920i® BCi Integrator

Belt Scale

Technical Manual

RICE LAKE® WEIGHING SYSTEMS

July 12, 2023

PN 179996 Rev F

The most current version of this publication, software, firmware and all other product updates can be found on our website:

www.ricelake.com

Revision History

This section tracks and describes manual revisions for awareness of major updates.

Revision	Date	Description
F	July 12, 2023	Established revision history. Added compliance updates.

Table i. Revision Letter History

Contents

1.0 Introduction

This manual is intended for use by service technicians responsible for installing and servicing the 920i Integrator In-Motion Belt Scale System.

Manuals are available from Rice Lake Weighing Systems at www.ricelake.com/manuals

Warranty information is available at www.ricelake.com/warranties

1.1 Safety

Safety Definitions:

DANGER: Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. Includes hazards that are exposed when guards are removed.

WARNING: Indicates a potentially hazardous situation that, if not avoided, could result in serious injury or death. Includes hazards that are exposed when guards are removed.

CAUTION: Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.

IMPORTANT: Indicates information about procedures that, if not observed, could result in damage to equipment or corruption to and loss of data.

General Safety

Do not operate or work on this equipment unless this manual has been read and all instructions are understood. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Rice Lake Weighing Systems dealer for replacement manuals.

WARNING

Failure to heed could result in serious injury or death.

Some procedures described in this manual require work inside the indicator enclosure. These procedures are to be performed by qualified service personnel only.

Take all necessary safety precautions when installing the scale carriage including wearing safety shoes, protective eye wear and using the proper tools.

Do not allow minors or inexperienced persons to operate this unit.

Do not operate without all shields and guards in place.

Do not jump on the scale.

Do not use for purposes other then weight taking.

Do not place fingers into slots or possible pinch points.

Do not use load bearing components worn beyond 5% of the original dimension.

Do not use this product if any of the components are cracked.

Do not exceed the rated load limit of the unit.

Do not make alterations or modifications to the unit.

Do not remove or obscure warning labels.

Do not use near water.

Keep hands, feet and loose clothing away from moving parts.

1.2 FCC Compliance

United States

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canada

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Class A prescites dans le Règlement sur le brouillage radioélectrique edicté par le ministère des Communications du Canada.

1.3 Electronic Integrator

Outputs from the belt travel speed sensor and the load cell carriage are combined by the integrator to produce a running total of weight crossing the belt conveyor scale. The integrator converts the signals into values representing the weight and speed of the material traveling on the conveyor.

1.4 Operation

The front panel has a large backlit LCD display, five configurable softkeys, five primary scale functions keys, nine numeric entry keys, four navigational keys and an enter key.

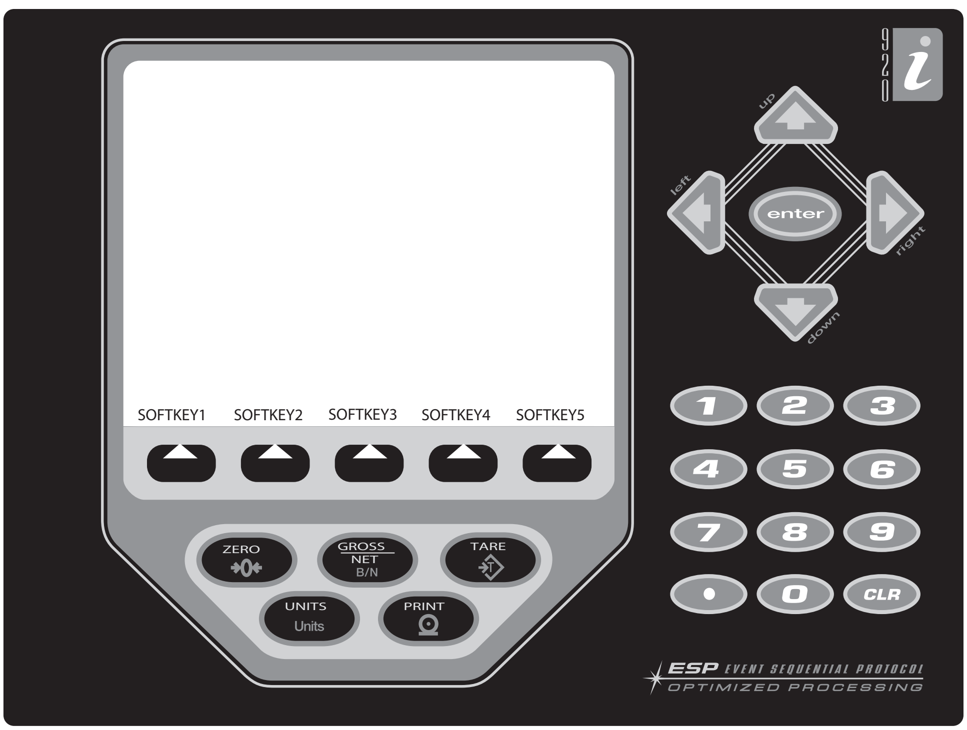


Figure 1-1. 920i Integrator Front Panel

1.4.1 Zero

Pressing 

initiates the zero function of the integrator. Periodic use of the zero parameter may be required due to weather conditions.

1.4.2 Print

Pressing 

prints the custom ticket if the print port is configured.

1.4.3 Reset Totalizer

Use these steps to reset the totalizer during operation of a belt scale.

1. Press the **Reset Totalizer** softkey to access this parameter. The integrator displays ***Clear Totalizer***?
2. Press **Yes** to clear the totalizer, or press **No** to leave the accumulated weight in the totalizer.

1.4.4 Diagnostics

The **Diagnostics** softkey displays the current mV input, PPS (pulses per second from the speed sensor), current analog output (if installed), current A/D counts and the master total. This informational data can be used for troubleshooting purposes.

1.4.5 Supervisor Mode

The **Supervisor Mode** softkey is used to enter the supervisor mode configuration parameters. If there is no passcode configured, the integrator enters directly into the supervisor mode. If a passcode is configured, the passcode must be entered before the integrator enters the supervisor mode. See Section 3.0 on page 22 for more information on the supervisor mode configuration parameters.

2.0 Setup and Wiring

The universal model of the integrator provides six cord grips for cabling into the unit: one for the power cord and five to accommodate cabling for option cards. Install plugs in all unused cord grips to prevent moisture from entering the enclosure.

2.1 Enclosure Disassembly

The integrator enclosure must be opened to install option cards and to connect cables for installed option cards.

WARNING: The integrator has no on/off switch. Before opening the unit, ensure the power cord is disconnected from the power outlet.

1. Ensure power to the integrator is disconnected.
2. Place the integrator face-down on an anti static work mat.
3. Remove the screws holding the backplate to the enclosure body.
4. Lift the backplate away from the enclosure and set it aside.

2.2 Cable Grounding

Except for the power cord, all cables routed through the cord grips should be grounded against the integrator enclosure.

To ground shielded cables:

1. Install grounding clamps on the grounding bar, using the ground clamp screws. Do not tighten the screws at this time.
2. Route the cables through the cord grips and the grounding clamps to determine the cable lengths required to reach the cable connectors.
3. Mark the cables to remove insulation and shield (Section 2.2.1).
4. Route stripped cables through the cord grips and grounding clamps.
5. Ensure the shields contact the grounding clamps and tighten the ground clamp screws.

2.2.1 Stripping Cables

Foil Insulated Cable

1. Strip the insulation and foil from the cable 1/2 in (15 mm) past the grounding clamp.
2. Fold the foil shield back on the cable where the cable passes through the clamp.
3. Ensure the silver (conductive) side of the foil is turned outward for contact with the grounding clamp.

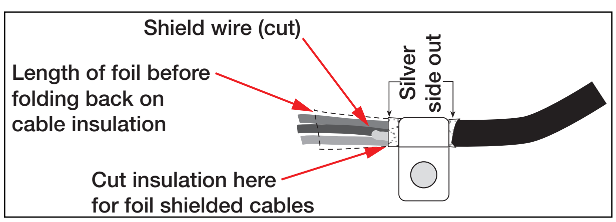


Figure 2-1. Foil Insulated Cable

Braided Shielding

1. Strip the insulation and braided shield from a point just past the grounding clamp.
2. Strip another 1/2 in (15 mm) of the insulation to expose the braid where the cable passes through the clamp.

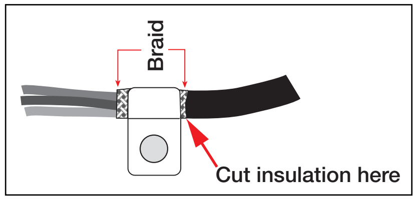


Figure 2-2. Braided Insulated Cable

Load Cell Cables

1. Cut the shield wire just past the grounding clamp. Shield wire function is provided by contact between the cable shield and the grounding clamp.
2. Route stripped cables through the cord grips and clamps. Ensure shields contact the grounding clamps.
3. Tighten the grounding clamp nuts.
4. Use cable ties to secure the cables inside of the integrator enclosure to finish the installation.

2.2.2 Cable Specifications

Cord Grip	Diameter Range
PG9 (PN 15626)	0.138 - 0.315 in (3.5 - 8 mm)
1/2 NPT (PN 15628)	0.197 - 0.472 in (5 - 12 mm)

Table 2-1. Cord Grip Diameter Ranges

Torque	in-lb	Nm
Cord grip nut (to enclosure)	33	3.7
Cord grip dome nut (around cable)	22	2.5

Table 2-2. Cord Grip Torque Values

2.3 Load Cells

To attach the cable from a load cell or junction box to an installed A/D card:

1. Route the cable through the cord grip and ground the shield wire.
2. Remove connector J1 from the single-channel A/D card. The connector plugs into a header on the A/D card.
3. Wire the load cell cable from the load cell or junction box to connector J1 as shown in Table 2-3.

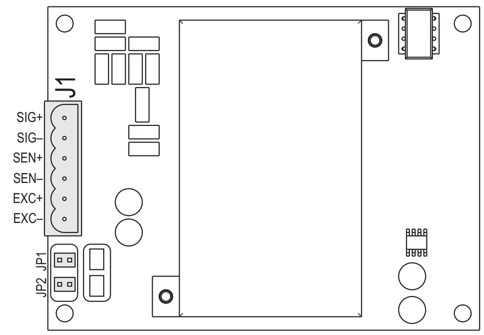


Figure 2-3. Single-Channel A/D Card

A/D Card Connector Pin	Function
1	+SIG
2	–SIG
3	+SENSE
4	–SENSE
5	+EXC
6	–EXC

Table 2-3. A/D Card Pin Assignments

NOTE: For 6-wire load cell cable (with sense wires), remove jumpers JP1 and JP2 before reinstalling connector J1. For 6-wire load cell connections on dual-channel A/D cards, remove jumpers JP3 and JP4 for connections to J2. For 4-wire installation, leave jumpers JP1 and JP2 on.

4. When all connections are complete, reinstall the load cell connector on the A/D card and use two cable ties to secure the load cell cable to the inside of the enclosure.

2.4 CPU Board

WARNING: Disconnect power before removing the integrator backplate.
Use a wrist strap for grounding and to protect components from electrostatic discharge (ESD) when working inside the integrator enclosure.

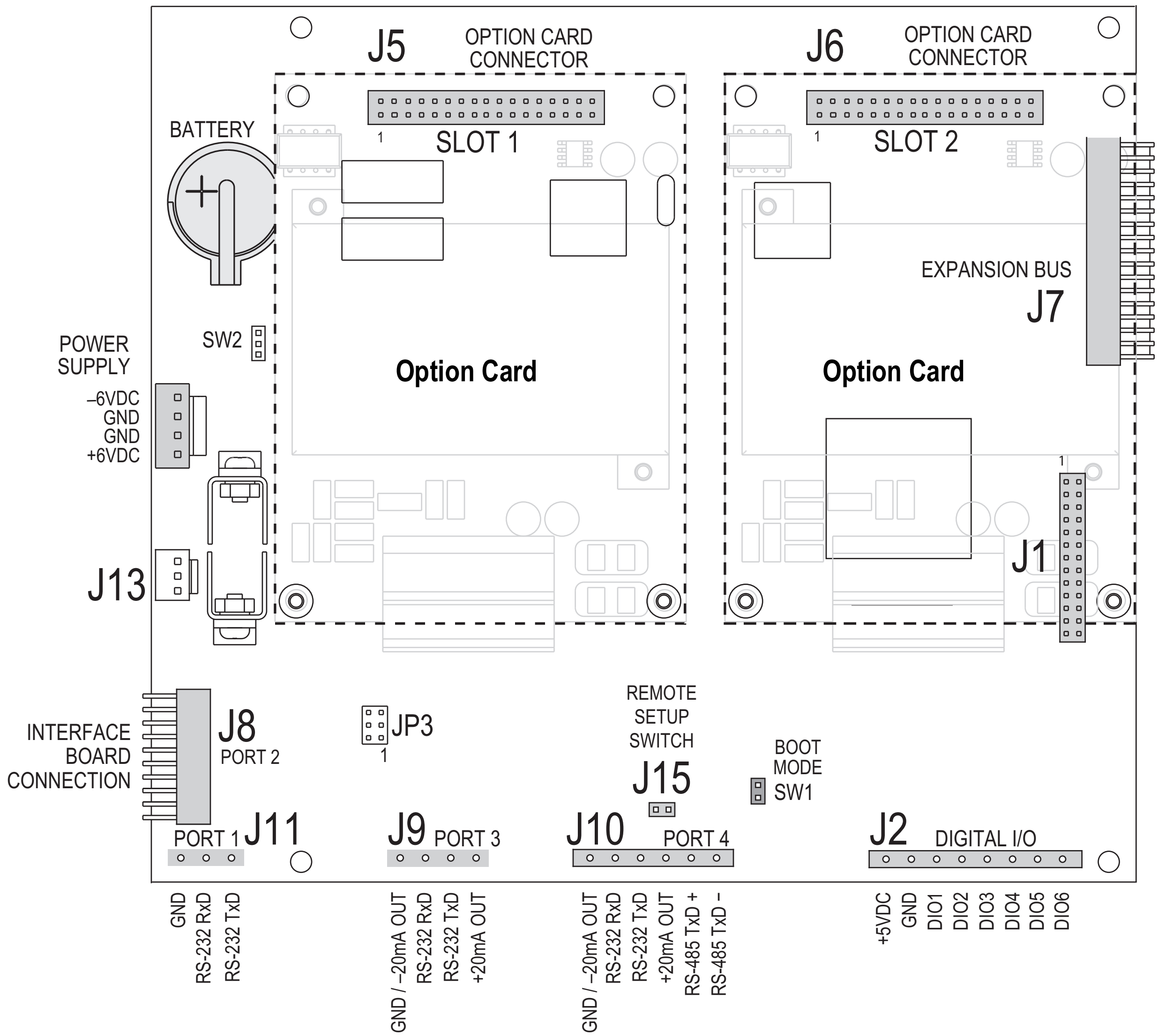


Figure 2-4. 920i CPU Board, (Rev H) with Option Cards

If the CPU board must be replaced, use the following procedure:

1. Disconnect power to the integrator.
2. Remove backplate, as described in Section 2.1 on page 10.
3. Unplug connectors J9, J10 and J11 (serial communications), J2 (digital I/O), P1 (power supply) and connectors to installed option cards.
4. Remove any installed option cards.
5. Remove the five screws and two nuts securing the CPU board.
6. Lift the CPU board carefully and disconnect connectors J12 (power to display), J4 (ribbon cable), J3 (keypad connector) and the cable J8 (Port 2 serial port).
7. Remove the CPU board from the enclosure. Cut cable ties to shift cables out of the way, if needed.

NOTE: To replace the CPU board, reverse the above procedure. Reinstall cable ties securing all cables inside the enclosure.

2.4.1 Battery Replacement

The lithium battery on the CPU board maintains the real-time clock and protects data stored in the system RAM when the integrator is not connected to AC power.

Data protected by the CPU board battery includes time and date, truck and tare memory, onboard database information and setpoint configuration.

Use Revolution® to store a copy of the integrator configuration on a PC before attempting battery replacement. If data is lost, the integrator configuration can be restored from the PC.

NOTE: Memory option card data is also protected by a lithium battery. All database information stored on a memory card is lost if the memory card battery fails.

Watch for the low battery warning on the LCD display and periodically check the battery voltage on both the CPU board and on installed memory option cards. Batteries should be replaced when the integrator low battery warning comes on, or when battery voltage falls to 2.2 VDC. Life expectancy of the battery is ten years.

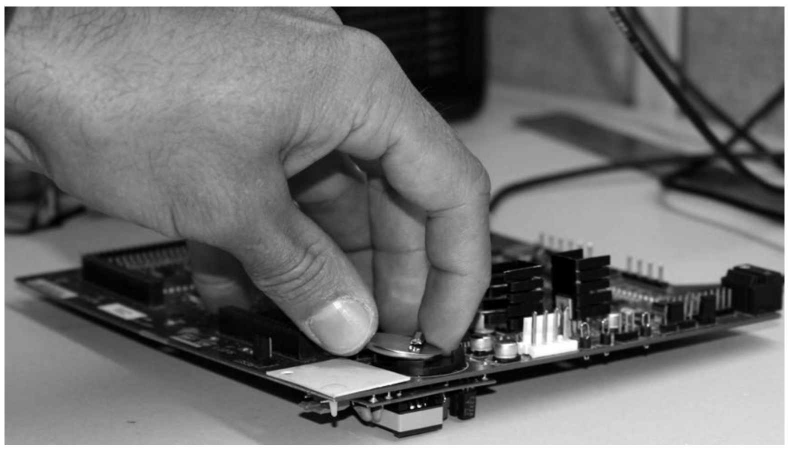


Figure 2-5. Battery Removal

Before replacing the battery:

1. Place the integrator in setup mode.
2. Press **SAVE/EXIT** to save the battery-backed memory (NVRAM) to flash. This operation saves the latest configuration information.
3. Return to ***Weigh*** mode.
4. Power off the integrator and replace the battery.
5. Place a finger tip in the notched area near the battery retaining spring and slide the battery out of position on the CPU board. Use care not to bend the battery retaining spring. When power is restored, a message displays stating the battery-backed memory is corrupt.
6. Press **ENTER** to restore the value saved in flash memory.

CAUTION: Risk of explosion if battery is replaced with incorrect type. Dispose of batteries per manufacturer instruction.

2.5 Option Cards

- The maximum number of option board slots is fourteen: two onboard slots, plus two six-card expansion boards
- The two-card expansion board is always placed at the end of the expansion bus; No more than one two-card expansion board can be used in any system configuration
- The panel mount or deep enclosure can accommodate a single two-card expansion board
- The wall mount enclosure can accommodate a two-card or a six-card expansion board
- Systems using two expansion boards are housed in a custom enclosure

2.5.1 Pulse Input Card

WARNING: Disconnect power before removing the integrator backplate.

Use a wrist strap for grounding and to protect components from electrostatic discharge (ESD) when working inside the integrator enclosure.

To install pulse input cards in the integrator:

1. Disconnect the integrator from the power source.
2. Place the integrator face-down on an anti-static work mat.
3. Remove the screws holding the backplate to the enclosure body. Retain for reassembly.
4. Align the large option card connector with connector J6 on the CPU board and press down to seat the option card in the CPU board connector.
5. Use screws and lockwashers provided in the option kit to secure the card to the threaded standoffs on the CPU board.

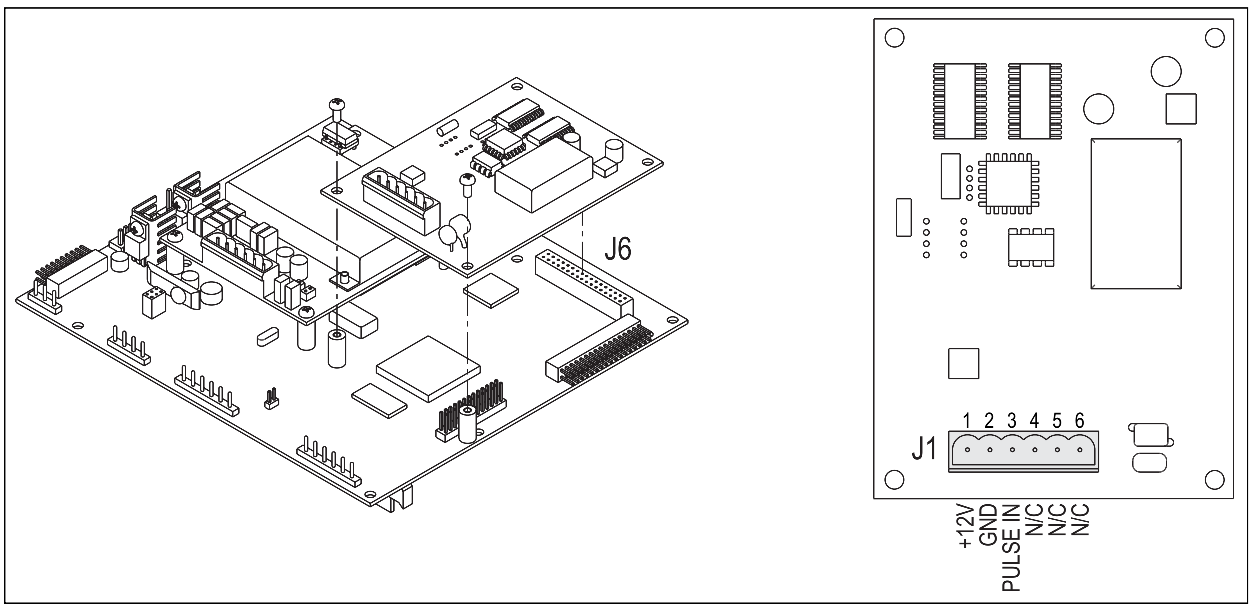


Figure 2-6. Pulse Input Card (PN 67605)

6. Make connections to the option card as required.
7. Use cable ties to secure loose cables inside the enclosure.
8. Reinstall the backplate (Section 2.8 on page 18).
9. Ensure no excess cable is left inside the enclosure and tighten cord grips.
10. Reconnect power to the integrator.

The integrator automatically recognizes all installed option cards when the unit is powered on. No hardware-specific configuration is required to identify the newly installed card to the system.

2.6 Serial Communications

The four communications ports on the CPU board support full duplex RS-232, 20 mA output, or RS-485 communications up to 115200 bps.

WARNING: Disconnect power before removing the integrator backplate.

Use a wrist strap for grounding and to protect components from electrostatic discharge (ESD) when working inside the integrator enclosure.

To attach serial communications cables:

1. Disconnect the integrator from the power source.
2. Place the integrator face-down on an anti-static work mat.
3. Remove the screws holding the backplate to the enclosure body. Retain for reassembly.
4. Route the cable through the cord grip and ground the shield wire as described in Section 2.2 on page 10.
5. Remove the serial connector from the CPU board and wire to the connector (Table 2-4).
6. Plug the connector into the header on the board.
7. Use cable ties to secure serial cables to the inside of the enclosure.

Table 2-4 shows the pin assignments for Ports 1, 3 and 4. Port 2 provides DIN-8 and DB-9 connectors for remote keyboard attachment of PS/2-type personal computer keyboards. DB-9 connector pin assignments for Port 2 are shown in Table 2-6 on page 17.

Connector	Pin	Signal	Port
J11	1	GND	1
	2	RS-232 RxD	
	3	RS-232 TxD	
J9	1	GND / –20mA OUT	3
	2	RS-232 RxD	
	3	RS-232 TxD	
	4	+20mA OUT	
J10	1	GND / –20mA OUT	4
	2	RS-232 RxD	
	3	RS-232 TxD	
	4	+20mA OUT	
	5	RS-485 A	
	6	RS-485 B	

Table 2-4. Serial Port Pin Assignments

2.7 Digital I/O

Digital inputs can be set to provide many integrator functions, including all keypad functions.

Digital inputs are active low (0 VDC), inactive high (5 VDC).

Digital outputs are typically used to control relays driving other equipment. Outputs are designed to sink, rather than source, switching current. Each output is a normally open collector circuit, capable of sinking 24 mA when active. Digital outputs are wired to switch relays when the digital output is active (low, 0 VDC) with reference to a 5 VDC supply.

Table 2-5 shows the pin assignments for connector J2.

J2 Pin	J2 Signal	Dig I/O Definitions
1	+5 VDC	—
2	GND	—
3	DIO 1	Batch Output
4	DIO 2	Totalizer Pulse Output
5	DIO 3	Totalizer Reset Input
6	DIO 4	Remote Print Input
7	DIO5	Remote Start Input
8	DIO6	Fixed Speed Input

Table 2-5. J2 Pin Assignments (Digital I/O)

Digital inputs and outputs are configured using the ***DIG I/O*** menu.

An optional 24-channel digital I/O expansion card (PN 67601) is available for applications requiring more digital I/O channels.

Serial ports are configured using the ***SERIAL*** menu.

An optional dual-channel serial communications expansion card, PN 67604, is also available. Each serial expansion card provides two additional serial ports, including one port supporting RS-485 communications. Both ports on the expansion card can support RS-232 or 20mA connections.

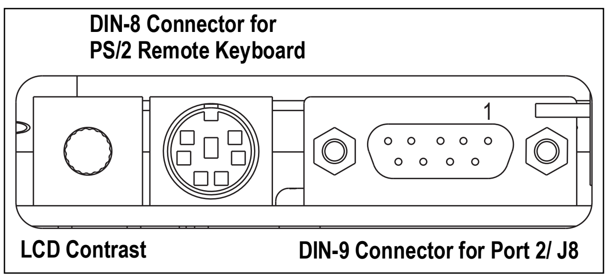


Figure 2-7. Interface Board Connections

DB-9 Pin	Signal
2	TxD
3	RxD
5	GND
7	CTS
8	RTS

Table 2-6. DB-9 Connector Pin Assignments

2.8 Enclosure Reassembly

1. Position the backplate over the enclosure.
2. Reinstall the backplate screws.
3. Use the torque pattern to prevent distorting the backplate gasket (Figure 2-8). Torque screws to 15 in-lb (1.7 N-m).

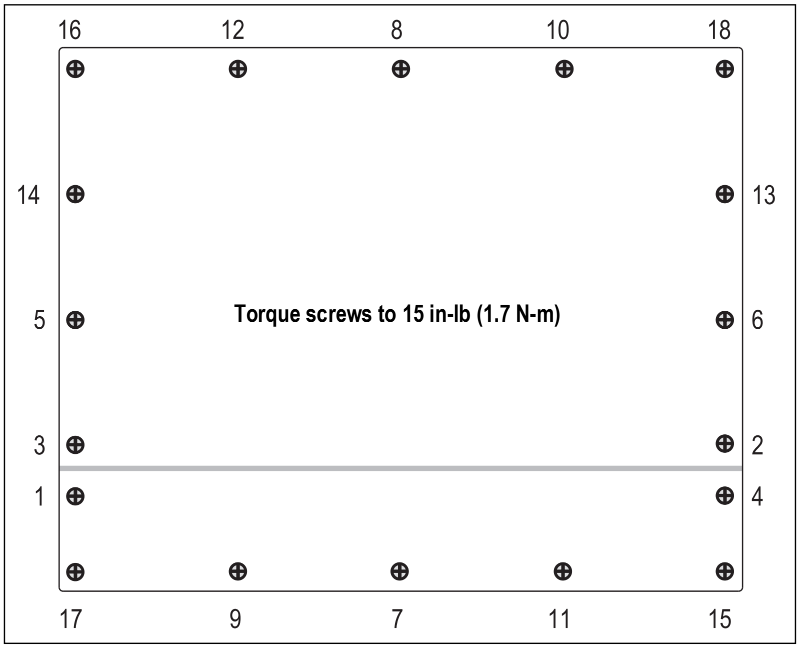


Figure 2-8. 920i Integrator Enclosure Backplate

2.9 Replacement Parts

Replacement parts for the 920i deep enclosure.

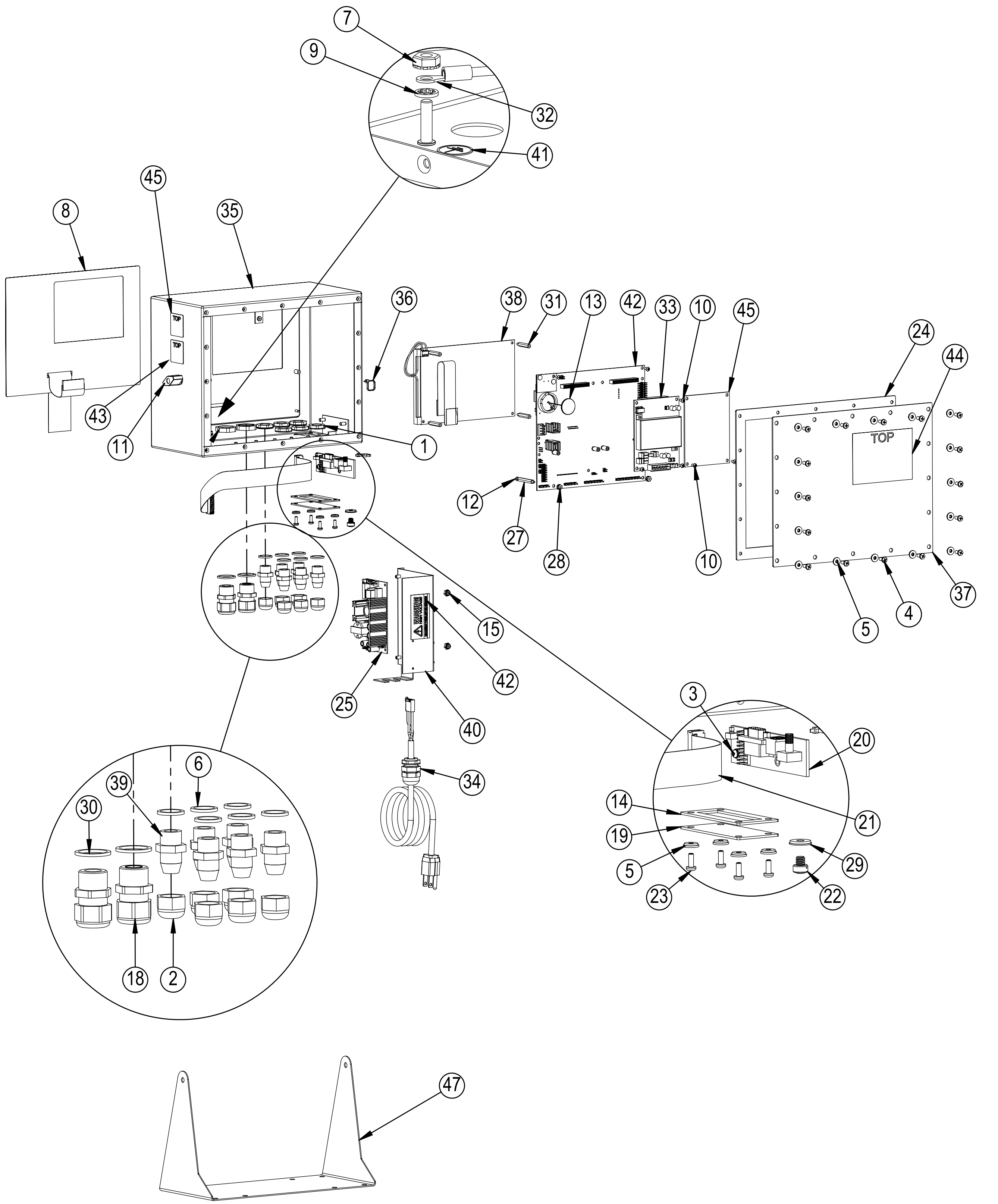


Figure 2-9. 920i Deep Enclosure Part Illustration

Item No.	Part No.	Description	Qty.
1	15627	Locknut, Black PCN9	6
2	15626	Cord Grip, Black PG9	6
3	55708	Screw, Mach 4-40NC x .38	2
4	14862	Screw, Mach 8-32NCx3/8	4
5	75062	Washer, Bonded Sealing #8	20
6	30375	Seal Ring, Nylon PG9	6
7	14626	Nut, Kep 8-32NC HEX	3
8	66502	Overlay, Membrane Switch	1
9	15134	Washer, Lock NO 8 Type A	3
10	14822	Screw, Mach 4-40 NCx1/4	13
11	103610	Knob, Tilt Stand	2
12	69898	Washer, Nylon #4 ID=.112	2
13	69290	Battery, 3 V Coin Lithium	1
14	67535	Gasket, Interface Board	1
15	58248	Nut, Lock 6-32NC HEX Nylon	2
17	15630	Locknut, 1/2 NPT Black	2
18	15628	Cord Grip, 1/2 NPT Black	2
19	67530	Plate, Interface Board	1
20	67869	Board, Interface 920i	1
21	68662	Cable, Ribbon Interface	1
22	42640	Screw, Mach 1/4-28NF x .25	1
23	14845	Screw, Mach 6-32NCx3/8	4
24	82854	Gasket, Backplate 920i	1
25	71333	Power Supply,6V 65W	1
27	68661	Standoff, Male-Fem 4-40NC	2
28	14618	Nut, Kep 4-40NC HEX	2
29	44676	Washer, Bonded Sealing	1
30	30376	Seal Ring, Nylon 1/2 NPT	2
31	67886	Standoff, Male-FEM 4-40NC	4
32	15601	Ground Wire	1
33	67610	Card, A/D Single Channel	1
34	85202	Power Cord Assembly,120VAC	1
	67795	Power Cord Assembly, 115 VAC and 230 VAC North American Units	1
	69998	Power Cord Assembly, 230 VAC European Units	1
35	82852	Enclosure, 920i Deep SST	1
36	15631	Cable Tie, 3" Nylon	2
37	82853	Backplate, 920i Deep	1
38	186273	Display, LCD Module 920i	1
38	186278	Wire Harness,65W Power	1
40	82856	Bracket, Power Supply	1
41	16892	Label, Ground Protective	1
42	117930	CPU board; Board marked as 109549; sold as 117930	1
43	16861	Label, Warning High	1
44	53307	Label, 4.000 x 2.875	1
45	53308	Label, 1.25 x 1.25 8000T	1
46	67605	Card, Pulse Counter 12VDC	1
47	15601	Wire Assembly, Ground 6"	1
48	82855	Tilt Stand, 920i Deep	1
–	71462	Fuses F1 & F2 (115 VAC and 230 VAC North American models), 3.15 A Time-Lag TR5	2
	72339	Fuses F1 & F2 (230 VAC European models), 3.15 A Time-Lag TR5	2
–	15887	Terminal Block, 6-position	1

Table 2-7. 920i Deep Enclosure Parts List

2.10 Parts Kit Contents

Table 2-8 lists the parts kit contents for the 920i deep enclosure model.

Part No.	Description	Qty.
14626	Kep Nut, 8-32NC	4
14862	Machine Screw, 8-32NC x 3/8	12
15133	Lock Washer, No. 8, Type A	4
15144	Nylon Washer	2
15631	Cable Tie (4–single A/D, 6–dual A/D)	4/6
15665	Reducing Gland for 1/2 NPT Cord Grip	2
15887	6-position Screw Terminal for Load Cell Connection (1–single A/D, 2–dual A/D)	1/2
19538	Cord Grip Plug (4–single A/D, 3–dual A/D)	4/3
30623	Fillister Head Screw, 8-32NC x 7/16	2
42149	Rubber Feet for Tilt Stand	4
42350	Capacity Label (1–single A/D, 2–dual A/D)	1/2
53075	Cable Shield Ground Clamps	4
68403	Wing Knobs for Tilt Stand	2
70599	6-position Screw Terminal for J2 and J10 (2)	2
71125	3-position Screw Terminal for J11	1
71126	4-position Screw Terminal for J9 and Optional Keyboard Connection	2
75062	Sealing Washers	14

Table 2-8. Parts Kit Contents (PN 126285)

3.0 Supervisor Mode

Several parameters can be accessed and set using the **Supervisor Mode** softkey from the main menu.

NOTE: All parameters must be configured prior to calibrating the unit.

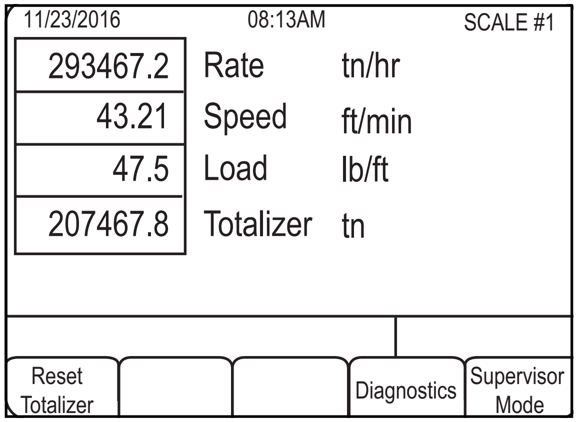


Figure 3-1. Supervisor Mode Softkey

1. Press the **Supervisor Mode** softkey to access the following menu.

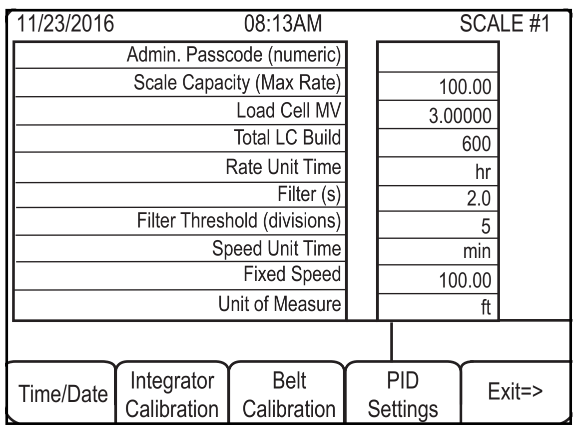


Figure 3-2. Supervisor Menu

2. Use the **Up** and **Up** arrow keys on the integrator to navigate the parameter list.
3. Press enter to select the parameter to edit.
   - If the parameter is an entered value, a prompt displays; Key in the new value; Press enter to accept the value
   - If the parameter has a list of available values, press enter to scroll through all available selections

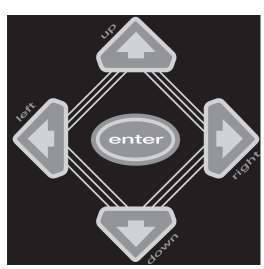


Figure 3-3. Navigation Keys

3.1 Admin.Passcode (numeric)

Setting an administrator password prevents unauthorized changes to system parameters and calibration.

1. Select the ***Admin.Passcode (numeric)*** parameter, the ***Enter Password*** prompt displays.
2. Enter the password and press **Enter**. The ***Supervisor*** menu displays (Figure 3-2 on page 22).

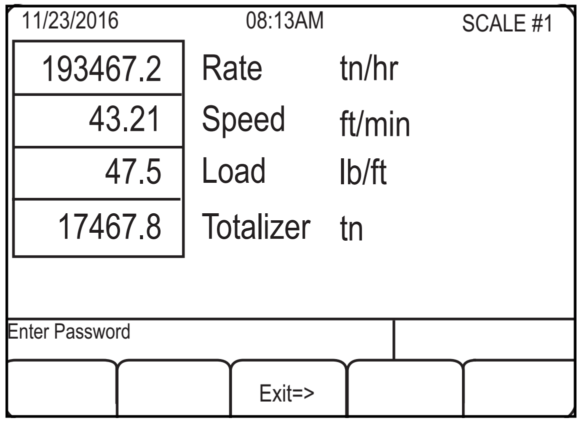


Figure 3-4. Enter Password

There are many parameters in the ***Supervisor Mode*** described in the following sections, but most are not used for a basic installation. These parameters must be set prior to calibration:

- Calibration weight (if using static weights to calibrate)
- Idler spacing
- Number of idlers
- Belt length
- Load cell MV
- Total load cell build

Filtering values are also commonly set, however these can be configured after setup and calibration.

NOTE: The angle of inclination is not required with Rice Lake Weighing Systems frames due to laterally opposed shearbeams.

3.2 Supervisor Mode Parameters

Parameter	Description
Scale Capacity	Defines the maximum rated capacity for the belt scale or the maximum amount of weight passing along the belt scale per hour; Enter Value: maximum rate in tons; Default = tons/hour
Load Cell MV	Average mv/v rating of all the load cells in the system; Enter Value: must be greater than 0
Total Load Cell Build	Defines the total capacity of all load cells in the system; *Example: If there are eight load cells and each has a rated capacity of X, multiply X by 8 to obtain the total load cell capacity. Enter this value into the integrator.*
Rate Unit Time	Defines the unit of time the rate displays in; Settings: **Hr.** - hour (default), **Min** - minute, **Sec** - seconds
Filter(s)	Defines the number of seconds filtering samples to average the scale load; measured in tenths of a second
Filter Threshold (Divisions)	Number of divisions the load must maintain for the filter to be enabled; If a change in weight is greater than this value, the filter is flushed
Speed Unit Time	Defines how the belt speed displays; Settings: **Hr.** - hour, **Min** - minute (default), **Sec** - seconds
Fixed Speed	Configures a fixed belt speed for the integrator; then the integrator does not calculate the belt speed using the speed sensor; Once a value is set, the integrator uses the fixed value; Units of measure are in ft/min or m/min depending on how the integrator has been configured for speed; Time units can be changed to seconds or hours; Enter Value: default = 0 ***NOTE: An input relay is required when using fixed speed. Relay should be wired to conveyor motor RUN signal.***
Unit of Measure	Defines how the belt is measured and speed is calculated; Settings: **Ft** - feet (default), **M** - meters
Unit of Rate	Defines how the rate displays; Settings: **tn** - tons (default), **lb** - pounds, **kg** - kilograms, **t** - metric tons, **lt** - long ton
Rate Count By	Defines the count by and decimal divisions of the displayed rate; Enter Value: 1, 2, 0.1, 0.01, etc
Totalizer Count By	Defines the count by and decimal divisions of the totalizers; Enter Value: 1, 2, 0.1, 0.01, etc
Load Display Units	Defines the weight units belt loading displays in; Settings: **lb** - pounds (default), **kg** - kilograms
Load Count By	Defines the count by and decimal divisions of the displayed load; Enter Value: 1, 2, 0.1, 0.01, etc
Auto Zero Tracking Range (%)	Percentage of full scale in which zero tracking is attempted; if the rate is higher than this value, zero tracking is turned off
Auto Zero Tracking Deviation (%)	The percentage of full scale allowed to zero track off; *Example: If set to 2% of full scale and the capacity is 100, 2 would be the maximum rate automatically zeroed off.*
Dead Band	The accumulator only totalizes the amount, if the rate is above the dead band value; Enter Value
Cal. Test Weight	Defined as the value of the total weight used to calibrate the belt scale; This parameter changes on all the above measurement and weight parameters; Default is measured in lb
Cal. Test Chain	Defines the value of the test chain used to calibrate the scale; Test chains are rated in lb/ft or kg/m; Check the chain rating to obtain this value; Default is measured in lb/ft
Calibration Load	The weight of material used in a material test and in a Material Calibration; The calibration load weight value must have the same units as the totalizer; Enter Value *Example: If the totalizer units are **tn**, enter the calibration load as **tn*** ***NOTE: The calibration load does not need to be entered prior to calibrating the scale.***
Material Factor	Adjusts the span value to correct for dynamic loading at the weigh frame; This value is computed during calibration and can be adjusted manually *Example of calculating the Material Factor is:* $\frac{\text{Desired}}{\text{Actual}}$ x Material Factor = Material Fac *Actual Tons = Real weight of material on the scale* *Registered Tons = Measured weight of material the 920i BCi totalizer displays*
Span Error%	The percentage of error calculated during the span calibration; The relation between the calculated span and the actual registered span
Zero Counts	Illustrates the raw dead load counts of a calibrated system; The value can be recorded and entered manually in the event of a complete integrator replacement
Zero Error%	Percentage of error calculated during the zero calibration; This is a direct relation between theoretical zero and actual zero with dead load on the load cells
Idler Spacing	Defines the spacing between the idlers and determines the weighing surface of the belt scale; Determine idler spacing; The value is entered into the integrator ***Idler Spacing*** parameter; Enter Value: Default = 48" ***NOTE: If the unit of measure is in feet, enter this value in inches.*** ***If the unit of measure is in meters, enter this value in meters.***

Table 3-1. Supervisor Mode Parameters

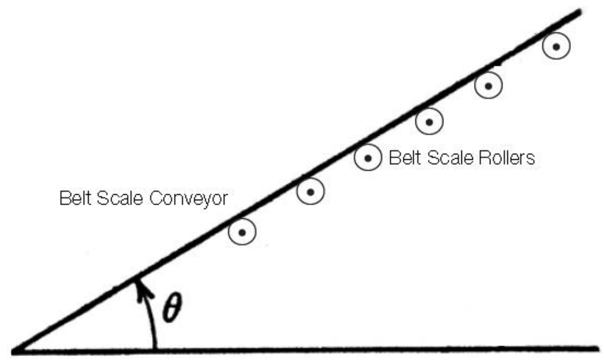
Parameter	Description
Number of Idlers	Defines the number of scale idlers used in the system; Enter the number of scale idlers; Default = 1
Belt Test Revolutions	Defines the number of conveyor belt revolutions made after the belt speed calibration is done; enter the number of full belt revolutions for the deadload and span calibrations; Default = 1 • Deadload, or zero calibration runs for a pre-determined amount of time during which the belt runs with no weight on it • Span calibration runs for the same amount of time with a known weight applied to the scale
Pulses per Revolution	Number of pulses recorded for a complete revolution of the belt; The value can be recorded and entered manually in the event of a complete integrator replacement; Default = 3600
Belt Length	Total length of the conveyor belt; The value can be recorded and entered manually in the event of a complete integrator replacement; To measure the belt length, spray a paint marking on the belt; Measure down to the other end and multiply by two for the total belt length; Enter total belt length; Default = 600
Belt Angle	Angle of the conveyor measured in degrees; This should be used when using the integrator with weigh frames containing only one or two load cells 
Pulses Per Unit Measure	Number of pulses the integrator needs to count for the belt to move one unit of measure; The integrator calculates this during a speed calibration; Default = 6.0
Test Duration	Time, in seconds, for a timed calibration; Based on the length of time it takes for a complete revolution, multiply by three for the duration time; Enter the desired length of time to run the calibration; Default = 60 seconds ***NOTE: Per Handbook 44, the requirement is to test at least three revolutions of the belt.***
Tons Per Pulse	Number totalizer units accumulated to generate a pulse output for a remote totalizer; It sends a pulse from the digital output bit defined by the Totalizer Pulse Bit setting; Enter Value: Default = 0.1
Pulse Duty Cycle (in seconds)	Defines how long Tons Per Pulse stays on; Required for older model PLC's for the pulse to be recognized; Enter Value: Default = 0.25 seconds
Low Rate Alarm Value (%)	Determines the point at which the low rate alarm becomes active; Default = 0
Maximum Speed Value	The value needed to determine an over speed condition; Default = 300
Low Rate Alarm Bit	Defines which digital output bit activates for the low rate alarm, which is determined by the Low Rate setting; Default = 0
High Rate Alarm Bit	Defines which digital output bit activates for the high rate alarm, which is determined by the Scale Capacity settings; Default = 0
Speed Alarm Bit	Defines which digital output bit activates for the high speed alarm, which is determined by the Maximum settings; Default = 0 ***NOTE: When an alarm bit is set to 0, the alarm becomes disabled.***
Load Cell Alarm Bit	The system monitors the load cell mV/V signal; If the signal drops below -0.5mV/V or above 4.5mV/V ***LOAD CELL ALARM*** is displayed and the associated Load Cell Bit Alarm is turned on
Totalizer Pulse Bit	Defines the digital output bit for the totalizer pulse output; Default = 2
Fill Output Bit	Defines the digital output bit used for the fill output; Default = 1
Remote Print Input Bit	Defines which digital input bit works the same as the **Print** key on the front of the integrator; Default = 4 ***NOTE: There are six onboard I/O bits. Depending on their use, they may need to be reconfigured to OUTPUT or PROGIN.*** • To use as a remote button supported by the integrator software, set to PROGIN • To use as one of the alarm bits, set to OUTPUT
Print Output Port	Defines which serial port the print format is sent from; Default = 0 ***NOTE: Port 3 should not be used for a streaming port.***
Print Format	Defines the format of the printed output when the **Print** key is pressed, or a ***KPRINT EDP*** command is received (Section 3.2.1 on page 26)

Table 3-1. Supervisor Mode Parameters (Continued)

Parameter	Description
Stream Output Port	Defines which serial port the stream format is sent from; The integrator only streams if this is set to a valid port with a value greater than zero; Default =0 ***NOTE: Port 3 should not be used for a streaming port.***
Stream Format	Defines the format of the stream or continuous serial output; the format is made up of the same tokens as the print format and other characters; Enter Characters: Default = **<R><NL>** ***NOTE: The default stream continuously outputs the rate value only.***
Clear Totalizer with Print	Toggle to select ***Yes*** or ***No***
Remote Totalizer Reset Input	Defines a digital input bit used to reset the reset totalizer; Affects only the reset totalizer and not the master totalizer; The master totalizer can only be reset through the ***Supervisor*** menu; Default = 0
Integrator Identification	The integrator ID is an alpha-numeric string up to 8 characters; This can be used for printing or streaming information using the token **<UID>**
Preact Length	Used to dynamically adjust the target value based on the rate of the belt scale; Enter the distance from the feed gate to the midpoint of the weigh idler and the first dual idler; Enter the preact length in feet and press the **Enter** key to save
Enable Batching	Set to ***On*** to enable batching; When enabled, the system can control gates for filling applications; When enabled, ***Start Fill*** and ***Target Settings*** softkeys are displayed; Default = ***Off***
Analog 1 Mode	Defines tracking for optional analog output one; Settings: • ***Rate*** - Tracks to the maximum rated capacity of the belt scale (Scale Capacity on page 24) • ***Load*** - Tracks to the maximum total cell build of the system (Total Load Cell Build on page 24) • ***Speed*** - Tracks to the maximum speed value (Maximum on page 25)
Analog 2 Mode	Defines tracking for optional analog output one; Settings • ***Rate*** - Tracks to the maximum rated capacity of the belt scale (Scale Capacity on page 24) • ***Load*** - Tracks to the maximum total cell build of the system (Total Load Cell Build on page 24) • ***Speed*** - Tracks to the maximum speed value (Maximum on page 25)
Input Source	Settings: **Fieldbus** (default), Internal; When Fieldbus is enabled, see Section 6.0 on page 37

Table 3-1. Supervisor Mode Parameters (Continued)

3.2.1 Print Format

The print format is made up of tokens and other characters. Tokens are enclosed in less than (<) and greater than (>) signs, and during the printing process, are replaced with the value they represent. Characters not defined as tokens are printed as they are. To edit, press enter, edit the format, then press enter again to save.

Token	Description	Token	Description
<G>	Gross weight	<S>	Speed with units
<N>	Net weight	<L>	Load with units
<T>	Tare weight	<RT>	Reset totalizer
<A>	Analog output	<MT>	Master totalizer
<SP>	Space	<UID>	Integrator identification
<UL>	Scale units string	<RTU>	Reset totalizer units
<CN>	Consecutive number	<MTU>	Master totalizer units
<SN>	Scale number tag	<NL>	New line
<R>	Rate with units	<TI>	Time

Table 3-2. Available Print Tokens

The default printer format is:

TIME: <TI><NL>DATE: <DA><NL>MASTER TOTAL: <MT><NL>RESET TOTAL: <RT><NL>RATE: <R><NL>

The following is an example of the default printer format:

TIME: 03:07PM
DATE: 06/27/2013
MASTER TOTAL: 75.6
RESET TOTAL: 72.1
RATE: 143.5 tn/hr

3.3 Interfacing a PLC to the Belt Scale System

Setpoints can be read or written from a PLC. The command to write the value is 30,4 and the command to read the value is 320. Only the value variables in each setpoint are used.

The following setpoints contain the values from the variable needed in the belt scale.

Setpoint Value	Access Type	Description
SP4	Read/Write	Clear totalizer when set to a non-zero value
SP88	Read Only	When set to Use Percentage of Ingredient, calculates a percent of the Local flow-rate (Table 6-1 on page 38)
SP89	Read/Write	Set the PID flow target
SP90	Read Only	Input bits
SP91	Read Only	Output bits
SP95	Read Only	PID setpoint
SP96	Read Only	Analog value
SP97	Read Only	Return belt speed
SP98	Read Only	Return TN/HR (rate)
SP99	Read Only	Return load
SP100	Read Only	Return totalizer value

Table 3-3. Setpoint Values

Setting Setpoint #4 to a 1 Resets Totalizer

Output word #1 = 304 (Command word)

Output word #2 = 4 (Setpoint number)

Output word #3 = 16256 (MSW)

Output word #4 = 0 (LSW)

The BCI automatically resets this setpoint value to **0** after the totalizer value is reset.

Reading Load Setpoint Value

Values sent to the 920i from the PLC:

Output word #1 = 320 (Command word)

Output word #2 = 99 (Setpoint number)

Output word #3 = 0 (MSW)

Output word #4 = 0 (LSW)

Values returned to the PLC from the 920i containing the Load value = 800.5:

Input word #1 = 320 (Command word Returned)

Input word #2 = 777 (Status)

Input word #3 = 17480 (MSW)

Input word #4 = 8192 (LSW)

When a value is read it is returned in two integers that represent the float value.

The PLC needs to combine MSW and LSW integer values back into a float value.

The SLC500 uses the copy command to copy the MSW and LSW into a Float value. Only the MSW is used, the copy command knows it needs to use the next integer to make up the float.

If monitoring input bits on slot zero using setpoint 90, Table 3-4 indicates the value return for each bit.

Input Bits	Value
#1	1
#2	2
#3	4
#4	8
#5	16
#6	32

Table 3-4. Slot 0 Input Map

If monitoring output bits on slot zero using setpoint 91, Table 3-5 indicates the value return for each bit.

Output Bits	Value
#1	1
#2	2
#3	4
#4	8
#5	16
#6	32

Table 3-5. Slot 0 Output Map

3.4 Special Serial Commands

In addition to the integrator's standard EDP command set (920i Installation Manual, PN 67887), there are seven special commands specific to the belt scale functions.

Command	Function
F#1=MT	Master total
F#1=BT	Batch total
F#1=BR	Batch total reset
F#1=TPH	Tons per hour
F#1=UID	Integrator ID
F#1=RT	Set totalizer
F#1=BA	Batch status (1=running, 2=stopped, 3=not running)
F#1=STA	Start batch
F#1=STP	Stop batch
F#1=ABT	Abort batch
F#1=CT	Return target
F#1=CB	Current batched amount
F#1=TGxxxx	Edit target, xxxx = Target Flow

Table 3-6. Key Press Serial Commands

4.0 Calibration

The speed sensor and integrator components of the 920i Integrator In-Motion Belt Scale System must be calibrated for the system to work.

NOTE: The speed sensor calibration must be done prior to the integrator calibration.

4.1 Speed Sensor Calibration

A belt conveyor scale must be equipped with a belt speed or travel sensor that accurately senses the belt speed or travel sensor when the belt is empty or loaded.

Use the following steps to calibrate the speed sensor.

1. Press **Belt Calibration** softkey from the ***Supervisor*** menu. The integrator displays softkeys **Start**, **Finish** and **Exit**.
2. Mark a reference point on the conveyor belt and on the conveyor frame. This gives the operator a reference to count the number of revolutions the belt travels during the speed calibration. The more revolutions in a test, the better the speed and distance accuracy.
3. Press **Start** softkey. The integrator displays the number of pulses counted, the frequency of the pulses and the time the test is running.

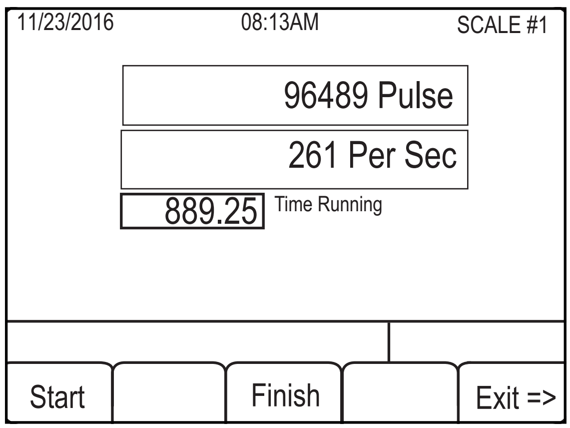


Figure 4-1. Pulses Counted

The display illustrates how the belt works. If the pulses and frequency don't change, the speed sensor wiring or sensor is bad. The operator must count the number of belt revolutions during this portion of the calibration procedure.

4. Press **Finish** softkey to end the speed sensor calibration. The integrator prompts user to enter the number of belt revolutions.
5. Enter the number of times the belt traveled past the reference point.

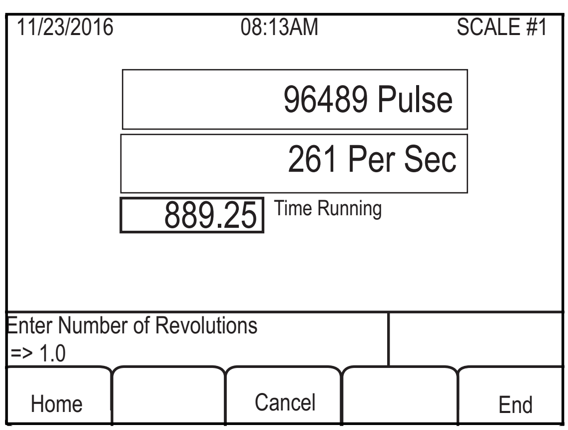


Figure 4-2. Enter Number of Revolutions

The integrator calculates the pulses per unit of measure. This is used for displaying the speed of the belt and totalizing the weight during operation. The number of belt revolutions and the test duration are also stored. These values are used for auto calibration when the integrator is calibrated to the load cell.

4.2 Calibration

There are three modes of integrator calibration:

- Zero cal
- Material cal
- Auto cal

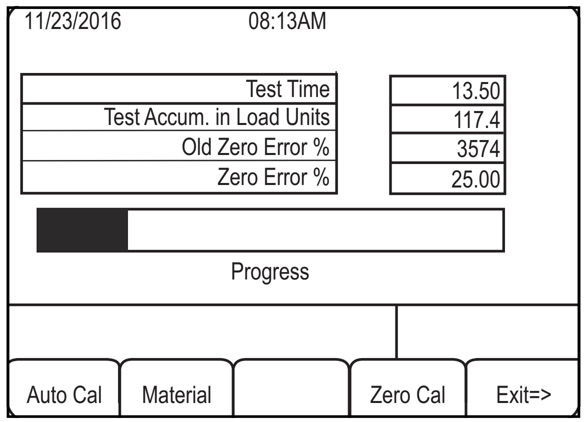


Figure 4-3. Calibration Method Softkeys

Zero Cal Calibration Mode

This mode calibrates the integrator based on a zero test. A zero calibration is based on the number of belt revolutions as established during the belt speed sensor calibration.

Use the following steps to perform a Zero Cal calibration.

1. Ensure there is no material on the belt.
2. Press the **Zero** key on the integrator. The previous zero information and the ***Zero Scale*** menu displays.
3. Press the **Start** key. The Zero Cal test runs. When the test is complete the new ***Zero % Error*** displays.
4. Press the **Yes** softkey to accept the value or the **No** softkey to reject the new zero value.

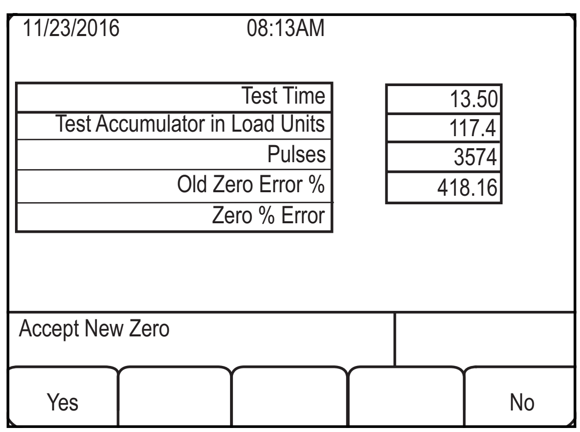


Figure 4-4. Zero Percentage Error Display

4.2.1 Auto Cal Mode

The integrator calibrates the span using the number of calibration revolutions as the reference for the calibration duration in the Auto Cal mode. Span calibrations are based on belt length defined by the number of revolutions and use either static weights or test chains. Use the following steps to perform an auto calibration.

1. Press **Auto Cal** softkey. The integrator displays the **Test Weights**, **Test Chain** and **Exit** softkeys.
2. Press either the **Test Weights** softkey or the **Test Chain** softkey depending on the span calibration method used.

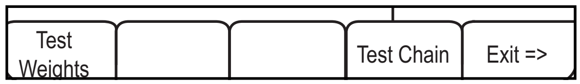


Figure 4-5. Zero Percentage Error Display

3. Load the scale with weights or chains.
4. Press the **Start** softkey to initiate the calibration sequence. After the integrator has run the span calibration, the ***Span Error%*** displays.

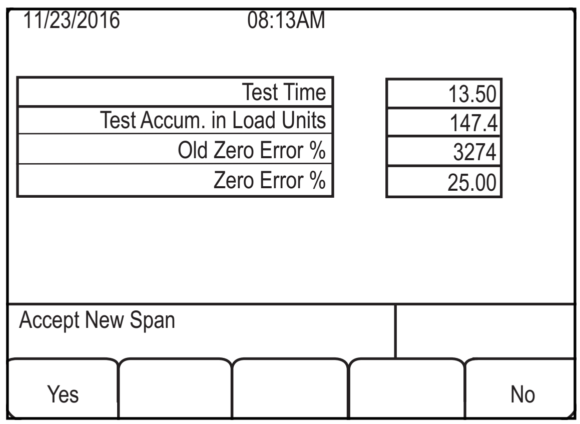


Figure 4-6. Percentage of Span Error Display

5. Press the **Yes** softkey to accept the value or the **No** softkey to reject (no change made to the span value).

NOTE: The zero and span cal can be stopped by pressing the Finish softkey and restarted by pressing the Start softkey. Press the Exit=> softkey to abort the process.

4.2.2 Material Calibration Mode

Use the material calibration mode to calibrate the scale with a known amount of material. The material must be pre-weighed, or weighed upon completion of the material calibration, on a reference scale.

Use the following steps to perform a material calibration.

1. Press the **Material** softkey. The **Span Cal** and **Exit =>** softkeys display.
2. Press the **Span Cal** softkey to initiate the calibration sequence. This is similar to the zero cal, however material is passed over the scale during the calibration test.
3. Press **Start**. The integrator begins taking span averages.
4. Press the **Finish** softkey to end the sequence. The integrator prompts for the amount of material in tons.
5. The operator may key in the new value and press enter or press CLR to exit with no changes.
6. The process can be aborted by pressing the **Exit =>** softkey.

4.3 System Calibration

There are two additional tests used in conjunction with calibrating the complete system.

- Material testing – used only with the material calibration
- Maintenance testing – used only with the auto calibration

4.3.1 Material Testing

Material testing is the only known way to establish repeatability and traceable accuracy of a conveyor belt scale system. Three or more successive material tests are required to achieve acceptance accuracy and demonstrate repeatability of the belt scale system. One or more methods of simulated testing is done to ensure accuracy once the material test is complete. Material tests should be done at least every six months and immediately following conveyor maintenance that may affect the scale.

Material testing consists of passing material previously weighed or material to be weighed over the belt conveyor scale. Ensure all material is weighed both on the reference scale and on the belt conveyor scale. The two weights are then compared, the differences figured and the error percentage is computed.

Use the following steps to perform a material test.

1. Check the reference scale (track scale, truck scale, dumper scale, hopper scale, etc.) to determine it is in compliance with the applicable regulatory agency or Handbook 44. The reference scale must not leak or be overloaded to the point where material is lost. According to Handbook 44 instructions the test shall not be less than 1000 scale divisions and must run at least three revolutions of the belt scale and at least 30 minutes or more. Below 41°F, the belt should be run longer.
2. Run the belt empty to warm up the belt. A reading is then taken from the integrator.
3. The belt is run for a period of time equal to the required time to deliver the minimum totalized load, (approximately 10 minutes) and the reading is taken again. The two readings should not vary more than ± increment of the scale. If the reading varies more, the zero must be adjusted. This process is repeated until an acceptable zero condition is achieved.
4. After taking the integrator reading, material is introduced onto the belt scale and the rate of flow must be carefully watched to rise more than 35% of the rated capacity. The ideal operating and weighing range is 50 to 85% of the rated capacity. In general, if the time the scale is operated under 35% of rated capacity after the infeed is opened and closed and doesn't exceed 10% of the running time, acceptable weighing is present.
5. After the weighing is complete, the belt should be running and empty. Do not stop the belt.
6. The reading is taken from the master totalizer again. The start value is subtracted from the stop value, which gives the tons (or pounds) weighed. This value is compared with the printer. The printer may show ± increment difference.
7. Compute the percent error. If the belt conveyor scale is out of tolerance, adjust the span by the computed error. Repeat Step 3 through Step 5. If the scale is in tolerance, the accuracy is established. Proceed to Step 8. If not, compute the error and adjust the belt conveyor span again. If the accuracy tolerance cannot be obtained, determine the problem before proceeding.
8. Conduct a final material test following Step 3 through Step 5 (do not adjust the span). If the belt scale is in tolerance, its repeatability is established.

NOTE: On the initial verification, two additional material tests are required, a total of three, to establish repeatability.

There are advantages and disadvantages to material testing.

Advantages of Material Testing	Disadvantages of Material Testing
Only method to establish traceable conveyor scale accuracy	Requires the availability of an accurate static scale
Permits testing at several feed rates to test linearity	Requires accumulation, transportation to static scales and static weighing of the test load material
Tests the entire system; electronics, scale carriage and the conveyor effects	

Table 4-1. Advantages and Disadvantages to Material Testing

4.3.2 Simulated Testing

A simulated load test of at least three consecutive test runs should be conducted within 12 hours of completion of the material test, to establish the factor relating the results of the simulated load test to the results of the material tests. The results of the simulated load test should repeat within 0.1%.

There are two methods of simulated load testing.

- Roller test chains
- Static test weights

There are advantages and disadvantages to each of the simulated testing methods.

Roller Chain – Simulated Testing Type

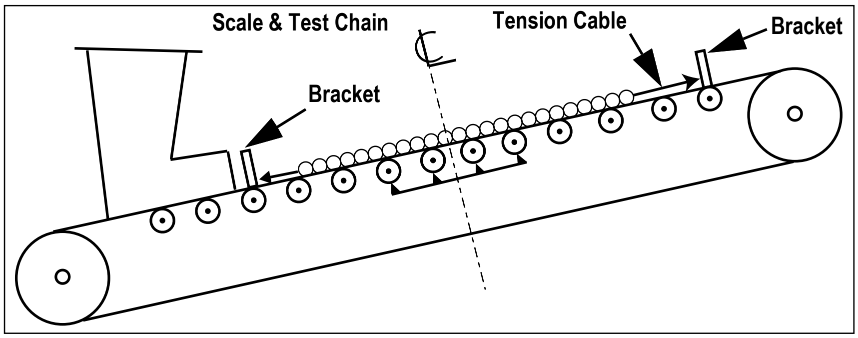


Figure 4-7. Roller Chain – Simulated Testing Type

Advantages	Disadvantages
Simulates some conveyor belt effects	Chains do not provide a traceable conveyor scale calibration standard
Acceptable simulated test	Heavy chains are difficult to handle
	Conveyor belt must be stopped to apply and remove
	Linearity test requires several chains
	Chains are costly

Table 4-2. Advantages and Disadvantages of Simulated Testing Types

Static – Simulated Testing Type

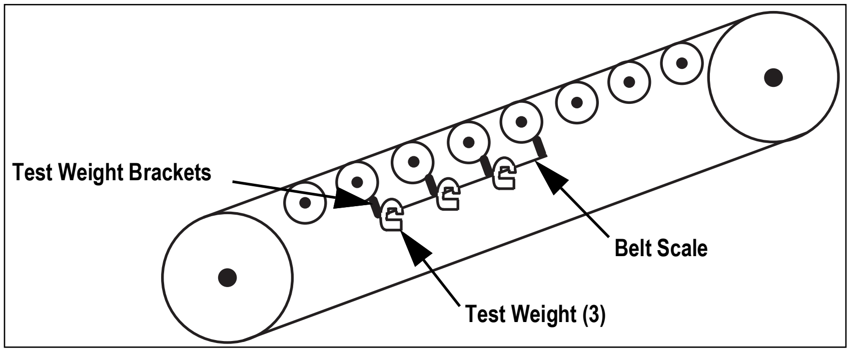


Figure 4-8. Static – Simulated Testing Type

Advantages	Disadvantages
Easy to apply	Weights do not provide a traceable conveyor scale calibration standard
Conveyor belt does not have to be stopped to apply	Does not simulate conveyor belt effects
Linearity test is easy to perform	
Detect load cell failures and applies force to the load cell	
Acceptable simulated test	

Table 4-3. Advantages and Disadvantages of Simulated Testing Types

4.3.3 Maintenance Testing

A belt scale should be tested weekly using one of the simulated testing devices, like test chains or test weights. Testing should be conducted at periodic maintenance intervals, between the material tests, to ensure the scale is performing correctly. Records of these tests should be kept in compliance with the applicable regulatory agency. Perform the following steps when doing maintenance testing.

1. Visually inspect the equipment to insure it is in good mechanical condition.

   Example: Scale area is clean, no obstructions, the idlers turn, the bearings are sound, etc.

2. Zero test the scale system (Section 4.2 on page 30). Adjust zero until within the tolerance of the applicable regulatory agency. An idle belt should run 30 minutes or more depending on the temperature prior to performing the zero test.
3. Span test the scale system (Section 4.2.1 on page 31), using the selected simulated test device. Adjust the span until within the tolerance of the applicable regulatory agency. Perform three to five repeatability tests. The scale should repeat to the given tolerance.
4. Remove the simulated testing device and check zero. The system is now ready for normal operation.

NOTE: If a convenient material test method is available, the simulated test need not be performed. The material test is then performed on a weekly basis. Test results should be kept in compliance with the applicable regulatory agency.

5.0 Run Sequence

Once configuration of the supervisor mode parameters are entered, the integrator is ready for daily operation.

The following sections give an overview of how to use the integrator during a normal work shift.

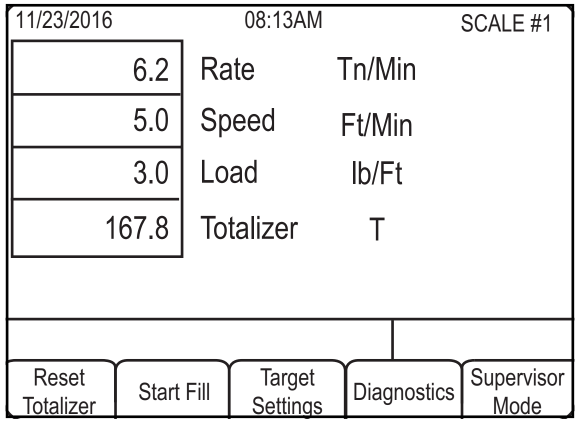


Figure 5-1. Integrator Main Menu

Additional softkeys used to run the integrator:

- Reset totalizer
- Start fill
- Target settings
- Diagnostics

5.1 Reset Totalizer

Resetting the totalizer clears the totalizer of all data. Press the **Reset Totalizer** softkey. ***Clear Totalizer?*** displays.

- Press **Yes** to clear the information; ***Totalizer has been reset*** displays
- Press **No** to keep the entered information

5.2 Start Fill

The **Start Fill** softkey starts the fill process and turns on the digital output until the target preact is met. Once the target preact is met, ***Stop Fill*** displays and the digital output is turned off.

- Press **Re-Start** to resume the fill process
- Press **Abort** to halt the filling process and return the integrator to normal operation

5.3 Target Settings

The target settings parameter allows the operator to change the target value of the fill and the fixed preact value.

1. Press the **Target Settings** softkey. The ***Target Setting*** menu displays.
2. Press the **Target** softkey and enter a new target value.
3. Press **Enter** to save.

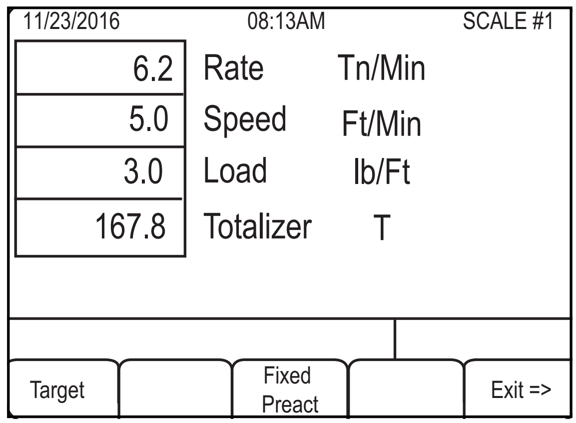


Figure 5-2. Target Setting Menu

4. Press the **Fixed Preact** softkey and enter the preact value in tons.
5. Press **Enter** to save the value.

NOTE: Changing the fixed preact value is not of use if the preact length is set in Configuration mode.

5.4 Diagnostics

Diagnostics examines the following parameters to ensure the outputs are working properly.

1. Press the **Diagnostics** softkey to display the ***Diagnostics*** menu.
2. Press the **Exit** softkey to exit the ***Diagnostics*** menu.

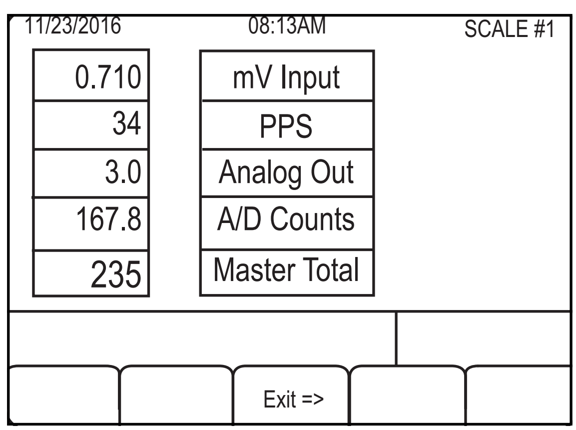


Figure 5-3. Diagnostics Menu

6.0 PID Controller

The basic function of a PID controller is to compare a continuously measured actual value with a target value and to adjust a command variable if a deviation is detected. The target value is the flow rate (weight / time). The command variable, adjusted by the PID controller, is the output signal that serves to control the frequency inverter of the AC drive, and thus the speed of the screw feeder or any other feeding device.

The PID controller compares the measured flow rate (kg/h) with the target value. If the measured value is lower than the nominal value, the controller increases the number of revolutions of the screw feeder via the frequency inverter. If the flow is too high, the number of revolutions is reduced accordingly.

6.1 Components of the PID Controller

6.1.1 Proportional Component P

The proportional component adjusts the control variable, for example of a screw feeder, proportionally to the deviation.
Deviation: *Dev = Actual -- Target*

The proportional gain **k** of the command variable is determined by: *k = P component * Dev*

Therefore, the P controller, without I and D component, does not adjust the control variable anymore if the deviation is zero.

On the other hand, a constant error always leads to the same adjustment, which in practice shows the result that the control variable is not changed anymore. The P controller adjusts itself to a constant value that, as a general rule, does not necessarily represent the target.

Essentially, the P controller reacts to changes of the deviation only. Depending on the value of the P component, that effect can be moderate or aggressive. If the P component is too big, the controller starts oscillating.

6.1.2 Integral Component I

The integral component takes previous deviations into consideration for the adjustment of the control variable.

The gain **k** of the command variable is determined by the integral component: *k = I Component * TotalDEV*

6.1.3 Derivative Component D

The derivative component provides reaction to the change of the deviation. It enhances the effect of the proportional component when greater deviations are experienced. For small deviations the effect of the P component is reduced.

The derivative component can be used to dampen and stabilize the controller.

The gain k of the command variable is determined by the derivative component: *k = D Component * (Dev - Devprevious)*

6.1.4 The PID Controller

The overall effect of the controller is the total of the individual components, proportional, integral and derivative.

The gain **k** of the command variable is determined by: *k = P Component + I Component + D Component*

If one of the values is set to zero, the respective component is not used.

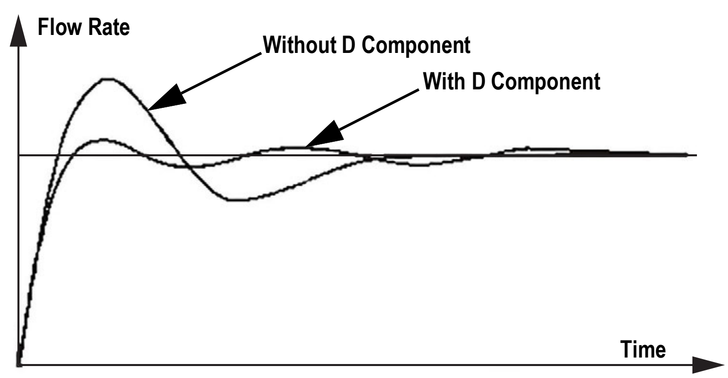


Figure 6-1. Damping of a Controller with Strong P Component by Adding a D Component

To provide a convenient method for the tuning of the PID controller during installation and commissioning, ***LOSS IN WEIGHT E*** offers the option to set the values for P, I and D components while feeding. This makes it possible to immediately see the effects of a change and to quickly reverse it, if required.

6.2 Start-up Tips

If a system is installed for which comparable data are not available, the parameters must be determined by testing or experience. To start:

1. Set the controller up with P-component only and the I and D components set to zero. Set the P component to a small value and monitor the flow rate and frequency of the inverter.
2. If the controller starts to oscillate (deviations in opposite directions are slowly reduced or get even bigger):
   - Reduce the P component
   - Gradually add a D component
3. Carefully adjust P and D components to find a setting in which the controller quickly reacts to deviations without starting to oscillate.
4. Slowly increase the I-component until the actual flow matches the target.

6.3 PID Settings

Parameter	Description
PID Mode	Enable or disable PID functionality; the setting ***Analog 1 Mode*** in the ***Supervisor*** menu determines the operation for Flow or Load; Settings: On, Off
Proportional	Uses the current error between setpoint and process value to calculate the correction of the regulating output; The bigger this value is, the greater the corrections to the regulating output; Number with decimals typically between 1.00 and 0.01
Integral	Uses the error over time between setpoint and process value to calculate the correction of the regulating output; The bigger this value is, the greater the corrections to the regulating output; Number with decimals typically between 1.00 and 0.01
Derivative	Uses the last error between setpoint and process value to calculate the correction of the regulating output; The bigger this value is, the greater the corrections to the regulating output; Number with decimals typically between 1.00 and 0.01
Target Input Damping	The amount of time damping the setpoint for the PID; Enter Value: 0.00-10.00
PEIC Delay	The amount of time to hold the regulating output in order for the response to be measured; Number with decimals (typically between 10.00 and 0.00) *Example: If the in-feed is some distance before the scale, the output regulation change takes a period of time before the scale will measure the resulting difference of the change.*
Maximum	Limits the regulation output to this percentage; Enter Value: 0.00-100.00%
Input Method	Used for Local/Remote configurations with ***Use Percent of Ingredient***; Settings: Manual, Fieldbus, Serial, Analog Input
Use Percent of Ingredient	In a Local/Remote configuration the percent of Ingredient is used to have the PID setpoint calculated as a percent of Local flow-rate; Settings: On, Off, Ext; Use Ext if using SP88 (Table 3-3 on page 27)
Reverse Operation	Reverses the operation of the regulating output; This is used to increase the belt load by lowering the belt speed; The calculation is 100 – calculated regulation = regulation output; To maintain a minimal output value, the **1.7. Maximum** should be used; Settings: On, Off
Target Over Tolerance Percent	An alarm is triggered if the error exceeds this value; Enter Value: 0.00 - 100.00%
Target Under Tolerance Percent	An alarm is triggered if the error exceeds this value; Enter Value: 0.00 - 100.00%
Running Output Bit	Set this output if the PID is active; Enter Value: 1-6
Over Tolerance Output Bit	Set this output if the ***Over Tolerance*** alarm is triggered; Enter Value: 1-6
Under Tolerance Output Bit	Set this output if the ***Under Tolerance*** alarm is triggered; Enter Value: 1-6
Local/Remote Input Bit	The input is used to switch between manual and remote setpoint operation, if this value is set higher than 0; Enter Value: 1-6

Table 6-1. PID Parameters

6.4 PID Display

The ***PID*** menu displays by pressing the **Units** key while the ***PID Mode*** is set to on.

This menu displays the relevant information for the PID operation.

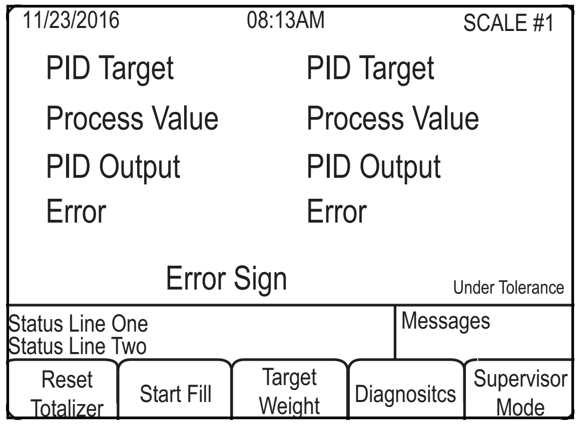


Figure 6-2. PID Main Menu

Prompt	Description
PID Target	Setpoint for the PID regulation
Process Value	Input for the PID, flow rate or belt load
PID output	Value calculated by the PID regulation and sent to the analog output or is available in the setpoint 96 register
Error	Difference between setpoint and process value
Error Sign	Visual representation of the error; Set by the ***Under Tolerance*** and ***Over Tolerance*** limits
Source	Indicates the source of the PID setpoint if the ***Local/Remote Input*** bit is used
Under Tolerance/Over Tolerance	Visual representation of the tolerance alarm

Table 6-2. PID Main Menu Prompts

6.5 Operation

The PID setpoint is set by pressing the **Target Weight** softkey, if the input method is set to manual.

If the input method is set to ***Fieldbus***, ***Serial*** or ***Analog*** input and ***Use Percent of Ingredient*** is set to ***On***, the percent of the local flow rate is set by pressing the **Target Weight** softkey.

The PID operation is started by pressing the **Start Fill** softkey or by **Remote Start Input Bit**.

Once started, stop the operation by pressing the **Stop Fill** softkey or by removing the **Remote Start Input Bit**.

7.0 Maintenance

The maintenance information in this manual is designed to cover aspects of maintaining and troubleshooting the 920i Integrator. Should a problem require technical assistance, contact Rice Lake Weighing Systems.

NOTE: Have the scale model number and serial number available when calling for assistance.

7.1 Maintenance Checkpoints

The scale should be checked frequently to determine when a calibration is required. It is recommended a zero calibration be checked every other day and a calibration checked every week for several months after installation. Observe the results and lengthen the period between calibration checks, depending upon the accuracy desired.

Establish a routine inspection procedure including not only the belt conveyor scale itself but the entire material handling system. Note any changes in the scale function and report them to the individual or department responsible for the scales' performance.

Belt Scale Maintenance Checklist						
Item	**Daily**	**Weekly**	**Monthly**	**Quarterly**	**Annually**	**Description**
Zero Calibration	x					Perform zero calibration procedure; If change is greater than .25%, identify cause and correct; Record results
Span Calibration		x				Perform auto span simulated load tests; Check repeatability and record results
Zero Reference Number				x		Compare zero number with reference an maximum change is 2%per year
Audit Trail				x		Review scale history
Line Voltage				x		Measure hot and neutral, hot to ground, neutral to ground; correct as necessary
Alignment					X	Complete per manual
Excitation					x	Verify value and stability
I/O					x	Check and verify performance of all I/O being used
Dead Band					x	Confirm settings and adjust as necessary
Auto Zero Track Limit					x	Record data
Auto Zero Track Correction					x	Record data
Passwords					x	Confirm and revise if required
Wire Terminations					x	Inspect for tightness and corrosion
Cable Integrity					x	Visual and ohm check (corrosion, moisture, deterioration)

Table 7-1. Maintenance Checklist

7.2 Belt Scale Troubleshooting Tips

The following sections cover basic troubleshooting tips for the belt scale. If the integrator in-motion belt scale fails to operate properly during or after performing set up and calibration, it is recommended to perform the procedure again and, if the problem still persists, follow the troubleshooting procedures listed in the following sections.

7.2.1 Calibration Shifts

Frequent calibration shifts should be isolated to zero shifts or span shifts.

7.2.2 Zero Calibration Shifts

Zero calibration shifts are normally associated with the conveying system. When a zero shift occurs, the span shifts by a like number of TPH, this then appears as a span shift.

Common causes of zero shifts:

- Material buildup on the carriage/weighbridge assembly
- Rocks lodged in the carriage/weighbridge
- Conveyor belt tracking
- Non-uniform conveyor training
- Conveyor belt belting stretch due to material temperature variations
- Trouble in the electronic measuring components
- Severely overloaded load cell

7.2.3 Span Calibration Shifts

Span calibration shifts are normally associated with the electronic measuring of components of the system, with one exception, which is the conveyor belt tension. A span shift is present if both points change by the same percentage TPH.

Common cause of span calibration shifts:

- Change in conveyor belting tension
- Speed sensor roll build-up and/or slipping
- Conveyor scale alignment
- Severely overloaded load cell
- Trouble in electronic measuring components

7.2.4 Field Wiring

If a problem with the belt scale wiring is suspected, check the electrical portion of the scale.

- Check for proper interconnections between the components of the system; All the wiring must be as specified on the installation drawings
- Check all wiring and connections for continuity, shorts and grounds using an ohmmeter
- Loose connections, poor solder joints, shorted or broken wires and unspecified grounds in wiring cause erratic readings and shifts in weight readings
- Check all cable shields to ensure grounding is made at only the locations specified in the installation drawings

7.3 Troubleshooting Tips

The following table lists general troubleshooting tips for hardware and software error conditions

Symptom	Possible Cause	Remedy
Integrator does not power up	Blown fuse or bad power supply	Check fuses and replace if necessary; If fuses are good, check all voltages on CPU board. Power supply should output both +6 V and –6 V levels to the CPU board; If power supply appears bad, check the small glass fuse (2.5A, 5x20 mm) on the power supply board
Front panel power integrator blinking (*i*)	Power supply overloaded	Check for shorts in A/D card regulators or in the DC-to-DC converter of installed analog output or pulse input cards
Blue screen	Contrast pot or Corrupt software	Check LCD contrast pot (under interface board access cover; reset or reload software
Error messages at startup: ***Tare and truck data pointers are corrupt***, ***Tare storage is corrupt***	Dead battery	Perform configuration reset then check for low battery warning on display; If battery is low, replace battery, perform another configuration reset, then reload files
Error message at startup: ***Divide by zero***	User program error	—
Dashes in weight display	Over or under range scale condition	Check scale; for out-of -range conditions in total scale display, check all scale inputs for positive weight values
Display reads: ***0.000000***	Scale not updating	Check for bad option card hanging the bus
Cannot enter setup mode	Bad switch	Test switch; Replace interface board if necessary
Serial port not responding	Configuration error	For command input, ensure port INPUT parameter is set to CMD
A/D scale out of range	Scale operation Load cell connection Bad load cell	Check source scale for proper mechanical operation; Check load cell and cable connection; Check integrator operation with load cell simulator
Locked — Scale in use	Scale assigned as an input to a total scale or is the source for a serial scale, analog output, or setpoint	If not correct, un-configure this scale assignment and reconfigure as required
Option x Error	Field bus card (Profibus, DeviceNet, or Remote I/O) in slot x failed to initialize	—
Option card failure	Possible defective card or slot	Disconnect power, install card in different slot, then apply power

Table 7-2. Basic Troubleshooting

7.4 Integrator Permanent Field Record

Keep this record to record maintanence performed on the BCi.

Conveyor Number ______________________________

Date ______________________________

Scale Capacity (Tons per Hour) ______________________________

Load Cell mv/v (Average) ______________________________

Total Load Cell Build = #4 x #7 ______________________________

Number of Weigh Idlers ______________________________

Number of Load Cells ______________________________

Idler Spacing ______________________________

Load Cell Capacity ______________________________

Conveyor Belt Length ______________________________

Pulses per Revolution ______________________________

Number of Test Revolutions ______________________________

Zero Counts ______________________________

Material Factor ______________________________

8.0 Compliance

EU DECLARATION OF CONFORMITY

EU-KONFORMITÄTSERKLÄRUNG
DÉCLARATION UE DE CONFORMITÉ

Rice Lake Weighing Systems
230 West Coleman Street
Rice Lake, Wisconsin 54868
United States of America

Type/Typ/Type: 820i and 920i series

English — We declare under our sole responsibility that the products to which this declaration refers to, is in conformity with the following standard(s) or other regulations document(s).

Deutsch — Wir erklären unter unserer alleinigen Verantwortung, dass die Produkte auf die sich diese Erklärung bezieht, den folgenden Normen und Regulierungsbestimmungen entsprechen.

Francais — Nous déclarons sous notre responsabilité que les produits auxquels se rapporte la présente déclartion, sont conformes à la/aux norme/s suivante ou au/aux document/s normatif/s suivant/s.

EU Directive	Certificates	Standards Used / Notified Body Involvement
2014/30/EU EMC	-	EN 61326-1:2013, EN 55011:2009+A1:2010, EN 61000-6-1:1995, EN 61000-6-2:2007
2014/35/EU LVD	-	IEC 60950-1 ed.2
2011/65/EU RoHS	-	EN 50581:2012

Signature: Richard Shipman

Place: Rice Lake, WI USA

Type Name: Richard Shipman

Date: May 3, 2019

Title: Quality Manager

UK DECLARATION OF CONFORMITY

UK
CA

Rice Lake Weighing Systems
230 West Coleman Street
Rice Lake, Wisconsin 54868
United States of America

RICE LAKE WEIGHING SYSTEMS

Type: 820i and 920i series

English We declare under our sole responsibility that the products to which this declaration refers to, is in conformity with the following standard(s) or other regulations document(s).

UK Regulations	Certificates	Standards Used / Approved Body Involvement
2016/1101 Low Voltage	-	IEC 60950-1 ed.2
2016/1091 EMC	-	EN 61326-1:2013, EN 55011:2009+A1:2010, EN 61000-6-1:1995, EN 61000-6-2:2007
2012/3032 RoHS	-	EN 50581:2012

Signature: Brandi Harder

Name: Brandi Harder

Title: Quality Manager

Place: Rice Lake, WI USA

Date: December 30, 2021

9.0 Specifications

Power

Line Voltages	115 or 230 VAC
Frequency	50 or 60 Hz
Power Consumption	
	115 VAC 400 mA (46 W) 230 VAC 250 mA (53 W)
Fusing	
115 VAC	2 x 2A TR5 sub-miniature fuses Wickmann Time-Lag 19374 Series UL Listed, CSA Certified and Approved
230 VAC	2 x 2A TR5 sub-miniature fuses Wickmann Time-Lag 19374 Series UL Recognized, Semko and VDE Approved

A/D Specifications

Excitation Voltage	10 ± 0.5 VDC, 32 x 700Ω load cells per A/D card
Sense Amplifier	Differential amplifier with 4- and 6-wire sensing
Analog Signal Input	
	Range 10 mV – 40 mV
Analog Signal	
	Sensitivity 0.3 µV/grad minimum @ 7.5 Hz 1.0 µV/grad typical @ 120 Hz 4.0 µV/grad typical @ 960 Hz
A/D Sample Rate	7.5–960 Hz, software selectable
Input Impedance	>35 M¾ typical
Internal Resolution	8,000,000 counts
Wt Display Resolution	9,999,999
Input Sensitivity	10 nV per internal count
System Linearity	±0.01% of full scale
Zero Stability	±150 nV/°C, maximum
Span Stability	± 3.5 ppm/°C, maximum
Input Voltage	
	Differential±800 nV referenced to earth ground
Input Overload	Load cell signal lines ±10 V continuous, ESD protected
RFI/EMI Protection	Communications, signal, excitation and sense lines protected

Digital Specifications

Microcomputer	Motorola ColdFire® MCF5307 main processor @ 90 MHz
Digital I/O	4 I/O channels on CPU board; optional 24-channel I/O expansion cards available
Digital Filter	Software selectable: 1–256, enhanced Rattletrap® hybrid digital filtering

Serial Communications

Serial Ports	4 ports on CPU board support up to 115200 bps; optional dual-channel serial expansion cards available
Port 1	Full duplex RS-232
Port 2	RS-232 with CTS/RTS; PS/2 keyboard interface via DB-9 connector
Port 3	Full duplex RS-232, 20 mA output
Port 4	Full duplex RS-232, 2-wire RS-485, 20 mA output

Operator Interface

Display	320 x 240 pixel VGA LCD display module with adjustable contrast, 75 Hz scan rate 26000 CD/m^2 brightness
Keyboard	27-key membrane panel, PS/2 port for external keyboard connection

Environmental

Operating Temperature	
	Legal -10 – 40°C (14 – 104°F) Industrial -10 – 40°C (14 – 104°F)
Storage Temperature	-10 – 70°C (14 – 158°F)
Humidity	0 – 95% relative humidity

Enclosure

Enclosure Dimensions	
Universal Enclosure (without tilt stand)	10.56" x 8.51" x 4.61" 268 mm x 216 mm x 117 mm
Deep Enclosure (without tilt stand)	10.76" x 8.51" x 5.25" 273 mm x 216 mm x 133 mm
Panel Mount Enclosure	11.5" x 9.1" x 5" 292 mm x 231 mm x 127 mm
Wall Mount Enclosure	14" x 18" x 6.75" 356 mm x 457 mm x 171 mm
Weight	
Universal Enclosure	9.5 lb (4.3 Kg)
Deep Enclosure	10.75 lb (4.9 Kg)
Panel Mount Enclosure	8.5 lb (3.9 Kg)
Wall Mount Enclosure	23 lb (10.4 Kg)
Rating/Material	NEMA Type 4X/IP66, stainless steel

Certifications and Approvals

c UL us LISTED

Universal Model
File Number: E151461

c UR us

Panel Mount Model
File Number: E151461, Vol 2

c UL us LISTED

Wall Mount Model
UL 508A control panel approved
File Number: E207758

UK CA

CE

RICE LAKE WEIGHING SYSTEMS

230 W. Coleman St. • Rice Lake, WI 54868 • USA USA: 800-472-6703 • International: +1-715-234-9171