HI 1756-FC

Feeder Control Module

User's Guide

Hardy Process Solutions Part Number: 0596-0318-01 Rev C
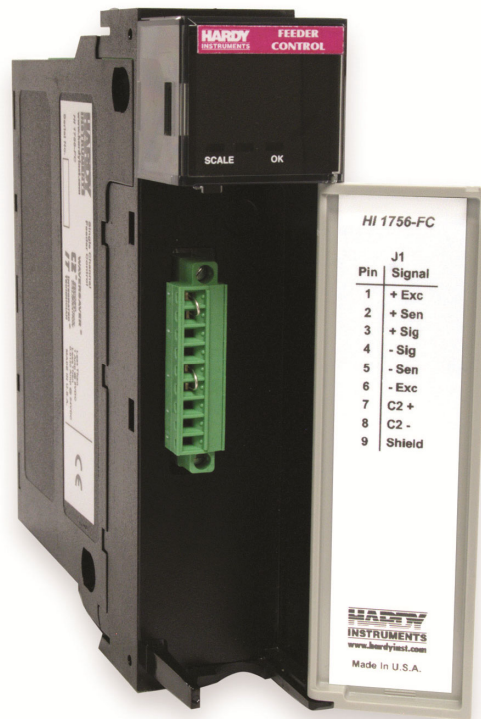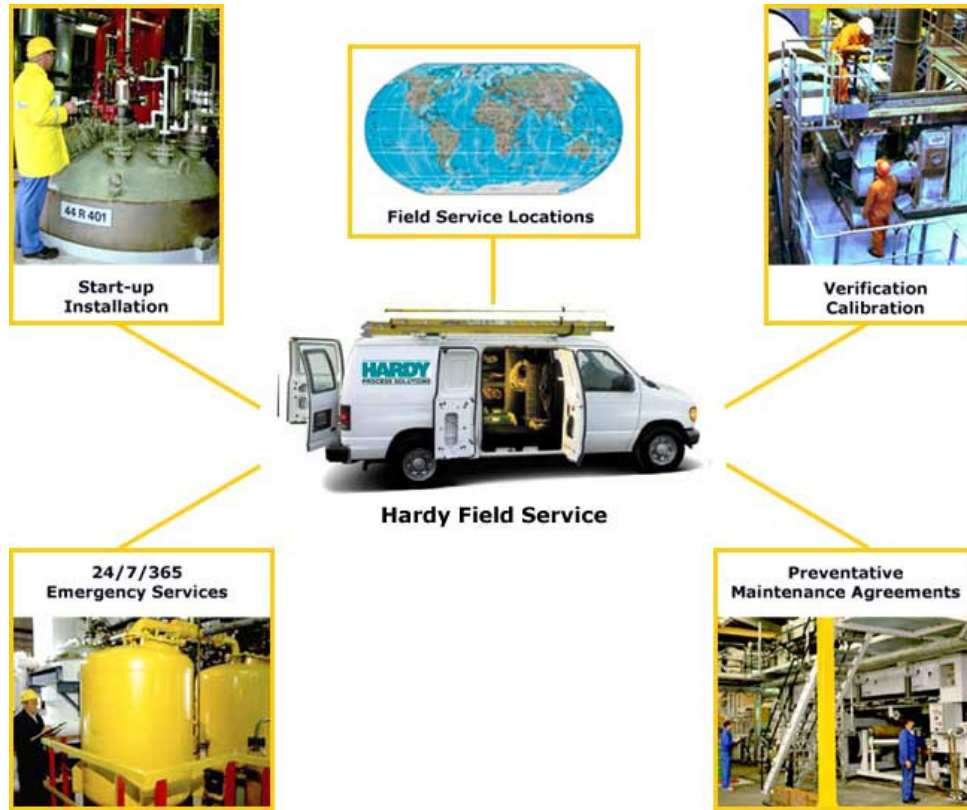
Field Service Locations

Start-up Installation

Verification Calibration

Hardy Field Service

24/7/365 Emergency Services

Preventative Maintenance Agreements

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- Plant audits and performance measurement
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Hardy Process Solutions has built a network of support throughout the globe.
For specific field service options available in your area please contact your local sales agent or our U.S. factory at +1 858-292-2710, Option 4

Contents

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Chapter 1 Overview

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This manual provides users and service personnel with specifications and procedures for installing, configuring, operating, maintaining, and troubleshooting the Hardy Process Solutions HI 1756-FC Rate Controller with WAVERSAVER.®

NOTE   *WAVERSAVER is a registered trademark of Hardy Process Solutions, Inc.*

To ensure good performance and maximum service life, follow all guidelines described in this manual. Be sure you understand all cautions, warnings, and safety procedures. If you find that the information in this manual does not provide the help you need, contact the Hardy Service Center at:

Phone: (858) 278-2900

FAX: (858) 278-6700

Web Site: www.hardysolutions.com

Support e-mail address: support@hardysolutions.com

About Hardy Manuals

An overview of each chapter's contents is listed below:

- Chapter One - Provides an overview of HI 1756-FC capabilities and features

- Chapter Two - Provides a overview of HI 1756-FC specifications

- Chapter Three - Describes the steps for installing both the standard and optional HI 1756-FC equipment and the HI 215IT series junction box

- Chapter Four - Explains how to configure the HI 1756-FC

- Chapter Five - Provides calibration instructions

- Chapter Six – Provides troubleshooting procedures for repair of the HI 1756-FC

HI 1756-FC Overview

The HI 1756-FC module is a self-contained, microprocessor-based ControlLogix I/O module. Its control inputs and outputs will easily plug into the backplane of an Allen-Bradley ControlLogix programmable controller and/or remote rack. The remote rack module is connected to the local chassis via a ControlNet link.

The analog-to-digital converter in the weigh module controller updates 100 times per second and is capable of 8,388,608 counts of resolution. This allows the instrument to tolerate large "dead" loads, over sizing of load cells/sensors, and still have sufficient resolution to provide accurate weight measurement and control.

The module supports both C2 electronic calibration and hard calibration (i.e., traditional calibration with weights).

The HI 1756-FC is a loss-in-weight controller that measures the flow rate from a feeding device located on a process weighing scale. The user enters the flow parameters, and an HI 1756-FC algorithm automatically calculates and adjusts the tuning parameters needed to maintain the desired rate. After comparing the desired flow rate to the actual flow rate (measured by calculating the loss of weight over short intervals), it computes the adjustments needed to achieve the desired rate and transmits signals to adjust the speed of the feeding device.

While the system rate calibration can fine tune the flow-rate parameters automatically, you can also make manual adjustments.

Typical Applications

Closed-loop rate control can be used in a variety of material-flow applications, such as auger, belt, and vibration-based feeders, converting them from volumetric to gravimetric.

The Feeder Controller controls a single-ingredient, single-feeder. It can be operated in batch, automatic, or manual mode.

Features and Capabilities

C2® Calibration

Traditional calibration uses certified test weights. C2® Electronic Calibration allows a scale to be calibrated without the need for test weights. A C2® weighing system consists of up to eight load cell sensors, a junction box, interconnect cable, and an instrument with C2® capabilities (e.g., the HI 1756-FC). Each Hardy Process Solutions C2-certified load sensor outputs digital information used for calculating the calibration. When the HI 1756-FC reads the signals from the load sensors, it calibrates the scale based on the load sensor's output plus a user-supplied reference point value (from 0 to any known weight on the scale).

NOTE   *C2® is registered trademarks of Hardy Process Solutions Inc.*

WAVERSAVER®

When measuring small weight changes, the affects of mechanical vibration and noise from the feeders and plant environment can introduce substantial interference. WAVERSAVER factors out vibration, noise, and other interference-related signals from the load cell so the rate controller can better decipher the actual weight data.

While WAVERSAVER can factor out noise with frequencies as low as 0.25 Hz, five cut-off frequencies can be selected, with higher frequencies providing a faster response time. The default factory setting is 1 Hz vibration frequency immunity.

Alarms

Two HI 1756-FC alarms flag deviations from your specified flow rate.

The Rate Tolerance Alarm can alert you concerning flow-rate changes. It can be set to trigger an alarm bit which, if sent to a PLC, can be used to respond (e.g., sound an alarm) when the flow rate is above or below the tolerance range you select for a time that exceeds a limit you set.

The Rate Exception Control (REC) Alarm is triggered by an out-of-tolerance flow rate using a guard band tolerance in conjunction with the Rate Tolerance Alarm. The REC sets statusword bits that can flag a low or high rate. These signals can be used to either send an alarm or shut down the feeder system. During an REC alarm state that has not resulted in shutdown, the controller will continue to maintain the flow rate while monitoring the loss in weight until the rate is within tolerance.

Integrated Technician™

The HI 1756-FC Integrated Technician™ (IT®), which requires an HI 215IT series junction box, provides built-in system diagnostics that makes it possible to diagnose weighing system problems. IT allows the reading of individual load sensor voltages and weights and isolates individual system components for quick and easy troubleshooting.

Digital Volt Meter (DVM) - Option

DVM requires the HI 215IT Series Junction Box to monitor mV/V readings for each load sensor and the total system. When the operator detects a problem, the DVM readings help

to isolate the faulty component. Further, the DVM readings can be used to level a system and to make corner adjustments to platform scales. Accuracy is +/- 2% or better of full scale.

If you do not have the HI 215IT or HI6010IT Junction Box connected to the module, the mV/V reading is the total for all load cells on the system.

Weighing System Tests - Optional

This test is used to diagnose drifting or unstable weight reading problems. It requires the HI 215IT Series Junction Box for full utilization. The ability to read the weight seen by the individual load sensors allows you to use this test for making cornering, leveling and load sharing adjustments to the weighing system.

The Weighing System Test provides the following problem detection support:

1. Disconnects the controller and engages an internal reference signal to see if the problem is inside of the instrument.

2. Disconnects the load sensors and engages an internal (in the junction box) reference signal to see if the cable between the instrument and the Junction Box is causing the problem.

3. Reads the weight of each load sensor to see if the load sensor might be causing the problem.

Automatic or Manual Control Modes

Automatic mode corrects for variations in desired flow rates automatically.

Continuous or Batch Modes

User selectable operating modes provide support for continuous or batch processing.

Automatic or Manual Refill

Automatic refill uses user-selectable refill points to start and stop the refill process without interrupting the feed process. HI and LO alarms are used to detect a refill failure.

The Manual Refill option only allows for manual refill at any time.

Two and Five-Point Automatic Rate Calibration

The 5-point auto rate calibration creates a high feed accuracy for a wide range of feed rates. It either provides the user with automatically calculated parameters, or it lets users manually enter their own derived values.

Chapter 2 Specifications

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Chapter 2 provides specifications for the HI 1756-FC feeder controller and other equipment that may come with the package. The specifications listed are designed to assist in the installation, operation and troubleshooting of the instrument. All service personnel should be familiar with this section before installing or repairing the instrument.

Basic Specifications

General

Resolution

Internal:1:8,388,608

Input

Up to eight 350-ohm Full Wheatstone Bridge, Strain Gauge Load Sensor/Cells (5 volt excitation) on one vessel.

Non-Linearity

0.0015% of Full Scale

Common-Mode Rejection

110dB at or below 60 Hz

Common-Mode Voltage Range

2.5VDC maximum (with respect to earth ground)

Backplane Input Voltage/ Power Load

5 VDC and 24 VDC

Backplane Current Load

<1 Amp at 5 VDC

0.0125 Amps at 24 VDC (with 4-350 Ohm Load Cells)

Backplane Power Load

< 5W at 5 VDC

< .3W at 24 VDC with 4-350 Ohm Load Cells

C2 Calibration Input

Isolation from digital section 1000 VDC minimum.

Cable lengths

1000 feet maximum of C2 authorized cable

250 feet maximum of C2 authorized cable (Maximum of 4 load sensors) with IT Junction box.

C2® Maximum Cable Length

1000' for C2, Non C2, or JB Card
250' for IT

Load Cell Excitation

5 VDC +/- 1.15 W maximum.

Isolation from digital section 1000 VDC minimum

C2 Calibration Output

Isolation from digital section 1000 VDC minimum

Number of Channels

1 Channel

Update Rate

110 Updates per Second

Averages

1-255 User-selectable in Single Increments

WAVERSAVER®

User Selectable
  OFF
  7.50 Hz
  3.50 Hz
  1.00 Hz (Default)
  0.50 Hz
  0.25 Hz

Digital Voltmeter (IT)

Accuracy ± 2% of full scale

Power and Utility Requirements

Voltage

24 VDC (Standard)

100/240 VAC Universal (Optional)

Frequency

47/63 Hz

Power

10 Watts maximum with options

Environmental Requirements

Digital Voltmeter

Accuracy +/- 2% of full scale

Operating Temperature Range

0 to 60º C (32º F to 140º F)

Temperature Coefficient

Less than 0.005% of full scale per degree C for Cal-LO and Cal-HI reference points

Storage Temperature Range

-40 to 85º C (-40 to 185º F)

Humidity Range

0-90% (non-condensing)

Approvals

UL and CE

Parameter Defaults

Parameters	Default	Parameters	Default
Chan Active	1	Total	**0.0**
Metric	0	Batch Total	**0**
span weight	100	Low Alarm Shut Down Rate	**0**
cal low weight	0	High Alarm Shut Down Rate	**100**
ROC time base	4	Alarm Delay	**100**
ROC time units	1	Rate Setpoint	**0**
Averages	1	REC P Limit	**10**
WAVERSAVER	3	7 Rate Cal Rates	**None**
PID_P	50	0 percent	**None**
PID_I	20	1st percent	**None**
batch amount	10	2nd percent	**None**
Preact	0	3rd percent	**None**
Mode	0	4th percent	**None**
Prime Time	0	5th percent	**None**
Pause Time	0	100 percent	**None**
Feed time	40	7 Rate Cal Percentages	**None**
Initial Refill on	0	0 Percent	**None**
Auto Refill On	0	1st Percent	**None**
Refill Start Weight	10	2nd Percent	**None**
Refill End Weight	100	3rd Percent	**None**
Refill Too High Weight	100000	4th Percent	**None**
Refill Shut Down Weight	0	5th Percent	**None**
Refill Op Adjust	0	100 Percent	**None**
Refill Op Adjust Percent	0	ADC Average	**None**
Wait Time	0	MANUALOP	**None**
REC Level	20	FAST_ROC	**None**
REC Time	60	Zerocount	**None**
REC Shutdown	0.0	CalLowCount	**none**
Shutoff Low Percent	**0.0**		

Chapter 3 Installation

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Chapter 3 covers unpacking, cabling, interconnecting, configuring, and installing the Weigh Scale Module. User and service personnel should read this chapter before installing or operating the Weigh Scale module.

Unpacking

Step 1.   Before signing the packing slip, inspect the packing and contents for damage of any kind. Report any damage to the carrier company immediately.

Step 2.   Verify that everything in the package matches the bill of lading.

Step 3.   Write down the Model and Serial number of the module. Store this information in a convenient location for reference when contacting The Customer Support Department for parts or service.

Step 4.   Be sure to complete the warranty registration on the Hardy web site.

Installing the HI 1756-FC

Allen-Bradley ControlLogix Processor or Remote Rack

WARNING   *Electrostatic discharge may damage semiconductor components in the module. DO NOT TOUCH THE CONNECTOR PINS, and observe the following handling precautions:*

- Wear an approved wrist-strap grounding device when handling the module.

- Touch a grounded object or surface to rid yourself of any electrostatic discharged prior to handling the module.

- Handle the module from the bezel in front away from the connector. Do not touch the connector pins.

- Do not install the module right next to an AC or high voltage DC module.

- Route all the load voltage cables away from high voltage cables.

A ControlLogix Chassis

Step 1.   Make sure that the module is oriented correctly for installation.

Step 2.   Gently slide the module into the Chassis.

Step 3.   Slide the digital board between the PCB Guides on the top plate and bottom plate of the chassis to line up the module connector with the backplane connector

PCB Guide
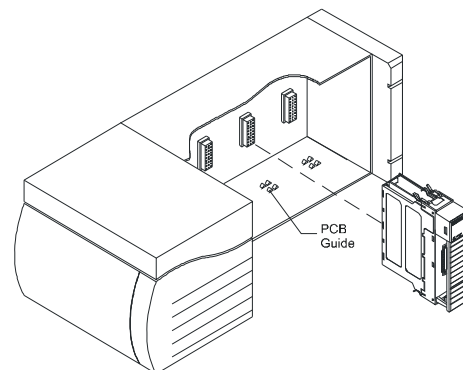
Inserting the module

Step 4.   When the module connector is touching the backplane connector, firmly but carefully push toward the chassis until the pins are plugged in and the top and bottom module releases are snapped into place.
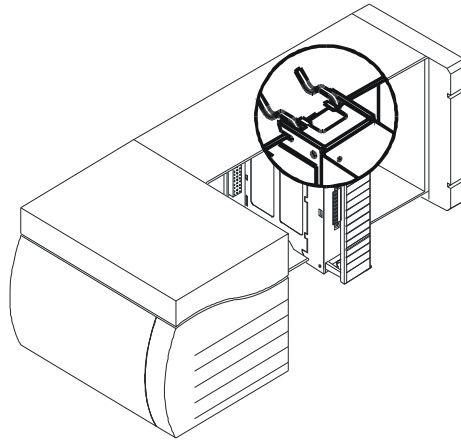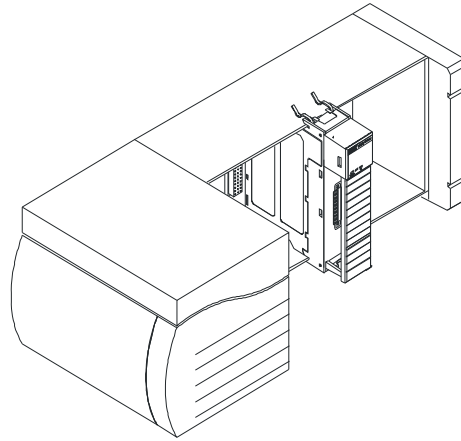
Module release(s)   Module installed in chassis

Removing the Module from the Chassis

Step 1.   Press down on the top and bottom module releases simultaneously until the module can be pulled away from the chassis. (See Figure above.)

Step 2.   Pull the module out of the chassis.

Step 3.   Store in a safe, secure location in an anti-static bag or the original enclosure.

Installing the Module I/O Connector

The I/O connector at the front of the module connects the module to the Remote Terminal Assembly (-RTA), a load sensor, or the HI 215IT Series Junction Box, depending on how many load sensors are installed in the weighing system. (See the pin-out diagram below.) A pin-out diagram is also located on the inside of the module door.

Step 1.   Open the module door to access to the I/O connector.

Step 2.   Install the cable and connector so it allows the module door to be shut.

Step 3.   With the plug oriented correctly (See the pin-out diagram below), plug the I/O male connector into the I/O connector at the front of the module.
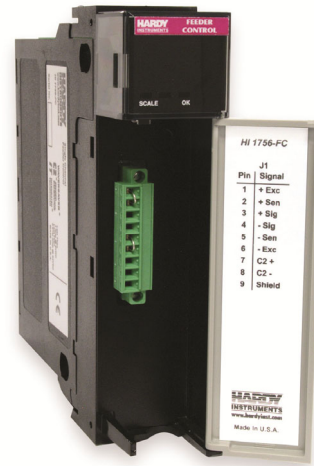
HI 1756-FC with door open

Note   *When the door is open, the button you see on the top right has no function.*

Check to be sure that the connector is completely

Single Channel
Pin 1 Exc+

plugged in before operating the module.	**Pin 2 Sense+**
	Pin 3 Sig+
NOTE *Most module-related problems are due to loose connections. Be sure to check the I/O connection first in the event you have a problem receiving information from the load cells or if the relays do not operate correctly.*	**Pin 4 Sig-**
	Pin 5 Sense-
	Pin 6 Exc-
	Pin 7 C2+
	Pin 8 C2-
	Pin 9 Shield

Load Cell Wiring Diagrams

The diagrams below show how Hardy Load Sensor with C2 wiring differs from standard Load Cell wiring.
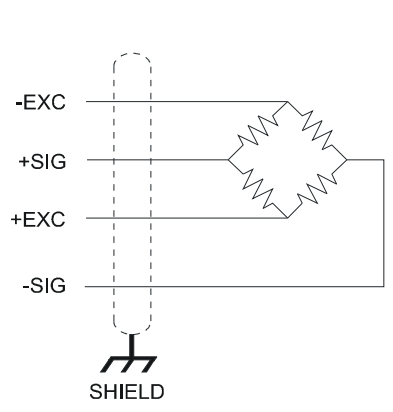
Industry standard load cells wiring
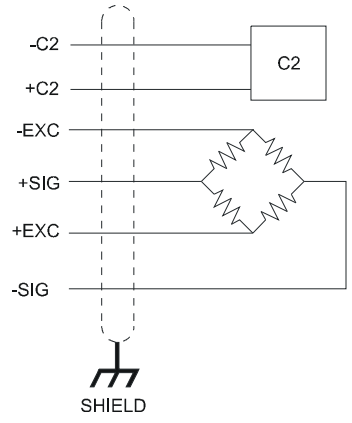
Hardy load sensor/c2 wiring

HI 1756 Remote Terminal Assembly (HI 1756-XX-RT)

The Remote Terminal Assembly (RTA) provides connection points between the cable assembly from the HI 1756-FC module and the individual wires from the junction box(es) or load sensor(s). The RTA comes with a standard 35 mm Din Rail Mounting and requires at least a 5" inch long DIN rail for mounting.
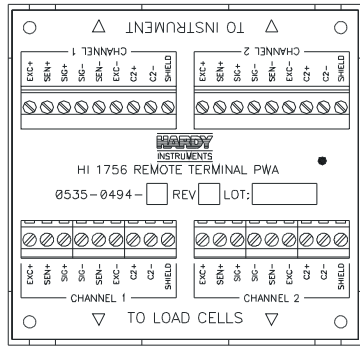
Remote terminal assembly

You must have sense jumpers or sense lines installed to properly reference the excitation voltage. To properly reference a C2 calibration, run sense lines and remove the sense jumper.

NOTE   *When using load cells that do not have sense lines, you will need to jumper the Sense (-) to the Excitation (-) and the Sense (+) to the Excitation (+) for one or both channels.*
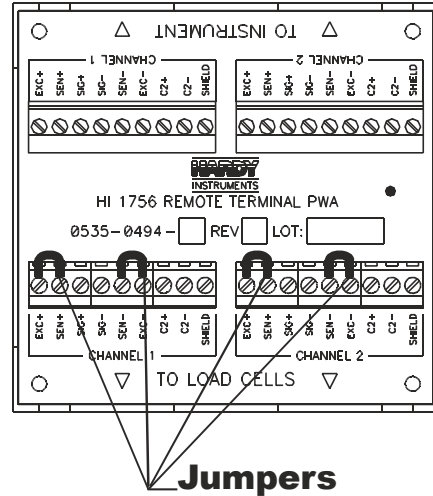
RTA with jumpers for load cells without sense lines

RTA Cable Assembly and Jumpers

A six-foot cable connects to the HI 1756-FC module.
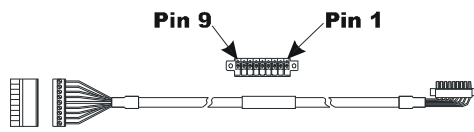
RTA cable assembly - HI 1756WS
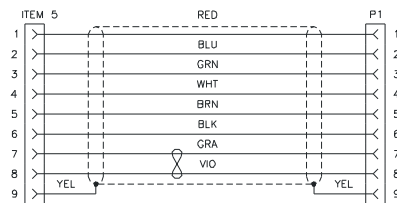
RTA cable schematic

Hardy HI 215IT Junction Box
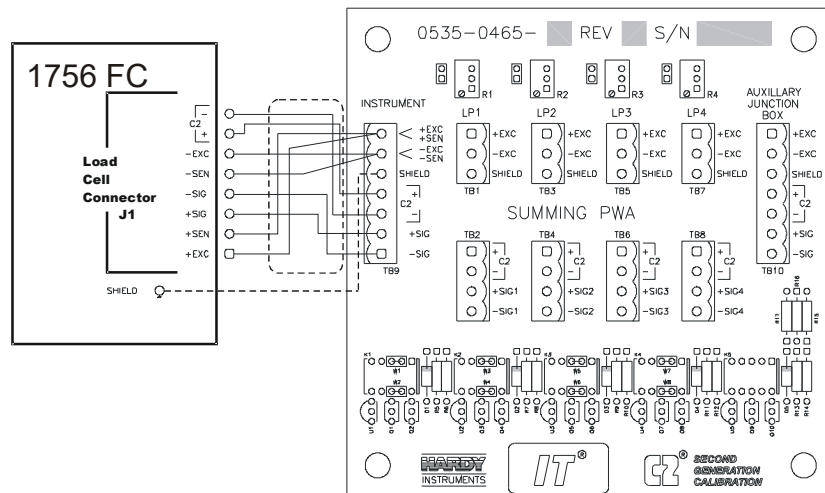
Hardy HI 215IT Junction Box Wiring Diagram

NOTE   *When connecting the Hardy HI 215IT Junction Box, you must remove the two factory installed jumpers 1&2 and 5&6 on the module and install sense lines.*

Chapter 4 Configuration

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Chapter 4 covers the settings used to prepare the controller for calibration and operation. The Setup procedures require Allen-Bradley's RS Logix 5000, Allen-Bradley RSLinx™ or RSLinx™ Lite.

Power Check

To make or change settings, there must be power to both the PLC and the module. Verify that the LEDs are lit for normal operation.

OK Module Status LED
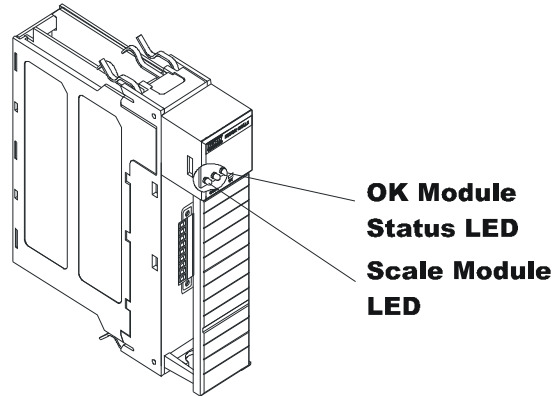
Scale Module LED

Module LEDs

LEDS

Scale Data LEDs

Flashing Green	Feeder is on
Steady Green Running	(Normal)
Steady Red	Error Read Failure or Error eeprom write. Contact HI Customer Support
Flashing Red	Read Convert Error.
LED is Off	Channel is Inactive

OK Module Status LED

Brief Steady	During power up the LED lights Red for about one second.
Flashing Green	In Program mode. (Normal)
Steady Green	In Run Mode. (Normal)
Steady Red	Config. Fault The eeprom checksum failed - bad serial eeprom
(Backplane Available)	data or blank serial eeprom. Contact HI Customer Support.
Steady Red	Internal Hardware watchdog timer fault (e.g. bad Hardware or Firmware). ASIC is non-operational.
Flashing Red	Communication Error.

Setting Up Communications

Linking the PLC with the HI 1756-FC Feeder Control Module

To set parameters for the weigh scale module, you must establish communications with a ControlLogix PLC. Follow the steps below to set up the communication link. You will need a new or open RS Logix® 5000 project. For instructions, see your RS LOGIX 5000 manual.

Step 1. Look for a list of folders on the left side of the screen. Scroll to and select the I/O Config folder, which will open a menu.

Step 2. Select New Module to display a list of modules.

Step 3. Select the Generic 1756 module to open the Module Properties form.

Step 4. Enter the following connection parameters in the appropriate fields:

- Name of Module
- Description of Module (Optional)
- Slot ID
- Input Assembly Instance:101 Size = 32
- Output Assembly Instance: 100 Size = 32
- Configuration Assembly Instance: 102 Size = 200

Step 5. Select DATA INT from the Comm Format pull-down list.
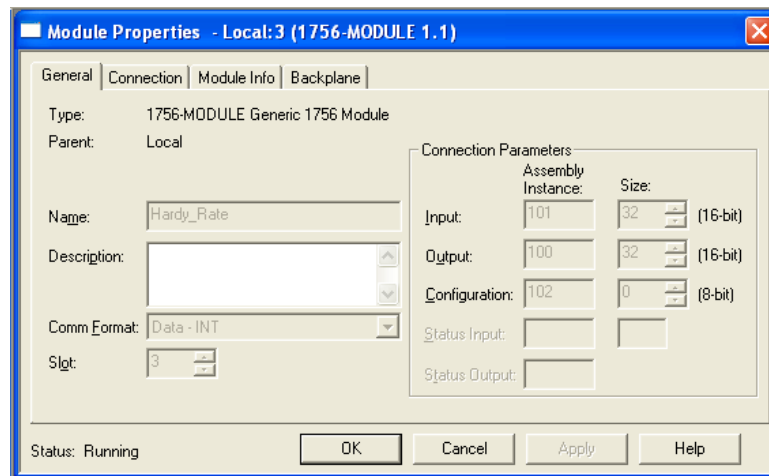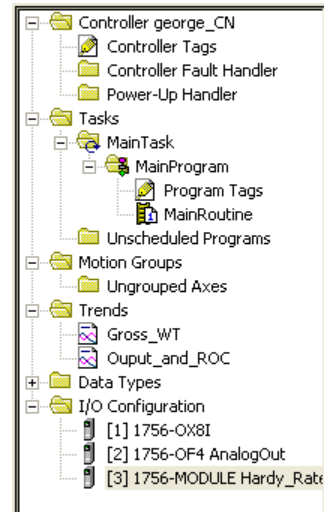
Module Properties Dialog Showing General tab

Step 6. Open the Connection Tab.

Step 7. Set the RPI to 20 milliseconds or greater. Do not set this parameter lower than 20 milliseconds.

Step 8. Click Finish.

Configuration Output Table Overview

To configure the module, you send commands via the PLC output table.

The 1756 module uses 32 16-bit INT words in and out. Only 5 words of the output table are normally used. (Command 0X5E uses ten and 0X5F uses seven)

Word	Command structure write
0	Command number
1	Format word (see Format Word below)
2	Value (LSW)
3	Value (MSW)
4	Parameter ID

Parameters can be read (READPARAM) or written (WRITEPARAM) one at a time:

- To read a parameter, put the readparam command number in word 0, the format word in word 1, and the parameter's number in word 2 of the output table.

- To write a parameter, put the writeparam command number in word 0, the format word in word 1, and the parameter's value in words 3 and 4 of the output table.

First Word - 0: Command Number

The first word in the output table is a command. The possible commands are:

Command	# Hex	Description
NOCMD	0	No command
STARTCMD	1	START
STOPCMD	2	STOP
REFILLCMD	3	REFILL
WRITENONVOLATILE	4	Saves all parameters (including calibration constants) to the non-volatile memory. Error Return Values: None
MANUALCMD	5	Enters manual mode
ABORTCMD	6	Stop, go straight to IDLE mode
CLEARALARMS	0x7	Clear all alarms from the rate status word
RELOADNONVOLATILE	0x10	Causes the weigh module to re-read the values stored in its non-volatile memory. Parameters changed since the last write non-volatile command are overwritten. Can be used to abort a calibration or parameter entry session. No error return values.
RATE_CAL_5_POINTS_ DEFINED	0x5E	Runs the 5-point rate calibration at percentage outputs defined at words 2-6. The percentages have 0 decimal places. They must be > 0, < 100, and in ascending order, with a minimum of 10 between them.
RATE_CAL_2_POINTS_ DEFINED	0x5F	Runs the 2-point rate calibration at percentage outputs defined at words 2-3. The percentages have 0 decimal places, and must be > 0, < 100, and in ascending order, with a minimum of 10 between

		them. This calibration operates at points 2 and 4 of a 5-point rate calibration. The other points are filled with data based on these 2 points.
RATE_CAL_5POINT_CMD	0x60	Runs the 5-point rate calibration at whatever points have previously been defined.
RATE_CAL_2POINT_CMD	0x61	Runs the 2-point rate calibration at whatever points have previously been defined.
CALLOWCMD	0x64	Sets the "calLowCount" parameter to the current A/D average counts when doing a hard calibration. Calls an Integrated Technician function during low calibration. **Error Return Values:** STATUSWORD - There was a conversion error or A/D conversion failure. HARDCALFAILCOUNTS - There are less than 1000 counts between the zero and the span weights.
CALHIGHCMD	0x65	Sets the Span Weight parameter to the current A/D average counts when doing Hard CAL. **Error Return Values:** STATUSWORD - There was a conversion error or A/D conversion failure. HARDCALFAILCOUNTS - There are less than 1000 counts between the zero and the span weights.
C2CALCMD	0x66	Performs a C2 Calibration. Uses CalLowWeight as the reference point. **Error Return Values:** STATUSWORD - There was a conversion error or A/D conversion failure. C2FAILNODEVS – Detected no C2 load cells. C2FAILCAPEQ - Detected two load cells with different capacities.
WRITEPARAM	0x67	**Writes the parameters. See Parameter Table below.** **Return Data**: COMMAND STATUS - The status is 0 if the command succeeded. If a range error was detected in one of the parameters, a non-zero value is returned indicating which parameter failed its range. **See Status Table below.**
READPARAM	0x69	**Reads the parameters. See Parameter Table below.** **Return Data:** COMMAND STATUS **See Status Table below.** PARAMETERS
SETDEFAULTPARAMS	0x94	Loads the default settings into RAM, and non-volatile RAM. Error Return Values: None

Command Return or Error Codes

Commands always return the command word and command status. The command status word may include the following codes:

Return Codes	# Hex	Description
SUCCESS	0	Pass
OUTOFTOLERANCE	-3	Out of tolerance
INDEXOUTOFRANGE	-4	Out of range
NOSUCHCMD	-5	Command bad
C2FAILNODEVS	-6	No C2 devices
C2FAILCAPEQ	-7	Failure, C2 capacities not equal
HARDCALFAILCOUNTS	-8	Fails, too few ADC counts between high - low
NOSUCHPARAM	-9	Parameter ID incorrect

Second Word - 1: Format Word

Format Word Decimal Point Parameters

Word 1 is the format word. The decimal point parameters, which are set via the format word, indicate the location of the decimal point within the values to follow (i.e., how many decimal places the integer values in the input and output tables have). The higher the number, the farther to the left the decimal point moves and the more precisely the rate is displayed. However, setting the decimal point far to the left does not ensure that the measuring device will be accurate enough to distinguish the requested level of precision from interference factors.

While the decimal point values for total, weight, and rate are separate, each has four bits in the format word. The maximum decimal place value is 7.

Formatword uses hex format 0000xxxxyyyyzzzz, where 0000 is not used at this time, xxxx = total DP, yyyy = Weight DP, and zzzz = Rate DP. The DP values position the decimal point within the number.

0x0123 means TOTAL decimal places is 1, WEIGHT decimal places is 2, RATE decimal places is 3. For example, writing the value 0x0123 in the format word sets the *total decimal place* value, which is used for the TOTAL and BATCH TOTAL values to 1. It sets the *weight decimal place*, which is used for the gross weight, to 2, and it sets the *rate decimal place*, which is used for the rate of change (ROC) values to 3.

Total Decimal Point (xxxx)

The Total Decimal Point parameter sets the location of the decimal point within the Totalizer value, which is based on the selected unit of measure.

Range: 0-7 (default 1) In most applications a decimal setting of 0 or 1 is recommended.

Weight Decimal Point (yyyy)

Set the Weight Decimal Point parameter to indicate the location of the decimal point within the weight values, which are based on the selected unit of measure.

Range: 0-7 (default 2)

Rate Decimal Point (zzzz)

The Rate Decimal Point Parameter sets the location of the decimal point within the Flow Rate value.

Range: 0-7 (no default)

Third / Fifth Words - 2, 3, 4: Parameter Number and Value

The third and fourth words in the output table, Parameter Value, are used by the WRITEPARAM command. The fifth word is the parameter ID, used by the WRITEPARAM and READPARAM commands. Parameter values are written with the least significant word first and one 32-bit integer per parameter. For details see the Parameter Table below. Expanded descriptions are listed below the table by hex number.

All parameters are DINT.

There are 14 spare parameters for possible future use.

Notes   *When set by a command, all parameters except the rate setpoint are saved to non-volatile memory. Both rate and scale calibrations are saved automatically when completed successfully. Totals are not saved automatically when changed, and will be lost if no WRITENONVOLATILE command is executed before power down.*

The section above "Format Word Decimal Point Parameters" explains Weight DP, Rate DP, and Total DP, which appear in the chart below.

Parameters	#hex /sub#	Brief Description (Note: Expanded descriptions are listed below the chart by hexadecimal number)
Chan Active	1	0-1 flag, determines if a channel is alive.
Metric	2	0-1. Report Weight In. Units of measure listed below
span weight	3	Calibration weight, high. Must be >0. Weight DP.
cal low weight	4	Calibration weight, low. Must be > or = 0. Weight DP.
ROC time base	5	In seconds, 0 decimal places. 1-1800 seconds.
ROC time units	6	0=sec,1=min,2=hr
NumAverages	7	Dint. 1-255. Default = 1
WAVERSAVER	8	0-5 See 8 below
PID_P	9	1 decimal places.
PID_I	A	1 decimal places.
Batch amount	B	Weight DP. Must be > or = zero.
Preact	C	Weight DP. No limits.
Mode	D	15 // 0=continuous or 1=batch.
Prime Time	E	seconds, 0 decimal places.
Pause Time	F	seconds, 0 decimal places.
feed time	10	seconds, 0 decimal places.
Initial Refill on	11	0 = no, 1 = yes
Auto Refill On	12	0=off, 1=on
Refill Start Weight	13	Weight DP. No limits
Refill End Weight	14	Weight DP. No limits
Refill Too High Weight	15	Weight DP. No limits.
Refill Shut Down Weight	16	Weight DP. No limits.
Op Adjust	17	0=off,1= learning, 2= fixed.
Op Adjust %	18	6 decimal places.
Wait Time	19	Seconds, 0 decimal places. Must be > or = 0

REC Level	1A	1 decimal place. Must be > or = 0.
REC Time	1B	Seconds, 0 decimal places. Must be > or = 0
REC Shutdown	1C	0=no, 1=yes
Shutoff Percent	1D	0 decimal places. 0-100
Total	1E	Total DP
Batch Total	1F	Total DP. Must be > or = 0
Low Alarm Shut Down Rate	20	Rate DP. No limits
High Alarm Shut Down Rate	21	Rate DP. No limits
Alarm Delay	22	Seconds, 0 decimal places. Must be > or = 0.
Rate Setpoint	23	Rate DP. Must be > or = 0, < MAX RATE.
Rate Calibration Parameters	See Rate Calibration Parameters section below	
REC_P_Limit		1 decimal place. Must be > 0 and < or = 100.0.
7 Rate Cal Rates	(xx32)	7 rate calibration rates. All are R DP > or = 0.
0 rate	0032	0x0032 is the minimum rate
1st rate	1032	0x1032 is the next stepped rate
2nd rate	2032	0x2032 is the next stepped rate
3rd rate	3032	0x3032 is the next stepped rate
4th rate	4032	0x4032 is the next stepped rate
5th rate	5032	0x5032 is the next stepped rate
100 rate	6032	0x6032 is the MAX RATE
7 Rate Cal Percentages	(xx33)	// 7 rate calibration percents. Uses 2 decimal places. 0.00-100.00
0 Percent	0033	0x0033 is the minimum %
1st Percent	1033	0x1033 is the next stepped %
2nd Percent	2033	0x2033 is the next stepped %
3rd Percent	3033	0x3033 is the next stepped %
4th Percent	4033	0x4033 is the next stepped %
5th Percent	5033	0x5033 is the next stepped %
100 Percent	6033	0x6033 is the MAX %
End Rate Cal section		
ADC Average	34	0x0034 // Read Only
STATE	35	0x0035 // read only – see mode list below
	Bit 0	Idle Mode
	Bit 1	Auto Mode
	Bit 2	Manual Mode
	Bit 3	Start Mode
	Bit 4	Stop Mode
	Bit 5	Shut Off Mode
	Bit 6	Pause Mode
	Bit 7	Rate Cal Mode
	Bit 8	Refill Mode
	Bit 9	Full Mode
	Bit 10	Manual Hold Mode
	Bit 11	Rate Cal Hold Mode

	Bit 12	Initial Refill Mode
MANUALOP	37	Two decimal places. This it the output percent when in MANUAL mode.
FAST_ROC	38	Lightly averaged rate of change, read only, RATE decimal places.
zerocount	0x0A00	AD counts at zero weight
calLowCount	0x0A01	

Numbers or letters in the titles below correspond to the values in Column 2, Hex#, above

Parameter 2   Metric (Unit of Measure)

The Unit parameter sets the scale and related displays to one of the following options:

- Pounds (lb) - Default
- Ounces (oz)
- Ton (ton) short ton
- Kilograms (kg)
- Grams (g)
- Metric Tonnes (t) long ton

Range: LB, OZ, TON, KG, G, T (default LB)

Any weight value input to the module (e.g. CALLOWWEIGHT, SPANWEIGHT) are in the currently selected unit. The unit of measure can be set at any time, not just at calibration. Set the metric before calibrating to verify the unit of measure.

Note   *The weigh scale module does not need to be recalibrated after changing the metric value.*

Parameter 3   Span Weight

The Span Weight is a reference point derived from an actual measured weight. This should not be confused with the Scale Capacity. If you have a 100 pound weight and you place it on the scale, the Span Weight would be 100 pounds.

Parameter 4   Cal low weight

This reference weight is the weight of any product on the scale that is not removed during calibration (derived from actual measured weight used at cal low or C2 cal). Normally, you would remove all "live load" weight from the scale to obtain a CalLow Weight of 0.0. The location of the decimal point in this value is based on the Weight decimal point parameter.

Range: Must be > or = 0.

Parameter 5   ROC time base

The Time Base is the length of time in seconds between two weight readings that are subtracted to determine the initial flow rate. By increasing the time base, you increase the time between weight readings. This allows more material to be dispensed during the time base period. Low flow rates require a longer time base than high flow rates. The controller measures weight to about 1 part in 10,000. The formula below provides a minimum. Auto rate calibration uses a minimum of 10 ROC Time periods to make the rate calculation.

TIME BASE > (SCALE CAPACITY/5000)/LOW SETPOINT (units per sec.)

SCALE CAPACITY/5000 = determines minimum weight increment

Example: (440/5000) = 0.088 lb

The lowest setpoint in units per second @ 3 lb per min is: 3 lb/60 sec = 0.05 lb/sec

Thus:

> TIME BASE = 0.088/0.05
> TIME BASE = 1.76 (rounded to 2)
> MINIMUM TIME BASE = 2 seconds

Range: In seconds, 0 decimal places. 1-1800 seconds.

Parameter 6   ROC time units

The units of time (seconds, minutes or hours) you want for the Rate of Change. The ROC display on the summary display will read in these units.

Range: 0=sec, 1=min, 2=hr (default Seconds)

Parameter 7   Averages

This is the number of samples to average when determining a value to reduce the affect of material impact and/or vibration as material moves on and off the scale. The Rate Controller takes 100 readings per second. If you average enough weight readings, the weight loss or gain remains smooth and the displayed value shows little or no fluctuation, although it is actually recalculated (by sliding average) with each reading. If a weight reading fluctuates too much, increase the number of readings in the average, but for applications that require a very quick weight reading, do not set this value too high.

The averaging parameter is most often set when using any device that outputs an erratic signal (e.g. a flow meter). Using the averaging function comes at the expense of response time. A setting of one average takes 10 milliseconds. A setting of 100 averages takes 1 second. The averaging function is a running average, where the input signals are totaled and the total is divided by the averaging number. The instrument reads one new signal plus the last number of averages signals and repeats the averaging process again.

For example: With a setting of 20 averages, the instrument reads the 20 most current input signals, totals the signals, divides by 20, drops the oldest one, reads one new signal along with 19 old readings, totals the signals, divides by 20, drops the oldest one, etc.

Range: 1-255 (default 1)

See also WAVERSAVER for information on filtering unstable weight readings.

Parameter 8   WAVERSAVER®

Chapter One provides a detailed description of WAVERSAVER's function and purpose. In short, WAVERSAVER helps to mitigate the effects of vibratory forces, allowing the HI 1756-FC to distinguish between actual weight data and mechanical noise in the signals the load cell sends. WAVERSAVER can be configured to ignore noise with frequencies as low as 0.25 Hz. High values allow faster readings, while the lower values raise the degree of filtration. 7.5 Hz provides the least vibration immunity with the fastest response time. 0.25 Hz provides the most vibration immunity with the slowest response time. The function is user selectable and can be turned off.

Range: OFF, 7.50 Hz, 3.50 Hz, 1.00 Hz (Default), 0.50 Hz, 0.25 Hz

Parameter 9   Rate Calibration Configuration PID P

The P parameter for Rate Calibration. See Chapter 5 for additional instructions on running Rate Calibration. Rate calibration determines this parameter, so you may not want to set it. It would be difficult to know what to enter.

P and I values: Use Rate Calibration to calibrate the system starting flow rate. Rate calibration establishes the feeder maximum rate, PI settings, and the starting OP% for a given rate setpoint. From that starting point, the controller adjusts the OP% to maintain an optimized setpoint. Environment and product conditions require monitoring and adjustment to meet the requested setpoint target.

You must calibrate the scale prior to rate calibration.

The PI controller calculates an output percentage based on the parameters P (proportional) and I (integral). The rate calibration process can set the values for P and I automatically.

The output percent is determined by the formula:

P*((Setpoint - ActualRate)/MaxRate + I * (integral of the proportional term)).

P and I Must be > or = 0

Parameter A   Rate Calibration Configuration PID I

The I parameter for Rate Calibration. See explanation under Parameter 9 above.

Parameter B   Batch amount

The batch amount and preact parameters are used when operating in Batch mode. The Batch Amount sets the amount of ingredient in weight units used per batch for the selected ingredient.

Range: ≥ 0.0 (default 0.0) It is not necessary to enter 0.00 for these parameters) The decimal point is positioned based on the Weight Decimal parameter for batch amount.

Parameter C   Preact

Preact is used when operating in Batch mode. It is the amount to allow between the batch amount signal and the time when the feeder actually stops feeding. Where the feeder slows to a stop, set the preact value so the desired batch amount is dispensed when the feeder stops completely. The decimal point is positioned based on the Weight Decimal parameter for preact. No limits.

Range: >0.0 (default 0.0) No limits.

Parameter D   Mode

You can operate either in continuous or batch mode depending on the process.

Range: 0=continuous or 1=batch.

Parameter E   Prime Time

The time in seconds it takes to get the system up to full flow for the first calibration point. on the first test OP% run of the rate calibration, the feeder must prime the feeding system and the feeding system must smoothly feed product at an OP % selected rate.

Range: 1-999 (default 5 sec) Must be > or = 0

Parameter F   Pause Time

This is the time you want the feeder to wait between Auto Rate Calibration cycles. If necessary, more material may be added to the feeder. Note that this parameter should be set long enough to allow the operator to trigger a "hold" in between feed runs.

We recommend that you make the Pause Time equal to or greater than the Timebase value you entered for the ROC.

NOTE   *If a feeder is manually paused before a cycle starts or during a cycle, when the test is restarted it will run from the beginning.*

Parameter 10   Feed Time

Feed Time is the test duration at each rate. Set this to a minimum of 10 X ROC time base. Make sure that your feeder hopper holds enough product to complete the high percentage rate test. You cannot pause or refill during a test phase.

Must be > 0. Range: 1-999

Parameter 13-18   Refills

Automatic Refill uses user-selectable refill points to signal a start or stop of the refill process without interrupting the feed process. HI and LO alarms can be used to flag a refill failure.

Manual Refill allows for manual refill at any time. The Manual Refill stops at the Refill High point.

Initial Refill

Initial Refill ensures that the feeder contains enough material to safely begin operation. It can help to decrease the number of refills during a run. Review how the Initial Refill works before you make this selection.

After you select Initial Refill and start the feeder, the instrument checks to see if the material in the hopper is below the refill end weight. If it is, the instrument goes into refill mode until the refill end weight is reached.

Parameter 11   Initial Refill on

This value serves as an ON/OFF switch for the initial refill function.

Range: 0 = no, 1 = yes (default NO)

Parameter 12   Auto Refill On

This value serves as an ON/OFF switch for the auto refill function.

Range: 0=off, 1=on

NOTE   *If Initial Refill is on with Auto Refill off, the unit still goes into refill mode until the unit high weight is reached. If you wish to prevent this, turn off Initial Refill when you turn off Auto Refill.*

Parameter 13/14 Refill Start Weight and End Weight

The Start Weight, which is set in mass units (actual gross weight), triggers a signal to begin the refill process. You need to determine when you want the refill to automatically begin (or an alarm to trigger so an operator can refill the feeder). The Start Weight value must be higher than the Lo Shutoff value. End Weight signals when the hopper is full.

Range: Start Weight >0.0 (default 10.0)   End Weight >0.0 (default 100.0)

Parameter 15/16 Refill Shutdown and Refill Too High Weight

The Refill Shutdown setting stops the process when there is insufficient or no material in the hopper. This setting can be 0 weight indicating nothing in the hopper or a weight setting somewhat above the 0 weight and below the Refill Start Weight value. The Refill Shutdown value must be below the Refill Start Weight value.

The weight you enter for Refill Too High will trigger an alarm should the weight go above this value while refilling.

Refill Shutdown Range ≥0 (default 0) Refill Too High Range >0 (default 100,000)

Parameter 17   OP Adjust

There are thee options:

OFF: (default) Turns off the function.

ON-LEARN: (works only with Auto Refill) The HI 1756-FC saves the % output and change in weight values from previous refills and continuously calculates the optimal Output % based on these values. This allows the instrument to adjust as conditions and the material or refill characteristics change over time.

ON-FIXED: With Auto Refill, you can use ON-FIXED to either lock in an effective learned value or enter a noted value that has worked well on previous applications.

Range: 0, 1 or 2

Parameter 18 OP Adjust %/wgt during refill

Refill OP Adjust %/wgt

This is the OP (Output Percentage) Adjust % per unit of wgt. Rate calibration determines this parameter, so you may not want to set it. It would be difficult to know what to enter.

The weight of an ingredient in a hopper can affect the rate of feed. For example, a liquid at the base of a full hopper is under greater pressure than a liquid at the base of a near empty hopper. If no adjustment is made, the liquid flows out faster when the hopper is full than when it is low. When the OP Adjust parameter is ON (i.e., not set to OFF), the OP Adjust %/wgt value will adjust the refill rate to compensate for any change in weight of the ingredient in the hopper. OP Adjust On Learn is used to calculate this value.

Range: -100 to +100 up to six decimal places   (Default 0.0)

Parameter 19   Wait Time

Time the controller waits for the material to settle before it calculates the batch total. Seconds, 0 decimal places. Must be > or = 0

Parameter 20   Low Alarm Shut Down Rate

If the actual flow rate is below the setpoint beyond the alarm delay time, the Lo Shutoff alarm can be configured to signal an alarm condition that can either shut the process down or lower the output to a set percentage (See Shutoff % Out below). The decimal point is positioned based on the Rate DP parameter.

NOTE   *The Lo Shutoff alarm value must be equal to or less than the lowest set point value.*

Range: No limits

Parameter 21   High Alarm Shut Down Rate

If the actual flow rate is above the setpoint beyond the alarm delay time, the Hi Shutoff alarm can be configured to signal an alarm condition that can either shut the process down or lower the output to a set percentage (See Shutoff % Out below). The decimal point is positioned based on the Rate DP parameter.

Range: No limits

Parameter 22   Alarm Delay

The number of seconds you want the instrument to delay before setting off either a HI shutoff or LO shutoff alarm after detecting a flow rate that is out of tolerance. This avoids nuisance alarms and gives the system time to clear a problem.

If a product is easily liquefied, set a very short delay to prevent large spills. If a product tends to plug or bridge set a longer delay.

Range: 0 decimal places. Must be > or = 0.

Parameter 23   Rate Setpoint

The Rate Setpoint is the ingredient target flow rate (Loss in Weight) you want to maintain for your process. The decimal point is positioned based on the Rate DP parameter.

Range: Must be > or = 0, < the maximum rate set for rate calibration.

REC Parameters

Parameter 1A   REC Level %

The REC Level % (RECPERCENT or REC LEVEL% parameter) is a percentage of Max Rate. It is the level of error above or below the Setpoint Rate that you can accept before the instrument goes into REC mode. For example: If the rate calibration Max Rate is 5.0 lb/min, and the REC level % is 20%, the allowable deviation is 1.0 lb/min from the Rate Setpoint before a Rate Exception error occurs.

Range: 0-100.0 (default 20%. This allows for a very large error. We recommend a setting between 5% and 10% and allowing a RE+ or RE- indication about every five min.)

Parameter 1B   REC Time

The time the unit must remain in the REC mode to get an alarm condition or if the Shutdown parameter is selected to shutdown the operation.

Range: 0-999 (default 10)

Parameter 1C   REC Shutdown

The REC Shutdown enables you to shutdown your operation if the system operates in REC mode beyond the time limit set in REC Time. If you select YES for REC Shutdown and the RE error goes beyond the REC Time, the HI 1756-FC goes to shutoff mode. If you select NO, once the deviation goes beyond the REC Time, the system only sends an alarm bit.

Range: NO/YES (default NO)

Parameter 1D   Shutoff Percent

A shutdown signal can trigger a fixed OP % response if Shutoff Percent is greater than 0.0%. This allows for processes that should not be halted completely, even if an error occurs, to continue at a slower rate.

Range: 0 decimal places. 0-100

Parameter 1E   Total

The controller records the total amount dispensed. The Total number displays the amount of material that has been processed from the start of the process until the process completes or is interrupted. You would probably not want to reset the Total value each time you start the module, but for error correction, the Total parameter can be cleared (in either continuous or batch modes). For example, if a power failure shuts the system down during a process, before you resume operation you can re-enter the lost total from the front panel.

CAUTION   *If you change the Total, stop the system.*

Total Range 0 - >99,999.0 wt units (default 0.0)

Parameter 1F   Batch Total

The Batch Total reads the total amount of material for the selected batch that has been processed from the start of a batch process until the batch process ends (by intent or other reason). When the Batch is complete, the Batch Total resets to 0.0 for the next batch. The Batch Total parameter can be changed should there be an error in the batch total amount while processing.

CAUTION   *If you change the Batch Total, stop the system.*

Batch Total Range 0 - >99,999.0 wt units (default 0.0)

Rate Calibration Parameters

Three types of calibrations determine the flow rate per output percentage:

1. **Two-point rate calibration**: Used for Auto RateCal. If a two-point Auto Rate Calibration is selected, two flow rate points (points two and four) are used for calculating other rate point values. The unit will go to the high rate output percent for a period of feed time plus prime time (See parameters E and 10 above). When this period is complete, it saves the actual rate as the high cal rate, then pauses for a period of pause time (See parameter F) before going to the low rate output percent for a period of feed time. When this period is complete, it will save the actual rate as the low cal rate. After doing the auto rate calibration at the low and high rates, the unit will estimate the zero rate output percent and the Max rate cal rate and will fill values for the first, third, and fifth five-point calibration rate pairs.

2. **Five-point rate calibration:** Five-point measurement used with Auto RateCal to provide tighter flow rate control. The user enters the output percent values, and the unit then runs at each of these output percents, starting with the highest one, for a period of feed time or feed time plus prime time on the first run. It saves the actual rates it observes into the cal rates and estimates the MaxRate and zero output rates.

3. **User-set rate calibration:** Used when you cannot do an Auto RateCal and you know the flow rate for all seven output percentage selections. If user-set calibration is selected, you must manually enter the PI settings and the output % and rate for all calibration pairs. The entered flow rates can come from experience with the material, often through trial and error. We recommend that you select output percentage points where your expected control set point falls between point two and point four.

Configuring Rate Calibration

NOTES   *Make sure you have enough material to do a Rate Cal at the highest OP%. If, for example, 30 seconds at 90% would empty the hopper, reduce the Rate Cal to a lower rate.*

RateCal Percents

RateCal Percents sets the output percentage for the three cal types.

1. For the 2 pt Cal Type (%Lo & % Hi), make sure that the Hi % is higher than the Lo % and that there is a separation of at least 10%. You enter Pt2 and Pt4.

2. For the 5 pt Cal Type (Pt1, Pt2, Pt3, Pt4, Pt5), each % should be $\geq$ 10% different.

3. For the User-set cal Type, you need to know the flow rates for all output percentage setpoints. You enter the output percentages and the known flow rates and the correct PI setting.

Range: 0 -100

You can edit other parameters, including adjustable values in the OP% (and/or Cal Rate) fields.

Example: A calibration pair Output percent of 25% and a cal rate 250 means that a rate of 250 weight units per unit time will be obtained when the output percent is 25 %.

Running Rate Cal

The user enters all OP percentages. The Auto Rate Cal will prime the system then run for the selected feed time based on the calibration type, pause time, and RateCal Percents you selected.

1. For the 2 pt Cal Type (Pt2 and Pt4), the two flow rates for the percentages you selected are the actual flow rates. The instrument calculates the remaining three flow rates.

2. For the 5 pt Cal Type, you provide the five RateCal percents between the Low and High output percentages.

3. For the User-set cal Type, you provide known flow rates for output percentage setpoints (Pt2 and Pt4) and the output percentages. This only establishes the rate lookup table for startup rates.

Input Table
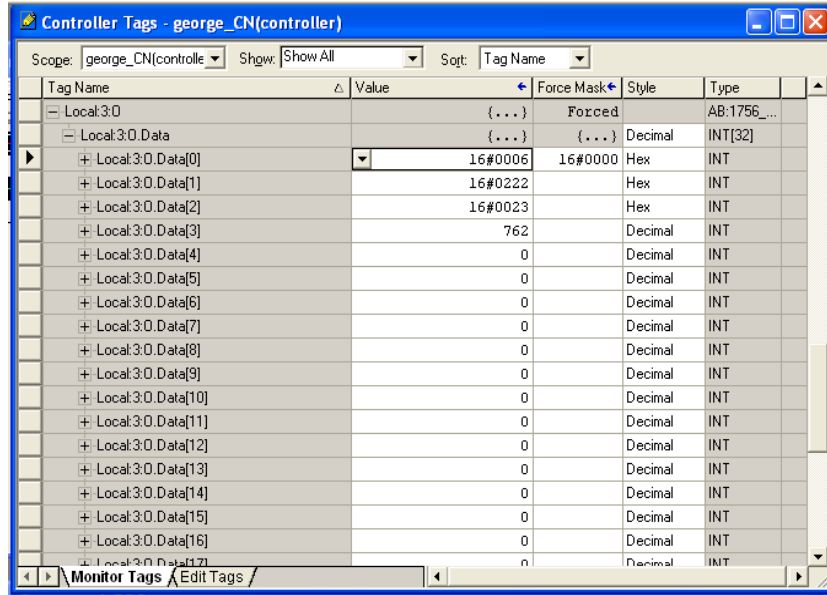
The first 5 words of the input table echo the output table, except that the format word is replaced with a command status that indicates whether a command succeeded or failed.

The next words are the OP% rate of change, the gross weight, rate setpoint, state, version, and the *module status word*. There is also a counter which continuously increments.

Command #	Offset	Description
CMD	0	Command # echo the command from the input
CMD_STATUS	1	Status of command
PARAM_VALUE	2	Parameter value (LSW)
PARAM_VALUE	3	parameter value (MSW)
PARAM_NUMBER	4	Parameter number, in read and write commands
OP	5	Operating %. 2 decimal places 0.00 - 100.00
ROC	6	Uses 'rate decimal places' ROC value (LSW)
ROC	7	ROC value (MSW)
GROSS_WEIGHT	8	Uses 'weight decimal places' Gross wt. (LSW)
GROSS_WEIGHT	9	Gross wt. (MSW)
RATESETPOINT	10	Uses 'rate decimal places' Total . (LSW)
RATESETPOINT	11	Total . (MSW)
STATE	12	State

VERSION	13	Firmware version
STATUS	14	Statusword (See Statusword below)
COUNTER	15	

Statusword

At word 14, the module returns a binary statusword where each bit indicates a state or condition within the module. To interpret these states, note which bits are ON and use the chart below to match each bit location to the state it represents.

For Example: If the statusword is 69 with a binary value of 0000 0000 0100 0101, bits 0, 2, and 6 are on. Bit 0 indicates an A/D conversion error, bit 2 indicates status is ON and bit 6 indicates a shutdown error.

STATUSWORD bit positions refer to these variables:

Word	#	Definition
ERRORADCONVERT	0x0001/0	**Millivolt return from the load cell system is out of range for the unit.**
ERRORADFAILURE	0x0002/1	**Unit's A/D converter not responding.**
STATUS_ON	0x0004/2	**System on or off**
ERRORLOWALARM	0x0008/3	**Low alarm**
ERRORHIGHALARM	0x0010/4	**High alarm**
ERRORCONTROL_LOST	0x0020/5	**Controller communication failure**
ERROR_SHUTDOWN	0x0040/6	**Shutdown**
ERROR_RANGE	0x0080/7	**Out of range value**
ERROR_REC	0x0100/8	**REC value over high limit**
ERROR_RECMINUS	0x0200/9	**REC value below low limit**
ERROR_REFILL_OVER	0x0400/10	**Exceed refill limit**
STATUS_REFILL	0x0800/11	**Refill process active**
STATUS_BATCH_COMPLETE	0x1000/12	**Batch process completed**
ERROREEPROMWRITE	0x4000/14	**EEPROM Hardware Error**
STATUSCHANENABLED	**0x8000/15**	**Set if channel is enabled**

States (Word 12 of input table)

Mode (state) Table

Mode	Value	Mode	Value
IDLE_MODE	0	RATE_CAL_MODE	7
AUTO_MODE	1	REFILL_MODE	8
MANUAL_MODE	2	FULL_MODE	9
START_MODE	3	MANUAL_HOLD_MODE	10
STOP_MODE	4	RATECAL_HOLD_MODE	11
SHUT_OFFMODE	5	INITIAL_REFILL_MODE	12
PAUSE_MODE	6		

Integrated Technician

If there is **NO** IT JBOX, the instrument can still measure the sense voltage, the overall load cell millivolts per volt, and the internal reference weight value. If the user has an IT

JBOX, the instrument can also read the weights and voltages of the individual sensors attached to the IT JBOX.

To initiate an IT test, do a WRITEPARAM command, with parameter number 0x0036, and a parameter value equal to the number of sensors, which should be 1-4 if you have an IT JBOX. If you do not have an IT JBOX, the parameter value does not matter.

To read back the results, do a READPARAM command, with parameter numbers 0x0036, 0x1036, 0xB036. The return values are listed below.

Integrated Technician Return Values Table

Return Value	# Hex	Description
PARAMID_ITECH	0x0036	
INSTANCE_VSENSE	0036	Sense voltage, 2 decimal places
INSTANCE_DVM_COMBINED	1036	millivolts per volt, 4 decimal places
INSTANCE_IREF_WEIGHT	2036	internal reference weight, weight decimal point
INSTANCE_JBOX_MV/V1	3036	Load cell 1 millivolts per volt, 4 decimal places
INSTANCE_JBOX_MV/V2	4036	Load cell 2 millivolts per volt, 4 decimal places
INSTANCE_JBOX_MV/V3	5036	Load cell 3 millivolts per volt, 4 decimal places
INSTANCE_JBOX_MV/V4	7036	Load cell 4 millivolts per volt, 4 decimal places
INSTANCE_JBOX_REF_WEIGHT	7036	reference weight on IT JBOX, weight decimal pt
INSTANCE_JBOX_WEIGHT1	8036	Sensor 1 on JBOX, weight decimal point
INSTANCE_JBOX_WEIGHT2	9036	Sensor 2 on JBOX, weight decimal point
INSTANCE_JBOX_WEIGHT3	A036	Sensor 3 on JBOX, weight decimal point
INSTANCE_JBOX_WEIGHT4	B036	Sensor 4 on JBOX, weight decimal point

CIP Messages

The weight and rate calibration values can be read and written by CIP messages.

- Message Type: CIP generic
- Service Code: 4C (hex)
- Class Name: 4
- Instance Name: 254
- Object Attribute: none, leave this blank

It is possible and convenient to configure the MSG instruction to use the same tag for both source and destination.

There are four read and write calibration commands, each consisting of 20 DINT values (80 bytes) as follows:

- Command (see the list of commands below)
- Channel (0 or 1)
- Rate Decimal points (0-7)
- 7 pairs of rate calibration values. Each pair has an operating percentage (OP) with two decimal places, and an associated rate, shown with the number of decimal places specified by the Rate Decimal points parameter.
- CalZeroCounts
- CalLowCounts
- CalibK

1. Command 1: Read calibration values. Use this command to read the rate and weight calibration values.

2. Command 0x81: Write rate calibration values. Use this command to set the 7 rate calibration pairs.

3. Command 0x82: Write weight calibration. Use this command to set the 3 weight calibration values: zero counts, low counts, and CalibK (weight per A/D count).

4. Command 0x83: Write both weight and rate calibration values.

The two commands below read and write configuration data. Each returns 52 DINT values, which are the command, the channel, and the format word, followed by 49 parameter values, which are listed in the order of the parameter IDs.

5. Command 0x0F: Read configuration data.

6. Command 0x8F: Write configuration data.

The format word is like the one in the configuration data table, but in the least significant word of the DINT rather than in the most significant word.

Note   *The values written via these commands are NOT saved automatically to the non-volatile memory and are lost on power down if no save to non-volatile command is given.*

Chapter 5 Calibration

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The Feeder Controller Module should be calibrated before use. We also recommend that you verify the calibration periodically or when not in use for extended periods of time. Users and service personnel should be familiar with the procedures in this chapter before installing or operating the Feeder Controller Module.

NOTE   *Do not perform a calibration while the application is in operation.*

Pre-Calibration Procedures

Verify that the load cells have been properly installed.

- Refer to your load cell I&M manual for proper installation instructions.

- On some sensors and cells an arrow indicates the direction of the applied load. If the arrow is pointing in the wrong direction, change the position of the load cell so that it is mounted in the direction of the applied load.

- Check for binding on the Load Cell or other parts of the weighing system.

CAUTION: *Binding on a scale/vessel or load cell does not allow the load cell free vertical movement and may prevent the instrument from returning to the original zero reference point.*

A load cell must be mounted so that 100% of the load (Vessel w/Contents) passes vertically through the load cell.

Verify that nothing is binding the load cell. This means that nothing is draped across the scale/vessel or the load cell, such as a hose, electrical cord, tubes, or other objects.

Verify that nothing is in contact with the scale/vessel other than service wires and piping that have been properly mounted with flexible connections.
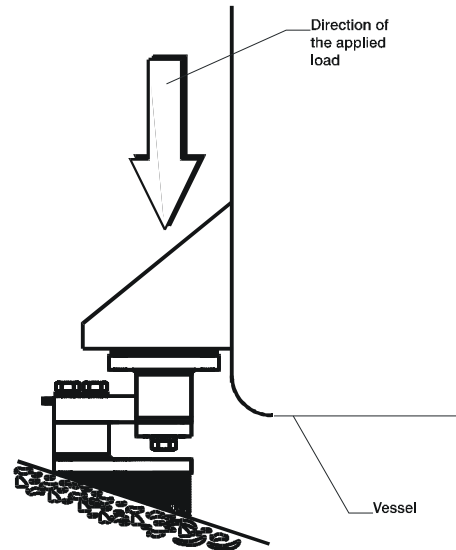
Properly Installed Load Cell

Electrical Check Procedures

Load Cell/Point Input/Output Measurements

The Feeder Controller Module is designed to supply 5 VDC excitation to as many as four 350-Ohm load cells/points. The expected output from each load cell/point will depend on the mV/V rating of the load cell/point and the weight.

For example, a 2mV/V load cell/point will respond with a maximum of 10 mVDC at the system's full weight capacity, which includes the weight of the vessel and the weight of the product as measured by the load cell/point. Thus, if the load cell/point weight

capacity is rated at 1000 pounds, the load cell/point will be 10 mVDC at 1000 pounds, 7.5 mVDC at 750 pounds, 5 mVDC at 500 pounds and so on.

A zero reference point will vary from system to system depending on the "Dead Load" of the vessel. "Dead Load" is the weight of the vessel and appurtenances only, with no product loaded. In our example we will assume the dead load to be 500 pounds.

The operating range for the scale in this example is 5-10 mVDC with a 500 pound weight range. Note that after zeroing the instrument, the 0 reading refers to the zero reference point and not absolute 0 mVDC or absolute 0 weight.

Millivolts/Weight Scale
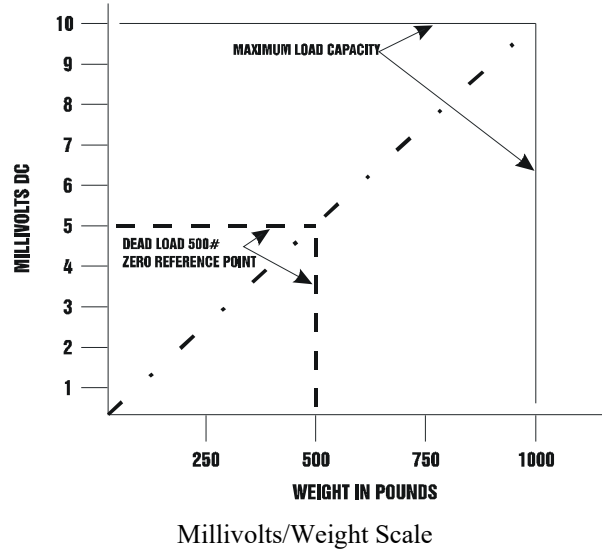
NOTE   *Load cell/point measurements are checked with a digital volt meter at the J1 connector on the front of the module or by using INTEGRATED TECHNICIAN with the HI 215IT Junction Box.*

Load Check

Place a load (weight) on the scale or vessel, and check to see if the weight reading on the input table changes in the proper direction.

For example: If the input table display reads 100 pounds and a 20-pound weight is placed on the vessel or scale, the ladder logic display should read 120 or some value over 100. With the input table display reading 100 pounds, if a 20-pound load is placed on the vessel or scale and the reading is 80 pounds, the reading is going in the wrong direction and indicates some problem with the system.

If the input table reads improperly or shows no change, something is wrong with the setup. If the input table changes weight in the proper direction, remove the weight and proceed to calibrate the module.

C2 Calibration

C2® calibration requires C2 load sensors. (If you have no C2 load sensors, see Hard Calibration below). The Weigh Module reads the performance characteristics of the individual load cells and detects the quantity of load cell(s) in the system. C2 Calibration can be performed via Allen Bradley RS LOGIX 5000 using either the output table or ladder logic.

WARNING: *LOAD CELL CABLE LENGTH HAS BEEN CALCULATED INTO C2 CALIBRATION DATA. HARDY RECOMMENDS THAT YOU DO NOT CUT YOUR ADVANTAGE® or ADVANTAGE LITE® LOAD SENSOR CABLES, BECAUSE YOUR C2 ACCURACY WILL BE AFFECTED AND THE WARRANTY WILL BE VOIDED.*

C2 Calibration Using Ladder Logic

Verify that the parameters have been setup for your weighing process in accordance with the setup information provided in Chapter 4.

A Ladder Logic Example is located at the Hardy Process Solutions Inc. Web Site. See http://www.hardysolutions.com. Click products > PLC Weighing Modules > HI 1756-FC. Click on the Docs & Programs tab and scroll down to Programs and Firmware. Select *HI 1756-FC Sample Programs* for the Ladder Logic example

Hard Calibration

Hard Calibration is the traditional method of calibration using test weights. Hardy recommends that the test weights total 80 to 100% of the load capacity.

Hard Calibration Ladder Logic Example

Verify that the parameters have been setup for your weighing process in accordance with the setup information provided in Chapter 4.

A Ladder Logic example on the Hardy Process Solutions Inc. web site explains how to set the weigh process parameters. Depending on your application, this Ladder Logic example may or may not meet your requirements.

The Hard Calibration Ladder Logic Example is located at the Hardy Process Solutions Inc. Web Site. See http://www.hardysolutions.com. Click products > PLC Weighing Modules > HI 1756-FC. Click on the Docs & Programs tab and scroll down to Programs and Firmware. Select *HI 1756-FC Sample Programs* for the Ladder Logic example.

Chapter 6   Troubleshooting

• • • • •

Chapter 6 provides procedures for troubleshooting the electrical, mechanical and firmware elements of the HI 1756-FC and for using Hardy's Integrated Technician (IT®) software utility to isolate problems. Flow charts provide troubleshooting s for the rate controller, load cells, and cabling.

Disassembly and Reassembly Notes, Warnings and Cautions

WARNING   *EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT OR REPLACE COMPONENTS UNLESS POWER HAS BEEN SWITCHED OFF OR AREA IS KNOWN TO BE NON-HAZARDOUS.*

- Always replace broken or damaged modules or hardware immediately.

- Always check to be sure that no loose parts are sitting on printed circuit boards or electrical connectors or wires when disassembling or reassembling.

- Always protect printed circuit boards from electrostatic discharge (ESD). Always use approved ESD wrist straps and anti-static pads.

- Always follow proper safety procedures when working on or around the Rate Controller.

This chapter describes several tests that can shorten the time for troubleshooting. Most problems require the use of two or more tests to determine the cause.

If a problem is isolated to a load cell, it may not mean the load cell is the damaged component. Mechanical imbalances and system piping stress (lack of piping flexures, cables draped over pipes etc.) can make a load cell seem to be the problem.

If you are in doubt as to how to resolve a problem or if you need assistance, look for Hardy Process Solutions Web-tech at http://www.hardysolutions.com. Web-tech is updated often and is available 365 days a year 24/7. It contains several frequently asked questions to aid you in troubleshooting, and it provides a form for requesting additional information and answers to questions, with no waiting on hold.

Weight and Voltage Testing

This test section looks at the readings from ALL the load cells to test overall system performance and signal voltage readings. This test works for all varieties of load cell connection systems.

Further investigation to isolate system problems requires the use of hand tools and multi-meters or the Integrated Technician Summing Junction Box and using the IT© Test section.

NOTE   *IT ®is a registered trademark of Hardy Process Solutions Inc.*

Weight

This displays the amount of force seen by all load cells installed in the summing junction box. Further investigation to isolate system problems will require the use of hand tools and Multi-meters or the Integrated Summing Junction box and using the IT test section. This force can show an imbalance or weight distribution problem. Review your system to insure proper balance. Motors can account for this problem. Piping should not apply any appreciable force on the scale.

mV/V

DC voltage signals are between 0-15 millivolts. Overloads and negative millivolt readings are not shown as actual readings but 15.3 for over voltage and 0.0 for negative voltage. You will need to use a multimeter with a 200 or 300 mVDC range to view the out-of-range voltages. Millivolt/volt equals the output from a load cell per each volt of excitation. The HI 1756-FC reads the load cell output in mV/V, which provides higher resolution (4 decimal places) than an mV reading. This provides more sensitivity to help you troubleshoot the condition of the load cell under certain conditions. Load cells are rated in millivolts/volts. To convert to mV, multiply the mV/V times the sense voltage.

IT Test

If your system has an Integrated Technician Summing Junction box, the IT test can help identify individual load cell problems up to a maximum of four load cell selections.

Sensor Number

Indicates which sensor is under test. Select the target sensor to be tested.

Warning   *Do not install your HI 215IT summing board in areas susceptible to high vibrations. The relays on the board can chatter and affect your weight readings and the vibration can crystallize the solder joints.*

General Troubleshooting Flow Chart Index

Drifting or unstable weight readings	→	**A**
Electrical, Mechanical and Configuration reviews	→	**B**
Verify individual load sensor operation	→	**F**
Trad. Cal - A/D Failure Error	→	**G**
Mechanical Inspection	→	**H**
Electrical Inspection	→	**J**
Load Sensor Installation	→	**K**

A1 - Guidelines for Instabilities on Formerly Operating System

A1

UNSTABLE RATE CONTROLLER

Disconnect external signal cables and shields, except AC Power

Monitor the reading for stability

STABLE?

Yes — Reconnect signal cables one at a time

No — Problem could be in the instrument. Contact Hardy Customer Support PH: 800-821-5831

Monitor the display for stability

If installing any cable causes unstable readings **REVIEW TROUBLESHOOTING SECTION B: B1.1-B1.7**

Go to B

B - Guidelines for Instabilities on Formerly Operating Systems (Cont'd)

```
   ┌───┐         ┌──────────────────────┐
   │ B │ ──────> │      Check for       │
   └───┘         │  Electrical Stability │
                 └──────────────────────┘
                            │
                            ▼
                         ╱──────╲
                        ╱  OK?   ╲ ── No ──> ( B1 )
                        ╲        ╱
                         ╲──────╱
                            │
                           Yes
                            │
                            ▼
                 ┌──────────────────────┐
                 │      Check for       │
                 │  Mechanical Stability │
                 └──────────────────────┘
                            │
                            ▼
                         ╱──────╲
                        ╱  OK?   ╲ ── No ──> ( B2 )
                        ╲        ╱
                         ╲──────╱
                            │
                           Yes
                            │
                            ▼
                 ┌──────────────────────┐
                 │  Check Configuration │
                 │    settings for      │
                 │      stability       │
                 └──────────────────────┘
                            │
                            ▼
                         ╱──────╲
                        ╱  OK?   ╲ ── No ──> ( B3 )
                        ╲        ╱
                         ╲──────╱
                            │
                           Yes
                            │
                            ▼
                        ╱────────╲
                       │  Go To   │
                       │    A     │
                       │ Stability │
                        ╲────────╱
```

B1 - Guidelines for Instabilities on Formerly Operating Systems (Cont'd)

B1 → Electrical

B1.1 → **Physical Grounding -**
All common equipment share a common ground point.
Keep the ground cable length to earth ground as short as possible.
Install a new ground rod if the cable length is excessive.

B1.2 → **Cable -**
Cuts or breaks in the load cell insulation allow moisture to wick into the cable and load points. This can setup stray capacitance charges and allow ground currents to exist. This could create a highly intermittent situation.

B1.3 → **Vessel, Fill and discharge piping -**
Ground all to a common point to eliminate electrical differences in potential and static build-up.

B1.4 → **Load Cells -**
Ground straps must be installed to provide a direct discharge path to ground around the load points.

B1.5 → **Cable Routing -**
Separate high voltage sources and cables form low voltage signal cables.
Stay a minimum of 14 inches from magnetic fields and VFD controls.
Avoid parallel high voltage and signal cable runs.

B1.6 → **Cable Shielding -**
Ground low voltage cable shields only at the controller end.
Grounding both cable ends produce ground currents.
Verify, with and ohm meter, the shield is only grounded at the weight controller.
Disconnect eh shield at the controller and check for an open circuit between ground and shield. Reconnect the shield to ground and confirm a proper ground path from the IT Junction box to the controller.
Verify the shield is not connected to ground at the IT Junction Box.
Load cell shields only pass thru the IT Junction boxes and are not connected ground at that pont.

B1.7 → Weight Controller - Common AC ground and Chassis grounds. → Go to B

B1 - Guidelines for Instabilities on Formerly Operating Systems (Cont'd)

B1

B2 ← **OK?** → No

Vessel -
When inspecting a vessel, the Center of Gravity (COG) should be low and centered equally over all the load cells. Insure the load is directly over or under the load point to avoid side-loading and that there isn't any side loading from piping or external forces. Install flexures on all piping to insure a free floating vessel.
Make sure the vessel and load cell mounts are mechanically stable and fixed.
Large changes in individual load cells indicate a shift in the COG or faulty load cells.
Piping and motors can effect the individual load cell readings.
Allow for a higher reading on load cells that support motors and piping.
Insure pneumatic lines are not applying pressure to the vessel when energized.
Use check (stay) rods to minimize vessel movement.
Make sure the check rods are loose and not interacting with the vessel.
Power down all vibration, vacuum and pressurization equipment during the test process.

Yes

B3 ← **OK?** → No

Configuration Settings
Incorrect WAVERSAVER settings can cause unstable weight readings. Adjust to the lowest WS setting that gives you a stable reading. Higher frequencies with low amplitude vibrations - Use WS settings 1 or 2 lower frequencies with high amplitude vibrations - Use WS setting 3 or higher incorrect number of decimal places. Reading weight increments beyond the equipment applications level. (Sed Guideline Calculations below)

Repeatability -
Divide the total load cell capacity, including decimal points by 10,000. (Expected stable weight reading)

Resolution -
Divide the total load cell capacity, including decimals points by 30,000. (The amount you can expect to see but not necessarily stable

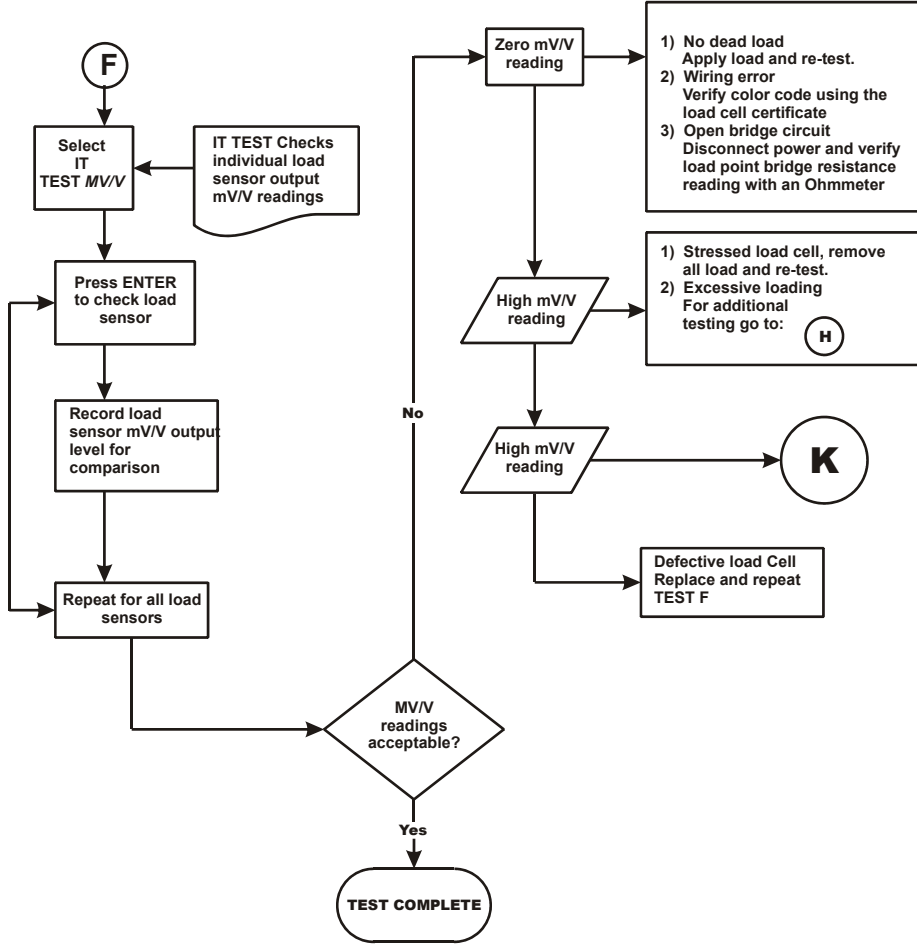Yes

Return to A STABILITY

C

F - Verify Individual Load Cell Millivolt Readings

Testing an individual load cell signal output requires an IT Summing Junction box or millivolt meter.
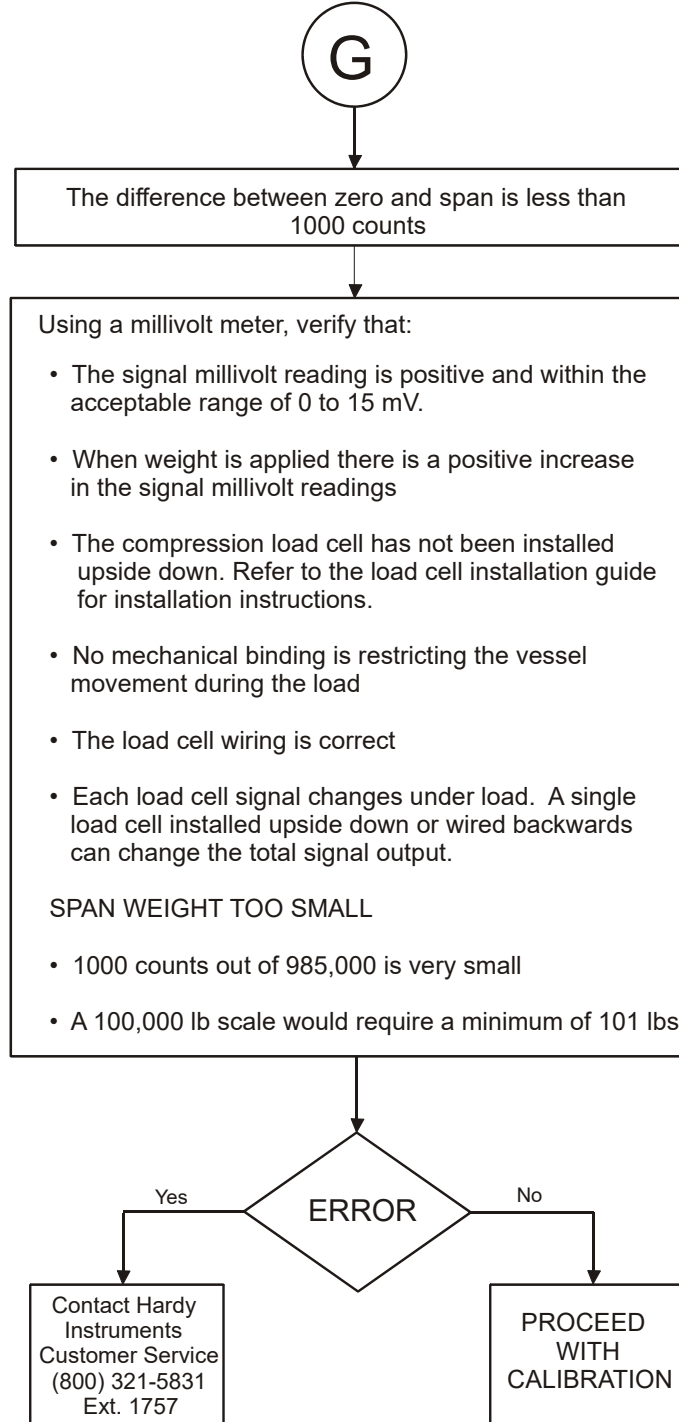
Use the load cell certificate to verify the millivolt per volt (mV/V) rating:

Example: 3mV/V load cells produce approximately 15mV at full load. That is 5 volts excitation x 3 mV/V. At a scale capacity of 1,000 lbs. with 100 lbs. of deadload when empty, the load point mV reading should measure 1.5mV.

```
          F

   Select            IT TEST Checks
    IT        ←──     individual load
  TEST MV/V           sensor output
                      mV/V readings

   Press ENTER
   to check load
    sensor

   Record load
   sensor mV/V output
   level for
   comparison

   Repeat for all load
     sensors
```

Zero mV/V reading
1) No dead load
   Apply load and re-test.
2) Wiring error
   Verify color code using the load cell certificate
3) Open bridge circuit
   Disconnect power and verify load point bridge resistance reading with an Ohmmeter

High mV/V reading
1) Stressed load cell, remove all load and re-test.
2) Excessive loading
   For additional testing go to: H

High mV/V reading   →   K

Defective load Cell
Replace and repeat
TEST F

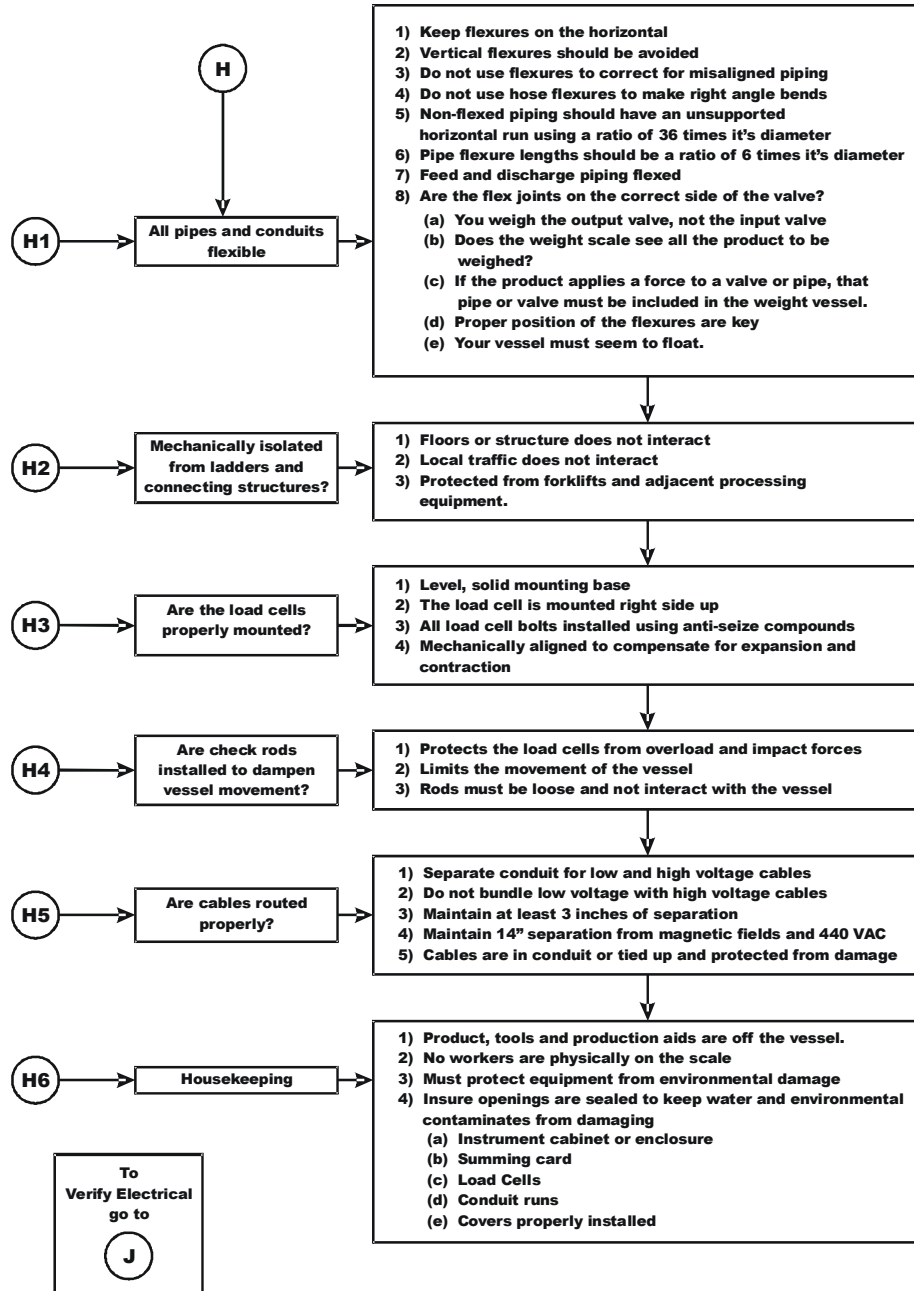No

MV/V readings acceptable?

Yes

TEST COMPLETE

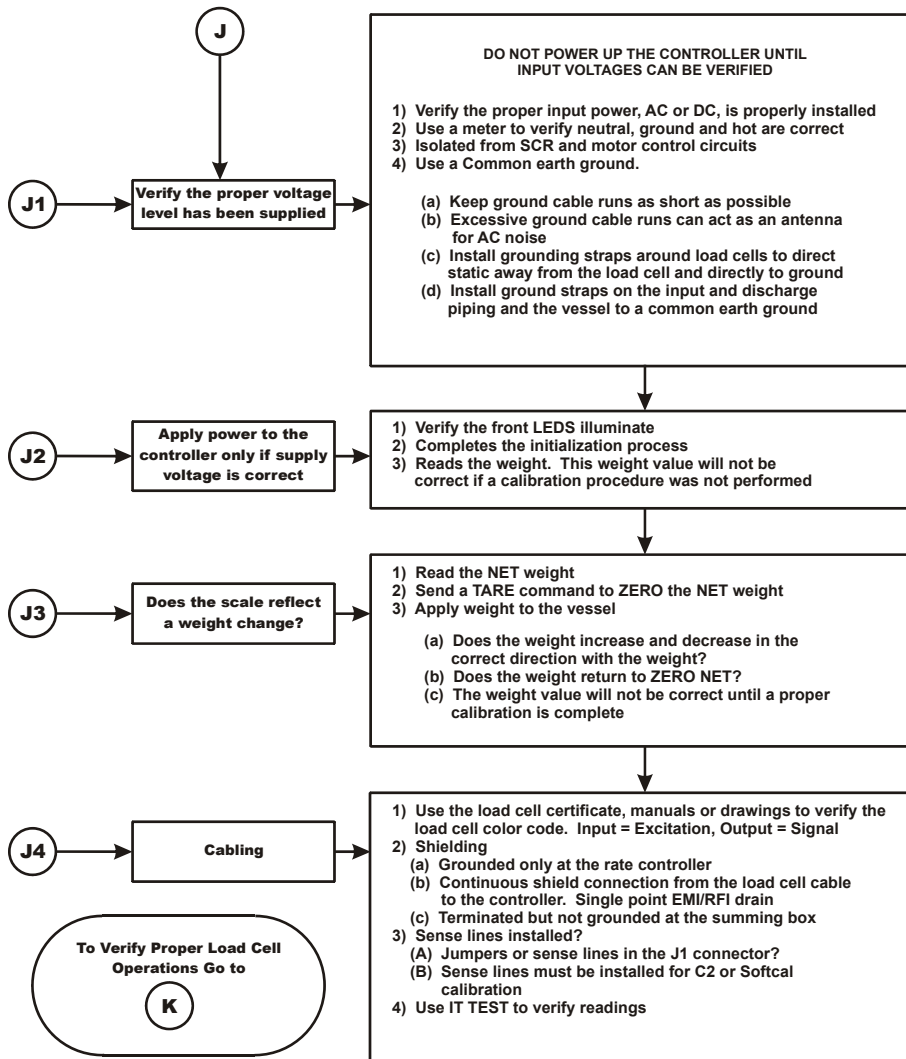## G - Calibration Failed: Not Enough Counts Between ZERO and SPAN

This error only occurs at the SPAN parameter. You may ZERO out chains and temporary calibration equipment to hold or hoist test weights. Zeroing the temporary weight does not effect the calibration.

G

The difference between zero and span is less than 1000 counts

Using a millivolt meter, verify that:

- The signal millivolt reading is positive and within the acceptable range of 0 to 15 mV.

- When weight is applied there is a positive increase in the signal millivolt readings

- The compression load cell has not been installed upside down. Refer to the load cell installation guide for installation instructions.

- No mechanical binding is restricting the vessel movement during the load

- The load cell wiring is correct

- Each load cell signal changes under load. A single load cell installed upside down or wired backwards can change the total signal output.

SPAN WEIGHT TOO SMALL

- 1000 counts out of 985,000 is very small

- A 100,000 lb scale would require a minimum of 101 lbs

ERROR

Yes → Contact Hardy Instruments Customer Service (800) 321-5831 Ext. 1757

No → PROCEED WITH CALIBRATION

H - Mechanical Inspection

H

H1 → **All pipes and conduits flexible** →
1) Keep flexures on the horizontal
2) Vertical flexures should be avoided
3) Do not use flexures to correct for misaligned piping
4) Do not use hose flexures to make right angle bends
5) Non-flexed piping should have an unsupported horizontal run using a ratio of 36 times it's diameter
6) Pipe flexure lengths should be a ratio of 6 times it's diameter
7) Feed and discharge piping flexed
8) Are the flex joints on the correct side of the valve?
   (a) You weigh the output valve, not the input valve
   (b) Does the weight scale see all the product to be weighed?
   (c) If the product applies a force to a valve or pipe, that pipe or valve must be included in the weight vessel.
   (d) Proper position of the flexures are key
   (e) Your vessel must seem to float.

H2 → **Mechanically isolated from ladders and connecting structures?** →
1) Floors or structure does not interact
2) Local traffic does not interact
3) Protected from forklifts and adjacent processing equipment.

H3 → **Are the load cells properly mounted?** →
1) Level, solid mounting base
2) The load cell is mounted right side up
3) All load cell bolts installed using anti-seize compounds
4) Mechanically aligned to compensate for expansion and contraction

H4 → **Are check rods installed to dampen vessel movement?** →
1) Protects the load cells from overload and impact forces
2) Limits the movement of the vessel
3) Rods must be loose and not interact with the vessel

H5 → **Are cables routed properly?** →
1) Separate conduit for low and high voltage cables
2) Do not bundle low voltage with high voltage cables
3) Maintain at least 3 inches of separation
4) Maintain 14" separation from magnetic fields and 440 VAC
5) Cables are in conduit or tied up and protected from damage

H6 → **Housekeeping** →
1) Product, tools and production aids are off the vessel.
2) No workers are physically on the scale
3) Must protect equipment from environmental damage
4) Insure openings are sealed to keep water and environmental contaminates from damaging
   (a) Instrument cabinet or enclosure
   (b) Summing card
   (c) Load Cells
   (d) Conduit runs
   (e) Covers properly installed

To Verify Electrical go to

J

J - Electrical Inspection

J

J1 → Verify the proper voltage level has been supplied →

DO NOT POWER UP THE CONTROLLER UNTIL
INPUT VOLTAGES CAN BE VERIFIED

1) Verify the proper input power, AC or DC, is properly installed
2) Use a meter to verify neutral, ground and hot are correct
3) Isolated from SCR and motor control circuits
4) Use a Common earth ground.

   (a) Keep ground cable runs as short as possible
   (b) Excessive ground cable runs can act as an antenna
      for AC noise
   (c) Install grounding straps around load cells to direct
      static away from the load cell and directly to ground
   (d) Install ground straps on the input and discharge
      piping and the vessel to a common earth ground

J2 → Apply power to the controller only if supply voltage is correct →

1) Verify the front LEDS illuminate
2) Completes the initialization process
3) Reads the weight. This weight value will not be
   correct if a calibration procedure was not performed

J3 → Does the scale reflect a weight change? →

1) Read the NET weight
2) Send a TARE command to ZERO the NET weight
3) Apply weight to the vessel

   (a) Does the weight increase and decrease in the
      correct direction with the weight?
   (b) Does the weight return to ZERO NET?
   (c) The weight value will not be correct until a proper
      calibration is complete

J4 → Cabling →

1) Use the load cell certificate, manuals or drawings to verify the
   load cell color code. Input = Excitation, Output = Signal
2) Shielding
   (a) Grounded only at the rate controller
   (b) Continuous shield connection from the load cell cable
      to the controller. Single point EMI/RFI drain
   (c) Terminated but not grounded at the summing box
3) Sense lines installed?
   (A) Jumpers or sense lines in the J1 connector?
   (B) Sense lines must be installed for C2 or Softcal
      calibration
4) Use IT TEST to verify readings

To Verify Proper Load Cell
Operations Go to

K

K - Load Sharing and Load Sensor Checkout

K

K1 → Load Cell wiring is complete and correct?

1) Does the mV signal increase in a positive direction
2) If you receive a negative result, check if load cell is mounted correctly.

   (a) The arrow goes with the direction of force
   (b) If there isn't an arrow, you must manually verify the correct direction. A negative reading indicates the load cell is upside down
   (c) Load cells in tension will not reflect a negative reading if installed upside down. If upside down, only the force applied by the cable will be included in the weight reading
   (d) If you are still receiving a negative signal, verify load cell wire color code

K2 → Multiple load cells MAP the mV reading. Balance the load

1) Verify a positive mV/V reading from each load sensor using IT TEST
2) Record the mV/V reading and compare each corner for proper load sharing
   (a) For proper load sharing you should see only a difference of +/- .5mV
   (b) Larger differences due to motors and piping should not exceed +/- 2mV
   (c) If there aren't any motors, valves or piping to explain the mV difference, adjust the corners and balance the mV readings
   (d) Use shims or if equipped adjusting bolts on the load cell mounting hardware
   (e) Drawing a load cell map helps determine the correct leg to adjust and in which direction

Three load cells balance like a three legged chair

1) Using a spirit level, verify the vessel is vertically and horizontally correct
2) Verify if any height change effects the attitude of adjacent vessels or piping
3) Adjust each leg to dynamically match mV outputs
4) Verify the mV readings and physical level when complete

Four or more load cells present a challenge

1) Use the Weight and Voltage test to determine the sum of the load cell signals to set your target mV reading for each load cell
2) Read the output of individual load cells
3) Adjust the load cell with the lowest reading to dynamically match the target mV readings obtained in Step 1
4) Read the mV readings from each load cell to verify a proper correction
5) Repeat steps 3 and 4 to achieve a proper load sharing vessel
6) Verify the mV readings and vessel level when complete

Monitor system for proper operation
Check out completely

Erratic Weight or Rate Control

This section explains how to resolve problems relating to rate and Rate of Change (ROC) calculation, Rate Exception Control (REC), motor speed control, and weight calibration.

Rate calculations

1. Rate calculations are no better than the scale's calibration accuracy. Verify the scale calibration using test weights.

2. Follow the weight troubleshooting flow charts and correct any equipment binding, rubbing, and piping problems.

3. After an initial rate calibration on a new system, verify the calibration several times to ensure consistency, and verify the calibration using the posted weight loss over time.

4. If the rate displayed does not match your test samples:

   - Re-calibrate the scale and then the rate.

   - Review the troubleshooting tips for mechanical influences relating to the feeder mechanism

   - Look for leaks in the delivery system or refill gate.

5. If the system is slow to change rate (or weight) readings.

   - Adjust the number of averages setting lower.

   - Adjust the WAVERSAVER setting lower.

   - See *REC +/- settings* below.

6. Look for a systematic and consistent weight loss. Determine what a stable rate should be. If the rate displayed on the monitor continuously falls and rises and you never get a stable rate or symmetrical weight loss pattern:

   - The rate may be too slow for the load call capacity.

   - The material may be bridging or liquefying and basically inconsistent.

   - The feeder motor may be feeding too fast, mechanisms may be damaged, or working conditions may not be right.

ROC calculation

The ROC reading does not necessarily indicate a smooth weight loss. The amount of ROC control required depends on the material currently being fed.

1. Since ROC calculations are developed from the weight reading, the weight reading must be correct.

2. The Loss In Weight (LIW) ratio is calculated from the total scale load cell capacity. If an LIW rate error greatly exceeds the weighing error:

   - Add decimal points up to 1 part in 50,000 to help determine the ROC.

   - Balance the WAVERSAVER setting and averages.

Motor speed control output signal

If the motor speed control output signal indicates a problem, but the voltage and current levels measured on the terminals is correct:

1. Adjust the OP% out in manual mode.

2. In the ON condition, verify that the output signal matches the percentage of full range. For example: 50% of a 0-10V signal should read 5 VDC at the analog out terminal.

3. Adjust the WAVERSAVER setting and averages.

If the output is properly wired back to the motor speed controller, verify that the PLC analog card parameters for that analog out are set correctly and that the HI 1756-FC analog signal is programmed for the corrected controller terminals.

Hardy Process Solutions Inc. does not provide motor speed control converters or analog out PLC modules. Consult the motor speed controller manufacturer's manual for troubleshooting and settings.

REC +/- settings

1. The rate exception control indicates whether the controller is running within the requested range. If a status bit is out-of-range, the REC status bit is displayed to indicate the direction. While this may indicate that the rate is too small for the scale's accuracy or resolution, the reading can be used to determine the effect of parameter and mechanical adjustments on improving the material flow control.

2. During auto rate calibration the PI settings are adjusted to optimize the flow rate for your feeder settings and material. The speed of oscillation can be used to view the effect of correction or adjustments to the PI settings.

   - P = 0-100% correction factor. P determines the amount of action or reaction that is made in response to an out-of-range rate indication

   - I = the speed of that action/reaction. This value normally requires only a small adjustment. (0.2 increments) If the rate is always high, reduce the I. If it is always low, increase I.

The feeder fails to stop in HOLD, STOP or IDLE

Determine whether the motor speed control OP% analog card module reacts properly and goes to the low setting.

1. Verify with a multimeter.

2. Follow the manufacturer's troubleshooting guide(s) to determine the malfunction.

3. Verify that the Analog out is returning to the low parameter setting as set in the PLC menu for that analog out channel.

NOTE *Send a Stop or Hold signal when a stop condition occurs. Do not rely on the analog signal to stop the feeder.*

System and Load Cell Tests

Overview of Typical Load Cell System

The typical load cell system consists of one or more load cells/points and an HI 1756-FC Rate Controller. If you have more than one load point, an optional summing junction box can read data for individual load cells.

Load Cell/Sensor/Point - is a strain gauge-based force transducer that generates an electrical signal proportional to the load applied to the scale. Tension or compression type load cells/points can be used to measure pressure, load, or torque.
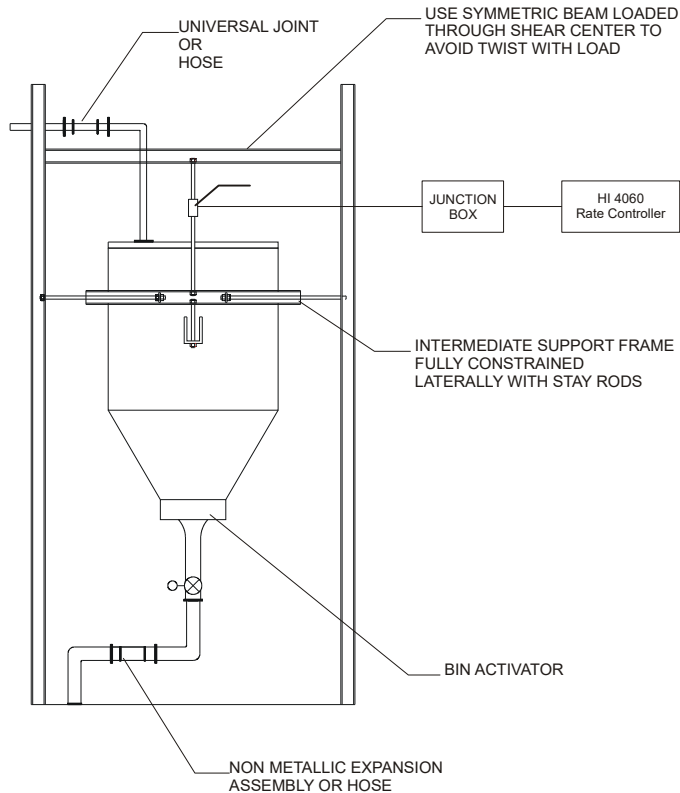
The load cell/point takes as an input the 5 volts DC excitation voltage generated by the HI 1756-FC. It generates a millivolt output proportional to the weight on the scale (0-10mV DC for 2mV/V load cells/points or 0-15mV DC for 3mV/V load cells/points).

Rate Controller - is the part of the HI 1756-FC instrument that, among other functions:

- Powers the load cell(s)/point(s)
- Reads the millivolt signal output from the load cell(s)/point(s)
- Digitizes, interprets, communicates the results in terms of weight and rate

INTEGRATED TECHNICIAN (IT®)

INTEGRATED TECHNICIAN (IT®) is a diagnostics utility that enables the operator to rapidly troubleshoot the individual load cells in a weighing system. An HI 215IT Summing junction box is required to read data for individual load points. It provides separate inputs for each load cell.

If you have more than one load cell without the IT junction box, there is no easy way to isolate the load cell signals.

If you have more than one load cell with the IT junction box, the system can provide both the average numerical values and values specific to each load cell. The number for a load sensor is based on the connections in the IT junction box.

Check the installation sequence in the box to determine which load sensor is number 1, 2 and so on. Always install the first load cell in position 1.

If you do not have the optional IT junction box, some of the options described below will not appear on either interface.

Warning   *Do not install your junction box in areas that are susceptible to high vibrations since the relays on the summing board can "chatter" and affect your weight readings.*

To determine if an instrument or cabling problem exists, verify the basic operation of the system by performing the following system checks.

Weight and Voltage Test

The Weight and Voltage tests are used to diagnose a weighing system and, if certain types of problems are indicated, determine their source. It provides the total scale input to the instrument, such as mV/V and Weight in the units selected (i.e. lbs, kg, oz, g).

Running the IT test will show the weight and voltage results for each load sensor, including the following values:

Weight: Weight value recorded on the sensor

mV/V: The mV/V reading is sufficient to balance the corners of your scale or vessel. These readings allow you to determine if the problem is in the instrument (internal) or in a load sensor(s) (external). The normal specification range for the Rate Controller is 0-15 mV. Readings outside this range (15.5 mV, 3.1 mV/V Maximum or any negative values), indicate an external problem. (most likely improper wiring).

When you check the results, if all the load sensors read 0.00, something is probably wrong between the HI 1756-FC and the HI 215IT junction box, e.g., the cable may be disconnected. Something could also be causing the box to not transmit the readings to the HI 1756-FC.

If you get no reading for one or possibly two or more load sensors (e.g., sensor 3 reads 0.00 or the reading is larger or smaller than it should be) and you know that the sensors are connected to the junction box, either the load sensor is malfunctioning or its cable to the junction box is loose or incorrectly wired.

General Policies and Information

Hardy Process Solutions provides world-wide support for its products. The following paragraphs describe Hardy's customer support services and equipment warranty. When returning a product, call the Technical Service Department listed below for a Return Authorization Number. You will need to provide your company name, address, telephone number, equipment model number, S/N, and a brief description of the problem.

NOTE   *For all non-warranty repairs a purchase order or credit card information is required. You can also go to the Hardy web site and request a Return Authorization number. An RA# will be e-mailed to you.* http://www.hardysolutions.com/service/repair.php

Warranty

A warranty problem may be handled by returning the product to the factory for repair or replacement under warranty. In the event you experience a problem with this instrument contact your local Hardy Representative or the Hardy Process Solutions Service Center to determine if the problem is covered under warranty.

Web Address: http://www.hardysolutions.com/Service/term.php

Ordering Replacement Parts

Contact the Hardy Process Solutions Sales Department to order replacement parts and option boards. Have your equipment model number and serial number ready.

Note   *System Support (Requires Purchase Order or Credit Card)*

Technical Service is provided as follows:

- **New system start-up:** Ensure that the installation is checked and correct; instruments are calibrated, and operators trained.

- **Service:** Engineers are trained and qualified to provide on-site installation, calibration, and maintenance.

- **On-site training:** A Hardy Support Representative can be scheduled to train your operations and maintenance personnel. This can be as simple as basic load cell theory or as complete as troubleshooting techniques which allow you to service your equipment.

For Further Information Contact

Hardy Technical Services

Hardy Process Solutions,

10075 Mesa Rim Road, San Diego, CA 92121

Telephone: +1 (858) 292-2710 Option 4

FAX: +1 (858) 278-6700

Web Site: http://www.hardysolutions.com

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Web Address: http://www.hardysolutions.com
Hardy Process Solutions Document Number: 0596-0318-01 Rev C

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