values. Toggle between the 2 display by pressing the PG4 button.

## 4.4 PI Control Display

Press the PG4 key to access the PI control main display (The PI Control function must be enabled).



Use the up/down and keypad to adjust the MAN OUT and AUTO SP value.

**Manual Mode:** Use the F4 and F5 key to increment and decrement the MAN OUT value.

**Auto Mode:** Use the F4 and F5 key to increment and decrement the AUTO SP value. Use the latch reset key to change the increment/decrement multiplier.

## PI Control Push buttons

The following push buttons are automatically assigned to PI functions when the PI Control is enabled. These keys are only active when the PI Control main display is showing.

**F1:** PI Start

**F2:** PI Stop

**F3:** PI Manual/Auto mode

**F4:** Manual analog output % increment (PI Manual mode). Auto SP increment (PI Auto mode).

**F5:** Manual analog output % decrement (PI Manual mode). Auto SP decrement (PI Auto mode).

**LATCH RESET:** Toggles setpoint multiplier

## 5 Menu System

### 5.1 Main Menu

The main menu is entered by pressing the  key. The following menu items will be displayed.

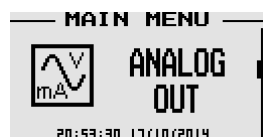


Belt Weigher setup menu

Press the up key to proceed to the next menu option



Alarm configuration setup menu



Analog output setup menu



RS232 and RS485 communications setup menu



Function keys setup menu



Digital inputs setup menu



PI Control setup menu




Miscellaneous items setup menu

Back to the start of the main menu

### 5.1.1 Exiting the menu system



Press the  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.

## 5.2 Belt Weigher Setup Menu



This menu configures the Belt Weigher parameters and also allows the user to calibrate the load cells.

```

— BELT WEIGHER —
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AUG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
  
```

This sub-menu configures the load cell parameters and also allows the user to calibrate the load cell system.

```

— LOAD CELL —
WEIGHT: kg
DEC PT: XXX.XXX
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 1S
LINEARISER SETUP
AUTO ZERO SETUP
  
```

Select the weight unit. The weight unit can be selected from “**kg**” kilograms, “**t**” metric tonnes, “**lb**” pounds and “**T**” imperial tons.

```

— LOAD CELL —
WEIGHT: kg
DEC PT: XXX.XXX
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 1S
LINEARISER SETUP
AUTO ZERO SETUP
  
```

Select the weight decimal point.

```

— LOAD CELL —
WEIGHT: kg
DEC PT: XXX.XXX
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 1S
LINEARISER SETUP
AUTO ZERO SETUP
  
```

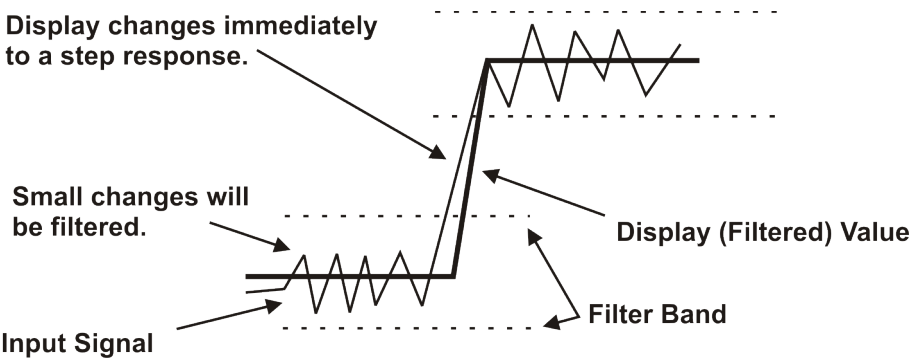
Select the display rounding in display counts. The round function rounds the display value to the nearest rounding increment. Eg. With a rounding setting of “**5**”, a display value of 233 will be rounded up to 235. A setting of “**10**” will create a dummy zero. The display rounding function can be used in conjunction with the digital filter settings to create a more stable display in noisy environments. The display rounding can be selected from “**1**”, “**2**”, “**5**”, “**10**”, “**20**”, “**50**”, “**100**” or “**200**” display counts.

### 5.2.1 Advanced Digital Filtering

The instrument contains an advanced digital filter algorithm. The filter works by filtering small changes between measurements but will react instantaneously to a large step response. There are 2 settings that are used to setup the digital filter, namely the filter band and the filter time. The filter band is the threshold in counts that the value must change by in order for the instrument to recognise it as a step response. The display will jump to this value immediately if a step response is detected. The filter time is the time in seconds that the input signal will be filtered provided that the input remains within the filter band setting. The filter is achieved by taking the moving average of the input signal for the filter time setting.

An increase in filter time leads to a more stable display but with a reduced reaction time. Use the filter time in conjunction with the filter band and display rounding settings to create a tradeoff between reaction time and display stability.

The diagram below illustrates the use of the filter time and the filter band.



```
— LOAD CELL —
WEIGHT: kg
DEC PT: xxx.xxx
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 1S
LINEARISER SETUP
AUTO ZERO SETUP
```

See the paragraph above for an explanation of the filter band.

```
— LOAD CELL —
WEIGHT: kg
DEC PT: xxx.xxx
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 3S
LINEARISER SETUP
AUTO ZERO SETUP
```

Select the filter time. See the paragraph above for an explanation of the filter time. A value of “1”, “3”, “5” or “10” seconds can be selected.

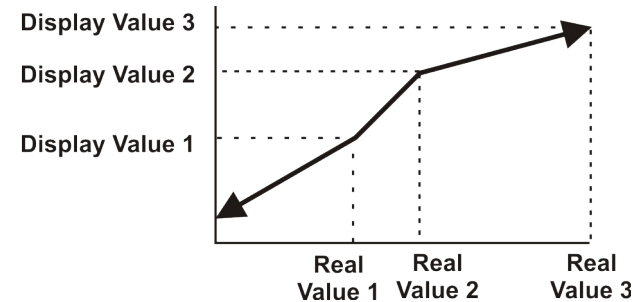
```
— LOAD CELL —
WEIGHT: kg
DEC PT: xxx.xxx
ROUND: 1
FILTER BAND: 0100
FILTER TIME: 1S
LINEARISER SETUP
AUTO ZERO SETUP
```

Lineariser setup sub-menu

For non-linear processes, up to 16 scaling points may be used to provide a piece-wise linear approximation. The greater the number of points the greater the accuracy. Each point has a real value and a corresponding display value. The real value is the actual value of the input as it would be with the lineariser feature turned off, the display value is the desired value.

Setup the lineariser as follows:

- The instrument must be setup and calibrated as normal.
- Apply test signals and record the actual readings on the display.
- Activate the lineariser and enter the real values and its corresponding display/desired value.
- The instrument can be checked by applying the original test signal and verifying the display value.



**Note:**  
If the measured value is above the last actual point then the lineariser will use the last 2 points to calculate the slope and similarly is the measured value is below the first actual point then it will use the first 2 points to calculate the slope.

```
— LINEARISER —
ENABLE: ON
POINTS: 3
REAL 1: +000.000
DISP 1: +000.000
REAL 2: +000.100
DISP 2: +000.200
REAL 3: +000.200
```

Select to enable the lineariser feature.



```
— LINEARISER —
ENABLE: ON
POINTS: 3
REAL 1: +000.000
DISP 1: +000.000
REAL 2: +000.100
DISP 2: +000.200
REAL 3: +000.200
```

Select the number of lineariser scaling points.



```
— LINEARISER —
ENABLE: ON
POINTS: 3
REAL 1: +000.000
DISP 1: +000.000
REAL 2: +000.100
DISP 2: +000.200
REAL 3: +000.200
```

Enter the actual or real value.



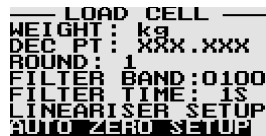
```
— LINEARISER —
ENABLE: ON
POINTS: 3
REAL 1: +000.000
DISP 1: +000.000
REAL 2: +000.100
DISP 2: +000.200
REAL 3: +000.200
```

Enter the display or desired value.



Back to the start of the lineariser setup menu

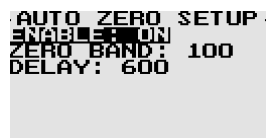
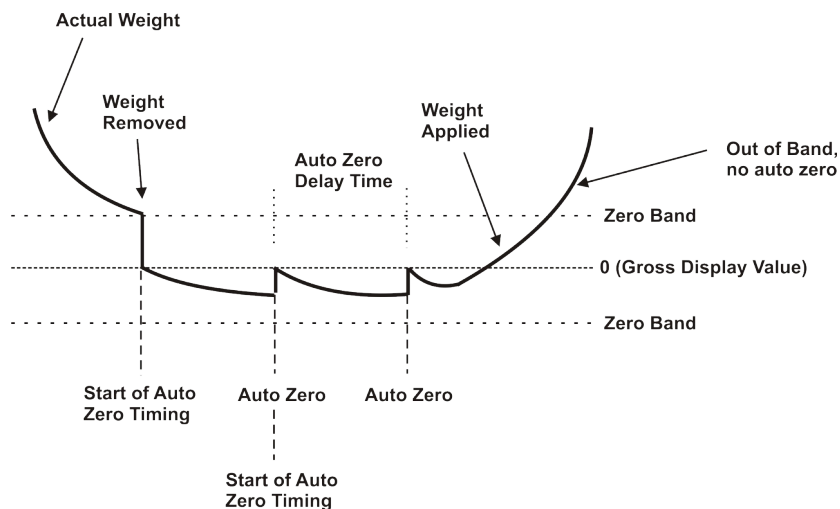
### Auto-Zero Tracking sub-menu



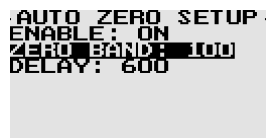
Auto-Zero Tracking sub-menu

The auto-zero tracking feature will zero the weight display at regular intervals as long as the measured weight is within the zero band setting. The LCD display will briefly flash “AUTO-ZERO” when an auto-zero has been performed. When the instrument restarts, the auto zero correction is lost, but it will start again with a new auto zero correction. Manual zeroing can also be done via a front push button or via a rear digital input. The auto-zero tracking function can be used to compensate for zero drift. Zero drift may be caused by changes in the electronics or accumulation of material on the weight system. The auto-zero band should be set large enough to track normal zero drift, but small enough not to interfere with normal measuring.

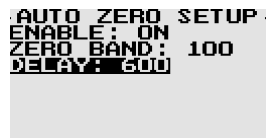
The diagram to the right illustrates the use of the auto-zero tracking function.



Select to enable the auto-zero tracking feature.



Enter the zero band setting in display counts. The auto-zero tracking will work within the limits of this band.

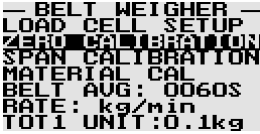


Auto-zero tracking delay time. This defines how often an auto zero is attempted.



Back to the start of the auto zero setup menu

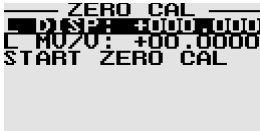
Zero Calibration sub-menu



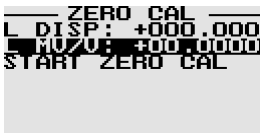
Zero Calibration sub-menu. The zero calibration is done to show a zero reading when there is no material on the belt system. The zero calibration is done by removing any deadweight from the belt itself and the weigh section. Make sure the belt system is running and that and that at least 1 full revolution of the belt has been achieved when doing the zero calibration feature.

The “L DISP” and “L MV/V” values do not need to be entered manually if the user is performing a dynamic zero calibration using the “START ZERO CAL”.

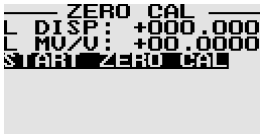
For best results the system should be given a warm up time of a minimum of 15 minutes before calibration takes



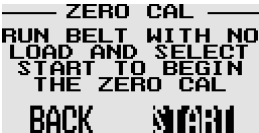
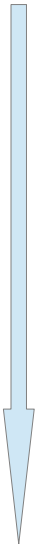
Enter the value in engineering units of the low calibration point of the system. This is normally zero.



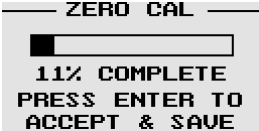
Enter the value in mV/V that corresponds to the low display value. This value is normally found on the load cells calibration certificate. The load cells offset zero error is normally expressed as uV (microvolts) at 10V excitation. Eg. A load cell zero error with no load is 560uV (0.56mV) at 10V excitation. To convert to mV/V divide by 10 which equals 0.056mV. This value must then be entered into the low mV/V setting.



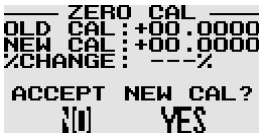
Select this menu item to perform a dynamic zero calibration of the belt system.



Select start to begin the dynamic zero calibration procedure.



Press enter to accept the zero calibration. Make sure the belt system is running and that and that at least 1 full revolution of the belt has been achieved when doing the zero calibration feature. The averaging time of the conveyor belt can be extended by increasing the sample time setting.



The belt conveyor system can now be stopped. Select if you wish to save the new calibration. The zero calibration and its corresponding mV/V value will be saved in the “L DISP” and “L MV/V” settings.

Back to the start of the zero calibration menu

Span Calibration sub-menu

```
— BELT WEIGHER —  
LOAD CELL SETUP  
ZERO CALIBRATION  
SPAN CALIBRATION  
MATERIAL CAL  
BELT AUG: 0060S  
RATE: kg/min  
TOT1 UNIT: 0.1kg
```

Span Calibration sub-menu

Place the test weights on the weigh section of the belt conveyor.

The “H DISP” and “H MV/V” values do not need to be entered manually if the user is performing a calibration using test weights and using the “START SPAN CAL”.

For best results the system should be given a warm up time of a minimum of 15 minutes before calibration takes

```
— SPAN CAL —  
H DISP: +020.000  
H MV/V: +02.0000  
START SPAN CAL
```

Enter the value in engineering units of the high calibration point of the system eg. 5000kg. This is normally the full rating value of the load cells.



```
— SPAN CAL —  
H DISP: +020.000  
H MV/V: +02.0000  
START SPAN CAL
```

Enter the value in mV/V that corresponds to the high display value. This value is normally found on the load cells calibration certificate. The required value is the rated value of the load cell in mV/V at full load.



```
— SPAN CAL —  
H DISP: +020.000  
H MV/V: +02.0000  
START SPAN CAL
```

Select this menu item to perform a span calibration of the belt system. This allows the user to enter and apply the high load cell calibration weight.



```
— SPAN CAL —  
APPLY A KNOWN  
WEIGHT APPROX.  
100% AND ENTER  
THE VALUE  
+020.000 kg
```

Apply the test weight to the weigh section and enter the display value that corresponds to the test weight.



```
— SPAN CAL —  
5% COMPLETE  
PRESS ENTER TO  
ACCEPT & SAVE
```

The instrument will start to average and calculate the mV/V value that corresponds to the test weight.



```
— HIGH CAL —  
OLD CAL: +02.0000  
NEW CAL: +00.0000  
%CHANGE: -100.0%  
ACCEPT NEW CAL?  
[N] YES
```

The test weight can now be removed. Select if you wish to save the new calibration. The high calibration value and its corresponding mV/V value will be saved in “H DISP” and “H MV/V” settings.

Back to the start of the span calibration menu

## Notes on calibration:

The span calibration can be calibrated in 2 ways. Either by using test weights or from the load cell calibration certificate. The instrument can be calibrated using the mV/V values from the load cell calibration certificate and entering this in the "H DISP" and "H MV/V" settings.

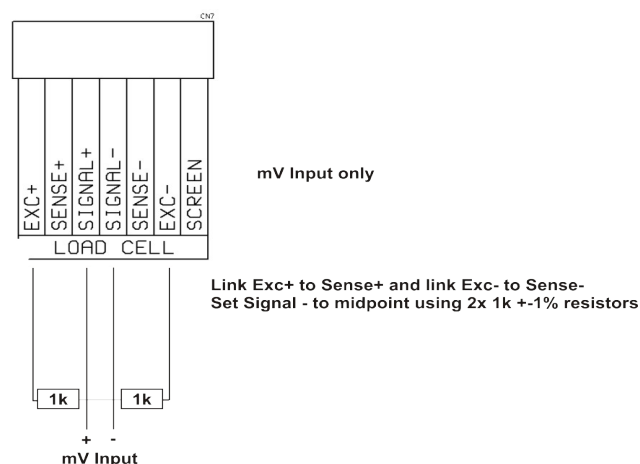
For best results the system should be given a warm up time of a minimum of 15 minutes before calibration takes place and the 2 known weights should be as different from each other as possible to allow the instrument to try and obtain the greatest resolution. The high calibration test weight should also be as close to the maximum system capacity as possible (Full load on the load cells)

## Calibrating using a Load Cell Simulator or mV simulator

Calibrating the instrument using a known test weight is the most accurate way to calibrate the instrument. Other calibration equipment such as a load cell simulator or mV calibrator can also be used.

Using a load cell simulator is the easiest and best way to calibrate the instrument and this requires no additional interface circuitry because the load cell simulator will setup the common mode voltage required by the input to the ADC.

The circuit as illustrated to the right must be constructed if trying to calibrate the instrument using a pure mV signal such that of a pure mV output calibrator. The resistors can be of a type 1k Ohm 1/4W 50ppm 1%. Please note that the resistor junction is only connected on the negative signal input. The below circuit is required to setup a common mode voltage for the ratiometric ADC.



## Material Calibration sub-menu

```

— BELT WEIGHER —
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AUG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
  
```

Material Calibration can be used to check the accuracy of the system, and if needed, automatically adjust the C-Factor (Rate correction factor).

The reference material can be weighed either before or after doing the Material Calibration.

```

ENTER SECURITY
CODE
0000
  
```

Enter the security code to access the Material Calibration feature.

```

— MATERIAL CAL —
C-FACTOR: 100.0%
START CALIBRATE
  
```

Enter the rate correction factor in percent (Manual entry). This factor adjusts the rate value proportionally and can fine tweak the rate value of the system.



```

— MATERIAL CAL —
C-FACTOR: 100.0%
START CALIBRATE
  
```

Select this menu option to start the Material Calibration (Automatic)



```

— MATERIAL CAL —
PERFORM ZERO AND
SPAN CALIBRATION
BEFORE RUNNING
MATERIAL CAL
  
```

Make sure the Zero and Span calibration is done prior to performing the Material calibration.



```

— MATERIAL CAL —
RUN BELT EMPTY.
SELECT START
ONCE NORMAL RUN
SPEED IS REACHED
BACK
  
```

Run the belt empty. Select start when normal running speed is reached.



```

— MATERIAL CAL —
RUN MEASURED
QUANTITY OVER
SCALE. PRESS
ENTER WHEN DONE
RATE: 0kg/min
TOTAL: 19.6kg
  
```

Run the reference material over the belt until completely finished.



```

— MATERIAL CAL —
ENTER REFERENCE
QUANTITY
22.0kg
  
```

Enter the weight of the reference material.



The reference material weight, measured weight, current C-Factor value and the new calculated C-Factor value is shown. Select “Yes” to accept the new C-Factor, or “No” to decline and return back to the menu system.

```

-- BELT WEIGHER --
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
    
```

Enter the averaging time for the belt system during the zero calibration, span calibration and dynamic tare of the belt system.

```

-- BELT WEIGHER --
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
    
```

Select the belt rate unit. The units can be selected from “0.1kg/min”, “kg/min”, “0.01kg/h”, “0.1kg/h”, “kg/h”, “0.1t/min”, “t/min”, “0.01t/h”, “0.1t/h”, “t/h”, “0.1lb/min”, “lb/min”, “0.01lb/h”, “0.1lb/h”, “lb/h”, “0.1T/min”, “T/min”, “0.01T/h”, “0.1T/h” or “T/h”.

```

-- BELT WEIGHER --
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
    
```

Select the totaliser 1 unit. The units can be selected from “0.1kg”, “kg”, “0.001t”, “0.01t”, “0.1t”, “t”, “0.1lb”, “lb”, “0.01T”, “0.1T” or “T”.

```

-- BELT WEIGHER --
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
TOT2 UNIT: 0.1kg
    
```

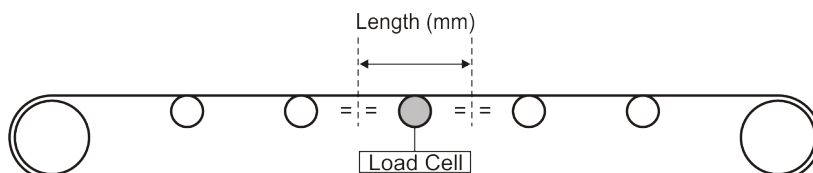
Select the totaliser 2 unit. The units can be selected from “0.1kg”, “kg”, “0.001t”, “0.01t”, “0.1t”, “t”, “0.1lb”, “lb”, “0.01T”, “0.1T” or “T”.

```

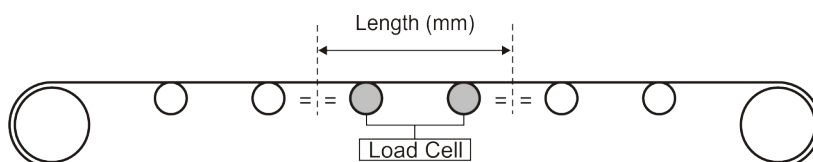
-- BELT WEIGHER --
LOAD CELL SETUP
ZERO CALIBRATION
SPAN CALIBRATION
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
TOT2 UNIT: 0.1kg
WEIGH LENGTH: 01000
    
```

Enter the weigh section length of the belt weigher in millimeters (mm). See examples below.

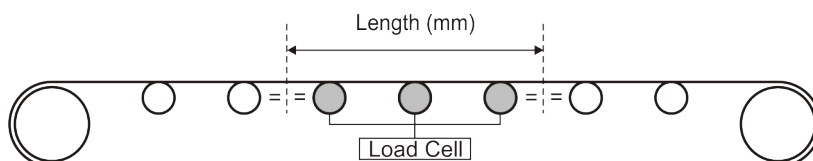
## 1 Roller on load cells



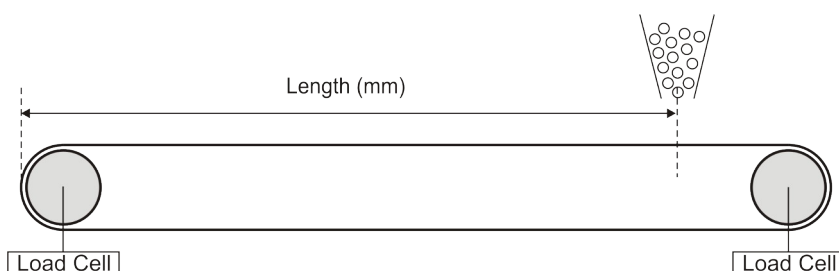
## 2 Rollers on load cells



## 3 Rollers on load cells



## Complete conveyor on load cells



```

— BELT WEIGHER —
MATERIAL CAL
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
TOT2 UNIT: 0.1kg
WEIGH LEN: 01000
DEAD BAND: ON
    
```



Select if you want to enable the dead band feature. Any belt rate value between the positive and negative dead band settings will not be added to the totalisers.

```

— BELT WEIGHER —
BELT AVG: 0060S
RATE: kg/min
TOT1 UNIT: 0.1kg
TOT2 UNIT: 0.1kg
WEIGH LEN: 01000
DEAD BAND: ON
DEAD POS: 010
    
```



Enter the dead band positive rate limit. Any belt rate value between the positive and negative dead band settings will not be added to the totalisers.

```

— BELT WEIGHER —
RATE: kg/min
TOT1 UNIT: 0.1kg
TOT2 UNIT: 0.1kg
WEIGH LEN: 01000
DEAD BAND: ON
DEAD POS: 010
DEAD NEG: -010
    
```



Enter the dead band negative rate limit. Any belt rate value between the positive and negative dead band settings will not be added to the totalisers.

```

— BELT WEIGHER —
TOT2 UNIT: 0.1kg
WEIGH LEN: 01000
DEAD BAND: ON
DEAD POS: 010
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
    
```



Select if you want to manually enter a belt speed or if you want the belt weigher to measure the belt speed using the encoder / tachogenerator input.

If the Belt Speed is set to “SET”

```

— BELT WEIGHER —
WEIGH LEN: 01000
DEAD BAND: ON
DEAD POS: 010
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: SET
SPEED SET: 0001000
    
```

Enter the average belt speed in m/min.

If the Belt Speed is set to “MEAS”

```

— BELT WEIGHER —
WEIGH LEN: 01000
DEAD BAND: ON
DEAD POS: 010
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
PULLEY DIA: 0100
    
```



Enter the pulley diameter (where the encoder / tachogenerator is connected to) including the belt thickness top and bottom in millimeters (mm).

```

— BELT WEIGHER —
DEAD BAND: ON
DEAD POS: 010
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
PULLEY DIA: 0100
ENC PUL/REV:0600
FREQ MEAS: >500Hz

```

Enter the pulses per revolution of the encoder / tachogenerator.

```

— BELT WEIGHER —
DEAD POS: 010
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
PULLEY DIA: 0100
ENC PUL/REV:0600
FREQ MEAS: >500Hz

```

Select if you want to measure frequency using period measurement “<500Hz” or pulse measurement “>500Hz”.

```

— BELT WEIGHER —
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
PULLEY DIA: 0100
ENC PUL/REV:0600
FREQ MEAS: <500Hz
FREQ FILTER: 2S

```

This menu item is only shown if the frequency measurement is set for “<500Hz”. This menu item selects the filter time of the frequency input.

```

— BELT WEIGHER —
DEAD NEG: -010
C-FACTOR: 100.0%
BELT SPEED: MEAS
PULLEY DIA: 0100
ENC PUL/REV:0600
FREQ MEAS: >500Hz
FREQ GATE: 1S

```

This menu item is only shown if the frequency measurement is set for “>500Hz”. This menu item selects the gate time interval for the frequency pulse counting.

```

— BELT WEIGHER —
BELT SPEED: MEAS
PULLEY DIA: 0100
ENC PUL/REV:0600
FREQ MEAS: >500Hz
FREQ FILTER: 2S
FREQ GATE: 1S
RATE: INSTANT

```

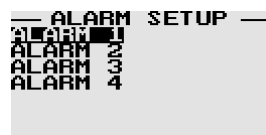
Select if the belt rate must be instantaneous or if it must be integrated over 1 minute.

Back to the start of the belt weigher configuration menu

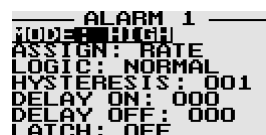
## 5.3 Alarm Configuration Menu



This menu configures the alarm parameters.

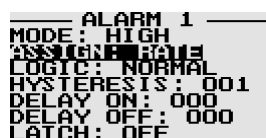


The Alarm 1 setup menu is shown below. The setup menu is identical for each of the alarms.

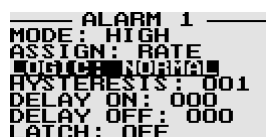


Select the alarm mode. The alarm mode can be set to:

- “OFF”: The alarm is disabled
- “LOW”: A low alarm is activated when the measured value is below the alarm setpoint.
- “HIGH”: A high alarm is activated when the measured value is higher then the alarm setpoint
- “DEV” A deviation alarm which is activated when the measured value falls outside of the deviation band.
- “PULSE TOT 1” Pulse output using totaliser 1.
- “PULSE TOT 2” Pulse output using totaliser 2.



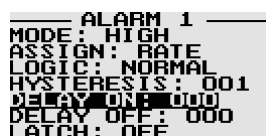
Select the alarm assignment. The alarm will use this value to compare against the set point value. The alarm can be selected to work off the “**WEIGHT**”, “**RATE**”, “**TOTAL 1**”, “**TOTAL 2**” or “**SPEED**”.



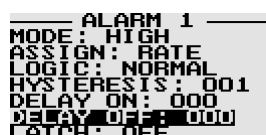
Select the alarm logic. The alarm can be set to “**NORMAL**” or “**INVERT**”.



Enter the alarm hysteresis value. The hysteresis value is normally used to prevent an alarm being activated and deactivated when a noisy measurement dithers around the set point value.



Enter the alarm on delay value in seconds that the alarm condition must persist before the alarm is activated.



Enter the alarm off delay value in seconds that the alarm condition must persist before the alarm is de-activated.



```

ALARM 1
MODE: HIGH
ASSIGN: RATE
LOGIC: NORMAL
HYSTERESIS: 001
DELAY ON: 000
DELAY OFF: 000
LATCH: OFF

```

The alarm can be set to remain activated even if the alarm condition has been removed. When the alarm condition has gone then the alarm latch can be reset by either a digital input or via the front alarm latch reset push button.



Back to the start of the alarm configuration menu

If the “DEV” alarm mode is selected.

```

ALARM 1
ASSIGN: RATE
LOGIC: NORMAL
HYSTERESIS: 001
DELAY ON: 000
DELAY OFF: 000
LATCH: OFF
DEV LOW: 0100

```

Enter the deviation low value. The low value of the band is the set point minus the deviation low value. This menu option is only shown if the alarm mode is set to deviation.



```

ALARM 1
LOGIC: NORMAL
HYSTERESIS: 001
DELAY ON: 000
DELAY OFF: 000
LATCH: OFF
DEV LOW: 0100
DEV HIGH: 0100

```

Enter the deviation high value. The high value of the band is the set point plus the deviation high value. This menu option is only shown if the alarm mode is set to deviation.

If the “PULSE TOT1” or “PULSE TOT2” alarm mode is selected.

```

ALARM 1
MODE: PULSE TOT1
PULSE LENGTH: 500

```

```

ALARM 1
MODE: PULSE TOT2
PULSE LENGTH: 500

```

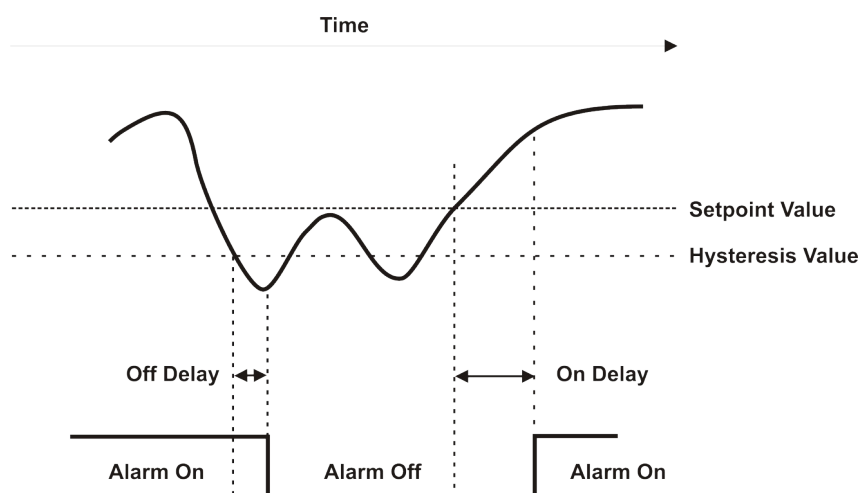


```

ALARM 1
MODE: PULSE TOT1
PULSE LENGTH: 500

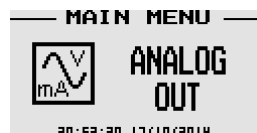
```

Enter the pulse width in milliseconds of the output pulse.



The above diagram illustrates the use of a high alarm with hysteresis and on/off delay.

## 5.4 Analog Out Configuration Menu



This menu configures the analog output parameters.

```

— ANALOG OUT —
TYPE: 4-20mA
ASSIGN: RATE
4mA: +000000
20mA: +020000
ERROR: OFF
  
```

Select the analog output type. The analog output type can be selected from “OFF”, “0-20mA”, “4-20mA” or “0-10V”.



```

— ANALOG OUT —
TYPE: 4-20mA
ASSIGN: RATE
4mA: +000000
20mA: +020000
ERROR: OFF
  
```

Select the source for the analog retransmission. The source can be selected from the “WEIGHT”, “RATE”, “TOTAL 1”, “TOTAL 2” or “SPEED”.



```

— ANALOG OUT —
TYPE: 4-20mA
ASSIGN: RATE
4mA: +000000
20mA: +020000
ERROR: OFF
  
```

Enter the display value that corresponds to the selected analog output low value. E.G. 0.000 display counts = 4mA. (4-20mA analog output type shown).



```

— ANALOG OUT —
TYPE: 4-20mA
ASSIGN: RATE
4mA: +000000
20mA: +020000
ERROR: OFF
  
```

Enter the display value that corresponds to the selected analog output high value. E.G. 20.000 display counts = 20mA. (4-20mA analog output type shown).



```

— ANALOG OUT —
TYPE: 4-20mA
ASSIGN: RATE
4mA: +000000
20mA: +020000
ERROR: OFF
  
```

Enter what must happen to the analog output when an error occurs with the measured weight. eg. Over-range, Under-Range etc. The analog error can be set to:

- “OFF”: The analog error feature is disabled.
- “OUT LOW”: The analog output will go to the minimum value when an error occurs.
- “OUT HIGH”: The analog output will go to the maximum value when an error occurs.

## 5.5 Communications Configuration Menu



This menu configures the RS232, RS485 and Ethernet communication parameters.

```
- COMMUNICATIONS -
UNIT ADDRESS:001
RS232 SETUP
RS485 SETUP
ETHERNET SETUP
```

Enter the communication address of the instrument. If more than 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.



```
- COMMUNICATIONS -
UNIT ADDRESS:001
RS232 SETUP
RS485 SETUP
ETHERNET SETUP
```

The ASCII out protocol address range is 0 to 255. The Modbus address range is 001 to 247.

RS232 Communications setup menu.



```
- COMMUNICATIONS -
UNIT ADDRESS:001
RS232 SETUP
RS485 SETUP
ETHERNET SETUP
```

RS485 Communications setup menu.



```
- COMMUNICATIONS -
UNIT ADDRESS:001
RS232 SETUP
RS485 SETUP
ETHERNET SETUP
```

Ethernet Communications setup menu.

The instrument has 3 built in communication protocols:

- 1) MODBUS RTU
- 2) MODBUS ASCII
- 3) A simple serial ASCII protocol for interfacing to large displays and serial printers.

Please see below for the MODBUS registers.

### 5.5.1 RS232 / RS485 Communication Setup Menu

The RS232 Communications setup menu is shown below. The setup for the RS485 communications setup is identical

```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```

Select the communication protocol. The communication protocol can be set to:

- “ASCII OUT”: A simple ASCII protocol to interface to serial printers and large displays. Please see the format of the ASCII out protocol in section 5.5.1
- “MODBUS RTU”: Modbus RTU protocol
- “MODBUS ASC”: Modbus ASCII protocol.

Select the communication baud rate. The baud rate can be selected from “1200”, “2400”, “4800”, “9600”, “19200”, “38400”, “57600” and “115200” baud.

Select the communication data bits. “7” or “8” data bits can be selected.

Select the communication parity bit. “NONE”, “ODD” or “EVEN” parity can be selected.

Select the communication stop bit. “1” or “2” stop bits can be selected.

Select the source for the communication data. This menu option is only shown if the ASCII Out mode is selected. The communication source can be selected from the “WEIGHT”, “RATE”, “TOTAL 1”, “TOTAL 2”, “SPEED”, “BELT” or “BELT CSV”.

This menu option is only shown if the ASCII Out mode is selected.

```

— RS232 SETUP —
PROT: ASCII OUT
BAUD RATE: 9600
DATA BITS: 8
PARITY: NONE
STOP BITS: 1
ASSIGN: RATE
PRINT: ON DEMAND

```



Select between print “ON DEMAND” or “CONTINUOUS” printing. Print on demand will print the ASCII string by either pressing the front print push button or by using a digital input. Continuous printing will transmit the ASCII string at a rate of 5 times a second.

This menu option is only shown if the ASCII Out mode is selected.

```
— RS232 SETUP —  
BAUD RATE: 9600  
DATA BITS: 8  
PARITY: NONE  
STOP BITS: 1  
ASSIGN: RATE  
PRINT: ON DEMAND  
DATE&TIME: ON
```

This menu option enables the date and time to be included in the ASCII output string.



Back to the start of the RS232 or RS485 configuration menu

5.5.2 Ethernet Communication Setup Menu

Only Modbus RTU is supported over the ethernet connection.

```
- ETHERNET SETUP -  
INFORMATION  
SETUP IP ADDRESS  
ETHERNET MODE
```

This menu option lists the ethernet parameters in an easy to read list



```
- ETHERNET SETUP -  
INFORMATION  
SETUP IP ADDRESS  
ETHERNET MODE
```

IP Address setup sub-menu



```
- ETHERNET SETUP -  
INFORMATION  
SETUP IP ADDRESS  
ETHERNET MODE
```

Ethernet Mode setup sub-menu

IP Address Setup Menu:

```
- SETUP IP ADDR -  
IP TYPE: STATIC  
IP ADDRESS  
SUBNET MASK  
DEFAULT GATEWAY  
DNS SERVER
```

Select Static IP or DHCP (automatic IP address)



The below menu items are only shown if Static IP address is selected

```
- SETUP IP ADDR -  
IP TYPE: STATIC  
IP ADDRESS  
SUBNET MASK  
DEFAULT GATEWAY  
DNS SERVER
```

ENTER STATIC  
IP ADDRESS  
192.168.000.001



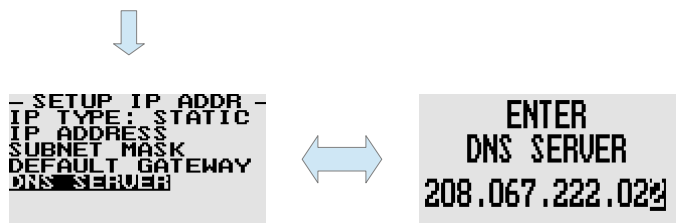
```
- SETUP IP ADDR -  
IP TYPE: STATIC  
IP ADDRESS  
SUBNET MASK  
DEFAULT GATEWAY  
DNS SERVER
```

ENTER  
SUBNET MASK  
255.255.255.001



```
- SETUP IP ADDR -  
IP TYPE: STATIC  
IP ADDRESS  
SUBNET MASK  
DEFAULT GATEWAY  
DNS SERVER
```

ENTER  
DEFAULT GATEWAY  
192.168.000.001



### Ethernet Mode Setup Menu:



Select “ON” for Modbus TCP/IP or “OFF” for Modbus RTU over TCP/IP.



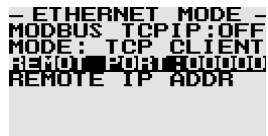
Select the Ethernet mode. Select between “TCP Server”, “TCP Client”, “UDP Server” or “UDP Client”

The below menu items are only shown if “TCP Server” or “UDP Server” is selected

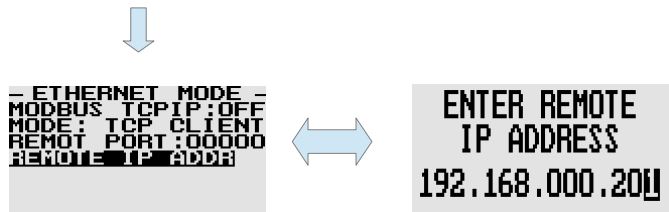


Enter the Local Port.

The below menu items are only shown if “TCP Client” or “UDP Client” is selected



Enter the Remote Port.



Default Ethernet Settings:

Error Code	Error Description
IP Type	Static
IP address	192.168.0.7
Subnet Mask	255.255.255.0
Gateway	192.168.0.1
DNS Server	208.67.222.22
Ethernet Mode	TCP Server
Local Port	23
Remote IP address	192.168.0.201

## Testing the Ethernet connection in Microsoft Windows

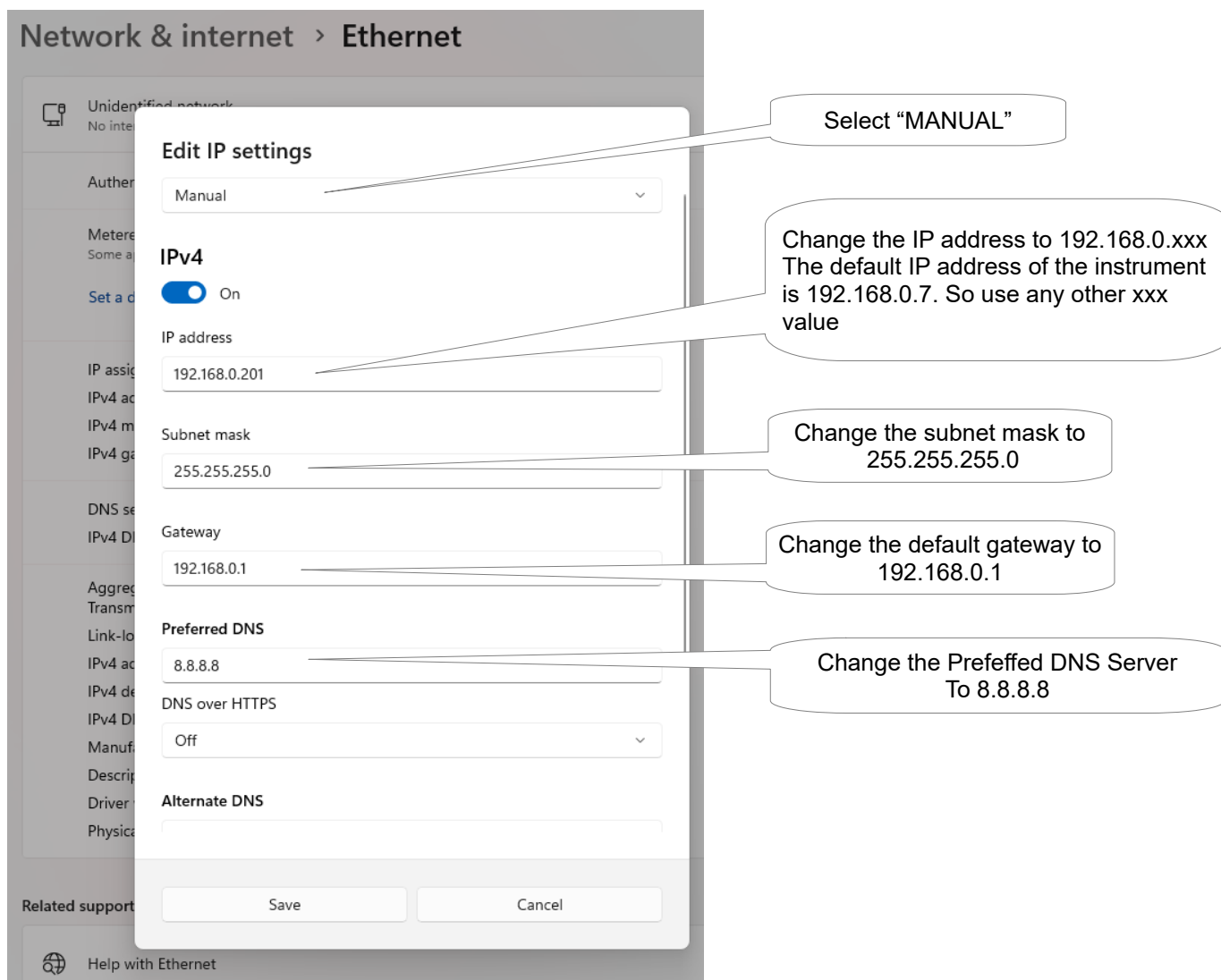
The following will explain how to setup and test the instrument in Microsoft Windows by using either a direct Ethernet connection or via a router.

Connect the instrument to the PC or routers Ethernet port using a standard Ethernet cable. Apply power to the instrument.

**If the DHCP is used, it must be sure that both the instrument and the test PC have IP addresses in the same subnet address range.** For example. The instrument is in DHCP mode and it is allocated to “192.168.0.xxx” but your PC is set for “192.168.11.xxx” and subnet mask “255.255.255.0”. Then, they can’t communicate with each other because they are in different IP address scope. You must be sure that your PC is in “192.168.0.xxx” address range.

**PLEASE NOTE THAT YOU WILL LOSE CONNECTION WITH YOUR COMPANY NETWORK BY RECONFIGURING YOUR PC ETHERNET NETWORK ADAPTER. THIS ONLY APPLIES IF YOU CONNECT TO YOUR COMPANY NETWORK VIA YOUR PC’S ETHERNET PORT.**

To change your IP address of the PC you need to right click on “Windows start”, select “Network Connections”, select “Ethernet”. Edit the IP settings. A window similar to the below will be displayed.



Click "SAVE" and close the window.

Run the **Modbus Poll PC** software, and configure as below.

**Connection → Connect:**

Change the connection  
To either "Modbus TCP/IP"  
Or  
"Modbus RTU/ASCII over  
TCP/IP"

### Connection Setup

Connection

Modbus RTU/ASCII Over TCP/IP

OK

Cancel

Serial Settings

COM1

9600 Baud

8 Data bits

Even Parity

1 Stop Bit

Advanced...

Mode

☒ RTU ☐ ASCII

Response Timeout

1000 [ms]

Delay Between Polls

20 [ms]

Remote Modbus Server

IP Address or Node Name

192.168.0.7

Server Port

23

Connect Timeout

3000 [ms]

☒ IPv4 ☐ IPv6

Change the IP address to  
192.168.0.7

Change the port to 23

**Setup → Read / Write definition:**

### Read/Write Definition

Slave ID: 1

Function: 03 Read Holding Registers (4x)

Address: 0

Quantity: 4

Scan Rate: 1000 [ms]

Disable

☐ Read/Write Disabled

☐ Disable on error

OK

Cancel

Protocol address. E.g. 40011 -> 10

Apply

Read/Write Once

View

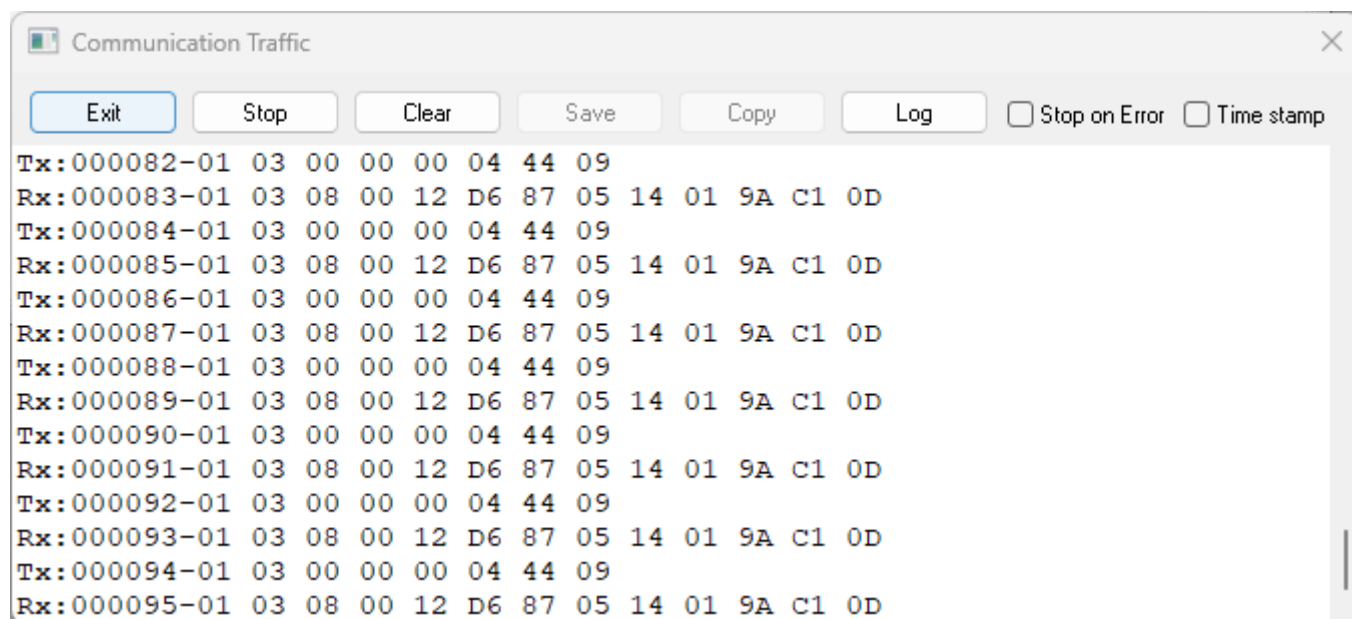
Rows

☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity

☐ Hide Alias Columns ☐ PLC Addresses (Base 1)

☐ Address in Cell ☐ Enron/Daniel Mode

# SUCCESS!!!!



### 5.5.3 ASCII Out Protocol

The instrument can output various ASCII strings depending on which string has been assigned to the ASCII out option.

#### 5.5.1.1 ASCII Out – Weight

**Example: \*123 12:23:45 01/01/2011 +123456.78 kg**

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <WEIGHT> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <WEIGHT UNIT> = kg, t, lb, T  
 <CR> = Decimal 13  
 <LF> = Decimal 10

#### 5.5.1.2 ASCII Out – Belt Rate

**Example: \*123 12:23:45 01/01/2011 +123456.78 kg/min**

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <BELT RATE> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <BELT RATE UNIT> = kg/min, kg/h, t/min, t/h, lb/min, lb/h, T/min, T/h  
 <CR> = Decimal 13  
 <LF> = Decimal 10

#### 5.5.1.3 ASCII Out – Totaliser 1

**Example: \*123 12:23:45 01/01/2011 +123456.78 kg**

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <TOTALISER 1> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <TOTALISER 1 UNIT> = kg, t, lb, T  
 <CR> = Decimal 13  
 <LF> = Decimal 10

#### 5.5.1.4 ASCII Out – Totaliser 2

**Example: \*123 12:23:45 01/01/2011 +123456.78 kg**

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <TOTALISER 2> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <TOTALISER 2 UNIT> = kg, t, lb, T  
 <CR> = Decimal 13  
 <LF> = Decimal 10

### 5.5.1.5 ASCII Out – Belt Speed

**Example:** \*123 12:23:45 01/01/2011 +123456.78 m/min

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <BELT SPEED> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <BELT SPEED UNIT> = m/min  
 <CR> = Decimal 13  
 <LF> = Decimal 10

### 5.5.1.6 ASCII Out – Belt Info

**Example:** \*123 12:23:45 01/01/2011 +123456.78 kg, +123456.78 kg/min, +123456.78 kg, +123456.78 kg, 123.45 m/min, +123456.78 kg

<\*> = Decimal 42  
 <AAA><SPACE> (Unit address. Only transmitted if address > 0)  
 <HH:MM:SS><SPACE><DD/MM/YYYY><SPACE> (Optional field if RTC selected) = Time & Date  
 <WEIGHT> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <WEIGHT UNIT> = kg, t, lb, T  
 <SPACE> = Decimal 32  
 <BELT RATE> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <BELT RATE UNIT> = kg/min, kg/h, t/min, t/h, lb/min, lb/h, T/min, T/h  
 <SPACE> = Decimal 32  
 <TOTALISER 1> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <TOTALISER 1 UNIT> = kg, t, lb, T  
 <SPACE> = Decimal 32  
 <TOTALISER 2> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <TOTALISER 2 UNIT> = kg, t, lb, T  
 <SPACE> = Decimal 32  
 <BELT SPEED> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <BELT SPEED UNIT> = m/min  
 <SPACE> = Decimal 32  
 <TARE VALUE> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE> = Decimal 32  
 <WEIGHT UNIT> = kg, t, lb, T  
 <CR> = Decimal 13  
 <LF> = Decimal 10

### 5.5.1.7 ASCII Out – Belt Info (CSV format)

**Example:** 123,12:23:45,01/01/2011,+123456.78,kg,+123456.78,kg/min,+123456.78,kg,+123456.78,kg,123.45,m/min,+123456.78,kg

<AAA> = Unit address  
 <HH:MM:SS> = (Optional field if RTC selected) Time  
 <DD/MM/YYYY> = (Optional field if RTC selected) Date  
 <WEIGHT> 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <WEIGHT UNIT> = kg, t, lb, T  
 <BELT RATE> = 10 digits right justified, leading zero suppression, including decimal point and polarity

<BELT RATE UNIT> = kg/min, kg/h, t/min, t/h, lb/min, lb/h, T/min, T/h  
 <TOTALISER 1> = 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <TOTALISER 1 UNIT> = kg, t, lb, T  
 <TOTALISER 2> = 10 digits right justified, leading zero suppression, including decimal point and polarity>  
 <TOTALISER 2 UNIT> = kg, t, lb, T  
 <BELT SPEED> = Speed 10 digits right justified, leading zero suppression, including decimal point and polarity>  
 <BELT SPEED UNIT> = m/min  
 <TARE VALUE> 10 digits right justified, leading zero suppression, including decimal point and polarity  
 <WEIGHT UNIT> = kg, t, lb, T  
 <CR> = Decimal 13  
 <LF> = Decimal 10

## 5.5.1.8 ASCII Out – NCS format

**#001 090 1.6 0.00 0.0 7884.1 8785**

<#> = Decimal 35  
 <AAA> = Unit address  
 <SPACE>  
 <SSS> = Sequence number  
 <SPACE>  
 <B LOAD> = kg/m 6 digits right justified, leading zero suppression, including decimal point and polarity>  
 <SPACE>  
 <BELT SPEED> = 6 digits right justified, leading zero suppression, including decimal point and polarity>  
 <SPACE>  
 <BELT RATE> = 8 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE>  
 <TOTALISER 1> = 8 digits right justified, leading zero suppression, including decimal point and polarity  
 <SPACE>  
 <TOTALISER 2> = 8 digits right justified, leading zero suppression, including decimal point and polarity  
 <CR> = Decimal 13  
 <LF> = Decimal 10

**The instrument can also be polled using the ASCII Out option. The instrument must be set on “PRINT: ON DEMAND” and the following string must be sent.**

<?> = Decimal 63  
 <AAA> = Unit address  
 <CR> = Decimal 13  
 <LF> = Decimal 10

## 5.5.4 The Modbus Protocol

Both Modbus RTU and Modbus ASCII protocols are supported.

## 5.5.5 Modbus Commands

The LT series of instruments 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

### 5.5.6 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
50	32 bit signed	R/W	Alarm 1 Setpoint High Word
51	32 bit signed	R/W	Alarm 1 Setpoint Low Word
52	8 bit unsigned	R/W	Alarm 1 Assignment 0: Weight 1: Rate 2: Totaliser 1 3: Totaliser 2 4: Speed
53	8 bit unsigned	R/W	Alarm 1 Mode 0: Off 1: Low 2: High 3: Deviation 4: Pulse output Totaliser 1 5: Pulse output Totaliser 2
54	8 bit unsigned	R/W	Alarm 1 logic 0: Normal 1: Inverted
55	16 bit unsigned	R/W	Alarm 1 Hysteresis
56	16 bit unsigned	R/W	Alarm 1 Deviation low
57	16 bit unsigned	R/W	Alarm 1 Deviation High
58	16 bit unsigned	R/W	Alarm 1 On Delay
59	16 bit unsigned	R/W	Alarm 1 Off Delay
60	8 bit unsigned	R/W	Alarm 1 Latch 0: Off 1: On
70	32 bit signed	R/W	Alarm 2 Setpoint High Word
71	32 bit signed	R/W	Alarm 2 Setpoint Low Word
72	8 bit unsigned	R/W	Alarm 2 Assignment 0: Weight 1: Rate 2: Totaliser 1 3: Totaliser 2 4: Speed
73	8 bit unsigned	R/W	Alarm 2 Mode

			0: Off 1: Low 2: High 3: Deviation 4: Pulse output Totaliser 1 5: Pulse output Totaliser 2
74	8 bit unsigned	R/W	Alarm 2 logic 0: Normal 1: Inverted
75		R/W	Alarm 2 Hysteresis
76	16 bit unsigned	R/W	Alarm 2 On Delay
77	16 bit unsigned	R/W	Alarm 2 Deviation low
78	16 bit unsigned	R/W	Alarm 2 Deviation High
79	16 bit unsigned	R/W	Alarm 2 Off Delay
80	8 bit unsigned	R/W	Alarm 2 Latch 0: Off 1: On
90	32 bit signed	R/W	Alarm 3 Setpoint High Word
91	32 bit signed	R/W	Alarm 3 Setpoint Low Word
92	8 bit unsigned	R/W	Alarm 3 Assignment 0: Weight 1: Rate 2: Totaliser 1 3: Totaliser 2 4: Speed
93	8 bit unsigned	R/W	Alarm 3 Mode 0: Off 1: Low 2: High 3: Deviation 4: Pulse output Totaliser 1 5: Pulse output Totaliser 2
94	8 bit unsigned	R/W	Alarm 3 logic 0: Normal 1: Inverted
95	16 bit unsigned	R/W	Alarm 3 Hysteresis
96	16 bit unsigned	R/W	Alarm 3 Deviation low
97	16 bit unsigned	R/W	Alarm 3 Deviation High
98	16 bit unsigned	R/W	Alarm 3 On Delay
99	16 bit unsigned	R/W	Alarm 3 Off Delay
100	8 bit unsigned	R/W	Alarm 3 Latch 0: Off 1: On
110	32 bit signed	R/W	Alarm 4 Setpoint High Word
111	32 bit signed	R/W	Alarm 4 Setpoint Low Word
112	8 bit unsigned	R/W	Alarm 4 Assignment 0: Weight 1: Rate

			2: Totaliser 1 3: Totaliser 2 4: Speed
113	8 bit unsigned	R/W	Alarm 4 Mode 0: Off 1: Low 2: High 3: Deviation 4: Pulse output Totaliser 1 5: Pulse output Totaliser 2
114	8 bit unsigned	R/W	Alarm 4 logic 0: Normal 1: Inverted
115	16 bit unsigned	R/W	Alarm 4 Hysteresis
116	16 bit unsigned	R/W	Alarm 4 Deviation low
117	16 bit unsigned	R/W	Alarm 4 Deviation High
118	16 bit unsigned	R/W	Alarm 4 On Delay
119	16 bit unsigned	R/W	Alarm 4 Off Delay
120	8 bit unsigned	R/W	Alarm 4 Latch 0: Off 1: On
130	8 bit unsigned	R/W	Analog Out Assignment 0: Weight 1: Rate 2: Totaliser 1 3: Totaliser 2 4: Speed
131	8 bit unsigned	R/W	Analog Out Type 0: 0 to 20mA 1: 4 to 20mA 2: 0 to 10V 3: Off
132	16 bit unsigned	R/W	Analog Out Low Value High Word
133	16 bit unsigned	R/W	Analog Out Low Value Low Word
134	16 bit unsigned	R/W	Analog Out High Value High Word
135	16 bit unsigned	R/W	Analog Out High Value Low Word
136	8 bit unsigned	R/W	Analog Out Error 0: Off 1: Analog Low 2: Analog High
140	8 bit unsigned	R/W	Com Address
141	8 bit unsigned	R/W	COM 1 (RS232) Protocol 0: ASCII Out 1: ASCII In 2: Modbus RTU 3: Modbus ASCII
142	8 bit unsigned	R/W	COM 1 (RS232) ASCII Out Assignment 0: Weight 1: Rate

			2: Totaliser 1 3: Totaliser 2 4: Speed 5: Belt
143	8 bit unsigned	R/W	COM 1 (RS232) ASCII Out Mode 0: On Demand 1: Continuous
144	8 bit unsigned	R/W	COM 1 (RS232) ASCII Out RTC 0: Off 1: On
145	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
146	8 bit unsigned	R/W	COM 1 (RS232) Data Bits 0: 7 Bits 1: 8 Bits
147	8 bit unsigned	R/W	COM 1 (RS232) Parity 0: None 1: Even 2: Odd
148	8 bit unsigned	R/W	COM 1 (RS232) Stop bits 0: 1 Stop Bit 1: 2 Stop Bits
160	8 bit unsigned	R/W	COM 2 (RS485) Protocol 0: ASCII Out 1: ASCII In 2: Modbus RTU 3: Modbus ASCII
161	8 bit unsigned	R/W	COM 2 (RS485) ASCII Out Assignment 0: Weight 1: Rate 2: Totaliser 1 3: Totaliser 2 4: Speed 5: Belt
162	8 bit unsigned	R/W	COM 2 (RS485) ASCII Out Mode 0: On Demand 1: Continuous
163	8 bit unsigned	R/W	COM 2 (RS485) ASCII Out RTC 0: Off 1: On
164	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
165	8 bit unsigned	R/W	COM 2 (RS485) Data Bits 0: 7 Bits 1: 8 Bits
166	8 bit unsigned	R/W	COM 2 (RS485) Parity 0: None 1: Even 2: Odd
167	8 bit unsigned	R/W	COM 2 (RS485) Stop bits 0: 1 Stop Bit 1: 2 Stop Bits
180	8 bit unsigned	R/W	Rate Key 0: Disabled 1: Enabled
181	8 bit unsigned	R/W	Total Key 0: Disabled 1: Enabled
182	8 bit unsigned	R/W	Print Key 0: Disabled 1: Enabled
183	8 bit unsigned	R/W	Belt tare Key 0: Disabled 1: Enabled
184	8 bit unsigned	R/W	Alarm Latch Key 0: Disabled 1: Enabled
190	8 bit unsigned	R/W	Digital Input 1 Assignment 0: Off 1: Min/Max value reset 2: Alarm latch reset 3: Rate/Total toggle 4: Belt tare 5: Print 6: Totaliser 1 reset 7: Totaliser 2 reset
191	8 bit unsigned	R/W	Digital Input 2 Assignment 0: Off 1: Min/Max value reset 2: Alarm latch reset 3: Rate/Total toggle 4: Belt tare 5: Print 6: Totaliser 1 reset 7: Totaliser 2 reset
192	8 bit unsigned	R/W	Digital Input 3 Assignment 0: Off 1: Min/Max value reset 2: Alarm latch reset 3: Rate/Total toggle 4: Belt tare 5: Print 6: Totaliser 1 reset

			7: Totaliser 2 reset
200	8 bit unsigned	R/W	Code Level 0: Only Alarms Setpoints not locked 1: Full Lockout
201	16 bit unsigned	R/W	Password
202	16 bit unsigned	R/W	Set RTC Date Years
203	8 bit unsigned	R/W	Set RTC Date Months
204	8 bit unsigned	R/W	Set RTC Date Days
205	8 bit unsigned	R/W	Set RTC Time Hours
206	8 bit unsigned	R/W	Set RTC Time Minutes
207	8 bit unsigned	R/W	Set RTC Time Seconds
300	8 bit unsigned	R/W	Lineariser Enable
301	8 bit unsigned	R/W	Lineariser Points
302->362	32 bit signed	R/W	Lineariser Real Point 1 to 16 High Word
303->363	32 bit signed	R/W	Lineariser Real Point 1 to 16 Low Word
304->364	32 bit signed	R/W	Lineariser Display Point 1 to 16 High Word
305->365	32 bit signed	R/W	Lineariser Display Point 1 to 16 Low Word
400	8 bit unsigned	R/W	Load Cell Unit
401	8 bit unsigned	R/W	Load Cell Decimal Point
402	8 bit unsigned	R/W	Load Cell Display Step Increment
403	8 bit unsigned	R/W	Load Cell Filter Time
404	8 bit unsigned	R/W	Load Cell Zero Band
405	32 bit signed	R/W	Load Cell Low Display High Word
406	32 bit signed	R/W	Load Cell Low Display Low Word
407	32 bit signed	R/W	Load Cell High Display High Word
408	32 bit signed	R/W	Load Cell High Display Low Word
409	32 bit signed	R/W	Load Cell Low Display mV/V High Word
410	32 bit signed	R/W	Load Cell Low Display mV/V Low Word
411	32 bit signed	R/W	Load Cell High Display mV/V High Word
412	32 bit signed	R/W	Load Cell High Display mV/V Low Word
413	16 bit unsigned	R/W	Load Cell Zero Band
414	8 bit unsigned	R/W	Load Cell Auto Zero Enable
415	16 bit unsigned	R/W	Load Cell Auto Zero Delay
418	32 bit signed	R/W	Load Cell Tare Value High Word
419	32 bit signed	R/W	Load Cell Tare Value Low Word
420	32 bit signed	R	Load Cell Gross Value High Word
421	32 bit signed	R	Load Cell Gross Value Low Word
422	32 bit signed	R	Load Cell Net Value High Word
423	32 bit signed	R	Load Cell Net Value Low Word

426	32 bit signed	R	Load Cell Maximum Value High Word
427	32 bit signed	R	Load Cell Maximum Value Low Word
450	8 bit unsigned	R/W	Averaging sample rate
451	8 bit unsigned	R/W	Rate unit
452	8 bit unsigned	R/W	Totaliser 1 unit
453	8 bit unsigned	R/W	Totaliser 2 unit
454	32 bit signed	R/W	Belt weigh length High Word
455	32 bit signed	R/W	Belt weigh length Low Word
456	32 bit signed	R/W	Belt dead band positive High Word
457	32 bit signed	R/W	Belt dead band positive Low Word
458	32 bit signed	R/W	Rate correction factor High Word
459	32 bit signed	R/W	Rate correction factor Low Word
460	8 bit unsigned	R/W	Belt speed
461	32 bit signed	R/W	Belt speed user value High Word
462	32 bit signed	R/W	Belt speed user value Low Word
463	32 bit signed	R/W	Pulley diameter High Word
464	32 bit signed	R/W	Pulley diameter Low Word
465	32 bit signed	R/W	Encoder Pulses/Rev High Word
466	32 bit signed	R/W	Encoder Pulses/Rev Low Word
467	8 bit unsigned	R/W	Frequency measurement type
468	8 bit unsigned	R/W	Frequency pulse gate time
469	32 bit signed	R	Belt rate value High Word
470	32 bit signed	R	Belt rate value Low Word
471	32 bit signed	R	Belt rate max value High Word
472	32 bit signed	R	Belt rate max value Low Word
473	32 bit signed	R	Belt speed value High Word
474	32 bit signed	R	Belt speed value Low Word
475	32 bit signed	R	Belt speed max value High Word
476	32 bit signed	R	Belt speed max value Low Word
477	32 bit signed	R	Belt frequency value High Word
478	32 bit signed	R	Belt frequency value Low Word
479	32 bit signed	R	Belt RPM value High Word
480	32 bit signed	R	Belt RPM value Low Word
481	32 bit signed	R/W	Totaliser 1 value High Word (The totaliser 1 value is updated only when the high word has been written first and then the low word)
482	32 bit signed	R/W	Totaliser 1 value Low Word
483	32 bit signed	R/W	Totaliser 2 value High Word (The totaliser 2 value is updated only when the high word has been written first and then the low word)
484	32 bit signed	R/W	Totaliser 2 value Low Word
485	8 bit unsigned	R/W	Dead Band Enable

486	32 bit signed	R/W	Belt dead band negative High Word
487	32 bit signed	R/W	Belt dead band negative High Word
500	8 bit unsigned	R/W	PI Control On/Off
501	8 bit unsigned	R/W	PI Control Action 0: Reverse 1: Direct
502	8 bit unsigned	R/W	PI Control Start 0: Manual 1: Auto 2: Power On
503	16 bit unsigned	R/W	PI Control Proportional gain
504	16 bit unsigned	R/W	PI Control Integral time
505	16 bit unsigned	R/W	PI Control Manual setting
506	32 bit signed	R/W	PI Control Auto setpoint High word
507	32 bit signed	R/W	PI Control Auto setpoint 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	Latched Alarm Reset
3	Min/Max Value Reset
4	Activate External Input 1
5	Activate External Input 2
6	Activate External Input 3
7	Set RTC
8	Reset Totaliser 1
9	Reset Totaliser 2
10	Display Rate
11	Display Totaliser 1
12	Belt Tare

## 5.6 Function Key Configuration Menu



This menu configures the front panel function key push buttons.

```
- FUNCTION KEYS -
RATE: ENABLED
TOTAL: ENABLED
PRINT: ENABLED
TARE: ENABLED
LAT RST: ENABLED
```

This menu option will enable the display rate push button. If enabled, this function key will allow the user to display the belt rate value on the LED display.

```
- FUNCTION KEYS -
RATE: ENABLED
TOTAL: ENABLED
PRINT: ENABLED
TARE: ENABLED
LAT RST: ENABLED
```

This menu option will enable the display totaliser 1 push button. If enabled, this function key will allow the user to display the totaliser 1 value on the LED display.

```
- FUNCTION KEYS -
RATE: ENABLED
TOTAL: ENABLED
PRINT: ENABLED
TARE: ENABLED
LAT RST: ENABLED
```

This menu option will enable the print push button. If enabled, this function key allows the user to print the assigned value via the RS232 or the RS485 interface. The print LED will briefly illuminate when the print push button is pressed. The print button will only work if either the RS232 or RS485 ASCII Out mode is selected.

```
- FUNCTION KEYS -
RATE: ENABLED
TOTAL: ENABLED
PRINT: ENABLED
TARE: ENABLED
LAT RST: ENABLED
```

This menu option will enable the belt tare push button. If enabled, this function key will allow the user to tare the belt weigher.

```
- FUNCTION KEYS -
RATE: ENABLED
TOTAL: ENABLED
PRINT: ENABLED
TARE: ENABLED
LAT RST: ENABLED
```

This function will enable the alarm latch push button. If enabled, this function key will reset any of the latched alarms when the alarm condition has been removed. This menu option is only displayed if any of the alarm latch functions have been enabled.

## 5.7 Digital Input Configuration Menu



This menu configures the five digital inputs. The digital inputs can be configured for specific functions as listed below. **Digital input 4 will be set to encoder if the belt speed is set to measure. Digital input 4 can be used as a programmable input if the belt speed is set to set.**

```
- DIGITAL INPUTS
DIN 1:OFF
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input is disabled.

```
- DIGITAL INPUTS
DIN 1:MAX RESET
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will reset the maximum recorder rate, speed and weight values to the current values.

```
- DIGITAL INPUTS
DIN 1:ALARM RESET
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will reset any of the latched alarms when the alarm condition has been removed. This menu option is only displayed if any of the alarm latch functions have been enabled.

```
- DIGITAL INPUTS
DIN 1:RATE/TOTAL
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will toggle the LED display between showing the rate and the totaliser 1 value. The rate LED will illuminate to indicate that the LED display is showing the rate value alternatively the total LED will illuminate to indicate that the display is showing the totaliser 1 value.

```
- DIGITAL INPUTS
DIN 1:TARE
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will start the belt tare function.

```
- DIGITAL INPUTS
DIN 1:PRINT
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

This menu option is only shown if either the RS232 or RS485 ASCII Out mode is selected. This digital input allows the user to print the display value via the RS232 or the RS485 interface. The print LED will briefly illuminate when the digital input is activated.

```
- DIGITAL INPUTS
DIN 1:T1 RESET
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will reset the totaliser 1 value to zero.

```
- DIGITAL INPUTS
DIN 1:T2 RESET
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will reset the totaliser 2 value to zero.

```
- DIGITAL INPUTS
DIN 1:BELT TEST
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

If the digital input is high then the belt weigher will operate as normal. If the digital input is low then the belt weigher will go into a belt test mode. During the belt test mode the totaliser values will not be added to the actual real totalisers. The totaliser values on the info displays will be color inverted to indicate that the belt weigher is in a belt test mode.

```
- DIGITAL INPUTS
DIN 1:BELT RUN
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
```

The digital input will act as a belt run/stop signal if the belt speed is "SET". If the digital input is high then the belt weigher will operate as normal. If the digital input is low then the belt speed and rate values will go to zero and the totalisers will not increment. The speed value on the info displays will be color inverted to indicate that the belt weigher is in the stop mode.

```

- DIGITAL INPUTS -
DIN 1:PI M/A
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
    
```

The digital input will change the PI control from manual to auto.

```

- DIGITAL INPUTS -
DIN 1:PI START
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
    
```

The digital input will start the PI control function.

```

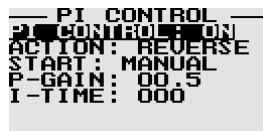
- DIGITAL INPUTS -
DIN 1:PI STOP
DIN 2:OFF
DIN 3:OFF
DIN 4:ENCODER
DIN 5:OFF
    
```

The digital input will stop the PI control function.

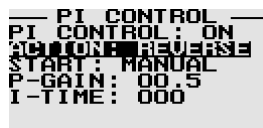
## 5.8 PI Control Setup Menu



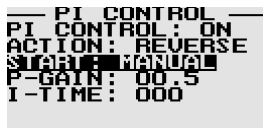
This menu configures the PI Control function. The PI function controls the analog out using the RATE value. The analog High value (10V or 20mA value) must be set correctly as it is used in the PI calculation.



Select to enable the PI control feature.



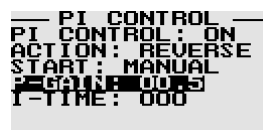
Select reverse or direct action for the control loop. Normally PI control is set for reverse action (Increasing process variable (PV) decreases the output). Direct action (Increasing process variable (PV) increases the output).



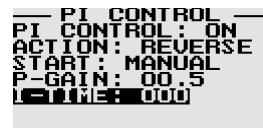
**Manual:** Starting the PI function causes the analog output to go to a manual setting between 0 to 99.9%. The PI function will change over to the Auto SP value (bumpless) when the PI man/auto function is activated. The analog output will go to 0% when the PI Stop is activated.

**Auto:** Starting the PI function causes the analog output to go to a manual setting between 0 to 99.9% for 1 second before changing over to the Auto SP value (bumpless). The analog output will go to 0% when the PI Stop is activated.

**Power On:** The PI function will automatically start 25 seconds after power has been applied to the instrument. The PI function causes the analog output to go to a manual setting between 0 to 99.9% for 1 second before changing over to the Auto SP value (bumpless). The analog output will go to 0% when the PI Stop is activated.



Set the proportional gain (0.5 to 50.0). The lower the proportional gain the smaller the corrections. The higher the proportional gain the higher the correction (This could result in overshoot or oscillations).



Set the Integral time. A shorter time results in fast offset correction and a long time results in a slow offset correction. An integral time of 0 turns the integral part off. The integral time can be set from 1 to 999 seconds.

## PI Control Push buttons

The following push buttons are automatically assigned to PI functions when the PI Control is enabled. These keys are only active when the PI Control main display is showing.

**F1:** PI Start

**F2:** PI Stop

**F3:** PI Manual/Auto mode

**F4:** Manual analog output % increment (PI Manual mode). Auto SP increment (PI Auto mode).

**F5:** Manual analog output % decrement (PI Manual mode). Auto SP decrement (PI Auto mode).

**LATCH RESET:** Toggles setpoint multiplier

## 5.9 Miscellaneous Configuration Menu



This menu configures the miscellaneous functions of the instrument.

```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```



```
- LCD CONTRAST -
[Progress Bar]
USE THE ←→ KEYS
TO ADJUST THE
CONTRAST
```

Select this menu option to adjust the LCD display contrast.



```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```

Select this menu option to turn the LCD backlight either on or off.



```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```



```
- SECURITY SETUP -
CHANGE CODE
MENU LOCK ONLY
```

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

“LEVEL: 0”: Full access, no protection.  
 “LEVEL: 1”: Menu lock only. Allow editing of the alarm setpoints.  
 “LEVEL: 2”: Full protection. Menu and alarm setpoints are password protected.

```
ENTER CURRENT
CODE
0000
```



```
ENTER NEW
CODE
0000
```



```
CONFIRM NEW
CODE
0000
```



```
MESSAGE
[! icon] CODE
CHANGED
```



```
ENTER SECURITY
CODE
0000
```

If a password has been set and one of the levels for access control has been selected then the instrument will prompt the user to enter the password. If the code is correct then it will allow the user into the menu system or edit the alarm setpoints otherwise it will return to the normal display mode.

```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```



```
- SET DATE&TIME -
YEAR: 2012
MONTH: 07
DAY: 19
HOUR: 22
MINUTE: 05
SECOND: 51
```

This menu option allows the user to set the RTC (Real Time Clock).



```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```



```
- INFORMATION -
MODEL: LT1320
FIRMWARE: 1.00
S/N: 0000000
```

This menu option shows the system information.

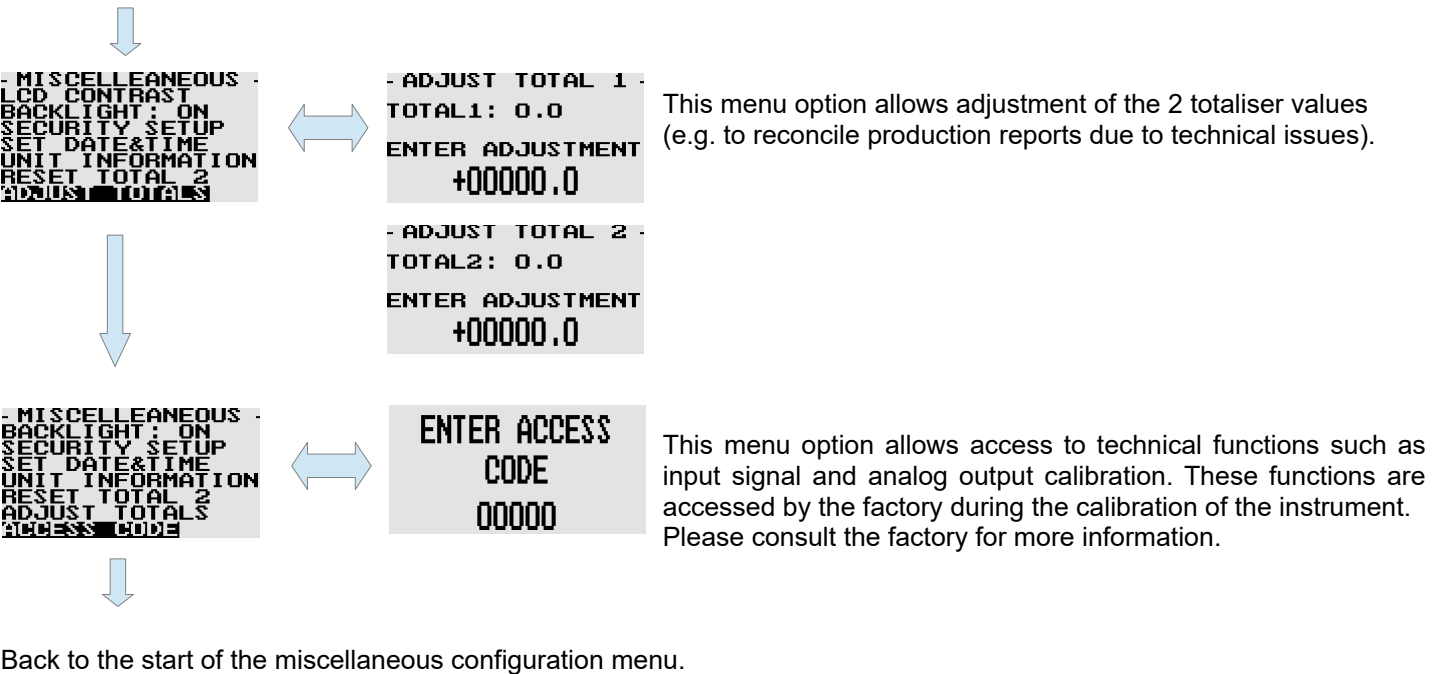


```
- MISCELLANEOUS -
LCD CONTRAST
BACKLIGHT: ON
SECURITY SETUP
SET DATE&TIME
UNIT INFORMATION
RESET TOTAL 2
ADJUST TOTALS
```



```
RESET
TOTALISER 2?
[0] YES
```

This menu option allows the user to reset the Totaliser 2 value to zero.



## 6 Error Messages

### Display Under Range:



If the display value exceeds the negative display threshold of -199999 then the LED display under range message is shown.

### Display Over Range:



If the display value exceeds the positive display threshold of 999999 then the LED display over range message is shown.

### Analog Out mA Open Loop Error:



The LCD display will briefly flash the loop error message every 5 seconds to indicate that a mA loop error has occurred. This error message will only be shown if the analog out has been set for any of the mA ranges.

### Other Error Messages:



Unit settings CRC error. Load default settings to restore to factory defaults. If the error message still persists then it could possibly be a non-volatile memory failure in which case the instrument will then have to be returned to the factory.



Unit settings 2 CRC error. Load default settings to restore to factory defaults. If the error message still persists then it could possibly be a non-volatile memory failure in which case the instrument will then have to be returned to the factory.



Calibration constants CRC error. The instrument could possibly have a non-volatile memory failure in which case the instrument will then have to be returned to the factory.

**MESSAGE**

**REPLACE BATTERY  
OR SET CLOCK**

The internal CR2032 battery needs to be replaced or the clock needs to be set. The clock needs to be running in order to save the totaliser and pulse output variables.

**MESSAGE**

**TOTALISERS  
CRC ERROR**

Totaliser saving CRC error. The instrument could possibly have a flat battery. Check the internal CR2032 battery voltage and replace if needed.

**MESSAGE**

**PULSE OUTPUT  
CRC ERROR**

Pulse output saving CRC error. The instrument could possibly have a flat battery. Check the internal CR2032 battery voltage and replace if needed.


## 7 Display Test, Firmware and Model Number

On start up, the instrument will do a LED display test whereby all the segments of the LED display are turned on. It will also display the model number and firmware revision number on the LCD display.

## 8 Firmware Upgrading

The instrument can be upgraded in the field by connecting the RS232 port to a PC and running the firmware update program. **Note that only the RS232 port can be used to upgrade the firmware. Please see the instrument firmware upgrade document for more information.**

## 9 Loading Default (Factory) Settings

Default settings can be loaded by pressing the  key at power up. The words "LOADING DEFAULT SETTINGS" will briefly appear on the LCD display. All settings will be revert back to the factory defaults.



LOADING  
DEFAULT  
SETTINGS

## 10 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.

## 11 Ordering Information

Add option codes to suffix of model number separated by hyphens.

### Option part numbers:

- 700 - Low voltage 10-30VDC isolated power supply
- 720 - 1 Solid-state relay
- 721 - 2 Solid-state relays
- 722 - 3 Solid-state relays
- 723 - 4 Solid-state relays
- 741 - Ethernet communication module
- 762 - 115VAC Inductive load suppressor
- 763 - 230VAC Inductive load suppressor
- 764 - 2A Slow blow replacement fuse
- 765 - R-C Snubber noise and arc suppressor

## 12 Notice

Specifications of the products displayed herein are subject to change without notice. Infiniteq cc, or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

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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.

## 13 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.