2150

DIGITAL INDICATOR

(Baggage Weigher)

Reference Manual

For use with Software Versions 1.1 & above

2150-600 Rev 1.1

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1. Introduction

The **2150** is a dedicated baggage weigher. It is a precision digital indicator using the latest Sigma-Delta A/D converter to ensure extremely fast and accurate weight readings.

The setup and calibration are digital, with a non-volatile security store for all setup parameters. There is an NVRAM store to ensure day to day operating settings (eg. **<ZERO>**, **<TOTALS>**, etc.), are retained when power is removed. There is a built-in clock for date-stamping printed outputs and the current time can be set to display at the top right of the instrument display.

The instrument has up to three internal setpoints with status display on the front panel. There are three Input/Output points on the auxiliary connector. Each one may be configured as a remote input or as a setpoint drive output.

1.1. 2150 Weight Indicator Illustration

Figure 1: 2150 Weight Indicator

1.2. The Manuals

This Reference Manual is part of a set of manuals covering the setup and operation of the Ranger **2150**. The set includes the following:

- **Reference Manual** (this book) - Contains detailed information on the calibration and setup of the **2150**. This manual is intended for use by Scale Technicians who are installing the instrument.
- **Operator Manual** - Aimed at the operation of the **2150**, and covers the day to day operation of the unit. This includes details of the operation of the front panel and external key functions.
- **Quick Start Manual** - Intended for Scale Technicians who are familiar with the **2150** and simply need a quick reference to menu options and connection diagrams, etc.

1.3. 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**.
…	Ellipses indicate an incomplete listing. For space considerations in this Reference Manual complete listings may not be shown.
⊗	Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.
®	Functions marked with ® are only suitable for remote inputs.

2. Specifications

Performance		
Display		Backlit alphanumeric LCD with six 27mm high digits
Backlight		LED backlight with adjustable brightness
Display Resolution		Up to 30,000 divisions, minimum of 0.25μV/division (Trade 6000 divisions at 1μV/division)
Count-by		1, 2, 5, 10, 20, 50, 100 (Entered in Displayed Weight)
Zero Cancellation		+ / – 2.0mV/V
Span Adjustment		0.1mV/V to 3.0mV/V full scale
Stability/Drift		Zero: < 0.1uV/°C, Span < 10ppm/°C, Linearity < 20ppm, Noise < 0.05μVp-p
Operating Environment		Temperature: –10 to +50°C ambient, Humidity: <90% non-condensing
Digital		
Setup and Calibration		Full digital with visual prompting in plain messages
Memory Retention		Full non-volatile operation
Digital Filter		Averaging from 1 to 100 consecutive readings
Zero Range		Adjustable from +/– 2% to +/–20% of full capacity
A/D Converter		
Type		24bit Sigma Delta
Resolution		8,388,608 internal counts
A/D Sync Filter		Fixed 25Hz, FIR filter > 80dB
Load Cells		
Excitation		8 volts for up to 8 x 350 ohm load cells (6-wire + shield)
Serial Comms		(Software option 0224)
Serial output		Single RS-232 as automatic transmit, network or printer drive
Input / Output		
Input		Button Input
Output		DC Volts as per Indicator voltage, 100mA maximum
Power Input		
Standard	General	9 to15VDC (60mA to 400mA depending on load cells and backlight)
Variants	AC DC	AC Power: 110/240VAC 50/60Hz 10VA fitted in s/s housing DC Power: 12-24VDC 10VA fitted in s/s housing
Dimensions		
Body size		189mm (L) x 99mm (H) x 23mm (D)
Panel cutout		Flush mounted with cable holes drilled separately (template provided)
Features		
Standard Features		Five point linearity correction
		Battery backed clock and calendar fitted as standard
Approvals		NSC S403 approval (6000 divisions at 1μV/division). NMI TC6033 approval (6000 divisions at 1μV/division). C-tick approved and CE approved.
Hardware Options		0080 (RS-232 / RS-485 Converter)
		0082 Port Splitter
		0083 Port Splitter
		0110 12VDC 500mA Plug Pack Power Supply
		0223 2150 Viewer Software and Cable
		0227 Relay Output Module
		0329 Stainless Steel Rear Housing, Gasket and Desk/Wall Bracket
		0330 (110/240 VAC Power Supply)
		0331 (12-24VDC Power Supply)
		0333 Desk/Wall Bracket
		0348 Panel Gasket

3. Installation

3.1. Introduction

The **2150** contains precision electronics and must not be subject to shock, excessive vibration or extremes of temperature, either before or after installation.

The inputs of the **2150** are protected against electrical interference, but excessive levels of electro-magnetic radiation and RFI may affect the accuracy and stability of the instrument. The **2150** should be installed away from any sources of 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 EMC immunity, termination of the load cell shield at the **2150** end is important (ie. with a sound connection to the **2150** case via the DB9 backshell).

3.2. Panel Mounting

The simplest way to mount the **2150** is to use the drill template supplied. The template indicates positions for the drill holes for the two 4mm 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 and also to display connection instructions. The drill template supplied with the indicator allows for front or rear machining of the panel.

An optional gasket (P/No 0348) is available for panel mounting installation.

3.3. DC Power Supply

The DC supply need not be regulated, provided that it is free of excessive electrical noise and sudden transients. The **2150** can be operated from a high quality plug-pack as long as there is sufficient capacity to drive both it and the load cells.

Note that the rated voltage of most plug–packs is specified for loads close to but less than their rated output. If substantially lower loads are used the voltage output rises. Conversely if the plug pack is run at its maximum load the voltage will drop and it will run very hot. Typically plug packs with a rating of 9VDC to 12VDC with current outputs of 0.5 to 1A are fine. The Plug Pack 500mA, option (P/No 0110) is recommended for use with the **2150**.

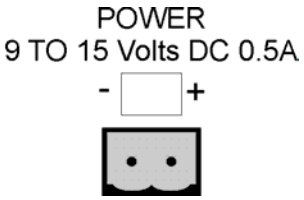


Figure 2: Power Connection

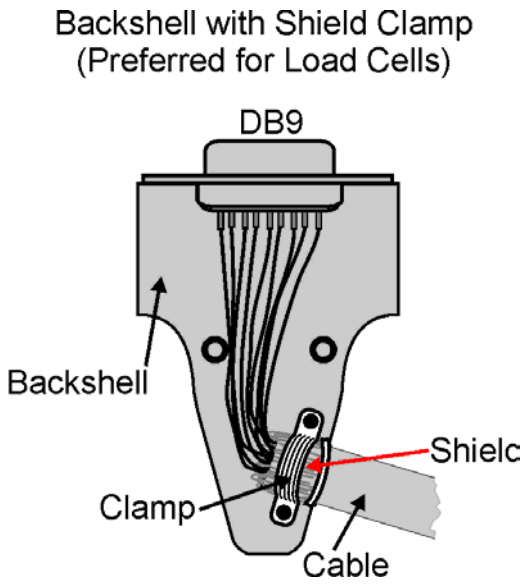
3.4. Load Cell Signals and Scale Build

Very low output scale bases can be used with the **2150** but may induce some instability in the weight readings when used with higher resolutions. Generally speaking, the higher the output, or the lower the number of divisions, the greater the display stability and accuracy.

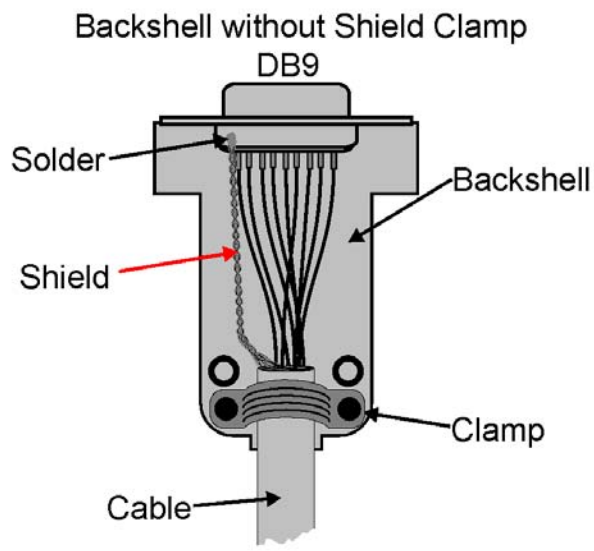
The **2150** has a milliVolt-per-Volt reading available which can be used to check scale base signal output levels. For more information refer to SCALE (Scale Base Test Display) page 34.

3.5. Connecting Shields

To obtain full EMC resistance with the **2150**, the load cell shield MUST be connected electrically to the metal shell of the DB9 connector.



The easiest way to connect the cable shield to the DB9 backshell is to fold the shield wires back over the outside of the cable insulation so the cable clamp of the backshell makes good electrical contact with the shield when installed.



A method for connecting the cable shield to the DB9 is to twist the shield wires together and solder the ends to the DB9 casing.

Figure 3: Cable Shield Connection

3.5.1. Cable Shield Connection and Earthing

- Care should be taken when connecting shields to maximise EMC immunity and minimise earth loops and cross-talk (interference) between instruments.
- For EMC immunity, termination of the load cell shield at the **2150** end is important (ie. with connection to the **2150** case via the shield connection).
- The **2150** enclosure is directly connected to the shield connections on the cables.
- The **2150** should 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 shield in this situation may be site specific.
- The unit complies with relevant EMC standards provided case ground connection is correctly made. Resistance measured between **2150** case and nearest earth point should be less than 2 ohms.

3.6. Unused Pins

It is important to note that unused pins are not to be connected. The reason being that the functions of the pins may not be compatible with equipment at the other end (eg. connecting output pins to a PC communications port may affect the operation of the PC). Consequently many commercial communications cables are not suitable for use.

3.7. Load Cell Connection

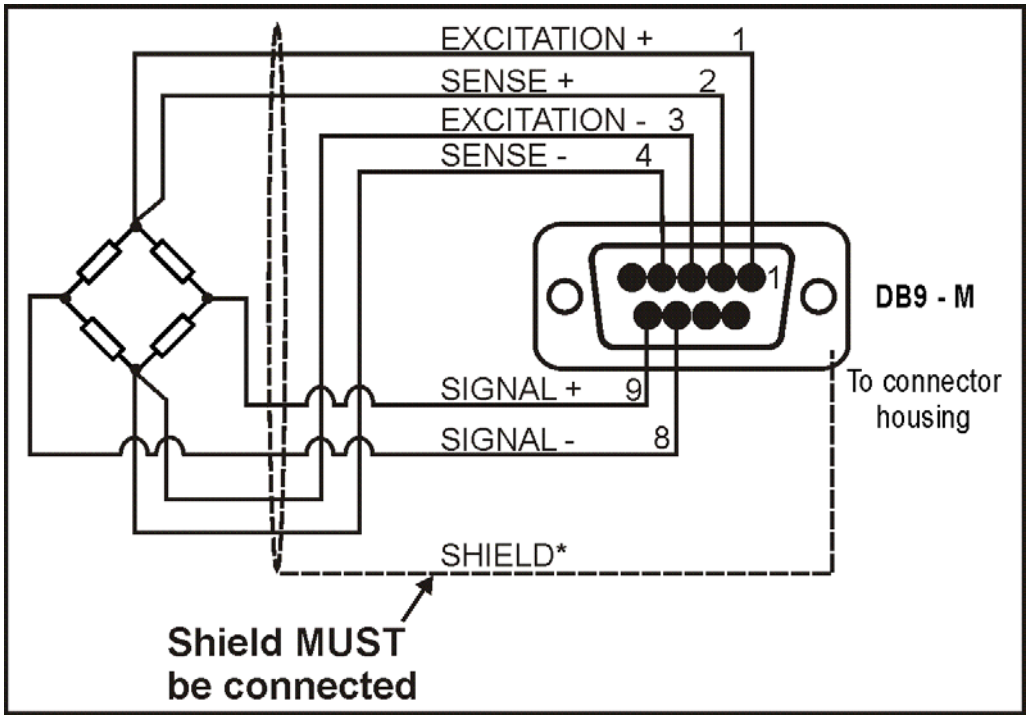
The following provides information on 6-wire and 4-wire connections.

3.7.1. 6-Wire Connection

The connection is made using a standard DB9 male plug that is supplied with the indicator. The load cell is wired for a 6-wire system as follows:

Pin	Function
1	Positive Excitation
2*	Positive Sense
3	Negative Excitation
4*	Negative Sense
8	Negative Signal
9	Positive Signal
* Sense lines MUST be connected.	

Table 1: 6-Wire Connections



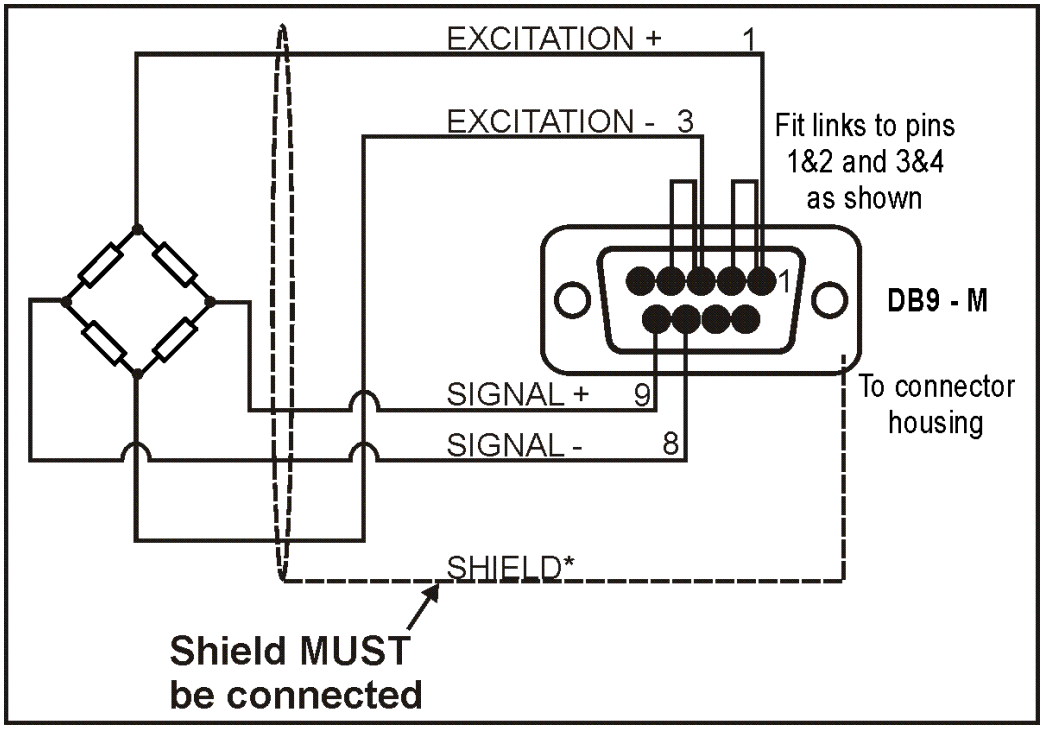
*For more information on Connecting Shields refer to page 9.

Figure 4: 6-Wire Connection

When wiring load cells, use only high quality shielded multi-core cable. The cable should be run as far away from any other cabling as possible (minimum separation distance 150mm).

3.7.2. 4-Wire Connection

When a 4-wire load cell system is connected, pins 1 and 2, and pins 3 and 4 must be joined by solder bridge or wire bridge. This is to ensure that the excitation voltages are fed into the sense inputs (pins 2 and 4). Failure to do this will result in the incorrect operation of the unit.



* For more information on Connecting Shields refer to page 9.

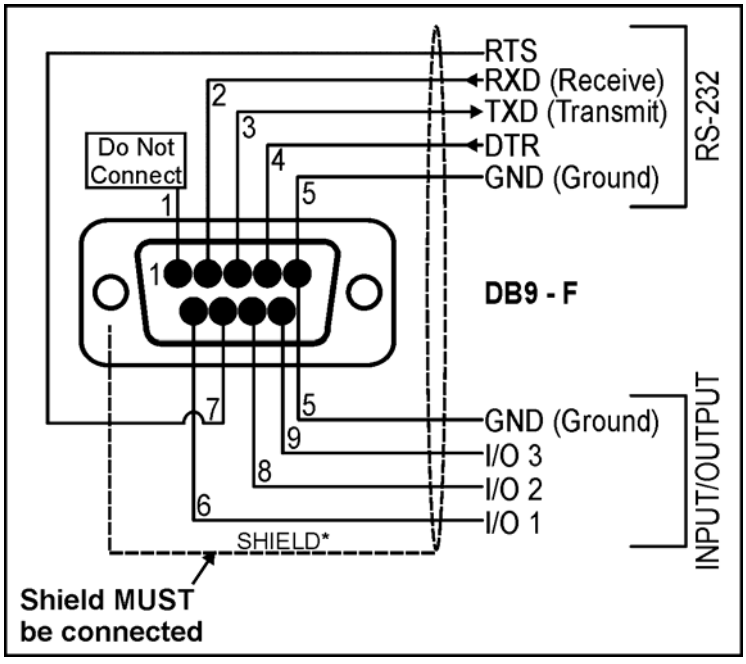
Figure 5: 4-Wire Connection

3.8. Auxiliary Connection

The **2150** has a male DB9 auxiliary connector which includes the RS-232 Serial Port and the three Input/Output connections.

Pin	Function	Description	Connect To
1	PWR	Power for communication accessory options	DO NOT CONNECT
2	RXD	RS-232 Receive Line	External Device Transmitter (Usually Pin 3 on PC DB9)
3	TXD	RS-232 Transmit Line	External Device Receiver (Usually Pin 2 on PC DB9 or Pin 3 on Printer DB25)
4	DTR	DTR Handshake Line	External Device Busy Line (Usually Pin 20 on printer DB25)
5	GND	RS-232 Digital Ground I/O Common	External Device Digital Ground (Usually Pin 5 for DB9 or Pin 7 for DB25)
6	IO1	Input or Output 1	
7	RTS	Request to Send	Used by Ranger 0080 RS-232/RS-485 converter
8	IO2	Input or Output 2	
9	IO3	Input or Output 3	

Table 2: Auxiliary Connection



Remote Display	
2150 Pin	**Remote Display Plug**
3 (TXD)	**RXD / Receive**
5 (GND)	**GND / Ground**

Printer	
2150 Pin	**Printer Plug – DB25F**
3 (TXD)	**RXD – Pin 3**
5 (GND)	**GND – Pin 7**
4 (DTR)	**DTR – Pin 20**

Direct Computer Link	
2150 Pin	**Computer DB-9F (DB-25F)**
2 (RXD)	**TXD – Pin 3 (Pin 2)**
3 (TXD)	**RXD – Pin 2 (Pin 3)**
5 (GND)	**GND – Pin 5 (Pin 7)**

Do not connect unused pins.

For more information refer to page 9.

* For more information on Connecting Shields refer to page 9.

Figure 6: Auxiliary Connection

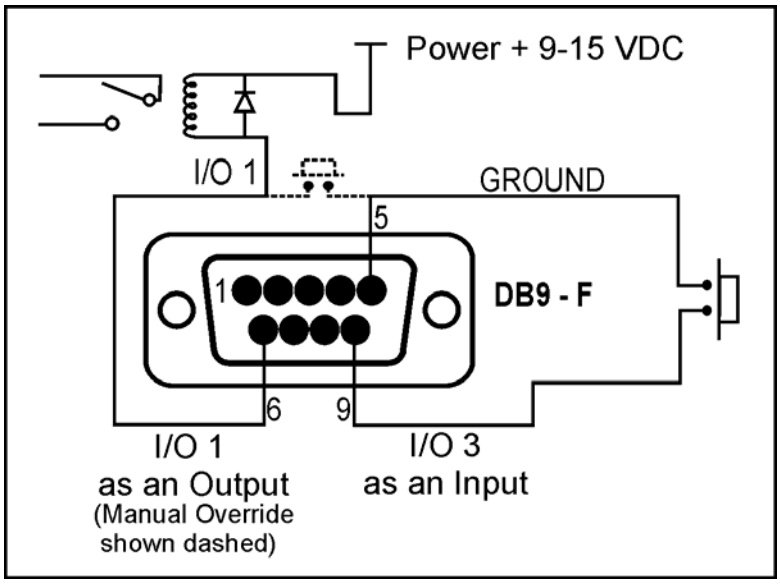


Figure 7: Connection of I/O Pins

3.8.1. Inputs

The **2150** assumes the I/O pin to be connected to GND (Pin 5) to register an active input (key press, etc.). Otherwise it assumes an open circuit.

3.8.2. Outputs

The output drivers of the **2150** are non-isolated open collector transistor drives which are capable of driving no more than 100mA each. For most applications this means that external relays will be needed. Use the same power supply for the external relays as for the **2150** itself. Connect a good quality bypass diode across the coil of any relays used as shown. As the relay state is changed a large voltage spike is produced the diode bypasses the spike protecting the relay driver. (1N4004 diodes are suitable for most applications).

3.8.3. Manual Override of Outputs

Due to the way the **2150** drives the outputs, it is possible to connect an external key from the I/O Pin to GND to implement a manual override for the output. The key state cannot be detected by the **2150** when the I/O pin is configured as an output, but the key can be used to directly drive the output load.

3.9. Hardware Options

Each of the hardware options for the **2150** comes complete with detailed installation instructions. The hardware options available for the **2150** are as follows:

3.9.1. 0080 (RS-232 / RS-422 / RS-485 Converter)

This device connects directly to the **2150** auxiliary port and converts the RS-232 signals into RS-485 signals. No external power is required for the **0080**

3.9.2. 0082 (Port Splitter)

This device connects directly to the **2150** auxiliary port. The **0082** device is designed to work with the 2100 Indicator to split out two separate data streams from the standard RS232 communications:
1. RS-232 network port
2. RS-232 transmit only port
The **0082** uses the RTS line from the 2100 to detect which port to direct the transmission. External power is not required for the **0082**.

3.9.3. 0083 (Port Splitter)

This device connects directly to the **2150** auxiliary. The **0083** device is designed to work with the 2100 Indicator to split out two separate data streams from the standard RS-232 communications:
1. RS-485 network port
2. RS-232 transmit only port
The **0083** uses the RTS line from the 2100 to select the transmission port. The **0083** always receives data on the RS-485 receive pins. External power is not required for the **0083**.

3.9.4. 0110 (12 VDC Power Supply)

This option is a 12 VDC 500mA plug pack power supply.

3.9.5. 0223 (Serial Communications Cable)

This is the serial communications cable for use with the free Viewer Software for setup and calibration via PC.

3.9.6. 0227 (Relay Output Module)

The relay output module mounts directly to the rear of the **2150** case. This module houses three 240VAC 2A relays that are driven directly by the **2150** I/O pins.

The auxiliary port is still available from the side of the **0227**, which enables connection of remote inputs and serial communications. When remote inputs are used with the 0227, the relays operate whenever the inputs are active.

3.9.7. 0329 (Stainless Steel Rear Housing, Gasket and Desk/Wall Bracket)

The stainless steel rear housing attaches directly to a standard **2150** using the panel mount screws provided with the instrument. The housing provides sealed cable entry for up to four cables and a desk/wall mount swivel bracket.

3.9.8. 0330 (110/240 VAC Power Supply)

The 110/240VAC power supply enables the **2150** to be run directly from mains power.

3.9.9. 0331 (12-24VDC Power Supply)

The 12/24VDC power supply enables the **2150** to be run essentially from any DC power source from 10 to 28VDC or from a low voltage AC power source of 9 to 15VAC. The power supply is compatible with the Relay Output Module (**0227**) with both options fitting into the stainless steel rear housing.

3.9.10. 0333 (Desk/Wall Bracket)

This is stainless steel desk and wall mounting bracket. The stainless steel bracket includes swivel clamps for viewing angle adjustment

3.9.11. 0348 (Panel Gasket)

This optional panel gasket is available for panel mounting installation.

4. Application Configuration Issues

4.1. General Setup Information

The **2150** configuration and calibration can be performed entirely from the front panel, using the digital setup facility. When Setup is used, all menu items are accessible and care must be taken to ensure no accidental changes are made to calibration and trade settings.

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.

4.2. 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 **2150**.

Note: Detailed descriptions of these and other terms used in this Reference Manual are described in the Glossary page 48.

Term	Definition
Units	Units of measurement (kilograms, tonnes, pounds, etc.).
Range	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.
Graduations	Maximum number of display steps between zero gross load and full capacity gross load. It is equal to the range divided by the count-by.
Division	A single graduation.

Example

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

The values are:

- Units = kg
- Range = 5000
- Count-by = 5

Calculating the graduations:	$\text{Graduations} = \frac{\text{Range}}{\text{Count-by}} = \frac{5000}{5} = 1000 \text{ divisions}$
Signal voltages can be calculated as follows:	
Calculating the full scale signal (load cell):	$\text{Full Scale Signal} = \frac{\text{Range}}{\text{Load Cell Capacity}} = \frac{5000}{10000} \times 2.0\text{mV/V} = 1.0\text{mV/V}$
Since the 2100 uses 8V load cell excitation, the absolute signal voltage is:	Absolute Signal Voltage = Excitation Voltage x Full Scale Signal = 8V x 1.0mV/V = 8.0mV
Calculating the signal resolution:	$\text{Signal Resolution} = \frac{\text{Absolute Signal Voltage}}{\text{Number of Graduations}} = \frac{8.0\text{mV}}{1000 \text{ divisions}} = 0.008\text{mV / division} \equiv 8\mu\text{V / division}$

4.3. 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.

4.3.1. FIR (Finite Impulse Response) Filter and Reading Rate

The first level of filtering provided is a FIR filter that is linked to the measurement rate. The measurement rate is fixed at 25Hz on the **2150**. This filter is a very high performance **tuned** filter that provides up to 180dB of attenuation at multiples of 25Hz and broadband filtering of between 40 and 80dB. For example the FIR filter provides 180dB of noise rejection at frequencies of 25, 50, 75 … Hz. The FIR filter introduces a delay of three samples to the step-response (or 120msec).

4.3.2. Digital Averaging

In addition to the FIR filter the **2150** has a fixed length sliding window average where the average of the last **n** readings is calculated. As each new reading is taken the oldest reading is discarded and a new average calculated. The length of the window can be configured in steps from one reading to 100 readings and is set using the FILTER item in the OPTION group. Each reading in the average adds a delay to the step-response equal to the measurement period or 40msec. For example, an average of ten readings results in the following total step-response:

(10 + 3) samples x 40milliseconds = 520milliseconds

4.4. Trade vs Industrial Mode

The **2150** may be operated in Trade or Industrial mode. The following table lists the operation differences for each of the two modes:

Element	Trade	Industrial
Underload	–1% or –2% of fullscale depending on zero range setting	–105% of fullscale
Overload	Fullscale +9 divisions	105% of fullscale
De-Zero	Not available	Clear the zero setting with a 2 second press of the Zero Key
Test Modes	Limited to 5 seconds	Unlimited time allowed

Table 3: Trade vs Industrial Mode

4.5. Setup Counter

Within Setup there are a number of critical steps that can affect the calibration and/or trade performance of the **2150**. If any of these steps are altered, the trade certification of the scale could be voided.

The **2150** provides a built in Setup Counter to monitor the number of times the critical steps are altered. The value of this counter is stored within the unit and can only be reset at the factory. Each time a critical step is altered, the counter will increase by one. Whenever the **2150** is powered up, or setup mode is entered, the current value in the counter is displayed briefly.

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

4.6. Passcodes

The **2150** has a passcode to provide a security lock on Setup.
Refer to FULL.PC (Security Passcode for Digital Setup) page 29 for more information.

4.7. Data Entry

Throughout the **2150** setup and operator interface, different data entry methods are used. Each method is described below:

4.7.1. 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.

Upper and lower limits are placed on some entries and an entry outside this range will cause the **2150** to display dashes (ie. - - - - - -).

Example 1: 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>** to accept all of the displayed digits (including the flashing digit) and re-display the item name.

4.7.2. 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 1: When in Setup follow the steps below to set Special Settings, Backlight.

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

Example 2: When in Setup follow the steps below to set Serial, Bits.

- Press **<GRP>** repeatedly to display the **SERIAL** group.
- Press **<ITM>** repeatedly to display the **BITS** item.
- Press **<SEL>** to select **BITS** and display the current settings.
- The currently chosen digit will be flashing. Press **<SEL>** to advance to the next digit.
- When the digit to be set is flashing press **<EDT>** to cycle through the options for that digit.
- When the desired digit option is flashing press **<OK>** to accept the setting and re-display the item name.

5. Basic Operation

The **2150** is a dedicated baggage weigher for use in airports and similar applications

5.1. User Interface Display and Controls

Figure 8: 2150 User Interface Display and Controls Illustration

5.1.1. Front Panel: Visual Display

The front panel of the **2150** has a six digit LCD display. Figure 8 shows the main elements of the front panel.

The **2150** has five main display 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.

- **Auxiliary Display**

  The Auxiliary Display can be set to show the current time in 24 hour format, the bag count or it can be turned off. When the **2150** is setup to show bag count, and less than 100 bags are counted, the auxiliary display will show **B-xx**. The **xx** represents the number of bags displayed. When the number of bags counted is greater than 100, **xxx** is displayed. The **xxx** represents the number of bags displayed.

- **Unit Indicator**

  The Unit Indicator displays the units of the weight reading as either grams (g), kilograms (kg), pounds (lb) or tonnes. If the instrument is set up to show the number of bags the units will show pieces (p).

- **Output Display**

  The Output Display shows the output status of the three possible outputs (ie. 1, 2 or 3).

- **Annunciators**

  Status annunciators show the following:

Annunciator Symbol	Key Name	Description
→0←	**ZERO**	Lit when the displayed reading is within ± ¼ of a division of true zero.
NET	**NET**	Lit when the display reading represents NET weight.
≈	**MOTION**	Lit when the displayed reading is not stable.
▲	**OVER**	If enabled in the setpoint setup, this annunciator will light when the weight is over the setpoint target.
⌴	**ZERO BAND**	Lit when the displayed weight is within the zero dead band setting.

Table 4: Editing 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 2150 Setup Display page 25.

5.2. Primary Function Keys

The **2150** has five primary function keys:

- ZERO
- ADD
- TOTALS
- CANCEL
- FINISH

The **Zero, Add, Totals, Cancel** and **Finish** keys are fixed to perform necessary weighing functions. . Each of the primary function keys has two separate functions:

- **Primary Function:** Available during normal weighing. This function is printed in white at the top of the key.
- **Editing Function:** Available during setup and calibration. The editing annunciators (above each key) display these functions, when the **2150** is in Setup mode.

5.2.1. Using the Primary Key Functions

A single press of each key triggers the weighing operation printed on the key. The **2150** allows individual keys to be disabled in the setup. All keys are enabled at the factory, but some keys may have been intentionally disabled during installation. If a key has been locked, a long beep sounds when it is pressed.

5.2.2. Stability Considerations

Once the **<ZERO>** or **<ADD>** key is pressed, the unit 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 10 seconds, the operation is cancelled and an error message is displayed.

To improve the stability of the weight reading, increase the filtering or relax the motion detection criteria. Refer to OPTION (Scale Options) page 27 for more information.

5.2.3. 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 by the **2150** 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 unit. Refer to Z.RANGE (Allowable Zero Operating Range) ⊗ page 28 for more information.

5.2.4. ADD Key

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

The **2150** 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. Refer to MIN.BAG (Minimum Allowable Bag Weight) page 28.
- 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 a small bag. The indicator beeps 3 times and displays the message **SMALL** and then **BAG**.

If the motion criteria are not met after 10 seconds the **2150** displays the error message **STABLE** and then **Error** and then aborts the add sequence returning to normal display. Refer to MOTION (Motion Detection) ⊗ page 27.

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 (Gross Weight Change) page 28.

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 **2150** sounds a long beep and displays the error message **ILOCK** and then **Error** for one second.

If the bag has been successfully added to the total, the **2150** 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 Auto-tare is active, the display will tare and show zero net, which allows multiple bags to be placed on the scale at the same time while still weighing each separately. When the bags are removed from the scale the **2150** reverts back to gross weighing automatically.

If **TOT.DSP** has been set to **ON** the **2150** 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.

5.2.5. 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 **2105** returns to normal weight display.

5.2.6. 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 long beep. Cancelled bags are printed as negative weights.

5.2.7. 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.

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

5.2.8. TEST Key

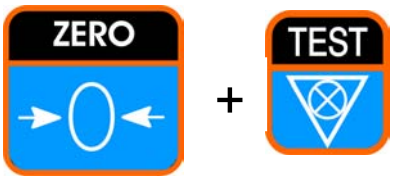
A single press of the **<TEST>** key starts a display test sequence.

6. Setup

The **2150** digital setup facility provides the means to configure and calibrate the instrument. The **2150** is an advanced instrument providing a large number of facilities. To simplify configuring the unit, all setup options in the **2150** are organised in a tree structure made up of **Groups** and **Items**. Refer to Setup Menu Quick Reference page 47 for a list of Groups and Items.

The **2150** provides two methods to access the Setup area. The **Full Digital Setup** method provides access to all functions in Setup. The **Operator Menu Setup** method provides access to only the Operator Menu (Setpoint Targets, Flight and Hysteresis).

6.1. Accessing Digital Setup



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

The **2150** will beep twice and then display the following:

- Setup
- Software Version (eg. V1.0)
- Setup Access Count (eg. C 00010)
- If a passcode has been configured, the setup passcode must be entered to gain access. Refer to FULL.PC (Security Passcode for Digital Setup) page 29 for more information.
- The first item in the Group list (ie. **BUILD**) will then display.

6.2. Exiting Digital Setup

There are two methods for exiting Digital Setup and returning to the Operator Interface.

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

6.3. 2150 Setup Display

The following figure illustrates a sample display when the **2150** is in Setup. The editing annunciators display only when in Setup and provide a means to make choices when setting up and calibrating the instrument. When in Setup an editing annunciator is chosen by pressing the keypad key beneath.

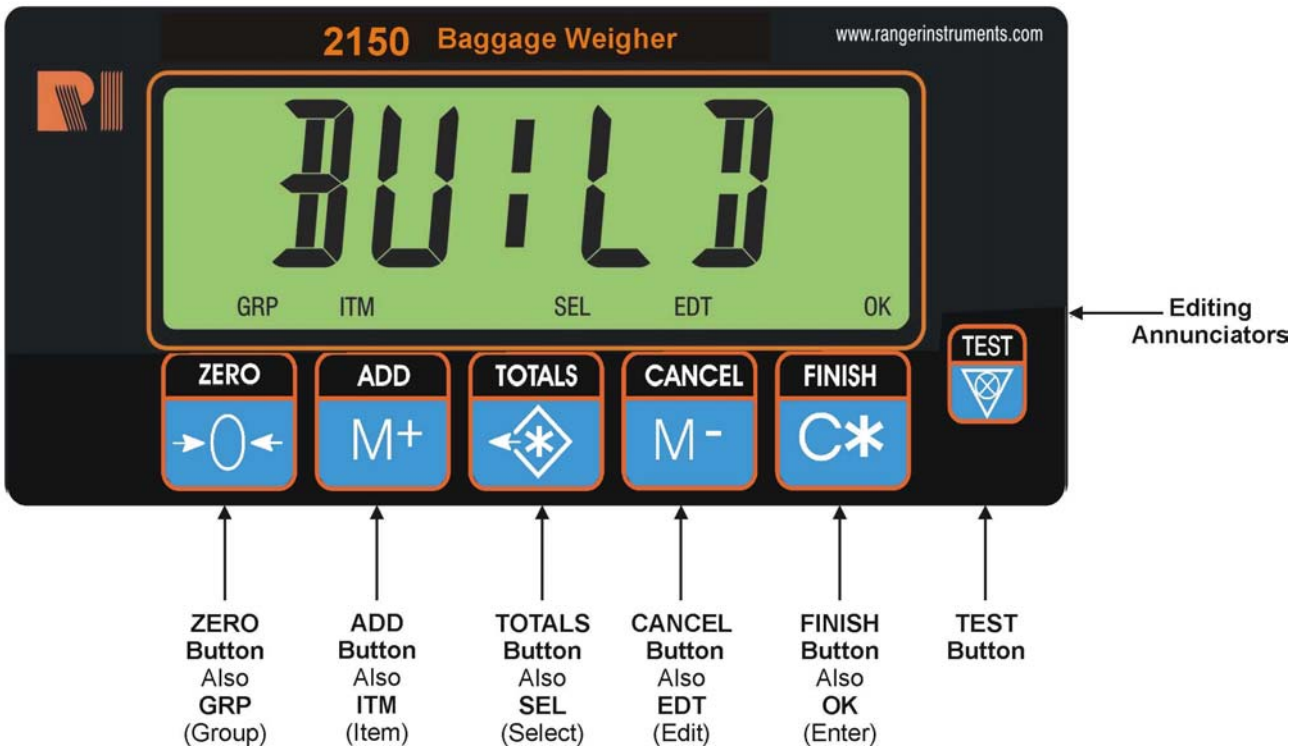


Figure 9: 2150 Setup Display and Controls Illustration

6.4. Setup: Groups and Items

All setup options in the **2150** are organised in a tree structure made up of **Groups** and **Items**. The Setup Menu Quick Reference page 47 lists the Groups and their subsequent Items. In Figure 9 the Group option **(BUILD)** is displayed. To simplify explanations, the following notation is used throughout the manual to identify the location of an item: (GROUP:ITEM).

6.4.1. GRP (Groups)

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.

6.4.2. ITM (Items)

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.

6.4.3. Using the Editing Key Functions

The role of each of the primary keys during editing is displayed on the editing annunciator above each of the keys. When in Setup, a single press of each key triggers the editing annunciator function. These functions are as follows:

Annunciator	Key Name	Description
GRP	ZERO	Steps through the list of Groups.
ITM	ADD	Steps through the list of items.
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 edit an item or to save changes and return to the menus.

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

6.5. 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. Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.

6.5.1. DP (Decimal Point Position) ⊗

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: 000000

6.5.2. CAP (Maximum Capacity) ⊗

Sets the nominal maximum capacity (or Range) 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 0.5.

6.5.3. RES (Count-by Resolution) ⊗

Sets the resolution (or Count-by) of the display. The resolution is the number by which the indicator will count. This is set in weighing units with the decimal point in place.

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

6.5.4. UNITS (Weighed Units) ⊗

Sets the units for display and printing.

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

6.5.5. HI.RES (High Resolution x10 mode) ⊗

Sets the instrument to display weight at 10 times resolution. This is intended for test purposes but may be used for non-trade weighing.

- Options are: ON or OFF
- Default: OFF

6.6. OPTION (Scale Options)

Items within this Group are used to configure the operating parameters of the scale. Only **some** of these items may be changed after calibration without affecting the calibration accuracy. Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.

6.6.1. USE (Scale Use) ⊗

This is where the basic use of the scale is set. This setting configures the **2150** for either Industrial or Trade operation. Trade configuration will limit the operation of the unit to comply with OIML (NSC) provisions. Industrial configuration removes all restrictions on operation. Refer to Trade vs Industrial Mode page 18 for more information.

- Options are: TRADE or INDUST
- Default: TRADE

6.6.2. FILTER (Reading Average)

The **2150** can average a number of sequential 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: 1, 2, 5, 10, 25, 50, 75 and 100
- Default: 10

6.6.3. MOTION (Motion Detection) ⊗

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 in weight change (0.5 or 1.0 graduations) per time period (0.2 to 1.0 seconds). Motion can be set from 0.5 graduations per 0.5 second (fine) to 5.0 graduations per 0.2 second (coarse). When set to **NONE**, the Motion Detection is ignored and Zero, Tare and Print actions are instantaneous.

- Options: NONE, 0.5–1.0t, 1.0–1.0t, 0.5–0.5t, 1.0–0.5t, 0.5–2.0t, 1.0–0.2t, 5.0–0.2t
- Default: 0.5–1.0t (0.5 graduations per 1.0 second)

6.6.4. AUTO.Z (Auto-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 Range.

- Options are: ON or OFF
- Default: OFF

6.6.5. Z.TRAC (Zero Tracking Sensitivity) ⊗

Zero tracking allows the display to adjust for minor changes in the zero balance of the scale. When enabled the **2150** will track weight readings within the zero dead band back to exactly zero at a maximum rate of 0.5, 2.0 or 10 graduations per second.

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

6.6.6. Z.RANGE (Allowable Zero Operating Range) ⊗

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

- Options are: –2% to +2%, –1% to +3%, –20% to +20%.
- Default: –02 to 02 (–2% to +2%)

6.6.7. Z.BAND (Zero Dead Band) ⊗

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 of the **2150** 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 **2150** displays the **zero band** annunciator. Refer to Annunciators page 21.

- Settable over the full weight range. Always enter a number in multiples of display units Refer to RES (Count-by Resolution) ⊗ page 26 for more information.
- Default: 0 (ie. –0.5 to 0.5 graduations)

6.6.8. AUTO.T (Auto Tare)

If Auto Tare is active the display will tare and show zero net when a bag is added. Multiple bags can be weighed individually without requiring the weighed bags to be removed from the scale base. When the bags are removed from the scale the **2150** reverts back to gross weighing automatically. Default: ON

6.6.9. I.LOCK (Gross Weight Change)

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. If the **<ADD>** key is pressed and the totaliser is not armed, the **2150** sounds a long beep and displays the error message **I.LOCK** and then **Error** for one second.
Default: 20

6.6.10. MIN.BAG (Minimum Allowable Bag Weight)

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.
Default: 20

6.7. CAL (Scale Calibration)

Items within this group perform various calibration routines. For detailed scale calibration procedures refer to Calibration page 35. 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. Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.

6.7.1. ZERO (Zero Calibration) ⊗

Select to perform Zero Calibration. While the zeroing is in progress the display will show **Z.in.P**.

6.7.2. SPAN (Span Calibration) ⊗

Select to perform Span Calibration. While the span calculation is in progress the display will show **S.in.P**.

6.7.3. ED.LIN (Edit Linearisation Points) ⊗

Select to view linearisation setup and start linearisation routines. Refer to Using Linearisation page 36 for more information.

6.7.4. CLR.LIN (Clear Linearisation Points) ⊗

Select to view linearisation setup and select linearisation points to clear. Refer to Using Linearisation page 36 for more information.

6.7.5. FAC.CAL (Restore Default Factory Calibration) ⊗

Select this choice to restore default factory calibration. This restores all settings in the **BUILD** and **CAL** menus back to factory defaults.

6.8. SPEC (Special Settings Menu)

Settings within this group control features including passcodes, key locking, key functions and display settings. Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.

6.8.1. FULL.PC (Security Passcode for Digital Setup)

The **FULL.PC** (Full Passcode) for Digital Setup can be set to restrict access to all Setup functions. This passcode is used to prevent unauthorised or accidental tampering in the instrument setup. The default passcode setting is **000000** which allows free access. Any other four digit number will enable the passcode functions and restrict access.

Note: The passcode must contain two leading zeros.

- Range 000000 to 009999
- Default: 000000

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

6.8.2. KEY.LOC (Front Panel Key Locking) ⊗

This item allows individual keys to be locked and unlocked. The display shows **ZATCF** to indicate each of the front panel keys (eg. **<ZERO>**, **<ADD>**, **<TOTALS>, <CANCEL>, <FINISH>**). A locked key will show a dash (-) instead of a letter. For example **-ATC-** means that the **<ZERO>** and **<FINISH>** keys are locked.

6.8.3. KEY.FN (Key Functions)

The functions of the three external inputs can be selected here. There are six key function choices. Each function is identified by a single letter abbreviation. Refer to Special Functions page 44 for details of the available key functions.

- Default: - - -

6.8.4. B.LIGHT (Backlight Operation)

Sets the operation of the backlight.

Options are:

- OFF: Backlight is off
- ON: Backlight is always on
- AUTO: Backlight turns off after 10 seconds of idle time.
- Default: ON

6.8.5. BRIGHT (Backlight Brightness)

The brightness of the LED backlight of the **2150** can be controlled with this setting. Lower brightness reduces the power consumption of the indicator.

- Options are: 1 to 10 with 1 = 10% and 10 = 100% of the maximum power consumption of the backlight. Each brightness step will add between 10mA and 15mA to the current consumption of the indicator depending on the voltage of the power supply.
- Default: 10

6.8.6. AUX.DSP (Auxiliary Display Setting)

The auxiliary display of the **2150** can be set to remain blank, display the number of bags or display the current time in 24 hour format.

- Options are: OFF, BAG or TIME
- Default: BAG

6.8.7. TOT.DSP (Display Total and Number of Bags)

When a bag is added the number of bags and total bag weight can be displayed.

Options are:

- OFF: Total and number of bags not displayed.
- ON: The Total and number of bags are displayed.
- Default: ON

6.9. SERIAL (Serial Communications Options)

Settings within this Group determine the serial and printing outputs. Refer to Serial Outputs page 38 for more information on Serial configuration.

6.9.1. TYPE (Serial Output Type)

The item determines the function of the serial port.

Options are:

- OFF: Disables serial port.
- SPL.NET: Sets the **2150** to function as a 2101 Remote Display master and network. A communications splitter is required.
- SPL.PRN: Enables master and printer driving. A communications splitter is required.
- MASTER: Send contents of LCD display to 2101 Remote Display.
- Default: SPL.NET

6.9.2. ADDR (Serial Address)

This is used to set the address of the **2150** (used in network applications).

- Range 00 to 31
- Default: 01

6.9.3. PRN.ID (Printer Identification)

Sets the **2150** printer identification. The printer identification is not printed if set to 000.

- Range 000 to 999
- Default: 1

6.9.4. PRN.TYP (Printer Type)

This is used to specify the print type (format).

- Options are: Single, Total and Ticket.
- Default: Single

6.9.5. PRN.COL (Printer Columns)

This is used to control the number of characters (printer columns) printed on one line. Refer to Printing page 40 for more information.

- Default: 40

6.9.6. PRN.HDR (Printer Header Format)

The print header is a maximum of 20 ASCII characters. Each character is entered as **nn.aaa** where **nn** is the position of the character in the header and **aaa** is the character represented in decimal.

- Default:””

6.9.7. PRN.FTR (Printer Footer Format)

The print footer is a maximum of 20 ASCII characters. Each character is entered as **nn.aaa** where **nn** is the position of the character in the footer and **aaa** is the character represented in decimal.

- Default:””

6.9.8. BAUD (Serial Baud Rate)

The baud rate determines the serial data transmission speed.

- Options are: 1200, 2400, 4800, 9600 and 19200
- Default: 9600

6.9.9. 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, O, E: Parity bit
- 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.

N 8 1 -			
None	**8 bits**	**1 stop**	**- none**
Odd	7 bits	2 stop	DTR
Even			

6.10. SET.PTS (Setpoint Settings)

Settings within this group configure the operational logic of the setpoint system.

Refer to Setpoints page 42 for a detailed explanation of bag weighing and setpoints.

6.10.1. OPTN A, OPTN B, OPTN C (Setpoint Options)

This is where the four options are set for each setpoint.

Refer to Setpoints page 42 for full details of all of these options.

- - - A			
- none	**- none**	**- none**	- none
Gross	Single	Flash	**Arrow**
Reading	Double		
Total			

An option is disabled when set to a dash (-).

- Default: - - - A

6.10.2. TARG A, TARG B, TARG C (Targets for each of the three setpoints)

This is where the targets are set for each setpoint.

- Range: –99999 to 999999
- Default: 000000

6.10.3. HYS (Hysteresis)

This is used to enter the hysteresis.

- Range: 000000 to 999999
- Default: 000000

6.11. CLOCK (Clock Settings)

Items within this group set time and date related functions. Items marked with ⊗ indicate that the setting is trade critical and the trade counter will be incremented if this setting is changed.

6.11.1. FMT (Date Format)

The item determines the date format on a printout.

- Options are: dmy, mdy, ymd
- Default: dmy

6.11.2. TIME (Set Time)

The correct time may be entered in this item. The time is entered in the format (00.HH.MM), where HH is the hours in 24 hour format (00-23) and MM is the minutes (00-59).

6.11.3. DATE (Set Date)

The current date may be entered in this item. The date is entered in European format (DD.MM.YYYY), where DD is the day of the month (01 – 31), MM is the month of year (01 - 12) and YYYY is the year (2000 - 2079). The **2150** requests the day and month first, followed by the year.

6.11.4. QA.OPT (QA Option Setting) ⊗

Enables/disables the Quality Assurance Calibration Due alarm. When enabled the **2150** will display **QA DUE**, from the day after the date set in the QA.DATE item below.

Options are:

- OFF: Turn feature off.
- ON: Turn feature on.
- Default: OFF

6.11.5. QA.DATE (QA Date) ⊗

The date when the next calibration check is due may be entered in this item. The date is entered in European format (DD.MM.YYYY), where DD is the day of the month (01 - 31), MM is the month of year (01 - 12) and YYYY is the year (1998 - 2097).

- Default: 01/01/2001

6.12. TEST (Special Test Functions)

Items within this Group allow access to the testing routines for the **2150**. With these routines the scale base output can be monitored and the inputs and outputs can be tested.

6.12.1. SCALE (Scale Base Test Display)

This is used to test the scale base for load cell or connection errors. It sets up the **2150** 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. In TRADE mode this display is only active for five seconds before returning to the menu.

6.12.2. FRC.OUT (Force Outputs)

Forces each of the output drivers in turn. Only those I/O pins that are not specified as inputs will actually be driven. All outputs turn OFF when leaving this step. The **<EDT>** key will advance through each output. Pressing **<OK>** will turn all outputs off and exit the test.

6.12.3. TST.INP (Test Inputs)

The input test allows the function of each of the inputs to be tested. All three external inputs are displayed at the same time. The status of each input is changed as contact closures are detected. A dash (-) indicates an input is not present. A number 1 to 3 indicates a particular input is active. For example, **- - 3** would indicate that input number three is active.

6.13. FACTRY (Factory Adjustment Menu)

6.13.1. DEFLT (Restore Factory Defaults)

Restores the digital setup of the **2150** back to the original **new** settings installed at the factory. The main use of this routine is to completely reset a **2150** that is being installed on a different scale. Restoring the factory defaults does not affect the calibration. To reset the calibration to factory condition, the Restore Factory Calibration (CAL:FAC.CAL) should be used. Refer to FAC.CAL (Restore Default Factory Calibration) ⊗ page 29.

6.13.2. – End – (Leaving Setup)

Refer to Exiting Digital Setup page 24.

7. Calibration

The calibration of the **2150** indicator is fully digital. The calibration results are stored in permanent memory for use each time the unit is powered up.

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

To perform a calibration, select the **CAL** Group using the **<GRP>** key.

The calibration programme will automatically prevent the **2150** from being calibrated into an application outside of its specification. If an attempt is made to calibrate the **2150** outside of the permitted range, an error message will display and the calibration will be abandoned. Refer to Error Messages page 45.

The **2150** has a wide-range amplifier. The non-trade calibration range of the instrument extends well beyond the Trade approved range.

Note: It should not be assumed that just because the 2150 has successfully calibrated a scale, that the scale is correct for trade use. Always check the scale build against the approval specification.

7.1. Performing a Digital Calibration with Test Weights

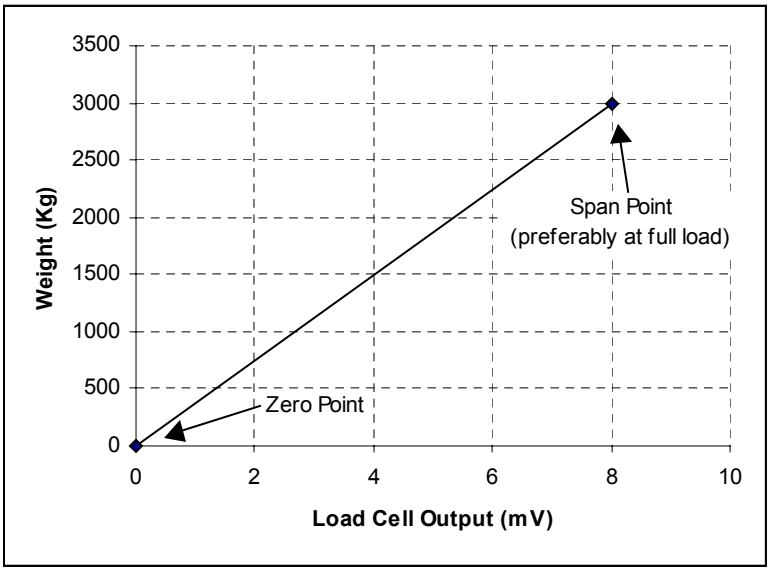


Figure 10: Chart - Zero and Span Points to Interpolate Weight from Load Cell

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 fullscale) 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 **2150** uses the zero and span points to interpolate a weight reading from the load cell reading.

7.1.1. ZERO (Zero Calibration Routine)

- Press the **<OK>** key to perform the Zeroing routine. The display will show the current weight. Remove all weight from the scale structure.
- Press the **<OK>** key again 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 **<OK>** to repeat the operation.

7.1.2. SPAN (Span Calibration Routine)

- Press the **<OK>** key to perform the Span setting routine. The display will show the current weight on the scale.
- 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 the limit calibration accuracy. The closer the test weight is to full range the better the accuracy.
- Press the **<OK>** key to show the calibration weight value. Change this to the correct calibration weight using the **<SEL>** and **<EDT>** keys.
- Press the **<OK>** key to trigger the Span Calibration routine. The display will show **S.in.P** to show 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 **<OK>** to repeat the operation.

7.2. Using Linearisation

This section provides instructions on the use of the linearisation. Linearisation is used to approximate the weight output to a non-linear scale. The chart below shows a non-linear characteristic for the load cell output. From the chart, it can be seen that the trace with no linearisation applied is a poor approximation to the real characteristic. By applying one or more linearisation points, more accurate weight readings can be achieved.

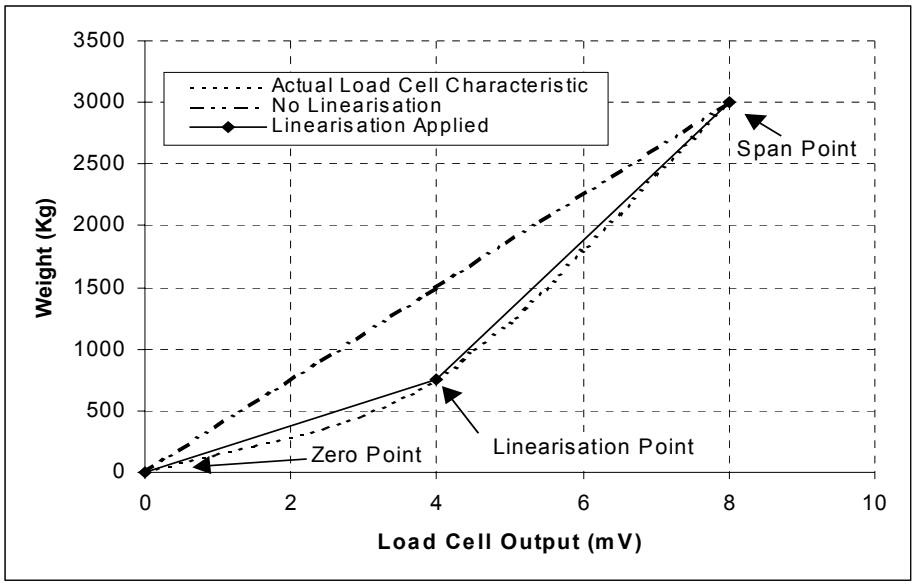


Figure 11: Chart - Non-Linear Characteristic for Load Cell Output

To perform a linearisation, a calibration of the zero and span points must have been performed. Both the zero and fullscale calibration points are used in the linearisation of the scale base. These two points are assumed to be accurately set and thus have no linearisation error.

A maximum of five linearisation points can be set independently anywhere in the operating range of the scale. Unused/unwanted points may be also cleared.

7.2.1. ED.LIN (Edit Linearisation Points)

- Press the **<OK>** key to view the list of linearisation points currently in use.
- Press the **<SEL>** key to step through the list of points. Each point is shown as **Ln.ppp** where **n** is the point number (1 to 5), and **ppp** is the approximate percentage of full scale where the linearisation is applied. For example, **L1.050** indicates that linearisation point one is active and was entered at about 50% of full scale. Unused linearisation points are shown with a row of dashes (eg. L2.- - -).
- Press **<OK>** to change the linearisation point selected or press **<ITM>** to exit without making any changes.
- After pressing **<OK>**, the current weight reading is displayed. Add the calibration test mass to the scale. The closer the test mass is to the point of maximum error in linearity the more effective will be the correction. Press **<OK>** to enter a corrected weight value for this point or **<ITM>** to exit without making changes.
- Use the **<SEL>** and **<EDT>** keys to enter the correct value of the calibration weight being used.
- Press the **<OK>** key to trigger the Linearisation routine. When the process is complete the display will show the weight to allow the new weight reading to be checked before returning to the menus. Press **<ITM>** to leave the routine or **<OK>** to repeat the operation.

7.2.2. CLR.LIN (Clear Linearisation)

- Press the **<OK>** key to view the list of linearisation points currently in use.
- Press the **<SEL>** key to step through the list of points. Each point is shown as **Ln.ppp** where **n** is the point number (1 to 5), and **ppp** is the approximate percentage of full scale where the linearisation is applied.
- For example, **L1.050** designates that linearisation point one is active and was entered at about 50% of full scale. Unused linearisation points are shown with a row of dashes (eg. L2. - - -).
- Press **<OK>** to clear the linearisation point selected or press **<ITM>** to exit without making any changes.
- Once **<OK>** has been pressed, the linearisation point will be cleared, and the display will return to **CLR.LIN**.

Note: All linearisation points are cleared by restoring the default calibration of the instrument. The zero and span settings are also cleared by this process.

8. Serial Outputs

The **2150** provides a number of serial output options allowing communications with external devices such as printers and remote displays. .

For wiring connections and pinouts, refer to Auxiliary Connection page 12). The functions available include:

- Networked Communications
- Printing
- Automatic output for 2101 Remote Display

When connected to a 2101 Remote Display data is sent constantly. When connected in any other configuration a serial splitter (0082 / 0083) is required.

The 2150 does not provide automatic weight output.

If SERIAL:TYPE is set to OFF the **2150** answers network communications.

All serial output options are enabled and configured using the Serial Communications options in the digital setup procedure.

8.1. Networking the 2150

The **2150** can be networked in two ways:

1. RS-232 can be used with the serial port switched OFF.
2. RS-232 or RS-485 can be used (along with a 2101 remote) using a serial splitter. The port needs to be set to **SPL.NET**.

8.1.1. Command Structure

The command structure for networking is:

STX CMD POLL ETX or STX CMD POLL CRLF

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 **2150.** 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

8.1.2. Command Types

- **Key Commands K: Kx**

Key commands allow the **2150** 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
Kf	External Key 1
Kg	External Key 2
Kh	External Key 3

CMD	Description
Second letter capitals (below) simulate long two second key press	
KA	Zero
KB	Add
KC	Totals
KD	Cancel
KE	Finish
KF	External Key 1
KG	External Key 2
KH	External Key 3

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

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 **2150**. 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*
RB	Read Target 2	Target 2 *CR LF*
RC	Read Target 3	Target 3 *CR LF*
RH	Read Hysteresis	Hysteresis *CR LF*
RT	Read time/date	hhmmssddmmyy *CRLF*
RP	Read printer header	Header hex string *CR LF*
RQ	Read printer footer	Footer hex string *CR LF*

- **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*
SBddd	Set Target 2	SB *CR LF*
SCddd	Set Target 3	SC *CR LF*
SGddd	Set In-Flight	SG *CR LF*
SHddd	Set Hysteresis	SH *CR LF*
SThhmmssddmmyyyy	Set time/date	ST *CR LF*
SPxxxxxxxxxxx	Set printer header	SP *CR LF*
SQxxxxxxxxxxx	Set printer footer	SQ *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

8.1.3. Master Serial Output

In **Master** mode the **2150** sends out the entire contents of the LCD every 100msec. This is designed to allow a 2101 Remote Display to exactly copy the contents of the 2150 LCD including all of the Annunciators and User Prompts.

The contents of the LCD are sent in the 2100 Master format. In this format the 2101 message data is in hexadecimal. Refer to 2101 Reference and Software manuals for further details.

8.2. Printing

With the use of a 0082 serial splitter the **2150** is capable of driving a printer. There are two ASCII format strings available to control the start and end of the printed ticket. **PRN.HDR** is sent before the first bag weight and **PRN.FTR** is send directly after the total is printed. These format strings can contain any ASCII character from 000 - 127 which allows plain text messages to be entered along with printer control codes. There are three different types of printer output. An example of each follows with the position of the format strings as shown.

8.2.1. Format String: Single

```
<Header>
15.4 kg, 10.7 kg, 9.8 kg, -9.8 kg, 14.7 kg
123:000015 10/12/2002 11:45 TOTAL 3 bags @ 40.8 kg
<Footer>
```

Note: The length of line is determined by **PRN.COL**.

8.2.2. Format String: Total

```
<Header>
TOTAL 3 bags @ 40.8 kg
123:000015 10/12/2002 11:45
<Footer Format>
```

Note: If **PRN.COL** < 30 the ID and date/time are printed over two lines instead of one.

8.2.3. Format String: Ticket

```
<Header Format>
15.4 kg
10.7 kg
9.8 kg
-9.8 kg
14.7 kg
TOTAL 40.8 kg
BAGS 3
123:000015
10/12/2002 11:45
<Footer Format>
```

Bag weights are printed every time the **<ADD>** key is pressed. Bags are cancelled when the **<CLEAR>** key is pressed and the total is printed when the **<FINISH>** key is pressed. (Note the 9.8, -9.8 sequence resulting from a cancelled bag weight.) The **000015** is a unique sequence number that is incremented with each ticket and cannot be cleared. The **123** is the **PRN.ID** setting. The sequence number is printed along with the date/time whenever the total is printed regardless of the format type.

9. Setpoints

The **2150** is capable of working with three internal setpoints. The status of these setpoints is displayed on the LCD. Each setpoint can be configured to perform a particular function and may be associated with a physical output driver or simply used as an indicator.

Note: Resources are shared with inputs and outputs.

9.1. Connection

Refer to Auxiliary Connection page 12 for the method of connection of the external output drivers.

9.2. Basic Setpoint Operation

In order to set up a bag weighing system, it must first be configured from the Digital Setup menus, under the Setpoints group (SET.PTS). Once the configuration has been performed, operator parameters (eg. targets) can be entered from the Digital Setup menus. Refer to Setup page 24.

The sections following provide details on each of the available setpoint settings.

9.2.1. Configuring a Setpoint

Setpoints define logical outputs that are activated when certain conditions are met. Generally, each setpoint will have a corresponding physical output. However, it is possible to configure a **2150** I/O pin as an input and operate the setpoint purely to control the display annunciators and alarms.

An active setpoint operates at all times. The operation of active weight setpoints is demonstrated in Figure 12 below. Also illustrated are the roles of target and hysteresis settings.

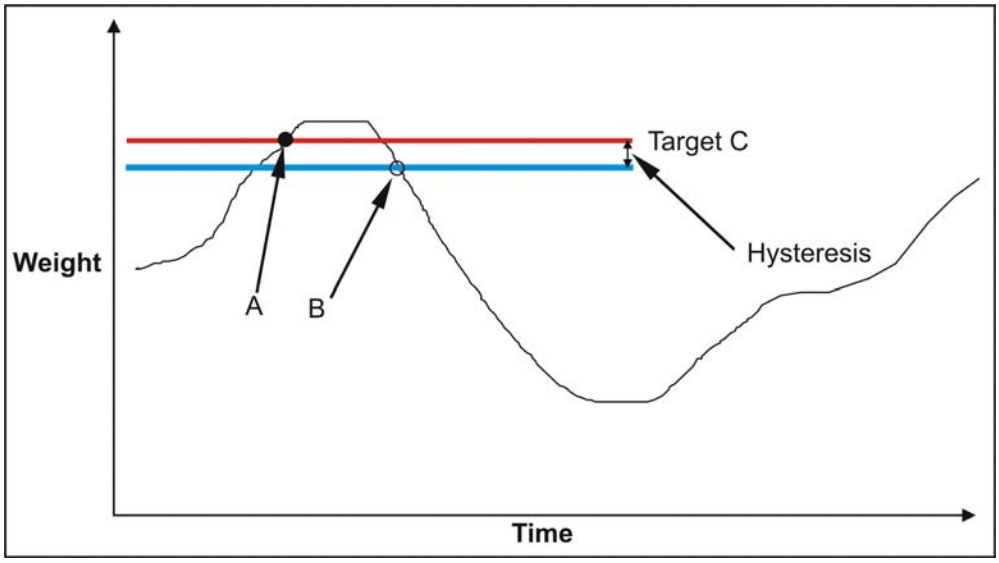


Figure 12: Setpoint Operation

A setpoint is activated when the total bag weight reaches the target. A setpoint is deactivated when the total bag weight decreases to the hysteresis setting. In Figure 12, **Target C** setpoint is activated at **A** and deactivated at **B**.

9.3. Setpoint Options

To increase flexibility of the setpoint system, a number of options are available for each type of setpoint. These options are set using an option entry item. A description of each option is given below.

- - - A			
Source	**Alarm**	**Flash**	**Arrow**
- none	**- none**	**- none**	- none
Gross	Single	Flash	**Arrow**
Reading	Double		
Total			

Table 5: Setpoint Options

9.3.1. SOURCE (None, Gross, Reading, Total)

This setting is used to select whether this setpoint uses gross reading, displayed reading or total weight.

9.3.2. ALARM (None, Single, Double)

The alarm setting is used to configure a beeping alarm to sound if a setpoint is active. The alarm can be single beeps or double beeps.

9.3.3. FLASH (None, Flash)

The flash setting is used to flash the display if a setpoint target is exceeded.

9.3.4. ARROW (None, Active)

This option is used to select whether this setpoint shows the **OVER** (Heavy Bag) annunciator. 

9.4. Operator Parameters

These settings can be accessed via the Full Digital Setup or Operator Menu Setup.

9.4.1. Targets

This is the target weight value. The **2150** calculates a trip point based on the values of targets. Targets may be entered as positive or negative values.

9.4.2. Hysteresis

The hysteresis / tolerance value forces a preset margin in the trip point. This stops the output from chattering due to minor weight fluctuations at the trip point value.

10. Special Functions

10.1. Introduction

The **2150** has up to three independent remote input functions that may be triggered by external keys connected to the auxiliary port. The function of each of these keys may be configured to any of the options detailed below. Refer to KEY.FN (Key Functions) page 30 for details of how to configure the remote input functions. Each function is identified by a single letter abbreviation identified below in brackets. For example if **KEY.FN** is set to **ABC** then activation of **input 1** simulates a **<ZERO>** key press, activation of **input 2** simulates an **<ADD>** key press, activation of **input 3** simulates a **<TOTALS>** key press.

Note: Resources are shared with inputs and outputs.

10.2. Key Functions

Front Panel Keys

- ZERO (A)
- ADD (B)
- TOTALS (C)
- CANCEL (D)
- FINISH (E)
- BLANK (X)

10.2.1. ® BLANK (X)

This function allocates the selected input as a blanking input. When active this input causes the front display to be blanked to dashes (- - - - - -) and blocks the operation of the front keys. This function is intended for use with tilt sensors on mobile weighing platforms to block operation of the weight indicator if the scale is not level.

11. Appendix

11.1. 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.

11.1.1. Weighing Errors

These messages show status messages or errors that have occurred during the normal weighing operation.

Error	Description
(U - - - - -)	The weight is below 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. Zero cannot be done at this weight.
(STABLE)(ERROR)	Scale motion has prevented a **<ZERO>** or **<ADD>** operation from occurring on command. (Try the operation again once the scale is stable.)
(QA.DUE)	The **calibration due** date has been set and the current date exceeds this limit. Press any key to clear the warning for one hour. To clear the warning permanently, recalibrate the instrument (CAL (Scale Calibration) page 29) and the set a new **calibration due** date (QA.DATE (QA Date) ⊗ page 33).
(I.LOCK)(ERROR)	The totaliser was not armed since the last **<ADD>** key.
(SMALL)(BAG)	The bag does not weigh enough and as a result it has not been added to the total.
(- - - - - -)	The operation was invalid and subsequently blocked.

Note: The **ZERO** and **STABLE** error messages are accompanied by a series of long beeps.

11.2. Diagnostic Errors

The **2150** 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
- Service = the **2150** must be returned for factory service

Error	Description	Resolution
(E 0001)	The power supply voltage is too low.	Check supply
(E 0002)	The power supply voltage is too high.	Check scale / cables
(E 0004)	The load cell excitation voltage is too low.	Check scale / supply
(E 0008)	The load cell excitation voltage is too high.	Check scale / supply
(E 0010)	The temperature is outside of allowable limits.	Check location
(E 0020)	Scale build is incorrect. The number of graduations has been set less than 100 or greater than 30000.	Fix up scale build
(E 0100)	The digital setup information has been lost.	Re-enter setup
(E 0200)	The calibration information has been lost.	Re-calibrate
(E 0300)	All setup information has been lost	Enter setup and calibrate
(E 0400)	The factory information has been lost.	Service
(E 0800)	The EEPROM memory storage chip has failed	Service
(E 2000)	ADC Out of Range Error. This may be caused from a broken load cell cable.	Check load cell cable
(E 4000)	The battery backed RAM data has lost data.	Re-enter setup
(E 8000)	The FLASH program memory is incorrect	Service

The **E** type error messages are additive. For example if a condition is detected where the power supply voltage is low, resulting in a reduction of excitation voltage, the resulting Error messages will be **E 0005** (0001 + 0004). 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)

11.3. Setup Menu Quick Reference

Group (GRP)	Item (ITM)
BUILD (Scale Build) page 26	DP (Decimal Point Position) ⊗ page 26
	CAP (Maximum Capacity) ⊗ page 26
	RES (Count-by Resolution) ⊗ page 26
	UNITS (Weighed Units) ⊗ page 27
	HI.RES (High Resolution x10 mode) ⊗ page 27
OPTION (Scale Options) page 27	USE (Scale Use) ⊗ page 27
	FILTER (Reading Average) page 27
	MOTION (Motion Detection) ⊗ page 27
	AUTO.Z (Auto-Zero on Startup) page 28
	Z.TRAC (Zero Tracking Sensitivity) ⊗ page 28
	Z.RANGE (Allowable Zero Operating Range) ⊗ page 28
	Z.BAND (Zero Dead Band) ⊗ page 28
	AUTO.T (Auto Tare) page 28
	I.LOCK (Gross Weight Change) page 28
	MIN.BAG (Minimum Allowable Bag Weight) page 28
CAL (Scale Calibration) page 29	ZERO (Zero Calibration) ⊗ page 29
	SPAN (Span Calibration) ⊗ page 29
	ED.LIN (Edit Linearisation Points) ⊗ page 29
	CLR.LIN (Clear Linearisation Points) ⊗ page 29
	FAC.CAL (Restore Default Factory Calibration) ⊗ page 29
SPEC (Special Settings Menu) page 29	FULL.PC (Security Passcode for Digital Setup) page 29
	KEY.LOC (Front Panel Key Locking) ⊗ page 30
	KEY.FN (Key Functions) page 30
	B.LIGHT (Backlight Operation) page 30
	BRIGHT (Backlight Brightness) page 30
	AUX.DSP (Auxiliary Display Setting) page 30
	TOT.DSP (Display Total and Number of Bags) page 30
SERIAL (Serial Settings) page 30	TYPE (Serial Output Type) page 31
	ADDR (Serial Address) page 31
	PRN.ID (Printer Identification) page 31
	PRN.TYP (Printer Type) page 31
	PRN.COL (Printer Columns) page 31
	PRN.HDR (Printer Header Format) page 31
	PRN.FTR (Printer Footer Format) page 31
	BAUD (Serial Baud Rate) page 32
	BITS (Serial Format Options) page 32
SET.PTS (Setpoint Settings) page 32	OPTN A, OPTN B, OPTN C (Setpoint Options) page 32
	TARG A, TARG B, TARG C (Targets for each of the three setpoints) page 33
	HYS (Hysteresis) page 33
CLOCK (Clock Settings) page 33	FMT (Date Format) page 33
	TIME (Set Time) page 33
	DATE (Set Date) page 33
	QA.OPT (QA Option Setting) ⊗ page 33
	QA.DATE (QA Date) ⊗ page 33
TEST (Special Test Functions) page 34	SCALE (Scale Base Test Display) page 34
	FRC.OUT (Force Outputs) page 34
	TST.INP (Test Inputs) page 34
FACTRY (Factory Adjustment Menu) page 34	DEFLT (Restore Factory Defaults) page 34
-END- (Leaving Setup)	To return to the Operator Interface. Refer to Exiting Digital Setup page 24.

11.4. Glossary

Term	Definition
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	Electromagnetic Compatibility Regulation
FIR	Finite Impulse Response
Fullscale	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 Fullscale divided by the resolution.
LED	Light Emitting Diode
OIML	International Organization of Legal Metrolology
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
RS-232, RS-485	Standards 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.
SYNC Frequency	The sampling frequency of the analog-to-digital converter. It is selectable at 25/30Hz on the 2150 and defines the FIR filter response.
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.).

11.5. List of Figures and Tables

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This document is designed as a guide to the operation of the product. It shall not form any contract. The specifications of the product may be altered without notice.

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