Modular IO User Manual

2 Channel Load Cell Interface Module (M-LCI2)

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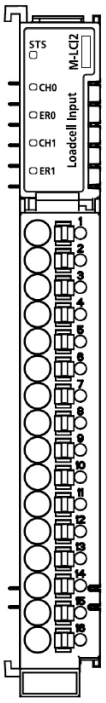

Revision:

Version	Date	Revised Contents
1.0	Dec 2025	First draft released

Intended audience of this manual

Thank you for choosing the Mitsubishi Electric India product.

Do not use this product until you have full knowledge of the equipment. Please forward this manual to end user.

This manual is intended to the following personnel,

- Managing in charge.
- Designing or developing personnel.
- Commissioning and maintaining personnel.
- Supervising personnel.
- Operating personnel.

Intended use of this product

This product is intended to be used as part of an industrial automation system. It is designed for installation within electrical control panels or enclosures and is intended to perform control, signal acquisition, and signal output functions in industrial environments.

The Modular IO stations are suitable for controlling and monitoring industrial machines, processes, and systems. These products are designed to be installed and maintained by trained professionals familiar with industrial automation, electrical safety, and applicable standards.

This product is not intended for:

- Use in life-support systems.
- Safety-critical applications without additional safety-rated components.

Scope of manual

This user manual provides the details of IO module ‘M-LCI2 (2Ch. Load Cell Interface Module’ of Modular IO series. This manual contains information on Specifications, Wiring, LED Indications, Parameters, IO data and features of M-LCI2 module.

For instructions about safety, disposal and transport precautions, replacement cycle, installation and wiring guidelines, configuration, diagnostic method and maintenance and troubleshooting refer to ‘Modular IO User manual’ (N16001AAMH)’

Terms and Conditions

- Mitsubishi Electric India Pvt. Ltd. shall have no responsibility or liability for any personnel injury or death, or loss or damage to the property caused by said product, if used or operated in applications which are not intended or excluded by instructions, precautions or warnings provided in this document for the said product.
- Specifications are subject to change without prior notice.
- The reproduction or transmission of this document or its contents in full or part is not allowed without written permission from the authority.

Precautions for safe use of product

Refer ‘Modular IO User manual’ (N16001AAMH) for precautions for safe use of product.

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In this manual, the safety precautions are classified into two levels: “⚠ WARNING” and “⚠ CAUTION”.

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠ CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

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Module Overview

Load cell converts weight or force into a measurable electrical signal.

Strain gauge load cells are most common type of load cells used in the industry. When a load or force is applied to the stain gauge, it causes deformation (strain) in it, which is then converted into an electrical signal proportional to the applied force.

M-LCI2 module provides 2 channels to interface 4-wire/ 6-wire strain gauge load cell sensor with various sensitivity levels.

The following are the few applications areas

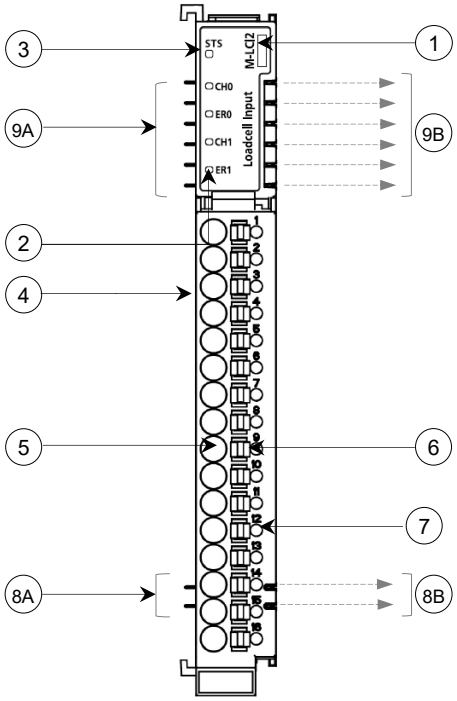
1. Weighing and filling system: Packing machinery, Automated filling stations.
2. Industrial automation and process control: Material handling applications.
3. Environmental monitoring and structural health Monitoring
4. Batching and mixing operations in chemical processing, food processing, and pharmaceuticals industry.
5. Concrete batching plants
6. Quality control and testing

Highlighting features:

- User configurable digital filter, averaging methods for stable gross weight value
- Easy configuration using ‘MIO Configuration Tool’
- Step by step easy calibration using Modular IO Configuration tool as well as from fieldbus master.
- Support for weighing functions like,
  - Tare subtraction
  - Zero set/ reset
  - Automatic zero tracking
  - Indication of stability status
  - Hold peak and bottom value of gross weight value

Part Names

The figure below describes part names of the module.



No.	Name	Description
1	M-LCI2	Module ordering code
2	Channel LED Indications	CH0, CH1: 2, Green colour LEDs for individual channel status ER0, ER1: 2, Red colour LEDs for individual channel error status
3	Module LED Indication	STS: 1, Bi-colour LED for module status
4	Terminal Block	16-point removable push type
5	IO Point	Wire insertion point for IO terminal
6	Push Button	Press to release wire
7	Test Point	To measure signal voltage
8A	Field Power Supply Interface	2 Incoming pins for field power supply interface
8B		2 Outgoing pins for field power supply interface
9A	System Power Supply Interface	6 Incoming pins for system power supply interface
9B		6 Outgoing pins for system power supply interface

Specifications

For ‘Environmental Specifications’ and ‘Approvals and Standards’ refer to ‘Overview’ section of ‘Modular IO User Manual (N16001AAMH)’.

The table below provides technical specifications of **M-LCI2**.

<table>
<tr><th>Specification</th><th colspan="5">Description</th></tr>
<tr><td>Number of load cell inputs</td><td colspan="5">2 channels</td></tr>
<tr><td>Input type</td><td colspan="5">Differential to interface a full-bridge strain gauge</td></tr>
<tr><td>Connection type</td><td colspan="5">4-wire/ 6-wire</td></tr>
<tr><td>Load cell rated output</td><td colspan="5">1.0 to 3.0 mV/V (User configurable)</td></tr>
<tr><td>Input conversion range</td><td colspan="5">-3.5 to 3.5 mV/V</td></tr>
<tr><td>Zero-point adjustment range</td><td colspan="5">-3.5 to 3.5 mv/V</td></tr>
<tr><td>Gain adjustment range</td><td colspan="5">-3.5 to 3.5 mV/V</td></tr>
<tr><td>Weight output value</td><td colspan="5">32-bit signed binary</td></tr>
<tr><td>Resolution</td><td colspan="5">24-bit</td></tr>
<tr><td>Accuracy</td><td colspan="5">Nonlinearity: Within ±0.02%/FS (ambient temp. 25°C)
Zero drift: Within ± 0.25 µV/°C
Gain drift: Within ± 15 ppm/°C
(With default settings and 6- wire sensor connection)</td></tr>
<tr><td rowspan="4">ADC conversion time</td><td colspan="5">Conversion time of analog to digital conversion is set with parameter ‘Conversion speed’. The table below shows the conversion time per channel for each setting.</td></tr>
<tr><td colspan="2">Conversion speed setting</td><td colspan="3">Conversion time per channel</td></tr>
<tr><td colspan="2">Fast</td><td colspan="3">190 µs</td></tr>
<tr><td colspan="2">Normal (Default)</td><td colspan="3">450 µs</td></tr>
<tr><td colspan="2">Slow</td><td colspan="3">825 µs</td></tr>
<tr><td>Step response time *1</td><td colspan="5">Depends on Filter setting and conversion speed setting
For default settings - 10ms per channel.</td></tr>
<tr><td>Input filtering</td><td colspan="5">User configurable software filter:
• 1st order IIR filter : Configurable levels 0 to 8 (Default 0 = disabled)
• Moving average: No. of averaging samples 1 to 255. (Default =32)</td></tr>
<tr><td rowspan="2">Input impedance</td><td colspan="2">Between SEN+ and SEN-</td><td colspan="3">Not less than 1 MΩ</td></tr>
<tr><td colspan="2">Between SIG+ and SIG -</td><td colspan="3">Not less than 100 MΩ</td></tr>
<tr><td>Absolute maximum signal input</td><td colspan="5">±2.5 V</td></tr>
<tr><td>Input protection</td><td colspan="5">Voltage transient protection</td></tr>
<tr><td rowspan="4">Load cell excitation</td><td>Rating</td><td colspan="4">5 VDC ±1%, 65mA / channel, 130mA max</td></tr>
<tr><td>Allowable load</td><td colspan="4">85 to 4010 Ω</td></tr>
<tr><td>Protection</td><td colspan="4">Short circuit</td></tr>
<tr><td>Overload</td><td colspan="4">2 (Channels) X 120% of maximum current</td></tr>
<tr><td rowspan="3">Isolation</td><td colspan="3">Input channels to internal circuit</td><td colspan="2">2500VDC, 1 min</td></tr>
<tr><td colspan="3">Input channel to Input channel</td><td colspan="2">No isolation</td></tr>
<tr><td colspan="3">Field power supply to input channel</td><td colspan="2">2500VDC, 1 min</td></tr>
<tr><td rowspan="2">IO Memory Consumption</td><td>Input Bits (IX)</td><td>Output Bits (QX)</td><td>Input Words (IW)</td><td colspan="2">Output Words (QW)</td></tr>
<tr><td>6 Bytes</td><td>3 Bytes</td><td>14 Words</td><td colspan="2">8 Words</td></tr>
</table>

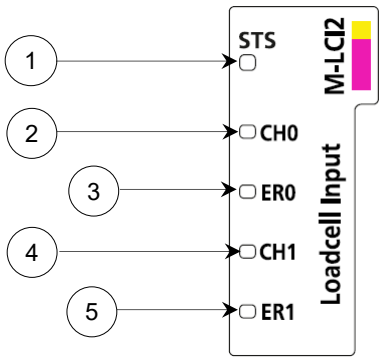
The table below provides Miscellaneous specifications of **M-LCI2**.

Specification	Description
No. of modules per Modular IO station	3 maximum
Configuration Tool	Modular IO Configuration Tool
Terminal Block (Removable push type)	16 point
Recommended Wire Size	0.5 sq. mm to 2.0 sq. mm (AWG 20 to 14), Solid wire or Stranded (flexible) wire with lugs.
Maximum distance for connecting load cell	100 meters (With 6-wire connection method)
Field power supply consumption	Not more than 75 mA
System Power Supply Consumption	Not more than 75 mA
Module Dimensions (H x W x D) in mm	105 x 13.2 x 83
Weight (in grams)	Not more than 98 g

*1 for detailed calculation method for step response time of weight value measured at Master PLC refer section 'Calculating weight value step response time at Master PLC'.

LED Indications

This section provides meaning of LED indications available on module.



	LED	Colour	Status		Description
1	STS	Bicolour	OFF		Module powered OFF
			Blue green	ON	Module is powered ON and communicating with Header module
				Single flash	Communication with Header is not established due to, • Module is powered ON and waiting for communication from Header. • Module mismatch.
			Red	ON	• Hardware calibration error.*1 • ADC error / Hardware failure is detected on module.
				Single flash	One of the following conditions occurred. • No communication with Header • Backplane bus fault detected
			Yellow	ON	24 VDC field power supply is not available.
2	CH0	Green	OFF		Channel not enabled due to one of the following cause • Channel disabled / parameter error • Sensor wire disconnected, • Excitation supply to sensor disconnected / short circuit / overload • Over range / Under range (Out of ±3.5mV/V)
			ON		Gross weight value in stable range
			Blinking x1		Gross weight value not stable.
			Flickering		Calibration mode
3	ER0	Red	OFF		No error of load cell interface
			ON		Major error. One of the cause below • Sensor wire disconnected, • Excitation supply to sensor disconnected / short circuit / overload • Over range / Under range (Out of ±3.5mV/V) • Calibration error *2
			Blinking x1		Minor error. Zero / Auto zero correction exceed
			Flickering		Error observed while executing calibration process. *3
4	CH1	Green	Same as LED “CH0” for channel 1.		
5	ER1	Red	Same as LED “ER0” for channel 1.		

*1 Hardware calibration error indicates, hardware calibration data is absent or not valid. Contact MEI service center.

*2 'Calibration error' indicates calibration data is invalid. Execute calibration of module as per procedure mentioned in section 'Calibration' of this document.

*3 'Calibration process error' indicates error detected during executing calibration process. You can check 'Calibration process error code' in IO data (IW n+13). For more details on calibration error codes, refer section 'Calibration' in this document.

Connection Diagram

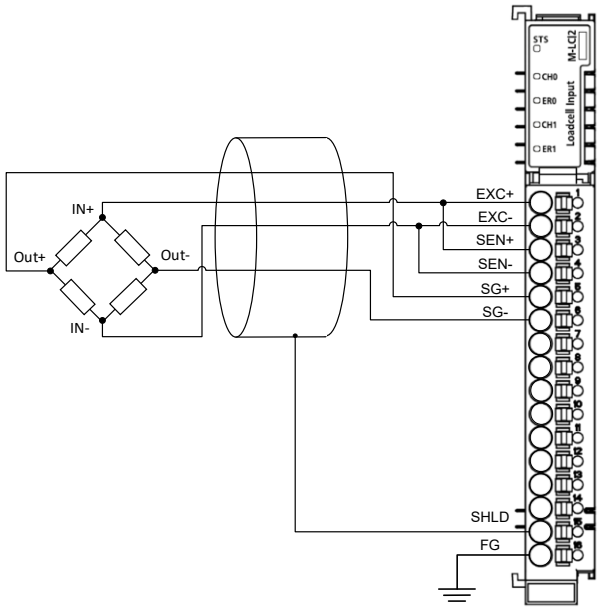
This section provides wiring details for input channels.

This module supports 4 wire as well as 6 wire connection methods. The figure below shows how to connect load cell sensor to module. Wiring description is also provided on right side wall of the module.

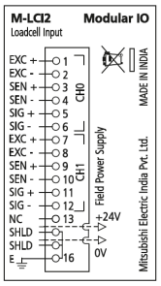
For common wiring recommendations, refer section ‘Wiring’ of ‘Modular IO User Manual (N16001AAMH).

4 wire sensor connection

The figure below shows 4 wire connection of load cell sensor to CH0 of the module.



M-LCI2: Wiring description

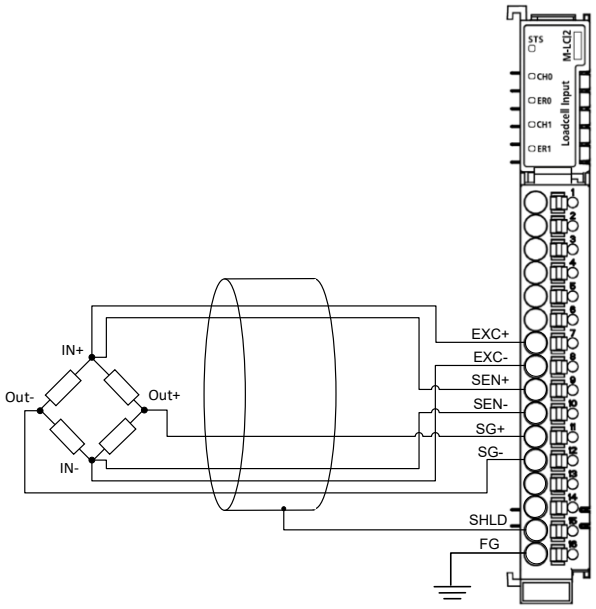


Following are the details for 4 wire load cell sensor connections

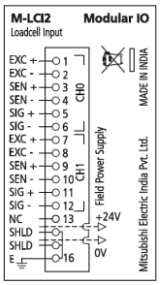
1. Connect excitation power supply (EXC+ and EXC–) to the load cell input supply. Module generates 5 VDC excitation power supply.
2. Install shorting links between the *Excitation* and *Sense* terminals—specifically between EXC+ and SEN+, and between EXC– and SEN–.
3. Connect the load cell output to the module terminals SG+ and SG–.
4. Connect wire shield to the module terminal SHLD.
5. Connect good quality Earth at FG terminal.

6-wire sensor connection

The figure below shows 6 wire connection of load cell sensor to CH1 of the module.



M-LCI2: Wiring description



Following are the details for 6 wire load cell sensor connections

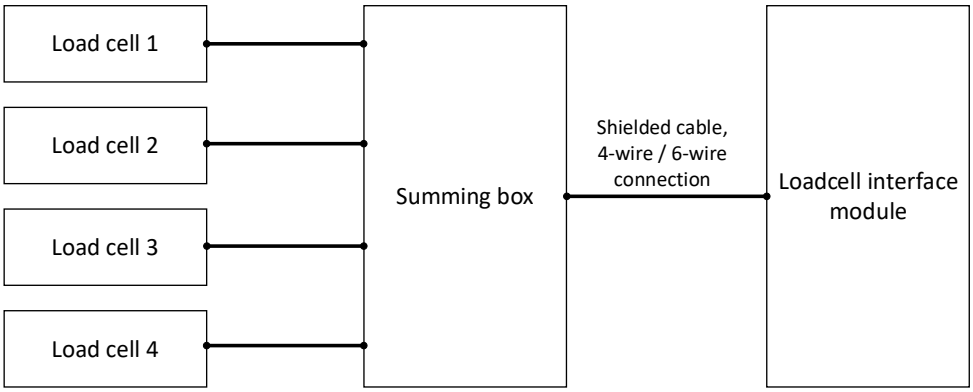
1. Connect excitation power supply (EXC+ and EXC–) to the load cell input supply. Module generates 5 VDC excitation power supply.
2. Connect the sense signals to the module terminals SEN+ and SEN-.
3. Connect the load cell output to the module terminals SG+ and SG–.
4. Connect wire shield to the module terminal SHLD.
5. Connect good quality Earth at FG terminal.

NOTE

- For M-LCI2, ambient temperature variations may affect the overall accuracy of the module. It is recommended to install module away from modules dissipating heat e.g. M-DA2 as far as possible.
- Use a shielded cable for the load cell connection and terminate the shield wire at the module's SHLD terminal.
- Ensure the functional ground terminal of the Load cell Input module is connected to good quality earth with resistance of 100 Ω or less.
- Ensure the wire resistance between the load cell and the module remains 5 Ω or less.
- For high-accuracy measurements, it is recommended to use a 6-wire connection. Using a 4-wire connection may cause degradation of measurement resolution due to changes in wiring resistance caused by temperature fluctuations.
- To minimize noise effects, keep the wiring between the load cell and the module separate from AC supply or power lines. Avoid installing them within the same duct.
- Install a noise filter (for field power supply and system power supply) on the power supply input if the same power source is used for equipment such as electrical welders or electric discharge machines, or if any high-frequency noise sources located nearby.

Parallel connection of load cells

When connecting multiple identical load cells (up to four) in parallel, the system functions as a single load cell. In such case, the total rated capacity is the sum of each load cell's rated capacity.
It is recommended to use summing box for connection of multiple load cells.



NOTE

- Multiple load cells used require the same specifications.
- Multiple load cells connected in parallel can be regarded as a single load cell of which rated capacity is 'N' x 'Rated capacity of individual load cell', where 'N' is the number of identical load cells connected in parallel.
- Ensure that the total load on excitation power supply does not exceed the modules allowable limit when connecting multiple load cells.

Parameters

Module M-LCI2 can be configured using Modular IO Configurator. Refer section ‘Modular IO Configurator’ of ‘Modular IO User manual’ (N16001AAMH) for more details of module configuration.

Configuration of M-LCI2 module involves configuration of Module parameters, Channel parameters.

Module Parameters

The table below provides a list of module parameters that user can set.

Parameter Name	Project Value	Comment
Conersion Speed	Slow Normal (Default) Fast	Sets conversion speed of ADC. Conversion time for each setting is as below Fast – 190 µs Regular – 450 µs Slow – 825 µs Selecting a slower conversion speed improves count stability and noise immunity.
Additional process data	Disabled (Default) Enabled	Enable / disable additional process data.
Calibration timeout	0 (Default) (Range: 0 to 600)	Calibration timeout in seconds. Module will automatically exit calibration mode if no action 0 = Timeout disabled. module remain in calibration state until next user action or power recycle. 1 to 600 = Timeout in seconds.
Weight update interval	3 (Default) (Range: 3 to 50)	This parameter defines how often the module sends the weight value (in milliseconds) to the header. • Decrease the interval to update the weight value more frequently. • Increase the interval to reduce backplane bus traffic. • For faster weight update time, fix the M-LCI2 module in slots near the header. • When the M-LCI2 module is used in a Modular I/O station with a large number of I/O modules, a faster weight update may increase the I/O update time of the modules fixed in slots after the M-LCI2 module.

Channel Parameters

The table below provides a list of channel parameters that user can set as per the application requirement.

Parameter Name	Project Value	Comment
Enable	Enabled [Default] Disabled	Enable / Disables input channel. If channel is not used, keep it disabled for faster updation of used channel.
Load cell rated capacity	30000 (Default) (Range: 0 to 3000000)	Unit used to specify should be matching with expected weight value unit. When multiple load cells are connected in parallel, set value as Rated capacity per load cell X Number of load cells.
Load cell rated output	1.0 to 3.0	Load cell rated output in mV/V unit.
Minimum division	1 (Default) (Range: 1 to 100)	This is the smallest step by which the weight value can change. It defines the resolution of the scale. Smaller values provide finer resolution, while larger values help reduce fluctuations caused by minor disturbances like air flow, noise and vibrations.
IIR low pass filter level	0 (Default) (Range: 0 to 8)	IIR low pass filter function reduces fluctuations in weight value. 0: Disable IIR low pass filter function. 1 to 8: IIR low pass filter level. Filter level: 1 ⇔ 8 Response speed: Fast ⇔ Slow Stability of weight value: Less stable ⇔ More stable
No. of samples for moving average	32 (Default) (Range: 0 to 255)	Moving average function reduces fluctuations in the weight value 0: Disable moving average function. 1 to 255: Sets number of moving average samples. No. of samples: 1 ⇔ 255 Response speed: Fast ⇔ Slow Stability of weight value: Less stable ⇔ More stable
Retain tare value	Enabled (Default) Disabled	Retain tare subtraction value after power recycle of Modular IO station.
Zero-point range	0 (Default) (Range: 0 to 10)	0 to 10.0% of Load cell rated capacity. Applicable for Manual zero function and Auto zero tracking function.
Retain zero set value	Enabled (Default) Disabled	Retain zero set value after power recycle of Modular IO station.
Auto zero tracking range	0 (Default) (Range: 0 to 65535)	Sets auto zero tracking range Unit used to specify should be matching with weight value unit. If value set to 0, auto zero tracking function will be disabled.
Auto zero tracking time	0 (Default) (Range: 0 to 10000)	Auto zero tracking time in ms. If value set to 0, auto zero tracking will be disabled.
Stable status range	2 (Default) (Range: 0 to 30000)	Sets stable status range. Unit used to specify should be matching with weight value unit.
Stable status time	1000 (Default) (Range: 0 to 10000)	Stable status time in ms If value set to 0, Stability detection function is disabled.

IO Data

IX memory

Channel	Data Type	Local Address	Bit Status	Comment
Module Status	BYTE	IX n	-	Byte represents the module's current operating status in a bitwise format, with each bit indicating a particular condition or error within the module.
Hardware error	BOOL	IX n.0	TRUE	Hardware error detected. Bit turns ON if self-test failures is detected like • ADC error • EEPROM read/write error • EEPROM data corrupted or not present • CAN bus off conditions
			FALSE	No hardware error detected.
Firmware watchdog error	BOOL	IX n.1	TRUE	Firmware error detected. MCU watchdog timeout.
			FALSE	No watchdog error
Hardware calibration error	BOOL	IX n.2	TRUE	Hardware calibration data is unavailable or has failed integrity verification.
			FALSE	Hardware calibration data is available and has passed integrity verification.
Calibration data error	BOOL	IX n.3	TRUE	Calibration data error detected. Calibration data is unavailable or has failed integrity verification.
			FALSE	Calibration data is available and has passed integrity verification.
Calibration process error	BOOL	IX n.4	TRUE	Error detected while performing calibration.
			FALSE	No calibration command issued, or no error detected while performing calibration.
Reserved	BOOL	IX n.5	-	Reserved status bit. Always remains OFF.
Reserved	BOOL	IX n.6	-	Reserved status bit. Always remains OFF.
Field power supply absent	BOOL	IX n.7	TRUE	No field power supply detected. Field power supply is absent or below permissible range of 18 VDC.
			FALSE	24 VDC Field power supply healthy.

Channel	Data Type	Local Address	Bit Status	Comment
CH0 errors	BYTE	IX n+1	-	Byte represents channel 0 errors in a bitwise format, with each bit indicating a particular error of the channel.
Excitation power supply error	BOOL	IX n+1.0	TRUE	Excitation power supply error detected • Excitation power supply short circuited • Excitation power supply disconnected Applicable only for 6 wire connection method.
			FALSE	The excitation voltage is within permissible range for correct load cell operation.
Input signal error	BOOL	IX n+1.1	TRUE	Input signal error is detected. • Input signal wire disconnected or broken. • Over range / Under range (Out of ±3.5mV/V)
			FALSE	Input signal from load cell is healthy.
Zero set correction exceeded	BOOL	IX n+1.2	TRUE	Indicates that the total amount of zero correction by the Zero set function exceeds the range set by “Zero-point range” setting
			FALSE	Indicates that zero correction is within the range set by “Zero-point range” setting
Auto zero correction exceeded	BOOL	IX n+1.3	TRUE	Indicates that the total amount of zero correction by the Auto zero tracking function exceeds the range set by “Zero-point range” setting
			FALSE	Indicates that zero correction is within the range set by “Zero-point range” setting.
Calibration parameter mismatch	BOOL	IX n+1.4	TRUE	The load cell parameters (load cell rated output, load cell rated capacity) set during calibration no longer match with the current load cell parameters. Recalibration advised.
			FALSE	Load cell parameters set during calibration match with the current load cell parameters.
Under range/Over range	BOOL	IX n+1.5	TRUE	The channel has detected an under-range condition (less than −3.5 mV/V) or an over-range condition (greater than 3.5 mV/V).
			FALSE	No Under range/Over range detected
Reserved	BOOL	IX n+1.6	-	Reserved status bit. Always remains OFF.
Reserved	BOOL	IX n+1.7	-	Reserved status bit. Always remains OFF.

Channel	Data Type	Local Address	Bit Status	Comment
CH0 status	BYTE	IX n+2	-	Byte represents channel 0 status in a bitwise format, with each bit indicating a particular condition of the channel.
Tare subtraction status	BOOL	IX n+2.0	TRUE	Indicates that tare subtraction is executed. Bit turns on in response to *'Tare subtraction'* command.
			FALSE	Indicates that tare subtraction is not executed.
Auto zero tracking status	BOOL	IX n+2.1	TRUE	Indicates auto zero tracking is enabled and performed at least once after power ON or last zero reset action.
			FALSE	Indicates auto zero tracking is disabled or not performed after power ON or last zero reset action.
Zero set status	BOOL	IX n+2.2	TRUE	Indicates that zero set command is executed. Bit turns on in response to *Zero set* command.
			FALSE	Indicates that zero set command is not executed.
Stable status	BOOL	IX n+2.3	TRUE	Variation of weight value is within Stable status range setting for Stable status duration setting or longer.
			FALSE	Variation in weight output value exceeds Stable status range setting OR channel error detected.
Peak hold status	BOOL	IX n+2.4	TRUE	Indicates peak hold function is active.
			FALSE	Indicates peak hold function is not active.
Reserved	BOOL	IX n+2.5	-	Reserved status bit. Always remains OFF.
Bottom hold status	BOOL	IX n+2.6	TRUE	Indicates bottom hold function is active. Bit turns on in response to Bottom hold command.
			FALSE	Indicates bottom hold function is not active.
Channel ready for conversion	BOOL	IX n+2.7	TRUE	Module ready for conversion. All error checks are completed, and no error is detected. Channel data is valid.
			FALSE	Module not ready for conversion • Hardware error detected by module • Firmware watchdog error detected by module • Hardware calibration error detected by module • Field power supply error detected by module • Channel disabled • Calibration data error detected by channel • Channel is in calibration mode • Excitation power supply error detected • Input signal error detected
CH1 errors	BYTE	IX n+3	-	Byte represents channel 1 errors in a bitwise format, with each bit indicating a particular error of the channel. Bitwise details are like 'CH0 errors'.
CH1 status	BYTE	IX n+4	-	Byte represents channel 1 status in a bitwise format, with each bit indicating a particular condition of the channel. Bitwise details are like 'CH0 Status'.

Channel	Data Type	Local Address	Bit Status	Comment
Calibration status	BYTE	IX n+5	-	Byte represents calibration process status in a bitwise format.
Ack calibration channel selection	BOOL	IX n+5.0	TRUE	CH1 selected for calibration
			FALSE	CH0 selected for calibration
Ack enter calibration mode	BOOL	IX n+5.1	TRUE	'*Enter Calibration Mode*' command is issued. Selected channel is entered in calibration mode.
			FALSE	*'Enter calibration mode'* command not active. Exits calibration mode executed successfully.
Ack calibrate zero	BOOL	IX n+5.2	TRUE	'*Calibrate zero*' command is executed successfully. On every rising edge of command, zero calibration values are recorded. Bit remains ON even after command is turned OFF.
			FALSE	*'Calibrate zero'* command is not initiated or error detected while executing the command. Bit resets only when calibration mode is exited.
Ack calibrate span 1	BOOL	IX n+5.3	TRUE	'*Calibrate span 1*' command is executed successfully. On every rising edge of command, span calibration values are recorded. Bit remains ON even after command is turned OFF.
			FALSE	'*Calibrate span 1*' command is not initiated or error detected while executing the command. Bit resets only when calibration mode is exited.
Ack calibrate span 2	BOOL	IX n+5.4	TRUE	'*Calibrate span 2*' command is executed successfully. On every rising edge of command, span calibration values are recorded. Bit remains ON even after command is turned OFF.
			FALSE	'*Calibrate span 2*' command is not initiated or error detected while executing the command. Bit resets only when calibration mode is exited.
Ack calibrate span without weight	BOOL	IX n+5.5	TRUE	'*Calibrate span without weight*' command is executed successfully. On every rising edge of command, span calibration values are recorded. Bit remains ON even after command is turned OFF.
			FALSE	'*Calibrate span 1*' command is not initiated or error detected while executing the command. Bit resets only when calibration mode is exited.
Ack save calibration values	BOOL	IX n+5.6	TRUE	'*Save calibration*' command is executed. This bit indicates calibration values are saved at least once after entering calibration mode. Bit remains ON even after 'Save calibration values' command is turned OFF.
			FALSE	Command '*Save calibration*' is not initiated after entering calibration mode. Bit resets only when calibration mode is exited by making 'Enter calibration mode' command OFF.
Ack clear calibration error	BOOL	IX n+5.7	TRUE	Ack of 'Clear calibration error' command.
			FALSE	'Clear calibration error' command not initiated.

** Address 'n' changes as per the slot position of IO module and configuration of Modular IO station*

QX memory

Channel	Data Type	Local Address	Bit Status	Comment
CH0 Control	BYTE	QX n	-	The channel control byte provides a bitwise representation of the control commands sent to the channel. Each bit corresponds to a specific command sent to the module.
Tare subtraction	BOOL	QX n.0	TRUE	On rising edge, tare subtraction is performed.
			FALSE	No action.
Tare reset	BOOL	QX n.1	TRUE	On rising edge, tare reset is performed.
			FALSE	No action.
Zero set	BOOL	QX n.2	TRUE	On rising edge, zero set is performed.
			FALSE	No action.
Zero reset	BOOL	QX n.3	TRUE	On rising edge, zero reset is performed.
			FALSE	No action.
Peak hold	BOOL	QX n.4	TRUE	Enables peak hold function. On rising edge, previous peak value is cleared.
			FALSE	Holding to new peak value stops. Gross weight value will continue to update in peak hold value.
Bottom hold	BOOL	QX n.5	TRUE	Enables bottom hold function. On rising edge previous bottom value is cleared.
			FALSE	Holding to new bottom value stops. Gross weight value will continue to update in bottom hold value.
Reserved	BOOL	QX n.6	-	Reserved status bit. Always remains OFF.
Reserved	BOOL	QX n.7	-	Reserved status bit. Always remains OFF.
CH1 Control	BYTE	QX n+1	-	Same as ‘CH0 Control’.
Calibration control	BYTE	QX n+2	-	The calibration control byte provides a bitwise representation of the calibration commands sent to the module. Each bit corresponds to a specific command sent to the module.
Calibration channel selection	BOOL	QX n+2.0	TRUE	CH1 selected for calibration
			FALSE	CH0 selected for calibration
Enter calibration mode	BOOL	QX n+2.1	TRUE	Put selected channel into calibration mode. Calibration process error will be set if channel selection is changed during calibration process.
			FALSE	Put selected channel into normal mode.
Calibrate zero	BOOL	QX n+2.2	TRUE	On rising edge, execute calibrate zero command. Registers standard weight and ADC raw count values.
			FALSE	No action.
Calibrate Span 1	BOOL	QX n+2.3	TRUE	On the rising edge, execute calibrate span 1 command. Registers standard weight and ADC count values.
			FALSE	No action.
Calibrate Span 2	BOOL	QX n+2.4	TRUE	On the rising edge, execute calibrate span 2 command. Registers standard weight and ADC count values.
			FALSE	No action.

Channel	Data Type	Local Address	Bit Status	Comment
Calibrate span without weight	BOOL	QX n+2.5	TRUE	On the rising edge, execute calibrate without weight command. Registers rated weight and equivalent ADC count based on hardware calibration.
			FALSE	No action
Save calibration values	BOOL	QX n+2.6	TRUE	On rising edge, save calibration values to non-volatile memory of the module.
			FALSE	No action
Clear calibration error	BOOL	QX n+2.7	TRUE	On the rising edge calibration errors are cleared. If the underlying error condition persist, error will not be cleared.
			FALSE	No action.

** Address 'n' changes as per the slot position of IO module and configuration of Modular IO station*

IW memory

Channel	Data Type	Local Address	Comment
CH0 Gross weight	DINT	IW n	Gross weight value for CH0.
		IW n+1	
CH0 Net weight	DINT	IW n+2	Net weight value for CH0. Net weight = Gross weight – Tare value
		IW n+3	
CH1 Gross weight	DINT	IW n+4	Gross weight value for CH1
		IW n+5	
CH1 Net weight	DINT	IW n+6	Net weight value for CH1. Net weight = Gross weight – Tare value
		IW n+7	
Additional process data 1	DINT	IW n+8	Holds additional process data as per selection by 'Additional process data selection 1'. Channel will be included only when parameter 'Additional process data' = 'Enabled'
		IW n+9	
Additional process data 2	DINT	IW n+10	Holds additional process data as per selection by 'Additional process data selection 2'. Channel will be included only when parameter 'Additional process data' = 'Enabled'
		IW n+11	
Additional process data selection 1	BYTE	IW n+12 (Byte 0)	Holds selection for additional process data. Process data selection will be as follows 0: Reserved 1. Acquired tare value CH0 2: Acquired zero value CH0 3: Accumulated auto zero tracking value CH0 4: Peak hold value CH0 5: Bottom hold value CH0 6: Zero calibration 24-bit ADC raw count CH0 7: Span1 calibration 24-bit ADC raw count CH0 8: Span2 calibration 24-bit ADC raw count CH0 9: 24-bit ADC raw count CH0 21- 29 – Same as 1 to 9 for CH1 Channel will be included only when parameter 'Additional process data' = 'Enabled'
Additional process data selection 2	BYTE	IW n+12 (Byte 1)	
Calibration process error code	WORD	IW n+13	Holds calibration process error codes. Refer section 'Calibration' for more details.

** Address 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

QW memory

Channel	Data Type	Local Address	Comment
Standard weight value for zero calibration	DINT	QW n+0 QW n+1	Standard weight for zero calibration. Setting range 0 to 3000000.
Standard weight value for Span1 calibration	DINT	QW n+2 QW n+3	Standard weight for span1 calibration. Setting range 0 to 3000000. Value must be greater than 'Standard weight value for zero calibration + 5% of rated weight'.
Standard weight value for Span2 calibration	DINT	QW n+4 QW n+5	Standard weight for span2 calibration. Setting range 0 to 3000000. Value must be greater than 'Standard weight value for Span1 calibration + 5% of rated weight'
Additional process data selection 1	WORD	QW n+6	Selection for additional process data for channel. Process data selection will be as follows 0: Reserved 1. Acquired tare value CH0 2: Acquired zero value CH0 3: Accumulated auto zero tracking value CH0 4: Peak hold value CH0 5: Bottom hold value CH0 6: Zero calibration ADC raw count CH0 7: Span1 calibration ADC raw count CH0 8: Span2 calibration ADC raw count CH0 9: ADC raw count CH0 21- 29 – Same as 1 to 9 for CH1 Channel will be included only when parameter 'Additional process data' = 'Enabled'
Additional process data selection 2	WORD	QW n+7	

** Address 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

Functions

Subsequent sections explain module functions in detail.

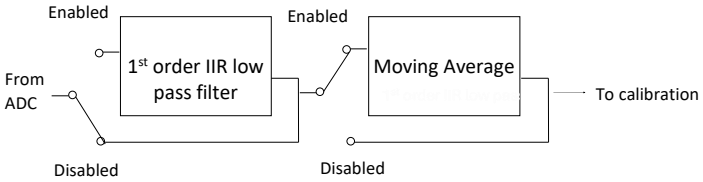
Filtering

Filtering removes noise components that are contained in low level input signals to suppress fluctuations of measurement values. It can remove electrical noise and mechanical vibration noise that are contained in input signals and provide stable measurement.

The following filters can be configured based on requirements.

1. 1st order IIR filter (Default disabled) Averaging (Default enabled)

Filters are executed sequentially as shown below



1st order IIR Low pass filter

1st order IIR low-pass filter is used to smooth the analog value. The filter works according to the following equation.

Filtering equation

$$Y = Y_{Old} + \frac{X - Y_{Old}}{2^{Filter\ Level}}$$

Here,

Y : Filter output value

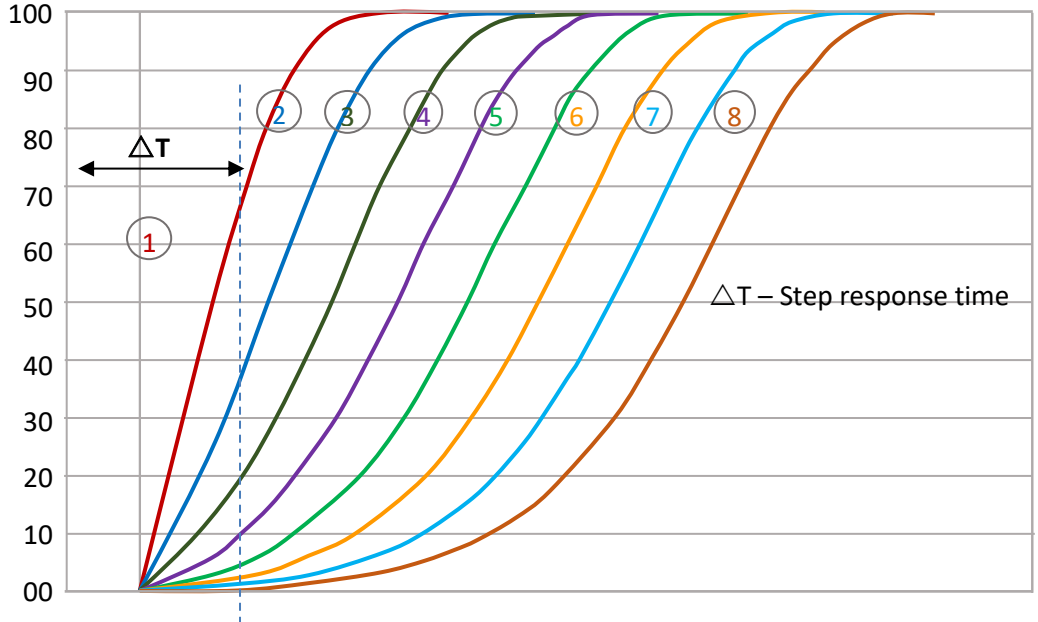
X : Filter input value

Y_{old} : Previous filter output value

Filter Level : 1 to 8 (0 means filer is disabled)

Step response of 1st order IIR low-pass filter

The graph below shows response of 1st order IIR low-pass filter to an input step change for 0 to 100% with different filter levels from 1 to 8.



The graph shown above is illustrative and intended to indicate the effect of filter level on step response time. For actual step response times corresponding to each filter setting, refer to the table below.

The table below can be used as a tentative guideline for the step response time of the IIR low-pass filter when only one channel is enabled.

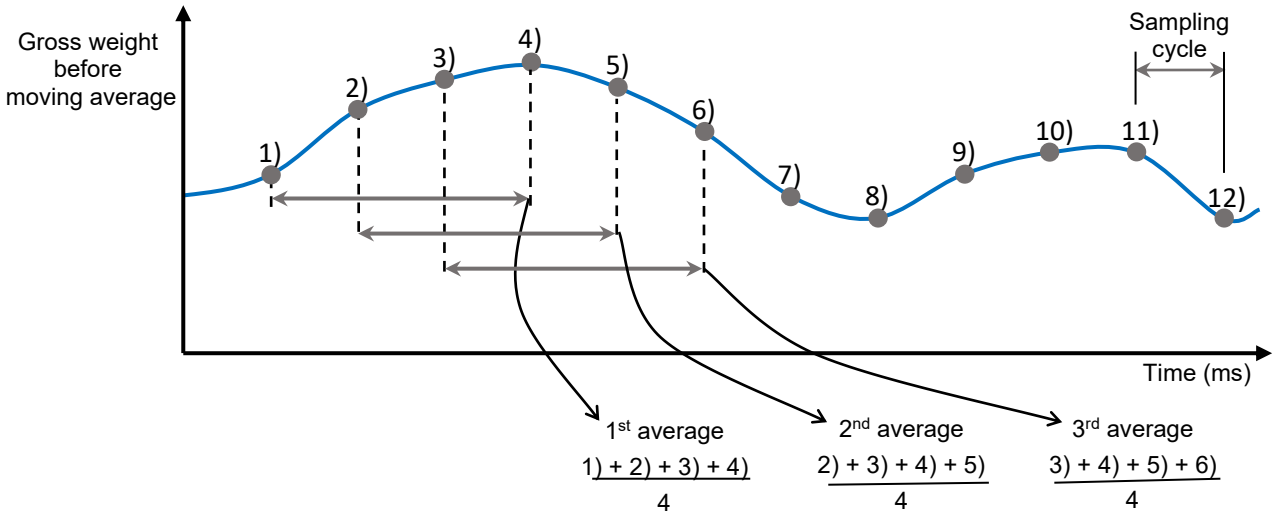
Filter level	Conversion speed		
	Slow	Normal	Fast
1	16	8	5
2	32	17	10
3	64	35	16
4	128	65	32
5	256	135	59
6	509	268	113
7	1013	541	212
8	2035	1073	434

Moving Average

Moving average is more dynamic and flexible method, where data points continuously move over the entire data set. Each time the converted value is sampled, the data is averaged over a predefined number of samples.

So, Processing time = Sampling cycle in ms (except the first cycle of averaging)

The graph below shows sampling of change in weight values and averaging carried out number of averaging samples equal to 4.



The table below can be used as a tentative guideline for the step response time with moving average filter.

No. of samples	Conversion speed		
	Slow	Regular	Fast
8	8	6	5
16	10	9	5
32	13	10	6
64	27	16	9
128	49	40	19
255	172	133	106

Stability Detection

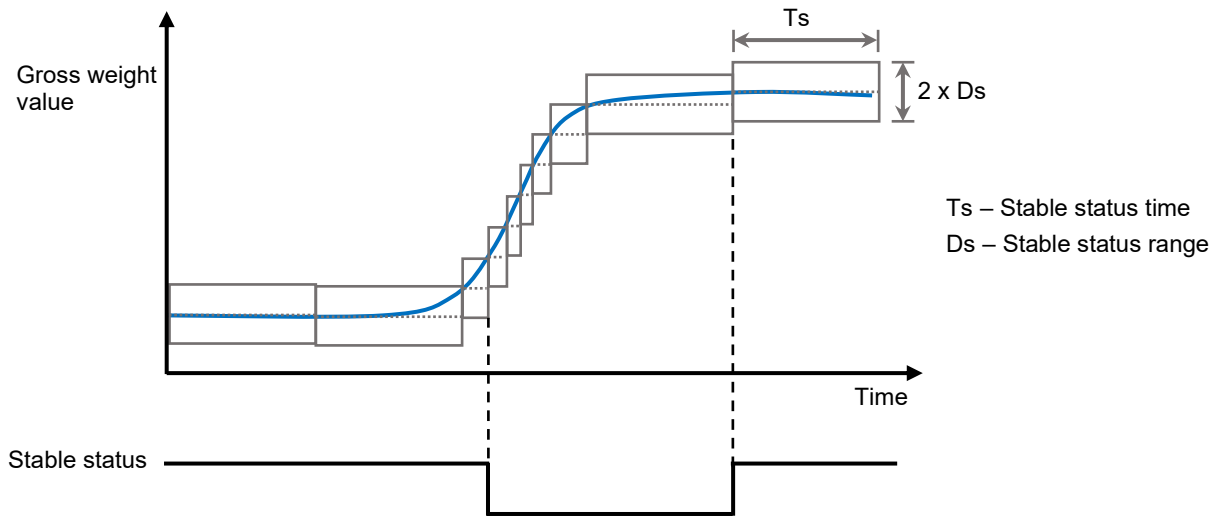
Stability is detected if the variation of weight value is within the range defined by ‘Stable status range’ over a duration defined by ‘Stable status time’ or longer.

‘Stable status range’ is specified in range 0 to 30000. Unit used to specify should be matching with weight value unit.

‘Stable status time’ is specified in steps of 1ms. Setting range is 0 to 10000.

If either ‘Stable status range’ or ‘Stable status time’ is set to 0, stability detection function is disabled.

The diagram below illustrates how stability detection works.



Parameters

- Stable status range
- Stable status time

Refer section ‘Parameters’ for more details.

IO memory

Group	Channel	Bit	Address
Diagnostics	CH0 status	Stable status	IX n+2.3
	CH1 status	Stable status	IX n+4.3

** Address ‘n’ changes as per the slot position of IO module and configuration of Modular IO station.*

Refer section ‘IO data’ for more details.

Tare Subtraction

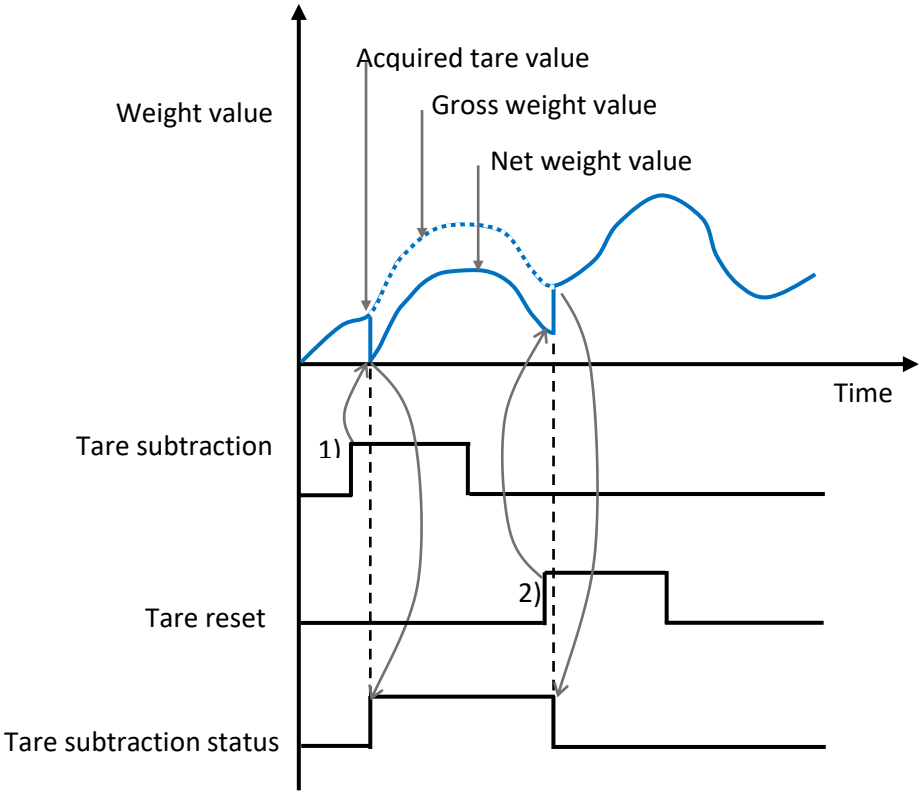
Tare subtraction involves measuring and subtracting the weight of the container or any other non-load components to obtain the net weight of the actual material being measured. This process helps to ensure that only the weight of the material of interest is recorded.

This function in the module will store the gross weight value as the tare acquired value and subtract it from a given gross weight value to provide the net weight value.

This function can be used when you want to measure only the weight of the measured material stored inside a tare (container).

Net weight is calculated by equation as below:

Net weight value = Gross weight value – Acquired tare value



No.	Description
1)	When the command bit “Tare subtraction” is changed from 0 to 1, the “Tare subtraction status” changes from 0 to 1 and tare subtraction is executed. The gross weight value at the start of execution of tare subtraction is stored as the acquired tare value, and the net weight value is calculated. The net weight value will become 0.
2)	When the command bit “Tare reset” is changed from 0 to 1, the “Tare subtraction status” bit changes from 1 to 0 and tare subtraction stops. Acquired tare value is cleared, and the net weight value will be equal to the gross weight value.

NOTE

Tare subtraction value will be retained after power ON/OFF if parameter ‘Retain tare value’ is ‘Enabled’.

IO memory

Group	Channel	Bit	Address
Control data	CH0 control	Tare subtraction	QX n.0
		Tare reset	QX n.1
Diagnostics	CH0 status	Tare subtraction status	IX n+2.0
Control data	CH1 control	Tare subtraction	QX n+1.0
		Tare reset	QX n+1.1
Diagnostics	CH1 status	Tare subtraction status	IX n+4.0
Channel data	Acquired tare value CH0, CH1 [*1]	NA	IW m+8, IW m+9 OR IW m+10, IW m+11

[1] 'Acquired tare value' can be read as 'Additional process data' by making data selection value =1 (CH0) or 21 (CH1) in 'Additional process data selection 1' (QW m+6) and Additional process data selection 2 (QW m+7).

** Address 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

Refer section 'IO data' for more details.

Auto-zero Tracking

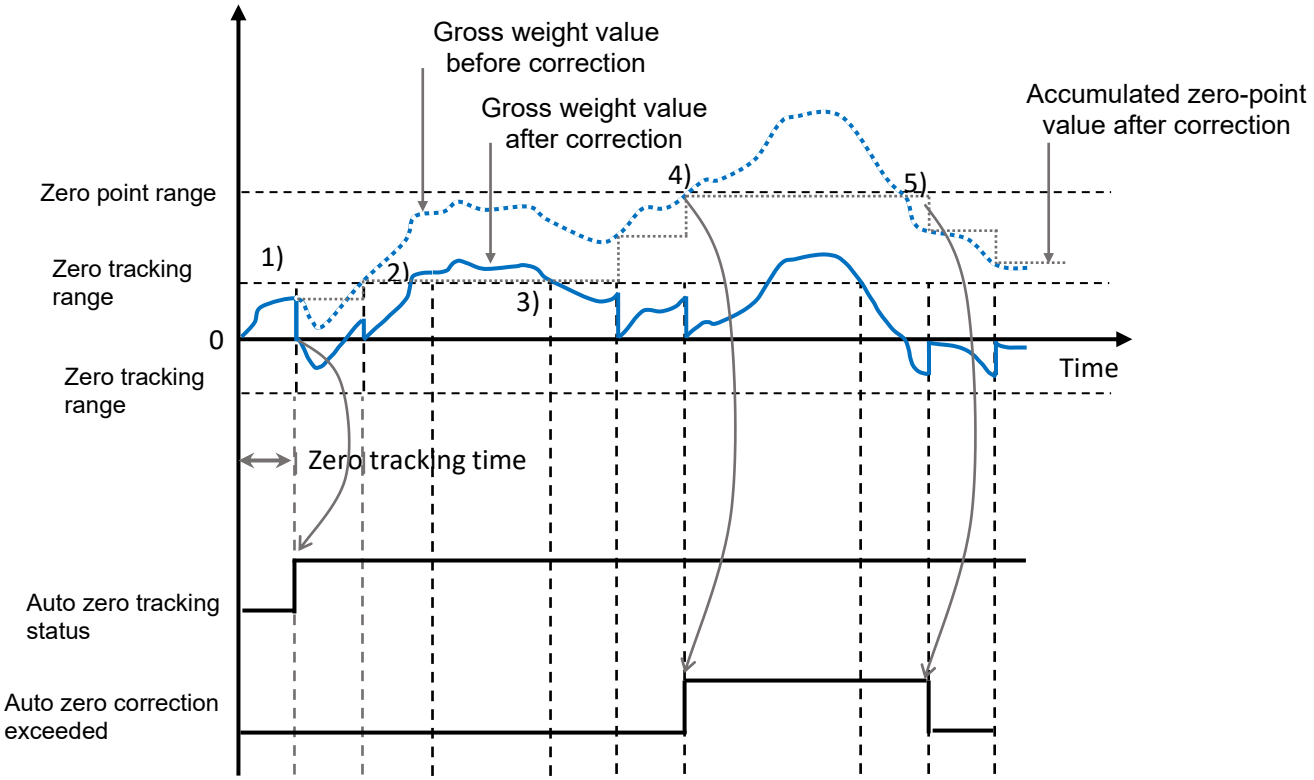
Auto zero tracking in a load cell system is a feature used to ensure that the zero point of the load cell remains accurate overtime, even with minor environmental changes drift. This is particularly useful in applications where the load cell may experience small changes in temperature, humidity or other factors that could cause its zero point to shift slightly.

When auto zero tracking is enabled, function automatically adjusts the zero point when “weight output value” does not return to 0 even when no measuring load is on the scale due to temperature change or any accumulation on the scale after the previous two-point calibration.

If the “Zero tracking time” has elapsed while gross weight output value is within the “Zero point range”, zero tracking is performed automatically and gross weight is set to 0.

NOTE

To use auto zero tracking function, ‘Zero set’ function must be enabled.



No.	Description
1)	When the “Zero tracking time” is elapsed while the gross weight value is within the “Zero-point range” setting and fluctuation is within 0 ± “Zero tracking range”, the gross weight value is automatically corrected to 0. After the gross weight value is corrected to 0, the zero-tracking operation is continued and the gross weight value is corrected repeatedly after each elapse of “Zero tracking time” if gross weight value fluctuation is within 0 ± “Zero tracking range”. Hence, correction is cumulative.
2)	If the gross weight value after the correction exceeds the 0 ± “Zero tracking range”, the zero-tracking operation is stopped.
3)	When the gross weight value after correction fluctuates again within the 0 ± “Zero tracking range”, the zero-tracking operation is resumed.
4)	When the original gross weight value exceeds the “Zero-point range” setting, the zero-tracking operation is stopped.
5)	When the original gross weight value is within the “Zero-point range” setting, the zero-tracking operation is resumed.

Parameters

- Auto-Zero Tracking – Enable
- Auto-Zero Tracking – Zero-point range
- Auto-Zero Tracking – Tracking range
- Auto-Zero Tracking – Tracking time

Refer section 'Parameters' for more details.

IO memory

Group	Channel	Bit	Address
Diagnostics	CH0 errors	Auto zero correction exceeded	IX n+1.3
	CH0 status	Auto zero tracking status	IX n+2.1
Channel data	Accumulated auto zero tracking value CH0[*1]	NA	IW m+8, IW m+9 OR IW m+10, IW m+11
Diagnostics	CH1 errors	Auto zero correction exceeded	IX n+3.3
	CH1 status	Auto zero tracking status	IX n+4.1
Channel data	Accumulated Auto zero tracking value CH1[*1]	NA	IW m+8, IW m+9 OR IW m+10, IW m+11

[*1] 'Accumulated auto zero tracking value' can be read as 'Additional process data' by making data selection value =3 (CH0) or 23 (CH1) in 'Additional process data selection 1' (QW m+6) and Additional process data selection 2 (QW m+7).

** Address 'm', 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

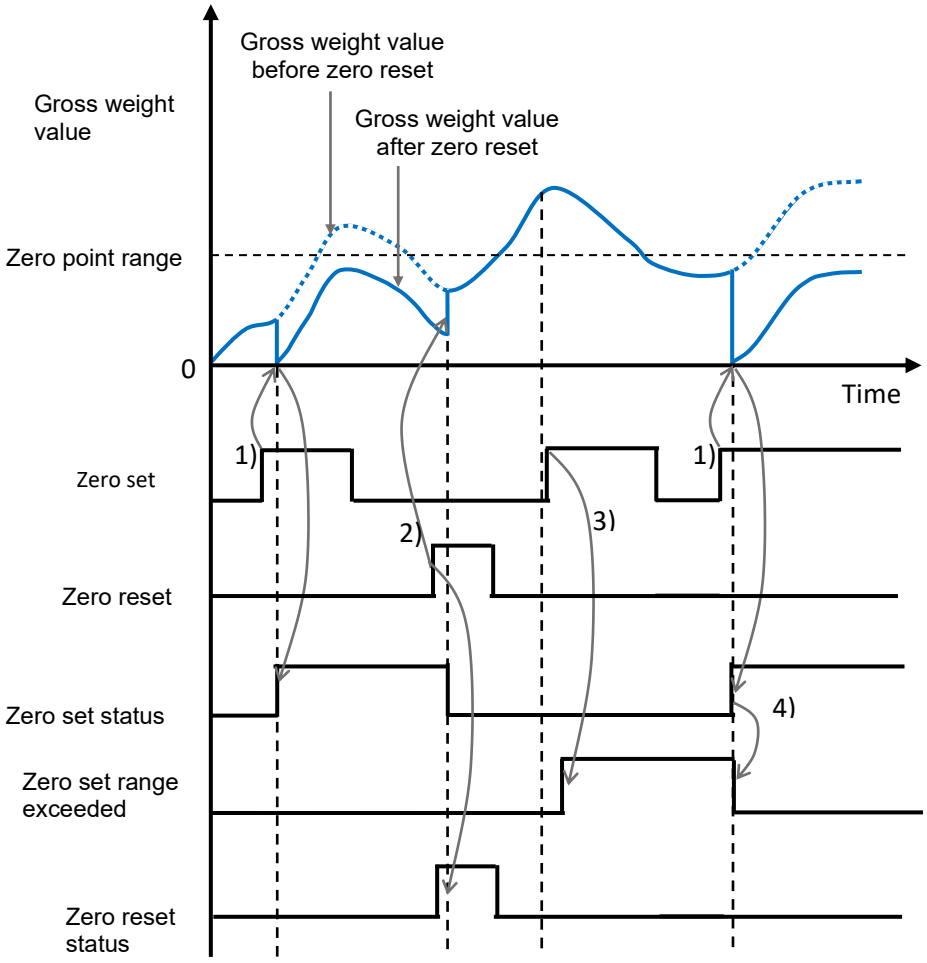
Refer section 'IO data' for more details.

Zero Set / Zero Reset

This function uses the sequence program to adjust the zero point when the zero point has changed after two-point calibration due to temperature change or any accretion on the scale

The zero-set function corrects the gross weight value to zero if gross weight value is within the “Zero-point range” setting.

The zero-reset function resets the correction that is performed by zero set function and returns to the zero-point set by zero calibration.



No.	Description
1)	When the command bit “Zero set” bit is changed from 0 to 1, the status bit “Zero set status” changes from 0 to 1 and the zero set is performed. The gross weight value is corrected to the zero point. ‘Acquired zero value’ is available in weight values.
2)	When the command bit “Zero reset” is changed from 0 to 1, the status bit “Zero set status” changes from 1 to 0 and the zero reset is performed. The correction is reset and returns to the zero point set by zero calibration. At this time, the gross weight value returns to the original gross weight value.
3)	If gross weight value exceeds the “Zero point range” setting, the zero set is not performed. If the gross weight value exceeds the “Zero point range” setting, when the “Zero set” bit is changed from 0 to 1, the “Zero point range exceeded” bit changes from 0 to 1.
4)	When “Zero set” bit is changed from 0 to 1 and zero set is performed successfully, the “Zero point range exceeded” bit is reset.

NOTE

Zero set value will be retained after power ON/OFF if parameter 'Retain zero set value' is 'Enabled'.

Related parameters

- Zero set / zero reset – Enable,
- Zero-point range
- Retain zero set value

Refer section 'Parameters' for more details.

Related IO memory

Group	Channel	Bit	Address
Diagnostics	CH0 errors	Zero set correction exceeded	IX n+1.2
	CH0 status	Zero set status	IX n+2.2
Control data	CH0 control	Zero set	QX n.2
	CH0 control	Zero reset	QX n.3
Channel data	Acquired zero value CH0 [*1]	NA	IW m+8, IW m+9 OR IW m+10, IW m+11
Diagnostics	CH1 errors	Zero set correction exceeded	IX n+3.2
	CH1 status	Zero set status	IX n+4.2
Control data	CH1 control	Zero set	QX n+1.2
	CH1 control	Zero reset	QX n+1.3
Channel data	Acquired zero value CH1 [*1]	NA	IW m+8, IW m+9 OR IW m+10, IW m+11

[*1] 'Acquired zero value' can be read as 'Additional process data' by making data selection =2 (CH0) or 22 (CH1) in 'Additional process data selection 1' (QW m+6) and Additional process data selection 2(QW m+7).

** Address 'm', 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

Refer section 'IO data' for more details.

Peak Hold / Bottom Hold

This function continues holding the peak value or the bottom value of the gross weight value.

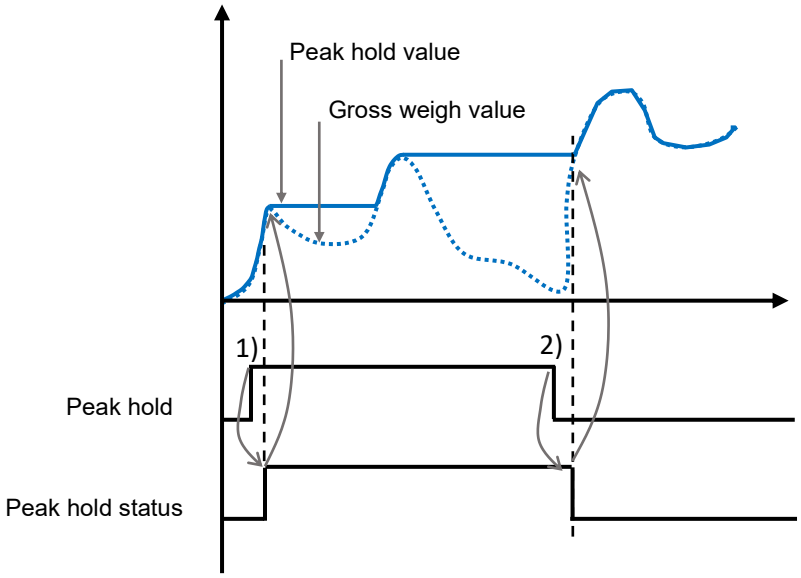
1) Peak Hold

The peak hold function captures and holds the maximum value (peak) of a signal over a specific period.

For load cells, this means it records the highest load measured during a particular time frame.

It's useful for applications where you want to track the highest load experienced by the load cell, such as in material testing or safety monitoring.

The figure below explains the peak hold function.



No.	Description
1)	When the command bit "Peak hold" is changed from 0 to 1, the "Peak hold status" bit changes from 0 to 1 and the peak hold is executed. The peak/maximum value of the gross weight value during hold becomes the peak hold value. Peak value is available in link devices "Peak hold value".
2)	When the "Peak hold" bit is changed from 1 to 0, the "Peak hold status" bit changes from 1 to 0 and holding to new peak value stops. Gross weight value will continue to update in peak hold value.

Related IO memory

Group	Channel	Bit	Address
Diagnostics	CH0 status	Peak hold status	IX n+2.4
Control data	CH0 control	Peak hold	QX n.4
Channel data	Peak hold value	NA	IW m+8, IW m+9 OR IW m+10, IW m+11
Diagnostics	CH1 status	Peak hold status	IX n+4.4
Control data	CH1 control	Peak hold	QX n+1.4
Channel data	Peak hold value	NA	IW m+8, IW m+9 OR IW m+10, IW m+11

[*1] 'Peak hold value' can be read as 'Additional process data' by making data selection =4 (CH0) and 24 (CH1) in 'Additional process data selection 1' (QW m+6) and Additional process data selection 2(QW m+7).

** Address 'm', 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

Refer section 'IO data' for more details.

2) Bottom Hold

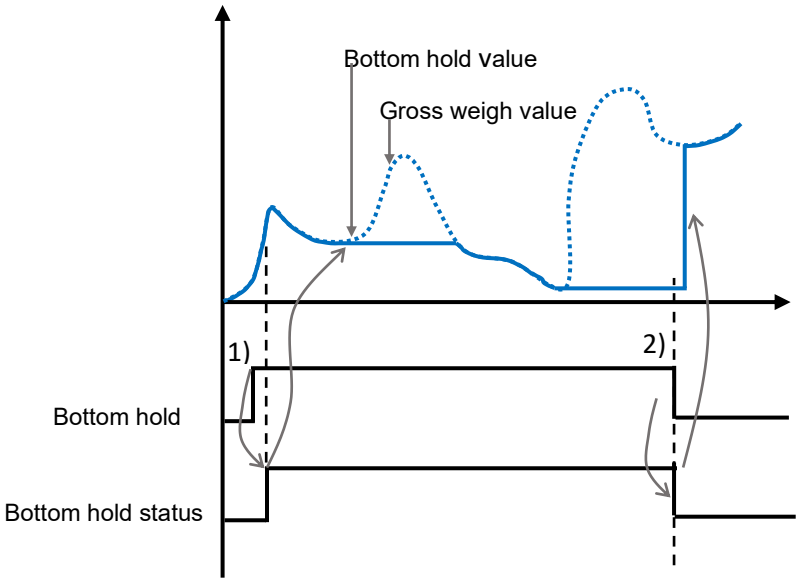
The bottom hold function is the opposite of peak hold.

It captures and retains the minimum value (bottom) of a signal over a specific period.

In load cell applications, it records the lowest load measured during a given time frame.

Like peak hold, it's valuable for monitoring purposes, especially when you need to track the lowest load experienced by the load cell.

The figure below explains the bottom hold function.



No.	Description
1)	When the command bit "Bottom hold" is changed from 0 to 1, the "Bottom hold status" bit changes from 0 to 1 and the bottom hold is executed. The bottom/minimum value of the gross weight value during hold becomes the bottom hold value. Bottom Hold value is available in link devices "Bottom hold value"
2)	When the "Bottom hold" bit is changed from 1 to 0, the "Bottom hold status" bit changes from 1 to 0 and holding to new bottom value stops. Gross weight value will continue to update in bottom hold value.

Related IO memory

Group	Channel	Bit	Address
Diagnostics	CH0 status	Bottom hold status	IX n+2.5
Control data	CH0 control	Bottom hold	QX n.5
Channel data	Bottom hold value	NA	IW m+8, IW m+9 OR IW m+10, IW m+11
Diagnostics	CH1 status	Bottom hold status	IX n+4.5
Control data	CH1 control	Bottom hold	QX n+1.5
Channel data	Bottom hold value	NA	IW m+8, IW m+9 OR IW m+10, IW m+11

[*1] 'Bottom hold value' can be read as 'Additional process data' by making data selection =5(CH0) and 25 (CH1) in 'Additional process data selection 1' (QW m+6) and Additional process data selection 2(QW m+7).

** Address 'm', 'n' changes as per the slot position of IO module and configuration of Modular IO station.*

Calibration

Calibration of loadcell input can be performed using IO memory of the module.

Function allows users to calibrate the load cell input from fieldbus master.

Also, Modular IO configuration Tool provides easy-to-use GUI to perform calibration. In this method, output test function is used to interact with IO memory of the module.

NOTE

Calibration can be performed on only one channel at a time.

Both method uses same IO memory for calibration, so they should not be used simultaneously.

In addition to installation, calibration should be carried out under the following conditions:

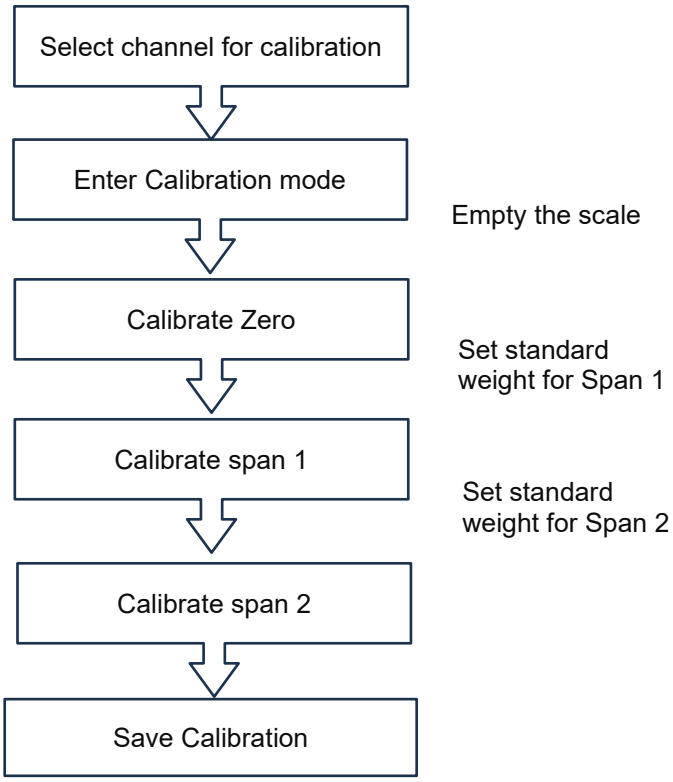
- The load cell sensor has been replaced.
- Mechanical components of the weighing system have been modified (e.g., platform, mounting structure).
- Module has been replaced.
- Offset is detected in weight values.

The following calibration methods are supported by module:

- 2-Point Calibration
- 3-Point Calibration
- Calibration Without Span Weight

1) 3-point Calibration / 2-point Calibration

Below steps are involved in 3-point calibration method.



The table below explains step by step procedure to execute 3-point calibration.

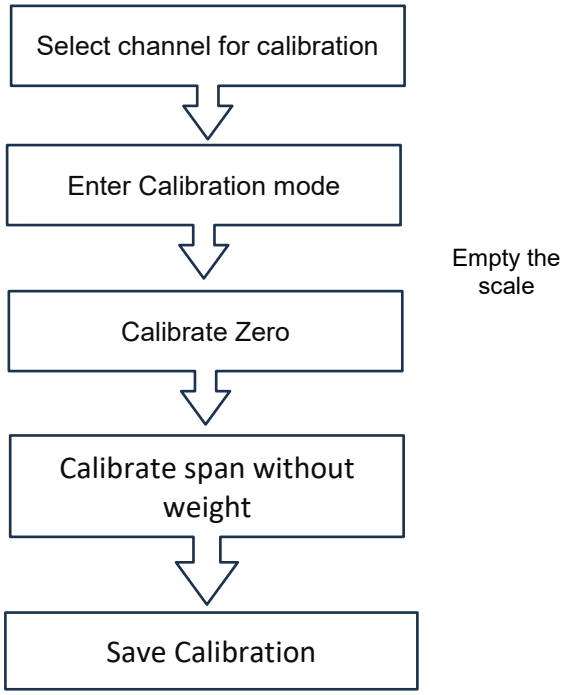
No.	Step	Procedure	IO memory used
1	Calibration channel selection	1. Select the channel for calibration. 2. Make sure 'Ack calibration channel selection' is received.	• Calibration channel selection. (QX n+2.0) • Ack calibration channel selected. (IX n+5.0) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
2	Enter Calibration mode	3. Turn ON command bit 'Enter calibration mode'. 4. Make sure 'Ack Calibration mode selected' is TRUE.	• Enter calibration mode (QX n+2.1). • Ack Calibration mode selected (IX n+5.1) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
3	Set standard weight for zero calibration	5. Remove any weight from scale to make it ready for zero calibration.	-
		6. Set standard weight in 'Output data → Standard weight value for zero calibration'. Set this value only when you want to perform zero calibration at non-zero weight.	• Calibration (over fieldbus) Weight → Standard Weight (QW m+0 - QW m+1)
4	Calibrate Zero	7. Turn ON command bit 'Calibrate zero' 8. After receiving 'Ack Capture zero', proceed to next step.	• Calibrate zero (QX n+2.2). • Ack Capture zero (IX n+5.2) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
5	Set standard weight for Span1 calibration	9. Place standard weight for Span 1 calibration on load cell.	-
		10. Set standard weight in 'Calibration (over fieldbus) Weight → Standard Weight'	• Calibration (over fieldbus) Weight → Standard Weight (QW m+2, QW m+3)
6	Calibrate Span1	11. Turn ON command bit 'Calibrate Span1' 12. After receiving 'Ack Capture Span1' = TRUE, proceed to next step.	• Calibrate Span1 (QX n+2.3). • Ack Capture Span1 (IX n+5.3) • Calibration process error code (IW m+13) • 7Calibration process error (IX n.4)
7	Set standard weight for Span2 calibration	13. Place standard weight for Span 2 calibration on load cell.	
		14. Set standard weight in 'Calibration (over fieldbus) Weight → Standard Weight'	Calibration (over fieldbus) Weight → Standard Weight (QW m+4, QW m+5)
8	Calibrate Span2	15. Turn ON command bit 'Calibrate Span2' 16. After receiving 'Ack Capture Span2' = TRUE, proceed to next step.	• Calibrate Span2 (QX n+2.4). • Ack Capture Span2 (IX n+5.4) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
11	Save calibration	17. Turn ON command bit 'Save calibration' 18. After receiving 'Ack Save Calibration' = TRUE, proceed to Exit calibration Mode.	• Save calibration (QX n+2.6). • Ack Save Calibration (IX n+5.6) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
12	Clear calibration error	19. Turn ON command 'Clear calibration error'. 20. After receiving 'Ack clear calibration error' , proceed to further steps.	• Clear calibration error (QX n+2.7) • Ack clear calibration error (IX n+5.7)

NOTE

Steps 'Set standard weight for Span2 calibration' and 'Calibrate Span2' are only applicable for 3-point calibration.

2) Calibration without weight

This method is intended for situations where it is not possible to place a physical span weight on the weighing platform. Instead, the system uses internal reference values to perform Calibration span without weight.



Below table explain step by step procedures to execute calibration span without weight.

No.	Step	Procedure	IO memory used
1	Calibration channel selection	1. Select the channel for calibration. 2. Make sure 'Ack calibration channel selection' is received.	• Calibration channel selection. (QX n+2.0) • Ack calibration channel selected. (IX n+5.0) • Calibration process error code (IW m+13) Calibration process error (IX n.4)
1	Enter Calibration mode	3. Turn ON command bit 'Enter calibration mode'. 4. Make sure 'Ack Calibration mode selected' is TRUE.	• Enter calibration mode (QX n+2.1). • Ack Calibration mode selected (IX n+5.1) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
2	Set standard weight for zero calibration	5. Remove any weight from scale to make it ready for zero calibration.	-
		6. Set standard weight in 'Output data → Standard weight value for zero calibration'. 7. Set this value only when you want to perform zero calibration at non-zero weight.	• Calibration (over fieldbus) Weight → Standard Weight (QW m+0-QW m+1)
3	Calibrate Zero	8. Turn ON command bit 'Calibrate zero' 9. After receiving 'Ack Capture zero', proceed to next step.	• Calibrate zero (QX n+2.2). • Ack Capture zero (IX n+5.2) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
4	Calibrate Span without weight	10. Turn ON command bit 'Calibrate Span without weight'	• Calibrate Span without weight (QX n+2.5). • Ack Calibrate span without weight (IX n+5.5) • Calibration process error code (IW m+13)

No.	Step	Procedure	IO memory used
		11. After receiving 'Ack Calibrate span without weight' = TRUE, proceed to next step.	• Calibration process error (IX n.4)
5	Save calibration	12. Turn ON command bit 'Save calibration' 13. After receiving 'Ack Save Calibration' = TRUE, proceed to Exit calibration Mode.	• Save calibration (QX n+2.6). • Ack Save Calibration (IX n+5.6) • Calibration process error code (IW m+13) • Calibration process error (IX n.4)
6	Clear calibration error	14. Turn ON command 'Clear calibration error'. 15. After receiving 'Ack clear calibration error', proceed to further steps.	• 1. Clear calibration error (QX n+2.7) • 2. Ack clear calibration error (IX n+5.7)

Calibration process Error Codes

If an error occurs during calibration via Fieldbus, an error code will be returned in the input memory 'Calibration process error code' IW m+13.

The following is a list of possible error codes:

Error code	Error name	Details	Recovery method
0	No Error	Calibration command active or calibration command executed successfully.	NA
1	Calibration Communication Failure	Any calibration command bit is set and communication error with header is detected before the respective action is completed.	1. Clear all calibration commands and exit calibration mode 2. Remove error condition. 3. Re-enter calibration mode. Error will be cleared when exit calibration is performed.
2	Calibration Input Error	Any calibration command bit is set and input signal error is detected before respective action is completed.	
3	Excitation power supply error is detected	Any calibration command bit is set and excitation power supply error bit is detected before respective action is completed.	
4	Invalid hardware calibration data	Enter calibration command is issued while hardware calibration error is detected by module.	
5	Calibration timed out	Calibration not completed within time specified by parameter 'Calibration timeout'.	
6	Calibration channel changed while in calibration mode	Calibration channel changed while calibration mode is enabled.	
7	Requested channel is not enabled	Requested channel is not enable	
8	Invalid zero calibration data	Calibration zero command is set and captured ADC raw count (as per Load cell rated output) is not in range. Zero calibration data valid range = (-Span calibration value of hardware calibration) to (Span calibration value of hardware calibration)	1. Clear calibration command that caused error. 2. Remove error condition 3. Set Clear calibration error command (QX n+2.7) Error will be cleared when exit calibration is performed or 'Clear calibration error command' is set.
9	Invalid zero calibration weight	Calibration zero command is set and standard weight value is not in range defined by parameter Load cell rated capacity. Valid range = 0 to Rated load cell capacity	

Error code	Error name	Details	Recovery method
10	Invalid span 1 calibration data	Captured ADC raw count (as per Load cell rated output) is not in range OR ADC raw count is too close (<5% of range defined by parameter Load cell rated output) to zero calibration raw count.	
11	Invalid span 1 calibration weight	Calibration span 1 command is set and standard weight value is not in range defined by parameter Load cell rated capacity OR Span 1 standard weight is too close to zero calibration weight (<5% of rated capacity). OR Span 1 standard weight is too small (<5% of the rated capacity of load cell).	
12	Invalid span 2 calibration data	Captured ADC raw count (as per Load cell rated output) is not in range OR ADC raw count is too close (<5%of range defined by Load cell rated output) to zero / Span 1 calibration raw count.	
13	Invalid span 2 calibration weight	Calibration span 2 command is set and standard weight value is not in range defined by parameter Load cell rated capacity OR Span 2 standard weight is too close (<5% of range defined by parameter Load cell rated capacity) to zero / span 1 calibration weight. OR Span 2 standard weight is too small (<5%) of the rated capacity of load cell.	
14	Invalid calibration data	Save calibration command is set and captured calibration ADC values are not valid. Save calibration is initiated before completion of zero or span calibration. Either of following value is not recoded ▪ Standard weight/calibration ADC count for zero calibration. ▪ Standard weight/calibration ADC count for span calibration for span1 and span2 calibration.	
15	Calibration write error	Error detected while saving calibration data to permanent memory.	
16	Zero and span calibration not performed	Calibration save command is set and zero calibration and/or span calibration is not performed	
17	Zero calibration not performed	Span 1 / Span 2 / Span calibration without weight is attempted before executing zero calibration.	

Error code	Error name	Details	Recovery method
18	Span1 calibration not performed	Span 2 is attempted before executing span 1 calibration.	
19	Multiple calibration commands triggered simultaneously	More than one calibration commands triggered simultaneously. This is detected by checking number of command bits changed from 0 to 1. Also, if new command is triggered before completion of previous command, then this error is declared.	

Calculating Step Response Time at Master PLC

Weight value step response time at Master PLC will depend on following factors;

- Number of channels enabled
- ADC conversion speed - Parameter setting ‘Conversion speed’
- Step response time of digital filters – Settings of IIR low pass filter and Moving average
- Time to send weight value from module to header - Parameter setting ‘Weight update interval’
- IO data update time from Header to Master PLC (Link scan time)

The following formula can be used to calculate the weight-value step response time at the Master PLC:

Weight value step response time = [CH0 step response time with filter] +
[CH1 step response time with filter] +
[Channel switching time (4ms)] +
[Parameter value ‘Weight update interval’ - 3 ms] +
[Fieldbus Link scan time]

- For ‘CH0’ and ‘CH1 step response time with filter’, refer section ‘Filtering’.
- For details on parameter ‘Weight update interval’, refer to the ‘Parameters’ section.
- For ‘Fieldbus Link scan time’ refer fieldbus master users manual.

If only one channel is enabled, omit the disabled channel’s step response time and the channel switching time. When CH1 is disabled, the formula becomes:

Weight value step response time = [CH0 step response time with filters] +
[Parameter value ‘Weight update interval’ - 3 ms] +
[Fieldbus Link scan time]

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