5034–PLM–HM

2–Channel Peak Tonnage Module

User Manual

GENERAL INFORMATION

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Solid state equipment has operational characteristics differing from those of electromechanical equipment. Because of these differences, and because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to property damage. Identifies information that is especially important for successful application and understanding of the product.

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Preface

Who Should Use This Manual

This manual illustrates the installation and operation of the 5034-PLM-HM. It is written for those who are responsible for design, installation, programming, or maintenance of an automation control system that uses the module.

You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application. If you do not, contact your local Allen–Bradley representative for the proper training before using this product

Terms and Abbreviations

Calibration – Procedure, performed by trained personnel, where machine or press is dynamically loaded to impact on load cells. A process of linearity measuring to determine the loading capacity of the machine.

Calibration Number – Amplification values established during machine calibration or pre–assigned on force load cells.

Channel – Refers to one of two, strain gage inputs available on the module's terminal block.

Load/Force – Measurement of impact during a machine cycle. Sensors provide the input for this measurement.

Look Window – Period of time the module is looking for force, which is activated by the cam being set.

Trend Deviation – Amount of change high or low from sample value to current value.

Resolution – The smallest detectable change in a measurement, typically expressed in engineering units (e.g. 0.15C) or as a number of bits. For example, a 12-bit system has 4,096 possible output states. It can therefore measure 1 part in 4096.

Sample – Load/force values established from a series of machine cycles. Also defined as Benchmark.

Reference Tons – Value used in calibration as the reference load/force applied to the sensor to enable accurate calibration.

Product Support

Contact your Helm representative or call Helm Instrument directly at 419/893-4356:

- Sales and Order Support
- Product Technical Training
- Warranty Support
- Support Service Agreement

Module Overview

The 5034–PLM–HM is a 2–Channel Peak Tonnage Module that provides accurate and reliable measurements, featuring capacity and trend alarms. Using strain gauge input, the 5034–PLM–HM module internally amplifies and conditions incoming signals, ensuring stable peak force measurement. Integration is simple using the included AOP to enable fast and straightforward setup. The 5034–PLM–HM is the perfect solution for your stamping, forging, die cast, and assembly applications.

Key Features

- 2 Independent Channels
- Capacity and Trend Alarms
- Internal Amplification and Signal Conditioning
- Accepts Industry Standard Load Cells
- Enhanced with an Add–on Profile (AOP)
- Reverse Load Measurement
- Built–in Auto Zero Balance

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Main Features

Operating Modes

Cal – Reports current raw value regardless of the state of the cam. No alarms are active.

Peak – Capacity alarms active. Reports peak and reverse load at falling edge of look window.

Monitor – Capacity and Trend alarms active. Reports peak, reverse load, and deviation at falling edge of look window.

Alarms

Capacity – User set high and low value normally tool or machine capacity. This provides protection for the application. It is active in both Peak and Monitor mode.

Trend – Percent or ton based high and low alarm calculated using averaged peak samples and user tolerances. Normally used for quality control.

Other Features

Parts/Cycle Counter – Count increments at the falling edge of the look window/cam. Only active in Peak or Monitor Mode. Automatically rolls over back to 0 when maximum variable is hit (65,535).

Reverse Load – Measurement of peak negative load/force being applied to the sensor.

Trend Deviation – Percent of change high or low from sample value to current peak value. The range of deviation is +4 through -4. When 4 is reported negative or positive the module has alarmed.

Manual Calibration Entry – Calibration numbers can be manually entered into the module, this is useful when replacing a module without recalibrating the machine.

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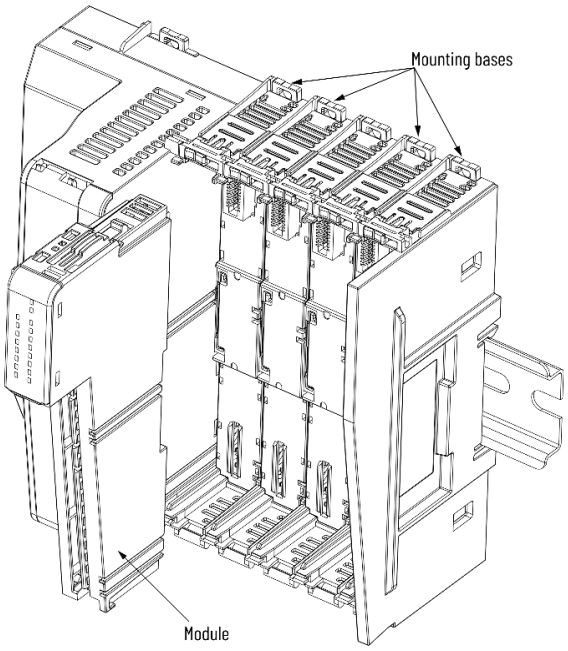
Installation and Wiring

ATTENTION: For complete installation procedures of the PointMax I/O system, refer to the official *"PointMax I/O System Installation"* document. This manual provides supporting guidance, but the official document should be used as the final source of instruction.

ATTENTION: The supporting components 5034–MB and 5034–RTB are ***NOT*** provided with purchase of a 5034–PLM–HM module.

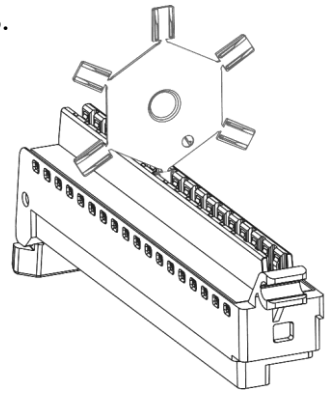
Installing the Module

1. With even force on the top and bottom, insert the 5034–PLM–HM into the mounting base. The lock at the top of the module should lock into the mounting base.



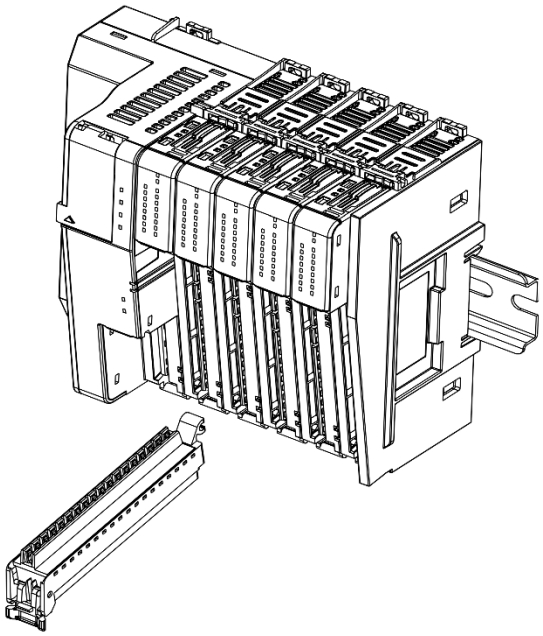
Installing the RTB Keys

1. The 5034–PLM–HM supports RTB keying to prevent incompatible terminal blocks from being installed into the module. The key slots for the 5034–PLM–HM are 3, 7, and 9. Installation of the keys is not required however, it is recommended to deter installation of a potentially catastrophically incompatible RTB.



Installing the Removable Terminal Block (RTB)

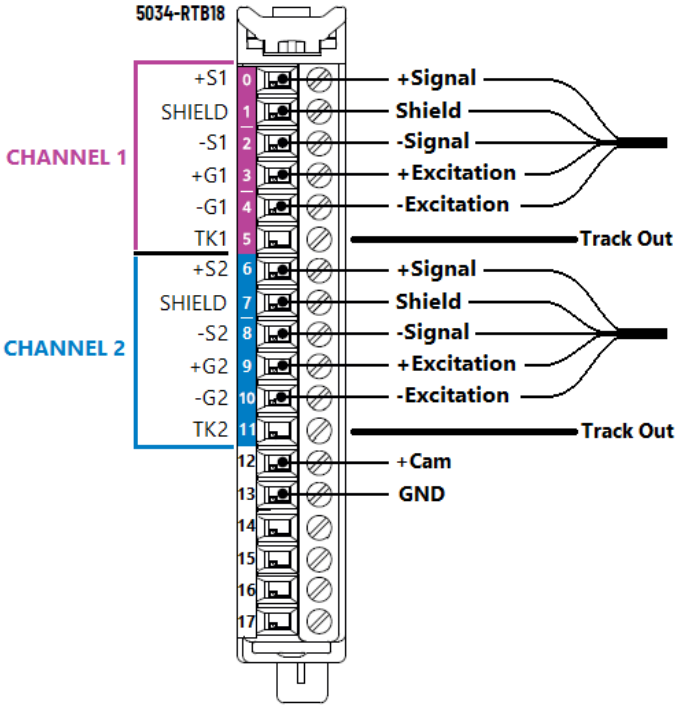
1. Attach the RTB pivot clip into the mounting base by firmly pressing it into place. Rotate the RTB until it latches securely into the module.

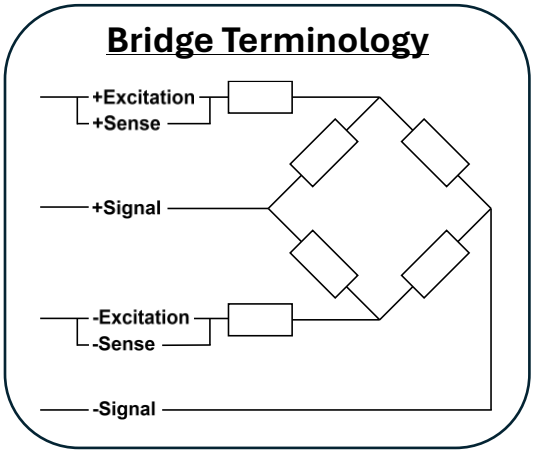


Wiring

Below is a diagram of the wiring guide of two independent channels for the RTB.

> **ATTENTION:** +Cam is based on +5V logic and should NOT have +24V connected, as doing so will damage the module. We offer a solution to convert 24V to 5V when using an external cam.





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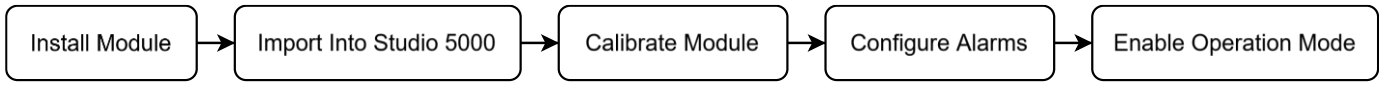
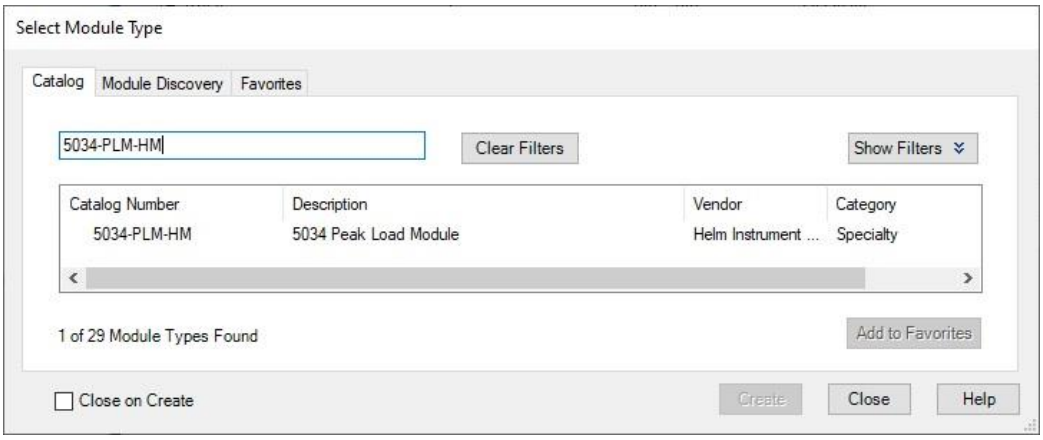
Setup and Usage

Setup of the 5034-PLM-HM is streamlined so that there are minimal steps needed to have the module fully functional. **Below is a flow chart detailing the required steps to set up and operate the module.**



1) Importing the Module into Studio 5000

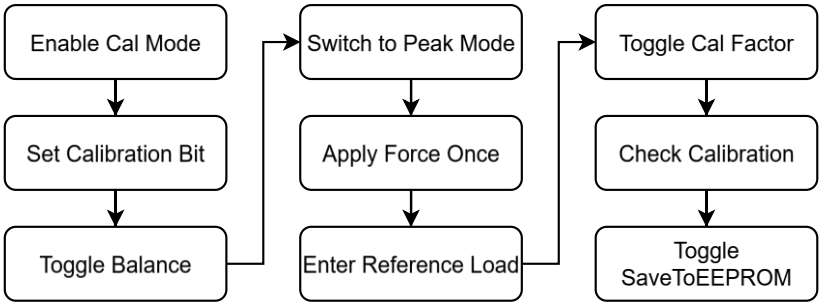
This module includes an Add–On Profile (AOP) for seamless integration. At this time, the AOP must be manually installed. In a future release, the AOP will be integrated into Studio 5000 eliminating the need to manually install add–on profile.



2) Calibration

Calibration is as simple as applying a known load one time. Before starting calibration, it is required to have a way to accurately measure what force is being applied to the machine. This measured force is known as the “Reference Load” or “Reference Tons”.

Calibration Flowchart



Calibration Procedure

Below are the required steps to calibrate the 5034–PLM–HM.

ATTENTION: The following calibration steps are channel specific. Before completing each step, verify that you are working on the intended channel and all required bits are set accordingly.

ATTENTION: Disable all alarms by setting their values to 0 before starting calibration. This ensures that the module will not give a false trigger and potentially impact the calibration process.

1. Enable Cal Mode

▷ IO:1:O.Mode	0		Decimal	USINT

2. Set Calibration Bit

IO:1:O.EnableCalibration	1		Decimal	BOOL

3. Toggle Balance

IO:1:O.Ch01.SetBalance	1		Decimal	BOOL

4. Switch to Peak Mode

▷ IO:1:O.Mode	1		Decimal	USINT

5. Apply Load Once(Cycle machine)
6. Enter in Reference Load

▷ IO:1:O.Ch01.ReferenceTons	100		Decimal	UINT

7. Toggle SetCalFactor

IO:1:O.Ch01.SetCalFactor	1		Decimal	BOOL

8. Apply load again and verify that the calibration worked
9. Toggle SaveToEEPROM tag (Saves calibration value internally)

IO:1:O.SaveToEEPROM	1		Decimal	BOOL

3) Operation

The 5034–PLM has two different modes of operation Peak and Monitor. Different modes of operation have different alarms active. In Peak mode only Capacity alarms are active. In Monitor mode both Capacity and Trend alarms are active.

Peak Mode

▸ IO:1:O.Mode	1	Decimal	USINT

Monitor Mode

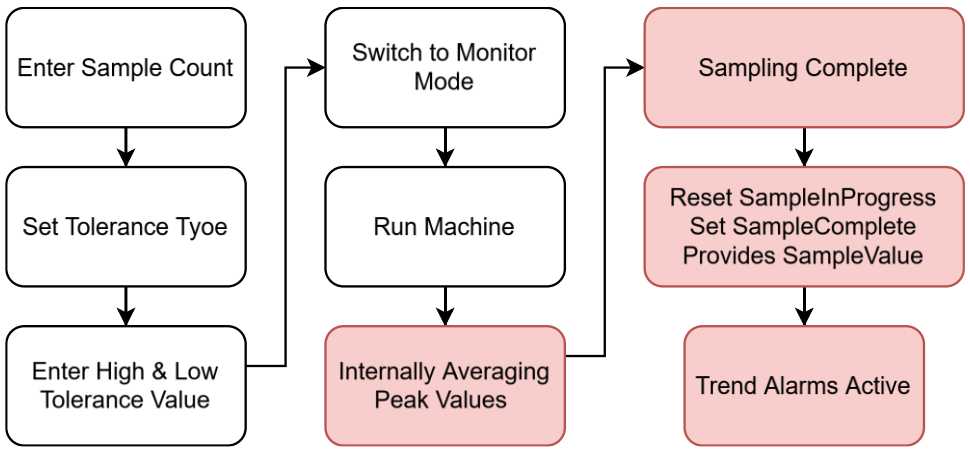
▸ IO:1:O.Mode	2	Decimal	USINT

Trend Alarm Settings

Trend alarms are internally generated alarms based on user–defined tolerance types and values. These are referred to as tolerance values, which the module can interpret as either a percentage or in tons. The internal trend alarm values are created after the module has completed the number of samples set by the user. When the module is set to monitor mode, it begins sampling peak values and averaging the captured samples. While actively sampling, the module sets the "SampleInProgress" bit. Once the sample is complete, it then uses the tolerance type and values to create high and low tolerance for each channel. Upon completion, "SampleInProgress" bit is reset, "SampleComplete" bit is set, and the average peak value calculated from the samples is output to the respective channel's output tag "SampleValue". The Tolerance values can be adjusted on the fly without the need to switch back and forth between peak and monitor mode.

Below is a flowchart on trend alarm operation, everything in red is an internal operation that does not require user input.

Trend Functionality Flowchart



Diagnostics and Troubleshooting

Cal Mode

During Cal Mode, instead of a peak load being given, the module provides the raw force measurement value in the "Ch0X.Peakvalue" input tags. This can be helpful when debugging issues with the loadcell/strain gauge or overall setup of the application.

Track Out

Track out is the analog voltage being used by the module to accurately measure the force on the loadcell. This can be used to ensure the module circuitry or loadcell/strain gauge is functioning correctly. The analog voltage measured at TK1 or TK2 (Located on the RTB, refer to the wiring diagram) is dependent on the resistance and mV/V of the loadcell/strain gauge connected to that specific channel.

Readout Tags

Readout tags allow a user to view values that are internally stored or used by the module. When a readout tag is enabled, the corresponding variable is displayed in the "Ch0X.PeakValue" input tag. This enables a user to verify the value written during calibration or in the output tags is accurate and being used by the module. Below is a simple breakdown of each tag and the value they return when enabled.

Tag Name	Output	Purpose
O.ReadCalFactor	CalFactor	Needed for storing calibration information. This value is important when replacing a module or troubleshooting.
O.ReadADTrim	ADTRIM	ADTRIM is a factory calibration value used by Helm Instrument for troubleshooting.
O.ReadReferenceTons	ReferenceTons	Shows the internal reference tons being used for peak value calculation.
O.ReadBalance	Balance	

Overlay LEDs

The front overlay of the module shown in the image below gives numerous ways of indicating operating modes and potential issues. Behavior of the "MODE" and "FAULT" LEDs are described below.

LED Name	LED Status	Description
ALARM	OFF	No Alarm
	SOLID RED	Alarm Active
MODE	OFF	CalMode is active
	SOLID YELLOW	Peak or Monitor Mode is active
	FLASHING RED & YELLOW	Incorrect mode configuration
FAULT	OFF	No Fault
	SOLID RED	Fault, Check module status bits for fault type
CAM	OFF	Cam Signal Low (Outside look window)
	SOLID YELLOW	Cam Signal High (Inside look window)

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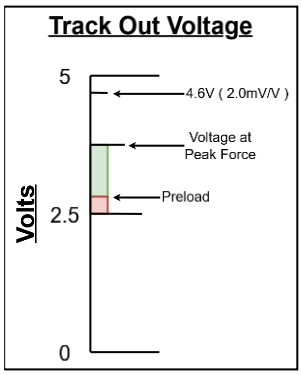
Sensor Issues

There are numerous causes for inaccurate readings or overall failure to use measurements. To narrow down the cause of the problem, below are some different ways to ensure the sensor is operating as designed with the module.

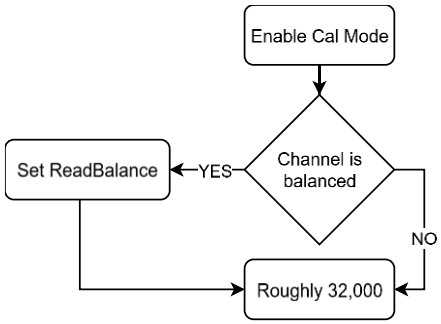
Checking Range

Damaged sensors, incorrect installation, or incompatible sensors can cause out of range or minimal sensor readings. Understanding the information below will narrow down the root cause for inadequate readings or ensuring installation is sufficient. Below is a diagram of the track out voltage range. Keep in mind that voltage is directly proportional to counts on the module.



Checking Raw Value / Preload

With no load applied, the track out voltage should be approximately 2.5V (32,000 count). After installation, some preload is typically present on the sensor. This preload shifts the no load reading and is represented by the red box in the diagram above. Depending on the direction of the preload, the no load voltage/counts may be above or below 2.5V or 32,000 counts. Use the diagram below to verify the raw value.



Preload only becomes a concern when it reduces available measurement range or over capacity margin. For example, if the preload is 3,000 counts and unscaled peak force is 4,000 counts, the module still has 25,000 of remaining range. This would be an acceptable preload. However, if insufficient over capacity margin is not available the module will not be able to measure the full peak potentially resulting in catastrophic failure.

Checking Resolution

Proper sensor location determines the peak force resolution the module can provide. By enabling the BypassScaling bit in peak mode, it is possible to view the number of raw counts being measured. When the machine is cycled, the raw counts represent the number of counts between the no load and peak force. For example, if BypassScaling is enabled and the machine is cycled, a raw peak force value of 2000 counts corresponding to an actual load of 200 tons provides a 0.1 ton resolution per count. Depending on the application requirements, the raw peak force value can be used to determine whether the sensor location should be adjusted.

I/O Tags:

Input

Tag Name	Usage	Data Type
I.RunMode	Not controlled by the module	BOOL
I.ConnectionFaulted	Not controlled by the module, shows if the connection is faulted or not	BOOL
I.ModuleStatus	Reports the status of the module as well as faults	UINT
I.CycleCounter	Number of cycles counted by the module via the cycling of the Cam	UINT
I.CurrentModeReport	Reports what mode the module is in (Should always report value in O.Mode)	USINT
I.CamReport	Reports the status of Cam (This works for both internal and external cam)	BOOL
I.SampleInProgress	Displays if the module is currently taking samples for the trend calculation	BOOL
I.SampleComplete	Displays if the module has successfully sampled enough to make an average for trend	BOOL
I.Ch01	Contains tag substructure associated with channel 1	
I.Ch02	Contains tag substructure associated with channel 2	
Each channel has the same sub–tag structure		
I.Ch0X.PeakValue	Reports peak value of force measured	UINT
I.Ch0X.SampleValue	Reports average value sampled for trend	UINT
I.Ch0X.ReverseLoad	Reports reverse load	UINT
I.Ch0X.TrendDeviation	4 through –4 depending on trend tolerance value	SINT
I.Ch0X.HighTrendAlarm	Reports if high trend alarm is active	BOOL
I.Ch0X.LowTrendAlarm	Reports if low trend alarm is active	BOOL
I.Ch0X.HighCapacityAlarm	Reports if high capacity alarm is active	BOOL
I.Ch0X.LowCapacityAlarm	Reports if low capacity alarm is active	BOOL

Output

Tag Name	Usage	Data Type
O.Mode	Sets the module into these modes: 0 – Calibration, 1 – Peak, 2 – Monitor	USINT
O.SampleCount	The amount of cycles used to create the trend average sample value	USINT
O.AlarmReset	Resets all alarms	BOOL
O.LowAlarmInhibit	Stops module from checking for low alarms	BOOL
O.BypassScaling	In peak mode, outputs the raw counts of the peak load	BOOL
O.EnableCalibration	Must be enabled to allow for SetCalFactor or SetBalance to run	BOOL
O.EnableExternalCam	0 – Internal Cam , 1 – External Cam	BOOL
O.Cam	Enables looking for a peak load or starts the look window(Only used when O.EnableExternalCam is set to 0)	BOOL
O.ToleranceValueType	0 – Percentage , 1 – Tons	BOOL
O.ReadCalFactor	Outputs the mV/V value each channel uses in its corresponding “I.Ch0X.PeakValue” tag	BOOL
O.ReadADTrim	Outputs the ADTRIM value each channel uses in its corresponding “I.Ch0X.PeakValue” tag	BOOL
O.ReadReferenceTons	Outputs the internally used reference tons value each channel uses in its corresponding “I.Ch0X.PeakValue” tag	BOOL
O.ReadBalance	Outputs the Balance value each channel uses in its corresponding “I.Ch0X.PeakValue” tag	BOOL
O.SaveToEEPROM	Writes cal factor, reference tons, and balance to flash for storage.	BOOL
O.Ch01	Contains tag substructure associated with channel 1	
O.Ch02	Contains tag substructure associated with channel 2	
Each channel has the same sub–tag structure		
O.Ch0X.HighCapacityAlarm	Alarm value for high capacity alarm	UINT
O.Ch0X.LowCapacityAlarm	Alarm value for low capacity alarm	UINT
O.Ch0X.HighTolerance	Tolerance amount for high trend alarm	USINT
O.Ch0X.LowTolerance	Tolerance amount for low trend alarm	USINT
O.Ch0X.ReferenceTons	Reference load/force used during calibration	UINT
O.Ch0X.EnableAutoZero	Zeros any deviation caused outside the look window	BOOL
O.Ch0X.ClearBalance	Restores the absolute force reading	BOOL
O.Ch0X.SetBalance	Zeros the force reading so existing load is ignored	BOOL
O.Ch0X.SetCalFactor	Runs calibration calculation for the channel	BOOL
O.Ch0X.SetManualCalFactor	Writes value inside of ManualCalFactor to the module	BOOL
O.Ch0X.ManualCalFactor	Entry for previous cal factor value or manual setting of cal factor	UINT

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Timing Diagram

Below is a diagram showing the behavior of internal and external operations. This can help give a user a better understanding of the requirements and internal flow of operations.