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1. Introduction

This instrument is a dedicated baggage weigher. It is a precision digital indicator using the latest Sigma-Delta analogue to digital conversion technology to ensure fast and accurate weight readings.

Figure 1: Weight Indicator

The setup and calibration of the instrument are digital, with a non-volatile security store for all setup parameters.

The instrument may be operated from a DC power source from 12V to 24V.

The instrument is fitted with opto-LINK communications as standard. This allows a temporary isolated communications link to be established with a PC using an opto-LINK cable, which enables software upgrades and the use of computerised setup and calibration via the Viewer software. Refer to opto-LINK (Optional) page 10 for more information.

1.1. Overview

This instrument provides ZERO and TOTALS functionality as well as more setup options (eg. serial and setpoint) and printing functionality.

This instrument has a relay output with status display on the front panel as well as a RS-485 network communications and printing port and a RS-232 remote display port. There is a built-in clock for date-stamping printed outputs.

1.2. Approvals

C-tick approved and CE approved.

1.2.1. Trade versions

- NSC approval (4000 divisions at 0.8µV/division)(pending).
- OIML approval (4000 divisions at 0.8µV/division).

1.3. The Manuals Set

This manual is part of a set of manuals covering the setup and operation of the instrument. The set includes the following:

- **Reference Manual** - Contains detailed information on calibration and setup. This manual is intended for use by Scale Technicians who are installing the instrument.
- **Communications Manual** - Contains details on the extended networking capabilities (communications protocol).

1.4. Document Conventions

The following document conventions (typographical) are used throughout this Reference Manual.

Bold Text	Bold text denotes words and phrases to note.
<Key>	**<Key>** denotes a Keypad key. **Note:** In the Specifications section the **<** symbol means **less than** and the **>** symbol means **greater than**.
^	This symbol denotes one space
Ä	Items marked with ⊗ indicate that the setting is available only in Full Setup and is trade critical. When trade critical settings are changed the calibration counter will be incremented.

2. Specifications

Performance	
Resolution	Up to 30,000 divisions, minimum of 0.25µV/division
Zero Cancellation	±2.0mV/V
Span Adjustment	0.1mV/V to 3.0mV/V full scale
Stability/Drift	Zero: < 0.1µV/°C (+ 8ppm of deadload max) Span < 8 ppm/°C, Linearity < 20ppm, Noise < 0.2µVp-p
Excitation	5 volts for up to 4 x 350 or 8 x 700 ohm load cells (4-wire or 6-wire plus shield) Maximum total load cell resistance: 1,000 ohms
A/D Type	24bit Sigma Delta with 8,388,608 internal counts
A/D Conversion Rate	20Hz with FIR filtering > 80dB
Operating Environment	Temperature: –10 to +40°C ambient Humidity: <90% non-condensing Storage: –20 to +50°C ambient IP65 when panel mounted
Case Materials	Stainless Steel, ABS, Silicon Rubber, Nylon, Polycarbonate
Packing Weights	Basic Stainless Steel Panel Mount Indicator: 0.49kg (17oz)
Digital	
Display	LED Backlit LCD with six 20mm high digits with units and annunciators
Setup and Calibration	Full digital with visual prompting in plain messages
Digital Filter	Sliding window average from 0.1 to 4.0 seconds
Zero Range	Adjustable from ±2% to ±100% of full capacity
Power Input	
Standard Power Input	12 to 24VDC, (2.5 VA max) - ON/OFF key with memory feature (locked by default)
Variants AC	AC Plug pack: 110/240VAC 50/60Hz in 12VDC 2.5A out
Features	
opto-LINK Data Coupling	Infra-red Connector for optional opto-LINK PC cable (to RS-232 or USB PC port)
Communications	RS-232 automatic transmit for remote display RS-485 network or printer connection. Transmission rate: 2400, 4800, 9600 or 19200 baud
Drive Output	1 single pole dual throw relay output (2A Max)
Battery Backed Clock Calendar	Battery life 10 years minimum

3. Installation

3.1. Introduction

The following steps are required to set up the indicator.

- Inspect indicator to ensure good condition.
- Use connection diagrams to wire up load cell, power and auxiliary cables as required.
- Use the panel mount template provided for hole locations.
- Refer to the Setup section page 21 for information on configuring and calibrating the instrument.

3.2. General Warnings

- Indicator not to be subject to shock, excessive vibration or extremes of temperature (before or after installation).
- Inputs are protected against electrical interference, but excessive levels of electro-magnetic radiation and RFI may affect the accuracy and stability.
- The instrument should be installed away from any sources of excessive electrical noise.
- The load cell cable is particularly sensitive to electrical noise and should be located well away from any power or switching circuits.
- For full EMC or for RFI immunity, termination of cable shields and correct earthing of the instrument is essential.
- Indicator and load cell cable are sensitive to excessive electrical noise. Install well away from any power or switching circuits.

3.3. Electrical Safety

- For your protection all mains electrical hardware must be rated for environmental conditions of use.
- Pluggable equipment must be installed near an easily accessible power socket outlet.
- To avoid the possibility of electric shock or damage to the instrument, always switch off or isolate the instrument from the power supply before maintenance is carried out.

3.4. Cleaning

- To maintain the instrument, never use harsh abrasive cleaners or solvents. Wipe the instrument with a soft cloth **slightly** dampened with warm soapy water.

3.5. Panel Mount Template

Use the panel mount template for hole locations. The template indicates positions for the six 3mm mounting screws through the panel. Also displayed on the template is the position of the rectangular hole that should be cut to allow for the connection of cables. The template supplied with the indicator allows for front or rear machining of the panel.

3.6. DC Power (12-24VDC PWR + , PWR –)

The DC supply need not be regulated, provided that it is free of excessive electrical noise and sudden transients. The instrument can be operated from a high quality plug-pack as long as there is sufficient capacity to drive both it and the load cells.

3.7. Load Cell Connection

Load cell cable connections are made to the rear of the instrument using screwless terminals. Wires must be stripped of insulation by at least 10mm. To install, depress the orange lever beside the terminal required and push wire into the hole. Release the lever and pull gently on the wire to ensure it is securely trapped in the terminal. It is not necessary to tin the ends of the wire with solder or to add crimp ferrules to the wires, however, these techniques are also compatible with the terminals and may ultimately make for a neater job.

3.7.1. Load Cell Signals and Scale Build

Very low output scale bases may be used but may result in some instability in the weight readings when used at higher resolutions. Generally speaking, the higher the load cell output, or the lower the number of divisions, the greater the display stability and accuracy.

The instrument can display the millivolt-per-volt reading that can be used to check scale base signal output levels. For more information, refer to SCALE (Scale Base Test Display) page 31.

The instrument may be connected for either 4-wire or 6–wire operation. To correspond with the actual cabling installation the instrument must be configured in setup to the correct setting. For more information, refer to CABLE (4-Wire or 6-Wire) ⊗ page 23.

3.7.2. 4-Wire Connection

The minimum connectivity requirements are the connection of four wires (ie. Excitation + and – along with Signal + and –). Internally the instrument has a precision analogue switch that connects the Sense + and – lines directly to the Excitation + and – lines when 4-wire mode is selected.

A 4-wire connection is only suitable for short cable runs. Where long cable lengths are needed, a 6-wire extension is required to maintain accuracy.

The BUILD:CABLE option must be set to **4** to allow for 4-wire connection. Refer to CABLE (4-Wire or 6-Wire) ⊗ page 23.

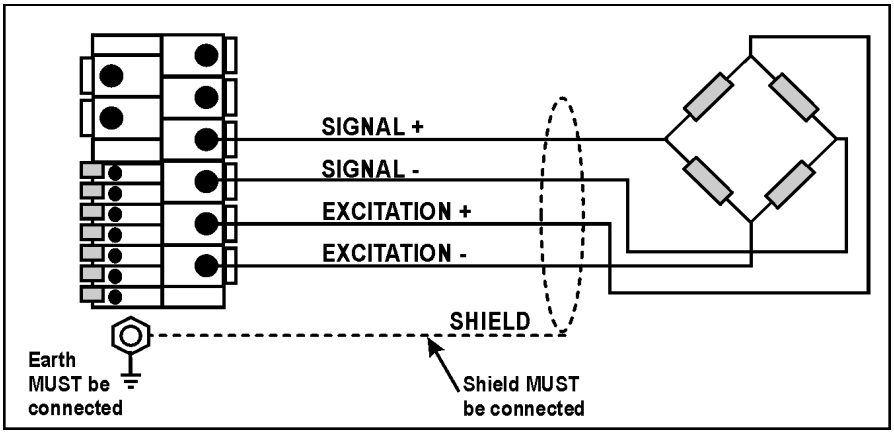


Figure 2: 4-Wire Connections

3.7.3. 6-Wire Connection

The excitation and signal lines are connected the same as for a 4-wire installation. The extra two wires (Sense + and –) should be connected to the Excitation + and – lines as close as possible to the load cell itself. Typically these connections are made in a load cell termination box.

The BUILD:CABLE option must be set to **6** (the default) to allow for 6-wire connection. Refer to CABLE (4-Wire or 6-Wire) ⊗ page 23.

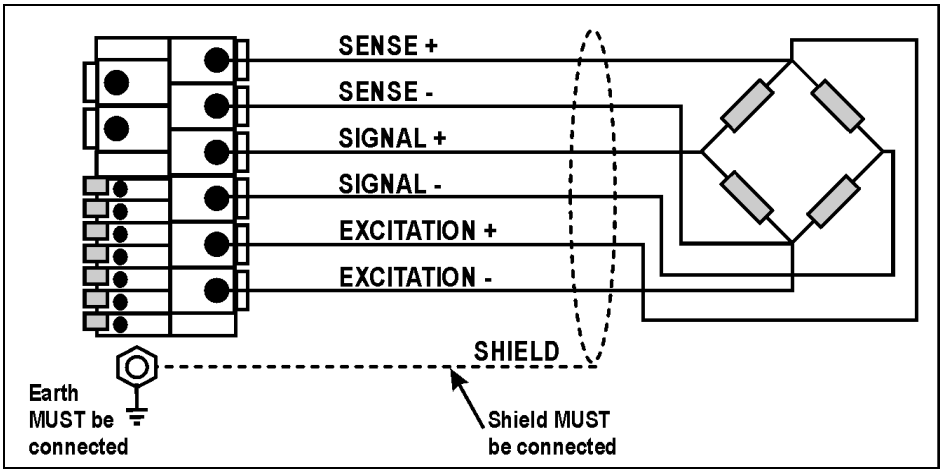


Figure 3: 6-Wire Connections

3.8. Auxiliary Connections

This section provides diagrams to illustrate the auxiliary terminal connections.

3.8.1. RS-232 Remote display

The REMOTE connector has power and RS232 transmit only connections required to connect a remote display. Automatic output for remote displays is enabled in all serial types (see page 27 Serial Output Type).

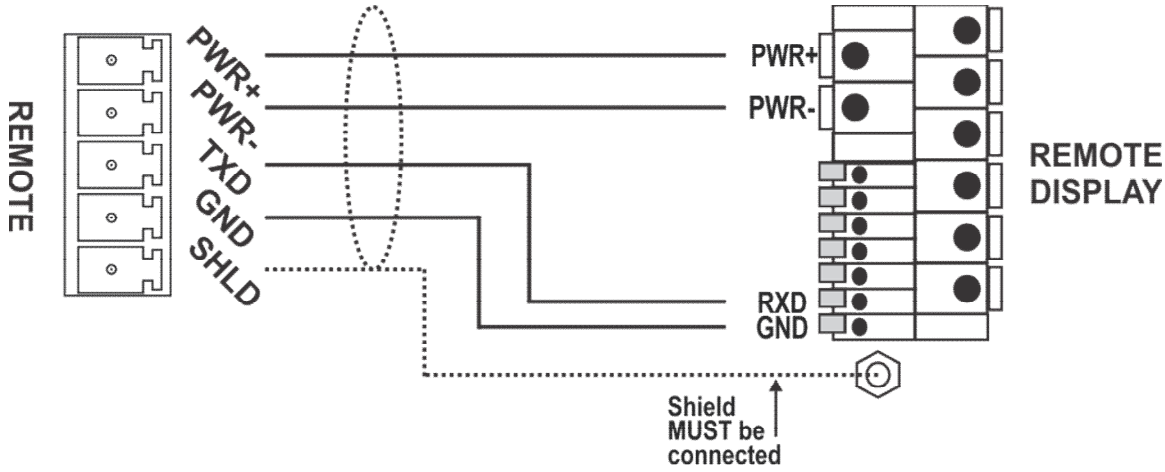


Figure 4: Instrument to remote display using the REMOTE terminal.

3.8.2. RS-485 Network

The NETWORK connector can be used for network communications when serial type is set to SPL.NET, SPL.RIN and SPL.PRO (see page 27 Serial Output Type).

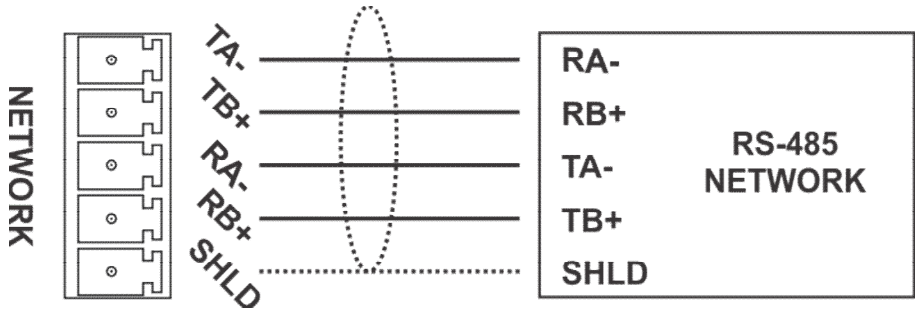


Figure 5: Network communications using the NETWORK terminal.

3.8.3. RS-485 Printer

The NETWORK connector can be used for printing when serial type is set to SPL.PRN (see page 27 Serial Output Type).

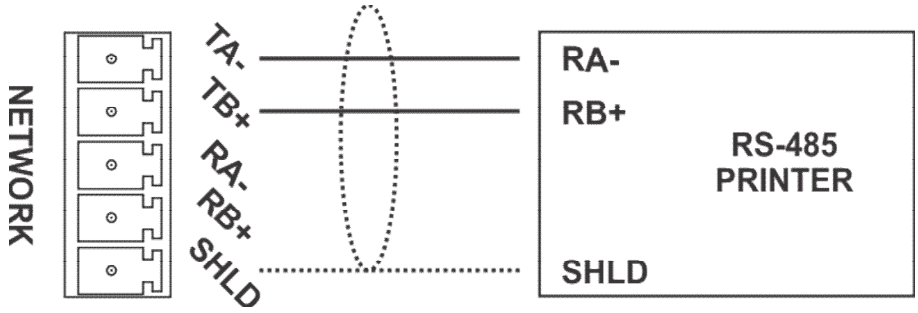


Figure 6: Printer connection using the NETWORK terminal.

3.8.4. Relay

The relay on the instrument is a single pole dual throw relay rated for 2A Max. It is driven by SETPT.1 on the indicator.

3.9. opto-LINK (Optional)

A temporary infrared communications link can be established between the instrument and a PC using an optional opto-LINK cable. The optional opto-LINK cable can be used to transfer setup and calibration information from a PC (eg. to be stored for later use and/or transferred to other instruments). It can also be used to download software upgrades to the instrument from a PC.

The PC end of the opto-LINK cable is a standard female DB9 connector, or USB connector. The instrument end of the cable consists of an infrared transceiver, which attaches to the left side of the instrument display. To facilitate a quick and simple connection, the infrared transceiver is secured in place by a permanent magnet located within the head of the opto-LINK.

Refer to opto-LINK Activation page 17 for more information.

WARNING
The opto-LINK head contains a strong magnet and care should be taken with its proximity to electronic media (eg. credit cards, floppy disks, etc.) and/or other electronic instrumentation.

3.10. Connecting Shields

To obtain full EMC or for RFI immunity, cable shields MUST be connected to the appropriate earth lug or SHLD terminal on the rear of the instrument.

Figure 7 illustrates an example of shielded loadcell wiring.

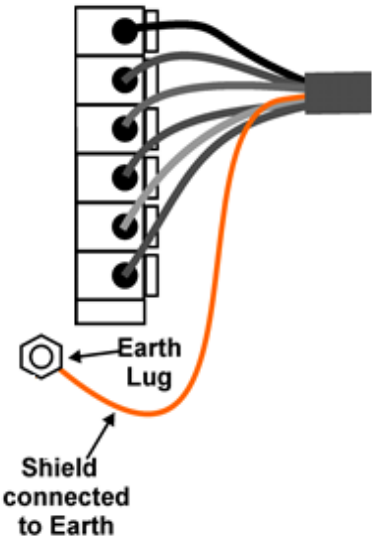


Figure 7: Cable Shield Connection

3.10.1. Cable Shield Connection and Earthing

- Care should be taken when connecting shields to maximise EMC or RFI immunity and minimise earth loops and cross-talk (interference) between instruments.
- For full EMC or for RFI immunity, termination of the cable shields at the earth lug is very important. The earth lug of the instrument must be separately connected to ground potential via a reliable link.
- The instrument should only be connected to earth via a single reliable link to avoid earth loops.
- Where each instrument is separately earthed, interconnecting cable shields should be connected at one end only.
- **Caution:** Some load cells connect the cable shield directly to the load cell (and therefore the scale base). Connection of the load cell cable shield in this situation may be site specific.

3.11. Regulatory Sealing Requirements

To comply with regulatory sealing requirements for each instrument, (ie. to ensure instruments are not accidentally or deliberately tampered with), it is important that proper sealing procedures be adhered to.

4. Data Entry

Throughout the setup and normal weighing mode, different data entry methods are used. Each method is described below.

When using the keypad for normal operation, press the key on keypad to initiate the feature.

4.1. Editing Annunciators

When in the setup menus the instrument displays editing annunciators. Figure 8 identifies each of the editing annunciators. When in Setup, press the corresponding keypad key below the annunciator.

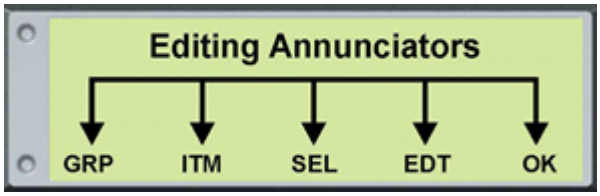


Figure 8: Editing Annunciators

Editing Annunciator	Key Name	Description
GRP	ZERO	Steps through the list of Groups.
ITM	ADD	Steps through the list of Items. Press this key to accept changes and return to the menus. (Also refer to the **OK** description below.)
SEL	TOTALS	Moves the editing cursor in some editing modes.
EDT	CANCEL	Steps through the available options when editing a particular item.
OK	FINISH	Press this key to accept changes and return to the menus. (Also refer to the **ITM** description above.)

4.2. Numeric Entry

A numeric entry box allows the input of a number. When entering a number, the display will show digits with the currently selected digit flashing. The **<SEL>** key is pressed to select a digit to change. When the digit is selected the **<EDT>** key is pressed to change the digit from **0** through **9**. The left most digit can also be changed to a dash (-) to enter a negative number. The **<OK>** key is pressed to accept the number that has been entered and return to the menu item.

Upper and lower limits are placed on some entries and an entry outside this range will cause the instrument to display dashes (ie. - - - - - -).

Example: When in Setup follow the steps below to set Build, Max Capacity.

Press **<GRP>** repeatedly to display the **BUILD** group.
Press **<ITM>** repeatedly to display the **CAP** item.
Press **<SEL>** to select **CAP** and display the current setting (eg. 0000.00kg).
The currently chosen digit will be flashing. Press **<SEL>** to advance to the next digit.
When the digit to edit is flashing, press **<EDT>** repeatedly to cycle from **0** through **9**.
When the new digit to be set is flashing either press **<SEL>** to move to the next digit to edit and repeat the previous step; or press **<OK>** or **<ITM>** to accept all of the displayed digits (including the flashing digit) and re-display the menu item name.

4.3. Selections and Options

A selection entry requires the choice of a single option from a list. When a Group and Item have been chosen, the **<SEL>** key is used to display the current setting for that item. The **<EDT>** key can be used to cycle through the options for that item. When the desired option is displayed the **<OK>** key can be pressed to accept the displayed option and re-display the item name.

Example: When in Setup follow the steps below to set Options, Filter.

Press **<GRP>** repeatedly to display the **OPTION** group.
Press **<ITM>** repeatedly to display the **FILTER** item.
Press **<SEL>** to select **FILTER** and display the current setting.
Press **<EDT>** to cycle through the options for that item.
Press **<OK>** or **<ITM>** to accept the displayed option and re-display the menu item name.

5. Basic Operation

5.1. Display and Controls

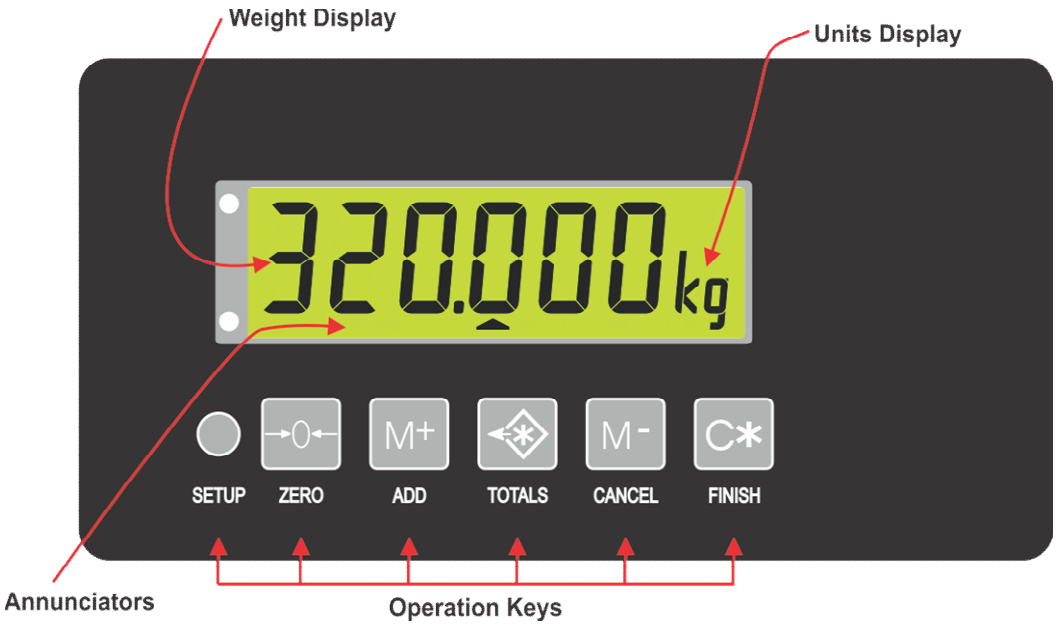


Figure 9: Display and Controls Illustration

5.1.1. Front Panel: Visual Display

The front panel has a six-digit LCD display. Figure 9 shows the main elements of the front panel.

The instrument has various sections for the visual output of weight information. Each display section is described below.

Weight Display

The Weight Display indicates the weight readings, setup information, errors and warnings.

Units Display

The Units Display shows the units of the weight reading as grams (g), kilograms (kg), pounds (lb), tonnes (t) or none. If the instrument is set up for counting the units display will show pieces (p).

Status Annunciators

Status annunciators show the following:

Symbol	Name	Description
→0←	**ZERO**	Visible when the gross reading is within ± ¼ of a division of true zero.
NET	**NET**	Visible when the displayed reading represents NET weight.
≈	**MOTION**	Visible when the displayed reading is not stable.
▲	**OVER**	Visible when the setpoint is set as type OVER, and the weight is above the target weight.
▼	**UNDER**	Visible when the setpoint is set as type UNDER, and the weight is below the target weight.
1	**OUT 1**	Visible when Output 1 is turned ON.
⌴	**ZERO BAND**	Visible when the displayed weight is within the zero 'dead' band setting. (The zero band symbol shows near the top right corner of the display.)
+ −	**LOW BATTERY**	Visible when battery voltage is too low and batteries need replacing or recharging. (The low battery symbol shows in the top right corner of the display.)

Table 1: Status Annunciators

When in Setup the editing annunciators are shown to identify the function of the front panel keys (ie. **GRP, ITM, SEL, EDT** and **OK**). For more information refer to Editing Annunciators page 12.

5.2. Operation Keys

The instrument has the following operation keys:

SETUP	
Primary Operation Keys ZERO ADD TOTALS CANCEL FINISH	Each of the primary operation keys has two separate functions.

5.2.1. Primary Function

A single press of each key triggers the weighing operation printed on it. The instrument allows individual keys to be disabled in the setup. All keys are enabled at the factory, but some keys may have been intentionally disabled (locked) during installation. If a key has been locked, a long beep sounds when it is pressed. If however, the key beeps normally, but does not appear to trigger the desired action, it is waiting for the weight reading to settle before the action can proceed.

5.2.2. Editing Function

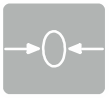
Available during digital setup and calibration, this function is displayed using the editing annunciators above each key. Refer to Editing Annunciators page 12.

5.3. Stability Considerations

Once a **<ZERO>** or **<ADD>** key is pressed the instrument waits for a stable valid reading before performing the associated operation. If the weight readings remain unstable or invalid due to some diagnostic error for longer than 5 seconds, the operation is cancelled and the **STABLE ERROR** message is displayed.

To improve the stability of the weight reading, increase the filtering or relax the motion detection criteria. Refer to FILTER (Reading Average) page 24 and MOTION (Motion Detection) ⊗ page 24 for more information.

5.4. ZERO Key



When an empty scale has drifted away from a true zero reading, this key is used to perform a zero adjustment on the scale display. The zero adjustment is stored when power is removed and is re-used when next powered up.

The amount of weight that may be cancelled by the **<ZERO>** key is limited via an item in the Setup of the instrument. Refer to Z.RANGE (Allowable Zero Operating Range) ⊗ page 24 for more information.

Long Press: When the indicator is set to Industrial mode a long press of the **<ZERO>** key will remove any stored zero adjustment. Refer to Industrial vs NSC and OIML Modes page 19 for more information on modes.

5.5. ADD Key

The **<ADD>** key is used to add the current bag to the total.

The instrument only adds a bag if:

- There are no errors present.
- The weight is within normal operation that is not Overload or Underload
- The bag weight is greater than the weight defined in menu item **MIN.BAG** and greater than 20 graduations.
- No motion is detected as determined by the motion settings of the instrument.

If the bag weighs less than the setting specified in the **MIN.BAG** menu item, it is regarded as an undersized bag. The indicator beeps 3 times and displays the message **SMALL** and then **BAG**. Refer to MIN.BAG (Minimum Bag weight) ⊗ page 25.

If the motion criteria are not met after 10 seconds the instrument displays the error message **STABLE** and then **Error** and then aborts the add sequence returning to normal display. Refer to MOTION (Motion Detection) ⊗ page 24.

In addition, the weight reading must have changed significantly since the last added bag. This is determined by a gross change of weight of more than the setting specified in the **I.LOCK** menu item. Refer to I.LOCK (Interlock) ⊗ page 25.

Individual bag weights do not need to differ by this amount but the reading must change at least by this amount before the totaliser can be armed. If the **<ADD>** key is pressed and the totaliser is not armed, the instrument sounds three short beeps and displays the error message **ILOCK** and then **Error** for one second.

If the bag has been successfully added to the total, the instrument displays **OK** for one second. If printing is enabled, the bag weight is printed. If it is the first bag weighed, the ticket header and sequence number are also printed.

If **TOT.DSP** has been set to **ON** the instrument cycles the display to show the current total and number of bags before returning to normal display. If the bags are already displayed on the AUX display the "number of bags" step is skipped.

5.6. TOTALS Key

The **<TOTALS>** key is used to step through the normal display, total and number of bags displays. If there is no activity for five seconds the instrument returns to normal weight display.

5.6.1. opto-LINK Activation

This feature is used to temporarily connect a PC to the instrument for calibration and setup purposes.

A long press of the **<TOTALS>** key will toggle the opto-LINK infrared communications On/Off.

When the opto-LINK has been (enabled) the following will occur:

- The instrument briefly displays the prompt **opto-L**.
- The editing annunciators (ie. GRP, ITM, etc.) will flash for up to five minutes while the instrument searches for activity. During this period, the instrument also disables the RS-232 communications.
- After a 5 minute period of no activity, the opto-LINK will be disabled and the editing annunciators will stop flashing. The instrument will also revert back to the normal RS-232 communications (ie. the SERIAL:TYPE setting will be re-activated).

5.7. CANCEL Key

The **<CANCEL>** key is used to cancel the last bag weight. The last bag weight can only be removed once. Subsequent presses of the **<CANCEL>** key result in a short beep. Cancelled bags are printed as negative weights.

5.8. FINISH Key

A single press of the **<FINISH>** key clears the total. If printing is enabled, the total weight is printed as well as the date/time and the footer. The weight must return to gross zero, as specified by the zero band setting, before the totaliser is re-armed. Refer to Z.BAND (Zero 'Dead' Band) ⊗ page 24.

Long Press: A long press of the **<FINISH>** key will clear the totals and print **TOTAL CLEARED** (if printing is used).

6. Configuration

6.1. General Setup Information

Configuration and calibration can be performed entirely from the front panel, using the digital setup facility. When **Full Setup** is used, all menu items are accessible and care must be taken to ensure no accidental changes are made to calibration and trade relevant settings. In addition, there is also **Safe Setup** that provides restricted access**.** This setup method ensures that only settings that are not calibration or trade sensitive can be changed.

Full and Safe Setup can be passcode protected to prevent unauthorised or accidental tampering. If the scale has been passcode protected, the setup menus cannot be accessed until the correct code has been entered.

6.2. Basic Weighing Terminology

The following terms are used throughout the setup procedure. Knowledge of these basic weighing terms is beneficial in setting up and calibrating the instrument.

Note: Descriptions of these and other terms used in this manual are listed in the Glossary Terms page 48.

Term	Definition
Units	Units of measurement (kilograms, tonnes, pounds, etc.).
Full Scale	Total change in weight between zero gross load and full capacity gross load.
Resolution or Count-by	Smallest change in weight units that the display can show.
Total Number of Graduations	Maximum number of display steps between zero gross load and full capacity gross load. It is equal to full scale divided by the count-by.
Division	A single graduation.

Example

This example provides a check to ensure the capability of an indicator to read a stable weight on extremely small divisions compared to the load cell capacities.

The check is to find out what the microvolt per division is and then compare this to the manufacturer's specification. If the manufacturer's specification is smaller than the calculated value, the unit is within the requirements of operation.

Note: The capability of an indicator may be different than the trade approval limit of the micro-Volt per division.

A 10,000kg 2.0mV/V load cell is used in an application requiring a 5000kg full scale, with weight displayed in 5kg increments.

The values are:

- Units = kg
- Full Scale = 5000
- Count-by = 5

Calculating the total number of graduations:	$\text{Total Number of Graduations} = \frac{\text{Full Scale}}{\text{Count-by}} = \frac{5000}{5} = 1000 \text{ divisions}$
Signal voltages can be calculated as follows:	
Calculating the full scale signal (load cell):	$\text{Full Scale Signal} = \frac{\text{Full Scale}}{\text{Load Cell Capacity}} = \frac{5000}{10000} \times 2.0\text{mV/V} = 1.0\text{mV/V}$
Since the instrument uses 5V load cell excitation, the absolute signal voltage is:	Absolute Signal Voltage = Excitation Voltage x Full Scale Signal = 5V x 1.0mV/V = 5.0mV
Calculating the signal resolution:	$\text{Signal Resolution} = \frac{\text{Absolute Signal Voltage}}{\text{Number of Graduations}} = \frac{5.0\text{mV}}{1000 \text{ divisions}} = 0.005\text{mV / division} \equiv 5\mu\text{V / division}$

6.3. Filtering Techniques

There is a trade-off between noise filtering and the step-response time of the system. The step-response is defined as the time between placing a weight on the scale and the correct stable weight reading being displayed. This does not affect the number of readings per second that are taken. It simply defines the amount of time that is required to determine a final weight reading.

The **FILTER** setting in the instrument setup shows the amount of time over which the averaging is taken. Increasing the averaging time will result in a more stable reading but will extend the time it takes the instrument to settle to a final reading. Refer to FILTER (Reading Average) page 24.

6.4. Industrial vs NSC and OIML Modes

Instruments may be operated in Industrial, NSC or OIML modes. These modes restrict certain aspects of the operation of the instrument to ensure compliance with the respective trade certified standards. For more information refer to the Calibration Counter section below and also to the USE (Scale Use) ⊗ section page 24 for setup information.

The following table lists the operation differences for each of these modes.

Element	Industrial	NSC	OIML
Underload	–105% of full scale	–1% or –2% of full scale depending on zero range setting	–1% or –2% of full scale depending on zero range setting
Overload	105% of full scale	Full scale +9 divisions	Full scale +9 divisions
Test Modes	Unlimited time allowed	Limited to five seconds	Limited to five seconds

Table 2: Industrial vs NSC and OIML Modes

6.5. Calibration Counter

Within the setup there are a number of critical steps that can affect the calibration and/or legal for trade performance of the instrument. If any of these steps are altered, the trade certification of the scale could be voided.

The instrument provides a built-in calibration counter to monitor the number of times the critical settings are altered. The value of the counter is stored within the instrument and can only be reset at the factory. Each time a critical setting is altered, the counter will increase by one. Whenever the instrument is powered up, or setup mode is entered/exited, the current value in the counter is displayed briefly (eg. C00010).

Industrial	NSC	OIML
The **Calibration Counter** increments when trade critical settings, marked with Ä**,** are changed. An example of the counter is **C.00019**.	The **Calibration Counter** increments when trade critical settings, marked with Ä**,** are changed. An example of the counter is **C.00019**	The **Calibration Counter** increments when trade critical settings, marked with Ä**,** are changed. An example of the counter is **C.00019**

The value(s) of the counter(s) is written on the tamperproof trade label on the front or top of the indicator for trade-certified applications and functions as an electronic seal. If any legal for trade settings are changed on the instrument, the current value of the calibration counter(s) will be different from the recorded value and the seal is broken. In this manual, items marked with Ä indicate that the setting is legal for trade critical settings.

6.6. Passcodes

The instrument has two levels of passcodes to provide a security lock on accessing Setup via the keypad.

- Full Setup Passcode
- Safe Setup Passcode

The Full Setup passcode can also be used to access Safe Setup.

6.6.1. Full Setup Passcode

Setting a passcode for Full Setup restricts any access to Full Setup. Refer to FULL.PC (Full Security Passcode for Digital Setup) page 26.

6.6.2. Safe Setup Passcode

Setting a passcode for Safe Setup restricts access to Safe Setup functions. Refer to SAFE.PC (Safe Security Passcode for Digital Setup) page 26.

6.6.3. Setup Lock-Out

If an attempt is made to enter Full or Safe Setup using an incorrect passcode, the instrument will respond with the message **ENTRY DENIED** and then the user will be returned to normal operating mode. A passcode counter has been set so that only three failed attempts can be made to access Full/Safe Setup. On the fourth attempt the user will be 'locked out' of Full/Safe setup. Should this occur the **ENTER PASS** prompt will not display, but instead the **ENTRY DENIED** message displays and returns the user to the normal operating mode. To rectify this issue the instrument must be turned off. When the instrument is turned back on the passcode counter is reset to zero (allowing the user to enter the correct passcode).

7. Setup

The instrument digital setup facilities provide the means to configure and calibrate the instrument.

7.1. Accessing Setup

There are two methods to access the Setup area. For further details of menu items available in each setup mode, refer to the Setup Menu Quick Reference page 44.

- The **Full Setup** method provides access to all functions in Setup, including legal for trade and calibration sensitive settings. Changes in Full Setup mode may result in the calibration counter being incremented. Items marked with Ä indicate that the setting is trade critical. Changes to passcodes and restoring the factory default settings can only be accessed in Full Setup mode. These items will however not increment the calibration counter. If an attempt is made to enter Full Setup using the incorrect passcode, the instrument will respond with the message **ENTRY DENIED**. Refer to Passcodes page 20 for more information.

Full Setup
To access **Full Setup**, first ensure the instrument is on. Then press and hold both the **<SETUP>** and **<FINISH>** keys together for two seconds. **Full Setup** can also be entered by pressing a push-button accessed from the rear of the instrument. Refer to OPTIONS:R.ENTRY page 25 for more details.

WARNING

All items in all menus will be enabled in **Full Setup**.
Care should be taken to avoid inadvertently altering the Build or Calibration settings.

- The **Safe Setup** method restricts access to the Trade Critical settings. Changes made in this mode will not increment the calibration counter. In this manual, items marked with Ä indicate that the setting is trade critical. If an attempt is made to enter Safe Setup using the incorrect passcode, or if an attempt is made to alter a trade critical setting while in Safe Setup, the instrument will respond with the message **ENTRY DENIED**. Refer to Passcodes page 20 for more information.

Safe Setup
To access **Safe Setup**, first ensure the instrument is on. Then press and hold both the **<SETUP>** and **<ZERO>** keys together for two seconds.

7.1.1. Setup Display Prompts

When accessing **Full** or **Safe Setup** the instrument will beep twice and then display the following:

- FULL or SAFE (depending on setup access type)
- SETUP
- Software Version (eg. V1.0)
- Calibration Counter (eg. C.00010). Refer to Calibration Counter page 20 for more information.
- If a passcode has been configured, the **ENTER PASS** prompt will display and the setup passcode must be entered to gain access. Refer to Passcodes page 20, SAFE.PC (Safe Security Passcode for Digital Setup) page 26 and FULL.PC (Full Security Passcode for Digital Setup) page 26 for more information.
- The title of the first Group (ie. **BUILD**) will then be displayed.

7.2. Exiting Full or Safe Setup

To save settings, exit setup and return to the normal weighing mode use one of the following methods:

Method 1: Press and hold both the **<SETUP>** and **<FINISH>** keys together for two seconds.
Method 2: Press and hold both the **<SETUP>** and **<ZERO>** keys together for two seconds.
Method 3: Press the **<GRP>** key repeatedly. When **- End -** displays press **<ITM>** or **<OK>**.

The instrument will beep and then display the following:

- SAVING
- Software Version (eg. V1.0)
- Calibration Counter (eg. C.00010). Refer to Calibration Counter page 20 for more information.
- The current weight will then display.

Warning: If the power is interrupted while in setup (ie. by disconnecting the power cable or pressing the **<POWER>** key), unsaved settings will be lost.

7.3. Groups and Items

All keypad setup options in the instrument are organised in a tree structure made up of **Groups** and **Items**. To simplify this document, Groups and Items will be notated as follows (GROUP:ITEM). Refer to Setup Menu Quick Reference page 44 for a list of all Groups and Items.

7.3.1. GRP (Group)

Setup is divided into a series of **Groups**. Each group has a distinctive group title. All options in any one group have related functions. The **<GRP>** key can be used to cycle through the available groups.

7.3.2. ITM (Item)

Each group is divided into individual **Items**. Each item represents a parameter that can be changed. Pressing the **<ITM>** key will enter the displayed group, allowing access to the items within the group. The **<ITM>** key can be used to cycle through the available items. The **<SEL>** key is then used to edit the item.

7.4. Setup Menus

The following sections describe the setup parameters of each of the Groups and Items in Setup.

7.4.1. BUILD (Scale Build)

Settings within this Group are used to configure the indicator to suit the current application. It is important to fully set the options within this group before calibration is attempted. Later changes to items within this group may invalidate the current calibration data.

DP (Decimal Point Position) Ä

Sets the location of the decimal point on the display. To avoid confusion, set this parameter first so that all other weight related values are displayed with the decimal point in the correct position.

- Can be set from 000000 (none) to 0.00000
- Default: 00000.0

CAP (Maximum Capacity) Ä

Sets the nominal maximum capacity (or full scale) of the scale. This is set in weighing units (eg. kg, t, etc.), with the decimal point in place. For example, if a scale is to weigh 500.0 kg in 0.5 kg increments, CAP is set to 500.0, and RES is set to 5.

- Range: 000100 to 999999
- Default: 001500

RES (Count-by Resolution) Ä

Sets the resolution (or Count-by) of the display. The resolution is the number by which the indicator will count.

- Options are: 1, 2, 5, 10, 20, 50 or 100
- Default: 1

UNITS (Weighed Units) Ä

Sets the units for display and printing.

- Options are: (g) grams, (kg) kilograms, (lb) pounds, (t) tonnes, ( ) none (ie. other units).
- Default: kg

HI.RES (High Resolution x 10 mode) Ä

Sets the instrument to display weight at 10 times resolution. This is intended for test purposes in trade applications but may be used for industrial weighing. This mode is indicated by the flashing of the units annunciator.

- Options are: ON or OFF
- Default: OFF

CABLE (4-Wire or 6-Wire) Ä

Sets the load cell input to operate in 4-wire (auto sense) or 6-wire mode.

- Options are: 4 or 6
- Default: 6

7.4.2. OPTION (Scale Options)

Items within this Group are used to configure the operating parameters of the scale.

USE (Scale Use) Ä

This is where the basic use of the scale is set. This setting configures the instrument for Industrial, NSC or OIML operation. Refer to Industrial vs NSC and OIML Mode page 19 for more information.

- Options are: INDUST (Industrial), NSC, or OIML
- Default: INDUST

FILTER (Reading Average)

The instrument can average a number of consecutive readings when calculating the displayed weight. This is used to dampen unwanted weight fluctuations caused by vibrations or dynamic forces. High settings will stabilise the display at the expense of rapid response to sudden weight changes.

- Options are: NONE, 0.2, 0.5, 1.0, 2.0, 3.0, 4.0 (time in seconds)
- Default: 0.5 (seconds)

MOTION (Motion Detection) Ä

Sets how much weight variation over a defined time period is allowed before the displayed weight is deemed to be unstable. This value is displayed as weight change (0.5 or 1.0 graduations) per second. When set to **OFF**, the Motion Detection is ignored and ZERO and PRINT actions are instantaneous.

- Options: OFF, 0.5-1.0, 1.0-1.0, 0.5-0.5, 1.0-0.5 (graduations per second)
- Default: 0.5-1.0 (0.5 graduations per second)

INIT.Z (Initial-Zero on Startup)

This function can be used to automatically ZERO the indicator during power-up. The amount of weight that can be zeroed is limited to +/– 10% of full scale.

- Options are: ON or OFF
- Default: OFF

Z.TRAC (Zero Tracking Sensitivity) Ä

Zero tracking allows the display to adjust for minor changes in the zero balance of the scale. When enabled, the instrument will track weight readings within the zero 'dead' band back to exactly zero at a maximum rate of 0.5 (SLOW) or 10 (FAST) graduations per second.

- Options are: OFF, SLOW, FAST
- Default: OFF

Z.RANGE (Allowable Zero Operating Range) Ä

This setting restricts the range over which the Zero functions can operate.

- Options are: -2_ 2, -1_ 3, -20_20, FULL
- Default: -2_ 2 (–2% to +2%)

Z.BAND (Zero 'Dead' Band) Ä

This is an adjustable margin either side of true zero that defines the zero 'dead' band. The zero 'dead' band is used by the automated functions to determine zero load (eg. a setting of 4 specifies that readings between –4.5 and 4.5 are considered to be zero).

When the displayed weight reading is within this band the instrument displays the **zero band** annunciator. Refer to Status Annunciators page 15.

- Settable over the full weight range. Always enter a number in multiples of display units. Refer to RES (Count-by Resolution) ⊗ page 23 for more information.
- Default: 0 (ie. –0.5 to 0.5 graduations)

R.ENTRY (Entry Means to Full Setup)

This setting can be used to restrict access to the full setup. The first entry to the full setup menu using the push button on the rear of the instrument causes all future access to the full setup to be restricted to the push button.

- Options are: OFF, ON
- Default: OFF

MIN.BAG (Minimum Bag weight) Ä

The MIN.BAG setting determines the minimum weight a bag must register for it to be added to the total weight when the **<ADD>** key is pressed.

- Range: 000000 to 999999
- Default: 000020

I.LOCK (Interlock) Ä

This setting determines the minimum weight change to arm the totaliser. It is not required that individual bag weights need to differ by this amount but the reading must change by this amount before the next bag can be added. If the **<ADD>** key is pressed and this condition has not been met, the instrument sounds a long beep and displays the error message **I.LOCK** and then **Error** for one second.

- Range: 000000 to 999999
- Default: 000020

7.4.3. CAL (Scale Calibration)

Items within this group perform various calibration routines. For detailed scale calibration procedures refer to Calibration page 32. Certain items in the Scale Build can affect the calibration of the scale. Always check that these sections are correctly configured to suit the current application before attempting to calibrate the scale.

ZERO (Zero Calibration) Ä

Select to perform Zero Calibration. While the zeroing is in progress the display will show **Z.in P**. Refer to ZERO (Zero Calibration Routine) page 33.

SPAN (Span Calibration) Ä

Select to perform Span Calibration. While the span calculation is in progress the display will show **S.in P**. Refer to SPAN (Span Calibration Routine) page 33.

DIR.ZER (Direct Zero Calibration) Ä

Select to enter the mV/V value of the zero calibration directly. This feature is used to enable approximate calibrations to be performed in situations where a standard ZERO calibration is impractical (eg. calibration on a partially filled silo).

DIR.SPN (Direct Span Calibration) Ä

Select to enter the mV/V value of the full scale capacity of the scale build. This feature enables the instrument to be calibrated based on the rated output capacity of the load cells rather than using test weights. The accuracy of this method is limited to the accuracy of the published load cell ratings.

FAC.CAL (Restore Default Factory Calibration) Ä

Select this choice to restore default factory calibration. This restores all calibration critical settings in the **BUILD**, **OPTION** and **CAL** menus back to factory defaults. The instrument will prompt with **Cont. N**. Press **<EDT>** to change to **Cont. Y** and **<OK>** to continue. If **Cont. Y** is chosen and then **<OK>** or **<ITM>** is pressed, the instrument will display **DONE** to indicate that the operation has been completed.

7.4.4. SPEC (Special Settings Menu)

Settings within this group control features including passcodes, key locking, key functions and display settings.

SAFE.PC (Safe Security Passcode for Digital Setup)

The **SAFE.PC** (Safe Passcode) allows partial access to Digital Setup (ie. only non calibration/trade critical settings can be changed). For the Safe Passcode to have any effect, the FULL.PC passcode must also be set. The default passcode setting is **000000** that allows free access. Any other number will enable the passcode functions and restrict access. Refer to Passcodes page 20 and Accessing Setup page 21 for more information.

- Range 000000 to 999999
- Default: 000000

FULL.PC (Full Security Passcode for Digital Setup)

The **FULL.PC** (Full Passcode) can be set to restrict access to Full Digital Setup. This passcode is used to prevent unauthorised or accidental tampering in the instrument setup. The default passcode setting is **000000** that allows free access. Any other number will enable the passcode functions and restrict access. Refer to Passcodes page 20 and Accessing Setup page 21 for more information.

- Range 000000 to 999999
- Default: 000000

It is important to note that when restricting Full access to Setup the passcode must not be forgotten. It is only possible to circumvent the passcode at the factory. Care must be taken when setting the Full Digital Setup Passcode to ensure that the instrument does not become permanently locked.

KEY.LOC (Front Panel Key Locking)

This item allows individual keys to be locked and unlocked. The display shows a dash (**–**) to indicate that a key is locked (inactive) or characters for each key that is active (ie. the characters **P12345** display). The letter **P** represents the **<SETUP>** key while the numbers **1234** and **5** represent the remaining operation keys. The operation keys are numbered from the left with the **<ZERO>** key being number **1**.

- Default: -12345 - All keys are unlocked (active)

AUT.OFF (Auto Power Off / Battery Operation)

The instrument can be set up to automatically power down after a period of no activity. Weight motion, network communications or any press of the keyboard is enough to keep the instrument powered on.

Options are:

- NEVER: Never power off
- 1, 5,10, 30 (time in minutes)
- Default: NEVER

B.LIGHT (Backlight Operation)

Sets the operation of the backlight. When operating the backlight with batteries the brightness is lowered automatically to conserve power and the backlight will automatically turn off after 10 seconds of inactivity. To turn on again, press the **<POWER>** key.

Options are:

- OFF: Backlight is off.
- ON: Backlight is on when weight motion, network communications or any keypress is detected.
- FORCED: Backlight is permanently on.
- Default: ON

BAT.VLT (Battery Voltage)

Battery Voltage	Low Battery Level
4.8V	4V
7.2V	6V
9.6V	8V
12V	10V
24V	20V
PWR	NO BATTERY
Li-Ion	12V

Default: PWR

Please note: A low battery annunciator will be displayed at 10% above low battery level. The indicator will assume it is on battery power when its input voltage is less than twice the low battery level for the selected battery voltage. In the PWR mode the indicator will always assume it has external power. Correct function of the low battery warning is dependent on correct setting of the battery voltage.

7.4.5. SERIAL (Serial Communications Options)

Settings within this Group determine the serial and printing outputs. Refer to Serial Outputs page 35 for more information on Serial configuration.

TYPE (Serial Output Type)

Sets the function(s) of the serial output.

Options are:

- SPL.RIN: Protocol B Network Communications with auto out.
- AUTO: Enables 10 Hz automatic transmission using the format selected below (SERIAL:FORMAT).
- SPL.NET: Protocol A network communications with auto out.
- SPL.PRN: Enables printer driving with auto out.
- SPL.PRO: Protocol C network communications with auto out.
- Default: SPL.RIN

FORMAT (Serial Output Format)

The Format determines the transmission format for AUTO and SINGLE serial types.

- FMT_1: Format 1.
- FMT_2: Format 2.
- MASTER: Send contents of LCD display to a remote display.
- CUSTOM: Send a custom print string to a remote display.
- Default: MASTER.

BAUD (Serial Baud Rate)

The baud rate determines the serial data transmission speed.

- Options are: 2400, 4800, 9600, 19200
- Default: 9600

BITS (Serial Format Options)

The Bits options allow the data transmission bit pattern and interface to be changed. The display will show the current setting in the form **n81-** where each character has a meaning as shown below.

Options are:

- N or O or E: Parity bit: (N) None, (O) Odd, (E) Even
- 8, 7: Number of data bits
- 1, 2: Number of stop bits
- -, D: DTR handshake disabled or enabled
- Default: n81-. (For most applications the default setting is applicable.)

ADDRES (Instrument Address)

Use this option to set the instrument address when operating with network communications.

- Range 01 to 31
- Default: 31

AUT.SPD (Auto Output Speed)

Use this option to set the Auto Output Speed for the instrument. There are four speeds to choose from 10, 5, 2 & 1Hz. If using a remote input Auto Output Speed must be set to 10Hz. Default: 10Hz.

SHOW.T (Show Totals)

The **SHOW.T** item stands for **Show Total**. When enabled the total will be displayed following each printout. This can be useful if the function key is being used for another purpose. Default: ON.

RST.CON (Reset Printed Consecutive Number) Ä

Use this option to reset the printed consecutive number back to **1**. The instrument will prompt with **Cont. N**. Press **<EDT>** to change to **Cont. Y** and

<OK> to continue. When **Cont. Y** has been chosen the instrument will display **DONE** to indicate that the operation has been completed.

7.4.6. SET.PTS (Setpoint Settings)

Settings within this group configure the setpoint system.

SETPT.1 (Output 1 Type)

The type of output control associated with output 1.

Options are:

- OFF: The output is disabled (turned off).
- ON: The output is enabled (turned on).
- OVER: The output is turned on when the source weight is over the target value and turned off otherwise.
- UNDER: The output is turned on when the source weight is under the target value and turned off otherwise.
- MOTION: The output will be driven whenever weight motion is detected.
- ZERO: The output will be driven whenever the weight motion is within the zero deadband.
- NET: The output will be driven whenever net weight is displayed.
- ERROR: The output will be driven whenever there is a diagnostic error.
- Default: OFF

SRC.1 (Weight Source for Output 1)

The weight source determines the weight reading that is used for output 1 comparisons.

Options are:

- GROSS: Use gross weight readings always.
- DISP: Use the displayed weight (gross or net).
- NET: Use net weight readings always.
- TOTAL: Use the total weight always.
- Default: GROSS

TARG.1 (Target for Output 1)

This is the target value for output 1. This target provides the threshold value when the OVER or UNDER type options are selected.

- Range: –99999 to 999999
- Default: 000000

HYS (Hysteresis)

This is used to enter the hysteresis.

- Range: 000000 to 999999
- Default: 000000

ALARM

Beep the buzzer when the setpoint is active.

Options are:

- NONE: No alarm.
- SINGLE: Single beep (repeated).
- DOUBLE: Double beep (repeated).

- Default: NONE

FLASH

Flash the display when the setpoint is active.

Options are:

- ON: Flash the display
- OFF: Do not flash the display
- Default: OFF

7.4.7. CLOCK (Clock Settings)

Items within this group set date and time related functions.

FORMAT (Date Format)

This sets the date format.

Options are:

- dd.mm.yy
- mm.dd.yy
- Default: dd.mm.yy

YEAR (Set Year)

- Range: 2000 to 2079

MONTH (Set Month)

- Range: 01 to 12

DAY (Set Day)

- Range: 01 to 31

HOUR (Set Hour)

- Range: 00 to 23 (24-hour format)

MINUTE (Set Minute)

- Range: 00 to 59

QA.OPT (Quality Assurance Option))

This sets the QA check on or off.

Options are:

- ON
- OFF
- Default: OFF

QA.YEAR (QA Year)

- Range: 2000 to 2099

QA.MNTH (QA Month)

- Range: 01 to 12

QA.DAY (QA Day)

- Range: 01 to 31

7.4.8. TEST (Special Test Functions)

Items within this Group allow access to the testing routines for the instrument. With these routines the scale base output can be monitored and the inputs and outputs can be tested.

SCALE (Scale Base Test Display)

Verifies the correct load cell capacity and/or load cell wiring is used. It sets up the instrument as a simple test meter to measure the load cell signal output. The display reads in millivolts per volt, factory calibrated to 0.1% worst case. When accessing this item, initially there should be no weight on the scale. In NSC, OIML or NTEP modes, this display is only active for five seconds before returning to the menu.

FRC.OUT (Force Outputs)

Forces each of the output drivers in turn. All outputs turn OFF when leaving this step. The **<EDT>** key will advance through each output (ie. ON.1 and ON.2). Pressing **<OK>** will turn all outputs off and exit the test.

O.LOAD (Overload Count)

Displays a count of the number of times that the A/D conversion has been out of range since the count was last reset. This value is read only and cannot be edited.

CLR.OLD (Clear Overload)

Clears the A/D conversion overload counter. The instrument will prompt with Cont. N. Press <EDT> to change to Cont. Y and <OK> to continue. When Cont. Y has been chosen the instrument will display DONE to indicate that the operation has been completed.

7.4.9. FACTRY (Factory Adjustment Menu)

DEFLT (Restore Factory Settings Except for Calibration and Build)

Restores all settings in the digital setup, which are not calibration critical back to the original **new** settings installed at the factory. The main use of this routine is to completely reset an instrument that is being installed on a different scale. The instrument will prompt with **Cont. N**. Press **<EDT>** to change to **Cont. Y** and **<OK>** to continue. When **Cont. Y** has been chosen the instrument will display **DONE** to indicate that the operation has been completed.

Restoring the factory options does not affect the calibration. To reset the calibration to factory condition CAL:FAC.CAL must be used. Refer to FAC.CAL (Restore Default Factory Calibration) ⊗ page 26. This menu item is only available when in Full Digital Setup mode.

7.4.10. – End – (Leaving Setup)

Refer to Exiting Full or Safe Setup page 22.

8. Calibration

The calibration of the indicator is fully digital and the results are stored in permanent memory for use each time the instrument is powered up.

Note: Some of the digital setup steps can affect calibration. The BUILD and OPTION settings MUST be configured before calibration is attempted.

To perform a calibration, when in Full Setup select the **CAL** Group using the **<GRP>** key. The calibration programme will automatically prevent the instrument from being calibrated into an application outside of its specification. If an attempt is made to calibrate outside of the permitted range, an error message will display and the calibration will be abandoned. Refer to Error Messages on page 45.

The instrument has a wide-range A/D converter. The industrial calibration range of the instrument extends well beyond the Trade approved range.

Note: It should not be assumed that just because the instrument has successfully calibrated a scale, that the scale is correct for trade use. Always check the scale build against the approval specification.

8.1. Performing a Digital Calibration with Test Weights

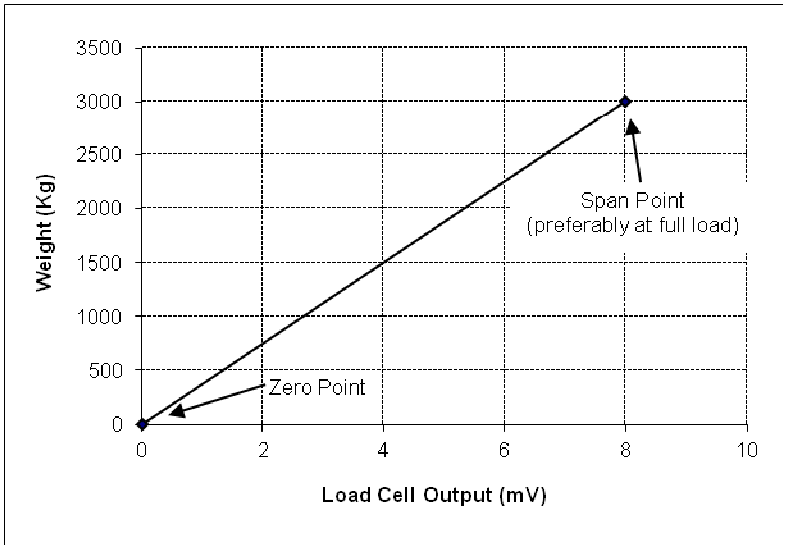


Figure 10: Chart - Zero and Span Points to Interpolate Weight from Load Cell

The Zero setting (CAL:ZERO) specifies a gross zero point for the scale. The Span setting (CAL:SPAN) specifies a second point **(preferably close to full scale)** used to convert the A/D readings into weighing units (eg. kg). Select either of the Zero (CAL:ZERO) or Span (CAL:SPAN) calibration items. It is important that an initial Zero calibration is performed before any SPAN calibrations. The chart shown here demonstrates how the zero and span points are used to interpolate a weight reading from the load cell reading.

Note: Calibration points (Zero and Span) must be spaced by at least 2% of Full scale from each other.

8.1.1. ZERO (Zero Calibration Routine)

Press the **<SEL>** key to start. The display will show the current weight. Remove all weight from the scale structure.
Press **<SEL>**, **<EDT>** or **<OK>** to execute a Zero Calibration. The display will show **Z.in.P** to indicate that zeroing is in progress. When the process is complete the display will return to weight to allow the zero to be checked.
Press the **<ITM>** key to leave the Zeroing routine or press **<SEL>**, **<EDT>** or **<OK>** to repeat the operation.

8.1.2. SPAN (Span Calibration Routine)

Press **<SEL>** or **<OK>** to start. The display will show the current weight.
Add the calibration test mass to the scale. The minimum acceptable span calibration weight is 2% of the scale range. A weight this small may limit calibration accuracy. The closer the test weight is to full scale the better the accuracy.
Press **<SEL>** or **<OK>** to show the calibration weight value. Change this to the correct calibration weight using the **<SEL>** and **<EDT>** keys.
Press **<ITM>** or **<OK>** to trigger the Span Calibration routine. The display will show **S.in P** to indicate that spanning is in progress. When the process is complete the display will return to weight to allow the new weight reading to be checked.
When the Span Calibration is complete, press the **<ITM>** key to leave the Spanning routine or press **<SEL>**, **<EDT>** or **<OK>** to re-edit the calibration weight and repeat the operation.

8.2. Performing a Calibration with Direct mV/V Entry

In applications where test weights are not easily available, it is possible to calibrate the instrument directly by entering the mV/V signal strength at Zero and full scale Span. The Direct Zero setting (CAL:DIR.ZER) specifies a gross zero point for the scale. The Direct Span setting (CAL:DIR.SPN) specifies the mV/V signal strength corresponding to an applied mass equal to the full scale reading. Clearly the accuracy of this type of calibration is limited to the accuracy of the direct mV/V data.

8.2.1. DIR.ZER (Direct Zero Calibration Entry)

Press the **<OK>** key to start. The display will show the current weight.
Press the **<OK>** key to enter the Direct Zero setting. Change the mV/V setting to the correct value for **Zero** using the **<SEL>** and **<EDT>** keys.
Press the **<OK>** key to store the new zero calibration. When the process is complete the display will return to weight to allow the new weight reading to be checked.
Press the **<ITM>** key to leave the Direct Zero routine or **<OK>** to repeat the operation.

8.2.2. DIR.SPN (Direct Span Calibration Entry)

Press the **<OK>** key to start. The display will show the current weight.
Press the **<OK>** key to enter the Direct Span setting. Change the mV/V setting to the correct value for the full scale signal strength, using the **<SEL>** and **<EDT>** keys.
Press the **<OK>** key to store the new span calibration. When the process is complete the display will return to weight to allow the new weight reading to be checked.
Press the **<ITM>** key to leave the Direct Span routine or **<OK>** to repeat the operation.

9. Serial Outputs

There is a bi-directional RS-485 port and a transmit only RS-232 port. Additionally, the instrument supports the optional temporary opto-LINK connection. Refer to opto-LINK Activation page 10.

The available serial options include:

- Network Communications
- Automatic Output
- Printing

To enable the connection of an operator display, the automatic weight output is permanently enabled on the RS-232 transmit only port. Network communications and printing are available on the RS-485 port. For wiring connections and pin outs, refer to Auxiliary Connection page 9.

9.1. Network Communications

9.1.1. COMM Protocol SPL.RIN

The **SPL.RIN** network communications feature is normally used to control indicators remotely from a central computer or PLC. The basic message format is as follows:

ADDR	CMD	REG	:DATA	8

ADDR

ADDR is a two character hexadecimal field corresponding with the following:

ADDR	Field Name	Description
80_H	Response	'0' for messages sent from the master (POLL). '1' for messages received from an instrument (RESPONSE)
40_H	Error	Set to indicate that the data in this message is an error code and not a normal response.
20_H	Reply Required	Set by the master to indicate that a reply to this message is required by any slave that it is addressed to. If not set, the slave should silently perform the command.
00_H .. $1F_H$	Indicator Address	Valid instrument addresses are 01_H to $1F_H$ (1 .. 31). 00_H is the broadcast address. All slaves must process broadcast commands. When replying to broadcasts, slaves reply with their own address in this field.

CMD is a two character hexadecimal field:

CMD	Command	Description
05_H	Read Literal	Read register contents in a 'human readable' format
11_H	Read Final	Read register contents in a hexadecimal data format
12_H	Write Final	Write the DATA field to the register.
10_H	Execute	Execute function defined by the register using parameters supplied in the DATA field.

REG	is a four character hexadecimal field that defines the address of the Register specified in the message. The viewer software will show the register address for each setting in the menu structure when they are accessed.
: DATA	carries the information for the message. Some messages require no DATA (eg Read Commands) so the field is optional. A ':' (COLON) character is used to separate the header (ADDR CMD REG) and DATA information, this must always be included even when no data is sent.
8	is the message termination (CR LF or ";").

Note: The hexadecimal codes are added in the fields described above when multiple options are active at the same time. For example an error response message from instrument address 5 would have an ADDR code of $C5_H$ ($80_H + 40_H + 05_H$).

9.1.2. Termination

Message termination for normal communications use either a CRLF (ASCII 13, ASCII 10) as a terminator or a semicolon (ASCII 59). There is no start-of-message delimiter.

9.1.3. Error Handling

If a command cannot be processed, the indicator returns an error. The ERROR bit in the ADDR field is set and the DATA field contains the Error Code as follows:

Error	DATA	Description
Unknown Error	$C000_H$	Error is of unknown type
Not Implemented Error	$A000_H$	Feature not implemented on this device
Access Denied	9000_H	Passcode required to access this register
Data Under Range	8800_H	Data too low for this register
Data Over Range	8400_H	Data too high for this register
Illegal Value	8200_H	Data not compatible with this register
Illegal Operation	8100_H	CMD field unknown
Bad parameter	8040_H	Parameter not valid for this execute register
Menu in Use	8020_H	Cannot modify register values while SETUP menus are active

Viewer Mode required	8010_H	Advanced operation chosen which requires the instrument to be in viewer mode.

Table 3: Network error codes

For more information on the SPL.RIN **COMM** Protocol please refer to the Communications Manual.

9.1.4. COMM Protocol SPL.NET

The command structure for SPL.NET networking is:

STX CMD POLL ETX

or

STX CMD POLL CR LF

Where:

CMD is the serial command

POLL is two digits giving this unit's network address (eg. **01** for address **1**)

Some commands result in a response from the instrument**.** All responses are in the following format:

RESPONSE CR LF

Where:

Response is a string of characters that may be a weight reading or an acknowledgment of some action.

CR is the ASCII character 13

LF is the ASCII character 10

9.1.5. SPL.NET Command Types

- **Key Commands K: Kx**

  Key commands allow the instrument to be operated via the network by simulating the actual pressing of it's keys.

  A key command is a two character command with the first character being capital **K**. The second letter specifies which key is pressed.

CMD	Description
Ka	Zero
Kb	Add
Kc	Totals
Kd	Cancel
Ke	Finish

CMD	Description
Second letter capitals (below) simulate a long two second key press	
KA	Zero
KB	Add
KC	Totals
KD	Cancel
KE	Finish

CMD	Description
Two key sequence (below) used to enter calibration menus	
KX	Simulates <SETUP> + <FINISH>

Example: **STX K a 01 ETX** will simulate pressing the **<ZERO>** key on instrument 01

CMD	Description
Kp	Special key command that requests the current displayed weight from the instrument. The returned weight information is the same format as for an auto output with the exception that there are no **STX** or **ETX** characters sent. Instead of the **STX ETX** characters a **CR LF** (as with all other network responses) follows the weight information.

Example: **STX Kp00 ETX** will return **"** **100.5G *CR LF* "**

- **Read Targets R: Rx**

  All of the Setpoint targets can be read using these commands. This is a two letter command with the first letter being capital **R** and the second letter specifying which target.

CMD	Description	Response
RA	Read Target 1	Target 1 *CR LF*
RH	Read Hysteresis	Hysteresis *CR LF*
RT	Read time/date	hhmmssddmmyy *CRLF*

- **Set Targets S: Sxddd**

  All of the Setpoint targets can be set using these commands. This is a two letter command with the first letter being capital **S** and the second letter specifying which target. Following this is the actual target data, which is sent as an ASCII string of digits without any decimal point.

  Example: a target of **100.5 kg** would be set as **SA1005**

CMD	Description	Response
SAddd	Set Target 1	SA *CR LF*
SHddd	Set Hysteresis	SH *CR LF*
SThhmmssddmmyyyy	Set time/date	ST *CR LF*

Note: All commands require a two digit Poll address at the end of the command. The characters **00** are used to specify any unit, or use the address setting of the instrument. The full command to set the target in the above example would be:

STX SA100500 ETX

9.1.6. COMM Protocol SPL.PRO

The command structure for SPL.PRO networking is:

STX **PP** ETX **CC**

Where:

PP is the pushbutton coil bits.

CC is the checksum.

The response is in the format:-

STX **WWWWWW TTTTTT BBB FF RR EXXXX** ETX **CC**

Where:

WWWWWW is the current weight.

TTTTTT is the current total.

BBB is the current bag count.

FF is the current active display annunciator coils.

RR is the operational error message coils.

EXXXX is the system errors.

CC is the checksum characters

Pushbutton coils:

Key	Value
Zero	80_H
Add	40_H
Totals	20_H
Cancel	10_H
Finish	08_H

Annunciator coils:

Annunciator	Value
Centre of Zero	80_H
Net	40_H
Motion	20_H
Zero band	10_H
Setpoint 1	08_H

Operational error message coils:

Error	Value
Underload	80_H
Overload	40_H
Zero error	20_H
Stable error	10_H
QA due	08_H
Interlock	04_H
Small bag	02_H
Invalid operation	01_H

See 10.4 Diagnostic Errors page 47 for system errors.

Note: The checksum is an XOR of each character of the transmitted message.

9.2. Automatic Weight Output

The automatic output is normally used to drive remote displays, a dedicated computer, or PLC communications.

The Automatic Weight Output and Single Output types have several formats available including:

- Format 1
- Format 2
- Master / Slave
- Custom

All serial output options are enabled and configured using the serial communications options in the digital setup procedure. Refer to SERIAL (Serial Communications Options) page 27.

The instrument computer communications can range from simple automatic streamed output, through to a command-response system. In addition to the opto-LINK, the instrument can be programmed and calibrated via the RS-232 serial port. The calibration counter is incremented when the calibration related steps are accessed via RS-232, the serial port or the opto-LINK. This means that calibration via the serial port or opto-LINK cannot be carried out without affecting the certification of a trade installation.

Auto Weight Format String

The weight format string may be set to the following formats:

Format	Description
FMT_1	**<STX> <SIGN> <WEIGHT(7)> <STATUS> <ETX>**
FMT_2	**<STX> <SIGN> <WEIGHT(7)> <S1> <S2> <S3> <S4> <UNITS(3)> <ETX>**

Where

- **STX:** Start of transmission character (ASCII 02).
- **ETX:** End of transmission character (ASCII 03).
- **SIGN:** The sign of the weight reading (space for positive, dash (-) for negative).
- **WEIGHT(7):** A seven character string containing the current weight including the decimal point. If there is no decimal point, then the first character is a space. Leading zero blanking applies.
- **STATUS:** Provides information on the weight reading. The characters G/N/U/O/M/E represent Gross / Net / Underload / Overload / Motion / Error, respectively.
- **UNITS(3):** A three character string, the first character being a space, followed by the actual units (eg. ^kg or ^^t). If the weight reading is not stable, the unit string is sent as ^^^.
- **S1:** Displays G/N/U/O/E representing Gross / Net / Underload / Overload / Error, respectively.
- **S2:** Displays M/^ representing Motion / Stable, respectively.
- **S3:** Displays Z/^ representing centre of Zero / Non-Zero, respectively.
- **S4:** Displays - representing single range.

9.3. Printing

When the instrument has print or automatic print enabled selection between the standard printing format and the programmable printing format is automatic. If there is programmable printing data available then it will be used for the printing. If there is no programmable printing data available then the standard printing format will be used.

- **Standard Printing**

The instrument has a single fixed printing format, that is used when the **<ADD>** key is pressed, that is as follows:

```
      4.91 kg G,
```

The print shows the displayed reading, units and **G** for Gross or **N** for Net.

In addition to the printout, the instrument adds the weight printed to the internal weight totals. A press of the **<FINISH>** key will print and clear these totals. The six digit sequential number is included in the finish print.

The following is a sample of a total ticket:

```
    4.91 kg G,   9.81 kg G,
-  9.81 kg ,
  14.71 kg G,
000135 20/11/2012 10:53
TOTAL       2 bags @        19.61 kg
```

9.4. Master Serial Output

In **Master** mode, the instrument sends out the entire contents of the LCD at the selected auto output speed.. This is essentially the same as AUTO output but the format of the output string is designed to allow a remote display to exactly copy the contents of the LCD including all of the annunciators and user prompts, etc.

9.5. Auto Output Speed

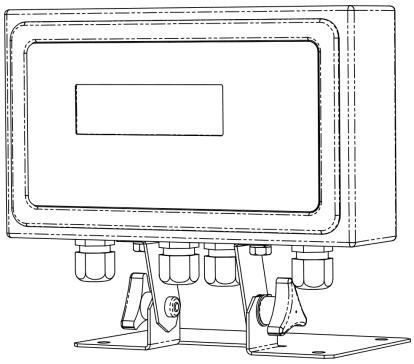
There are four speeds to choose from: 10, 5, 2 & 1Hz. If using a remote input auto output speed must be set to 10Hz.

10. Appendix

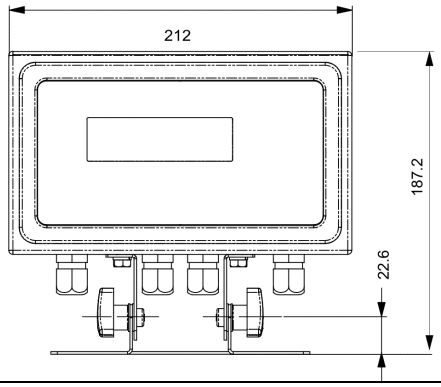
10.1. Instrument Dimensions

Weight Indicator (Desk Mounted) — Dimensions in mm (1 inch = 25.4 mm)

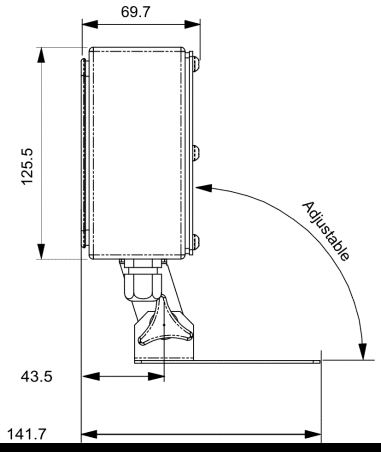
Desk Mounted 3D View



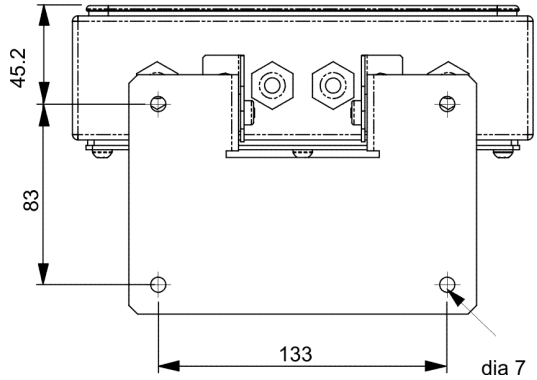
Front View



Side View

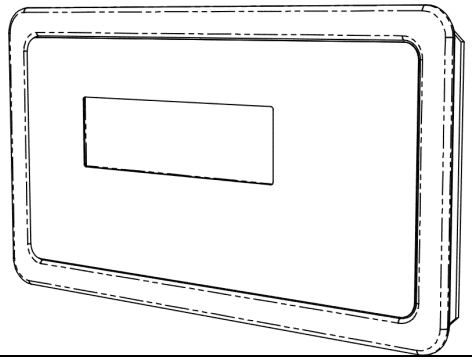


Bottom View

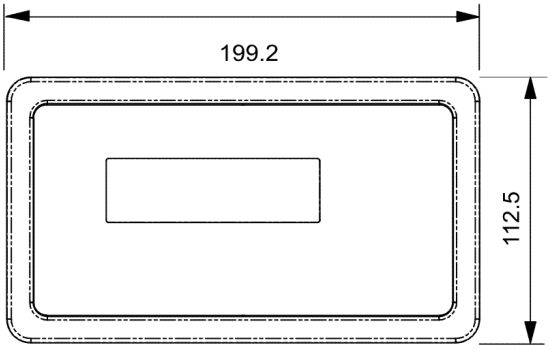


Weight Indicator (Panel Mounted) — Dimensions in mm (1 inch = 25.4 mm)

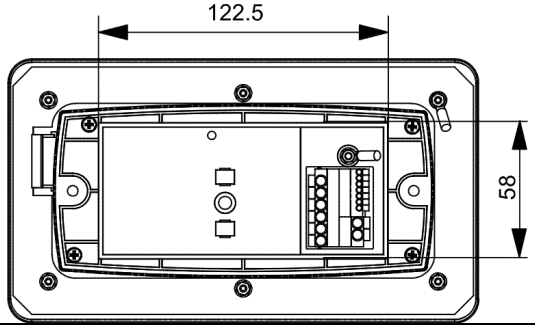
Panel Mounted 3D View



Front View



Rear View



10.2. Setup Menu Quick Reference

Note: ⊗ Available only in Full Setup. Changing this setting **will increment** the Calibration Counter.
1 Available only in Full Setup. Changing this setting **will not increment** the Calibration Counter.

Group (GRP)	Item (ITM)	Page	Ä
BUILD	DP (Decimal Point Position) ⊗	23	⊗
	CAP (Maximum Capacity) ⊗	23	⊗
	RES (Count-by Resolution) ⊗	23	⊗
	UNITS (Weighed Units) ⊗	23	⊗
	HI.RES (High Resolution x 10 mode) ⊗	23	⊗
	CABLE (4-Wire or 6-Wire) ⊗	23	⊗
OPTION	USE (Scale Use) ⊗	24	⊗
	FILTER (Reading Average)	24	
	MOTION (Motion Detection) ⊗	24	⊗
	INIT.Z (Initial-Zero on Startup)	24	
	Z.TRAC (Zero Tracking Sensitivity) ⊗	24	⊗
	Z.RANGE (Allowable Zero Operating Range) ⊗	24	⊗
	Z.BAND (Zero 'Dead' Band) ⊗	24	
	R.ENTRY (Entry Means to Full Setup)	25	⊗
	MIN.BAG (Minimum Bag weight) ⊗	25	
	I.LOCK (Interlock) ⊗	25	
CAL	ZERO (Zero Calibration) ⊗	25	⊗
	SPAN (Span Calibration) ⊗	25	⊗
	DIR.ZER (Direct Zero Calibration) ⊗	25	⊗
	DIR.SPN (Direct Span Calibration) ⊗	26	⊗
	FAC.CAL (Restore Default Factory Calibration) ⊗	26	⊗
SPEC	SAFE.PC (Safe Security Passcode for Digital Setup)	26	
	FULL.PC (Full Security Passcode for Digital Setup)	26	1
	KEY.LOC (Front Panel Key Locking)	26	
	AUT.OFF (Auto Power Off / Battery Operation)	27	
	B.LIGHT (Backlight Operation)	27	
	BAT.VLT (Battery Voltage)	26	
SERIAL	TYPE (Serial Output Type)	26	
	FORMAT (Serial Output Format)	26	
	BAUD (Serial Baud Rate)	26	
	BITS (Serial Format Options)	26	
	ADDRES (Instrument Address)	26	
	AUT.SPD (Auto Output Speed)	28	
	SHOW.T (Show Totals)	27	
	RST.CON (Reset Printed Consecutive Number)	27	⊗
SET.PTS	SETPT.1 (Output 1 Type)	29	
	SRC.1 (Weight Source for Output 1)	29	
	TARG.1 (Target for Output 1)	29	
	HYS (Hysteresis)	29	
	ALARM	29	
	FLASH	30	
CLOC	FORMAT (Date Format)	30	
	YEAR (Set Year)	30	
	MONTH (Set Month)	30	
	DAY (Set Day)	30	
	HOUR (Set Hour)	30	
	MINUTE (Set Minute)	30	
	QA.OPT (Quality Assurance Option)	30	
	QA.YEAR (QA Year)	30	

Group (GRP)	Item (ITM)	Page	Ä
	QA.MNTH (QA Month)	30	
	QA.DAY (QA Day)	30	
TEST	SCALE (Scale Base Test Display)	31	
	FRC.OUT (Force Outputs)	31	
	O.LOAD (Overload Count)	31	
	CLR.OLD (Clear Overload)	31	
FACTRY	FACTRY (Factory Adjustment Menu) DEFLT (Restore Factory Settings Except for Calibration and Build)	31	1
- END -	Save settings and return to normal weighing mode. Refer to Exiting Full or Safe Setup	22	

10.3. Error Messages

A number of error messages may be displayed to warn of operation outside of the acceptable limits. These messages are described below. Short messages (XXXXX) will appear as a single message on the display. Longer messages (XXXXX) (YYYYY) will appear on the display in two parts, first the (XXXXX) part, then the (YYYYY) part.

10.3.1. Weighing Errors

These messages show status messages or errors that may occur during normal weighing operation.

Error	Description	Resolution
(U - - - - -)	The weight is below the minimum allowable weight reading.	Increase the weight or decrease the minimum allowable weight reading.
(O - - - - -)	The weight is above the maximum allowable weight reading. Warning - overloading may damage mechanical scale elements.	Check the condition of load cell connections. Check for damaged load cell.
(ZERO) (ERROR)	The weight reading is beyond the limit set for Zero operation. The operation of the **<ZERO>** key is limited in the setup during installation. The indicator cannot be Zeroed at this weight.	Increase the Zero Range (Z.RANGE).
(STABLE) (ERROR)	Scale motion has prevented a **<ZERO>** operation from occurring on command.	Try the operation again once the scale is stable.

10.3.2. Setup and Calibration Errors

These messages show status messages or errors that may occur during the instrument setup and calibration.

Error	Description	Resolution
(ENTRY) (DENIED)	The instrument may be in Safe Setup and an item that needs Full Setup has been selected for editing.	Access Full Setup to edit the item.
	When accessing setup, more than three attempts have been made with the incorrect passcode. Refer to Setup Lock-Out page 20 for more information.	Turn the instrument off. When the instrument is turned back on, enter the correct passcode to access setup.
(PT.TOO) (CLOSE)	An attempt has been made to place a calibration point too close to an existing calibration point.	Re-enter the calibration point. Points must be spaced by at least 2% of full scale from each other.
(RES) (LO)	The scale build is configured for less than 100 graduations.	Check the resolution (count-by) and capacity settings.
(RES) (HIGH)	The scale build is configured for more than 30,000 graduations. (60,000 graduations for K303)	Check the resolution (count-by) and capacity settings.
(SPAN) (LO)	The load cell signal range (span) is too small for these settings.	Incorrect span weight entered (must be between zero and full scale). Scale wiring incorrect. Wrong load cell capacity (too large). Wrong or no calibration weight added to scale.
(SPAN) (HI)	The load cell signal range (span) is too large for these settings.	Incorrect span weight entered (must be between zero and full scale). Scale wiring incorrect. Load cell capacity too small for application.
(ZERO) (LO)	An attempt has been made to calibrate zero below -2mV/V.	Scale wiring incorrect
(ZERO) (HI)	An attempt has been made to calibrate zero above +2mV/V.	Remove all weight from scale. Scale wiring incorrect.

10.4. Diagnostic Errors

The instrument continually monitors the condition of the internal circuits. Any faults or out-of-tolerance conditions are shown on the display as an **E** type error message.

In the table below the following terms are used:

- **Check**: This item can be checked on site by service personnel.
- **Return for Service**: The instrument must be returned to the manufacturer for factory service.

Error	Description	Resolution
(E0001)	The power supply voltage is too low.	Check supply
(E0002)	The power supply voltage is too high.	Check scale / cables
(E0010)	The temperature is outside of allowable limits.	Check location
(E0020)	Scale build is incorrect. The number of graduations has been set too low or too high.	Fix up scale build
(E0100)	The digital setup information has been lost.	Re-enter setup
(E0200)	The calibration information has been lost.	Re-calibrate
(E0300)	All setup information has been lost	Enter setup and calibrate
(E0400)	The factory information has been lost.	Return for Service
(E0800)	The EEPROM memory storage chip has failed	Return for Service
(E2000)	ADC Out of Range Error. This may be caused from a broken load cell cable.	Check BUILD:CABLE setting. Check load cell cable, wiring, etc.
(E4000)	The battery backed RAM data has lost data.	Re-enter setup
(E8000)	The FLASH program memory is incorrect	Return for Service

The **E** type error messages are additive. For example if instrument is running off batteries and the temperature drops, the battery voltage may be too low. The resulting error messages will be **E 0011** (0001 + 0010). The numbers add in hexadecimal as follows:

1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - A - B - C - D - E - F

(For example, 2 + 4 = 6, or 4 + 8 = C)

10.5. Glossary Terms

Term	Definition
COMM	The communications protocol used to communicate with the R300 Series
Count-by	The smallest change in weight units that the display can show. See also Resolution.
Division	A single graduation.
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electro-Magnetic Compatibility Regulation
FIR	Finite Impulse Response
Full Scale	The maximum gross weight allowed on the scale. This is used to detect overload and underload conditions, etc.
Graduations	The maximum number of display steps between zero gross load and full capacity gross load. It is equal to the full scale divided by the resolution.
LED	Light Emitting Diode
NSC	National Standards Commission
NTEP	National Type Evaluation Program
OIML	International Organization of Legal Metrology
opto-LINK Cable	opto-isolated infrared communications link cable
PLC	Programmable Logic Controller
Range	Total change in weight between zero gross load and full capacity gross load (ie. the nominated total capacity of the scale). It is always given in displayed weight units.
Resolution	The smallest change in weight units that the display can show. See also Count-by.
RFI	Radio Frequency Interference
Ring Network	A network of up to 31 Instruments connected to a central computer
RS-232	Standard for communications hardware layers.
Step-Response	The step-response is the time between placing a weight on the scale and the correct weight reading being displayed.
Transients	A temporary voltage oscillation or spike caused by a sudden change of load (or other external influence).
Units	The actual units of measurement (kilograms, tonnes, pounds, etc.).

10.6. List of Figures

10.7. List of Tables

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