Engineering Note

IND360 POWERCELL

PROFIBUS PLC

METTLER TOLEDO

Menu

1. Overview

This Engineering Note is based on integration of Mettler Toledo's Industrial Weighing Automation Terminal IND360 POWERELL with a Profibus PLC. Go to www.mt.com/ind-ind360-downloads to download all the necessary files and documents.

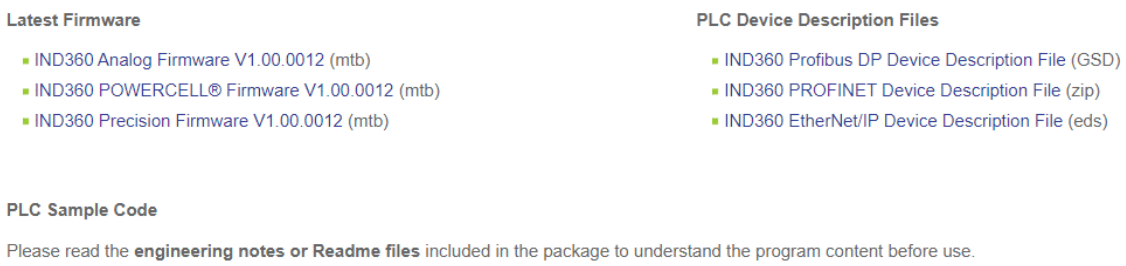


Figure 1-1: IND360 POWERCELL download page

Note: The configuration used in this sample code is based on the default settings：

Siemens TIA Portal V14 SP1

SAI data format: 2-Block format

GSD file： MT1153.GSD;

IND360 device firmware version： IND360_Powercell_V1.00.0012.mtb

It is recommended to integrate one IND360 POWERCELL into the PLC Profibus network and go through the sample codes to understand the functionality of each Function Block. To add more IND360 POWERCELL into the Profibus network, follow the steps listed in Chapter 6. Add New IND360 POWERCELL.

2. Setup of Project Development Environment

2.1. Hardware Integration

Connect the PLC and IND360 with the appropriate PROFIBUS DP cable.

2.2. Open the Sample Code

To open and use this sample code "IND360_POWERCELL_PBDP.ap14", you need to use Siemens TIA Portal version 14 SP1 or higher. All the required GSDML files will be installed automatically while opening the sample code.

2.3. Switching Project Languages

Under Tools -> Project Languages -> Editing Language, choose the preferred language for your project. Selections are English (United States) and Chinese (People's Republic of China).

Figure 2-1: Switching Project Languages between English and Chinese

2.4. Select the correct controller model

There are three projects included in one sample code, each project uses different Siemens PLC model:

1. "S7-300" uses S7-300 series PLC with IND360 POWERCELL weighing terminal;
2. "S7-1200" uses S7-1200 series PLC with IND360 POWERCELL weighing terminal;
3. "S7-1500" uses S7-1500 series PLC with IND360 POWERCELL weighing terminal;

Choose the most relevant project according to your PLC type to download into the PLC.

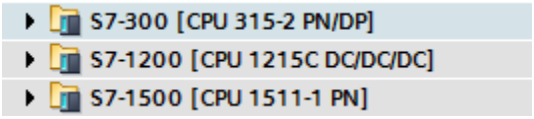


Figure 2-2: three projects in the sample code

To change the PLC model: Go to Device Configuration under the project folder, right click on the current controller, select "Change Device" and choose the new controller as well as its firmware version.

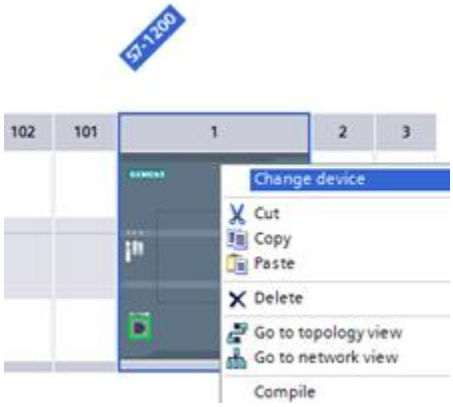


Figure 2-3: Change controller type

Compile and download the project into the controller.

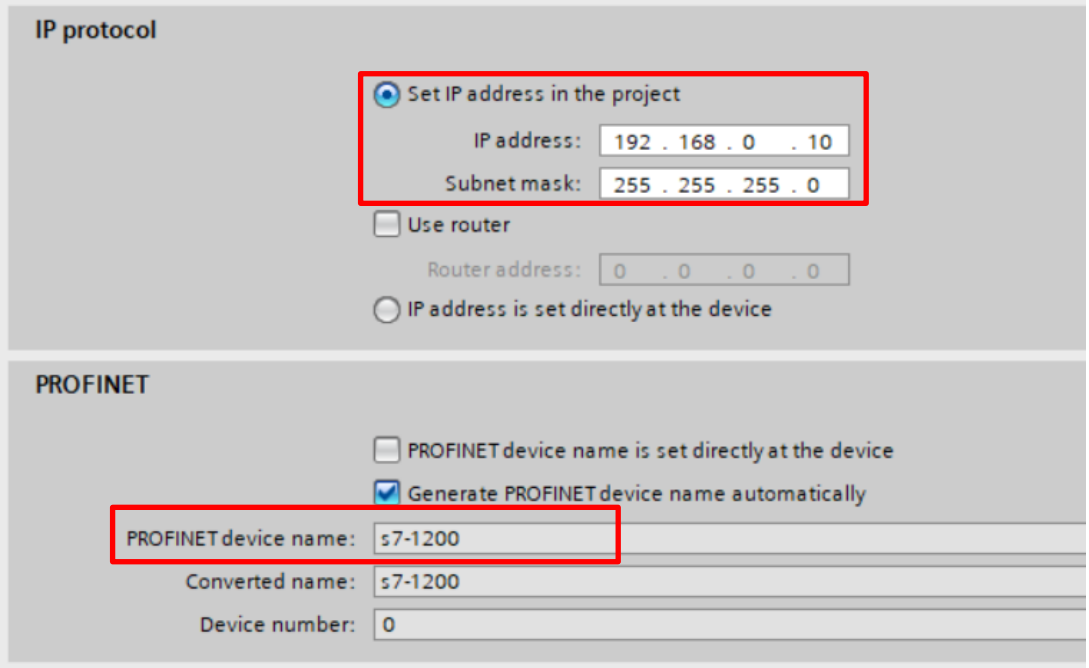


Figure 2-4: PLC Device Properties – Ethernet Addresses

Select the "MT_IND_Application" program, click on "Go Online" button to start using the sample code.

Figure 2-5: go online with MT_IND_Application

3. SAI Data Structure in Device Overview

In the Device Overview, the SAI input and output data structure has been assigned with the respective I and Q addresses as shown below. For more details on SAI data structure, please refer to the User Manual: Standard Automation Interface – Reference Guide and User Guide English (pdf), which are downloadable from the IND360 Download Page.

Full User Manual

- IND360base Weighing Terminal Full Users Guide (pdf)
- IND360tank/vessel Weighing Terminal Full Users Guide (pdf)

- Standard Automation Interface - Reference Guide - IND360 English (pdf)
- Standard Automation Interface - User Guide - IND360 English (pdf)

Figure 3-1： the SAI User Manual on the IND360 Download page

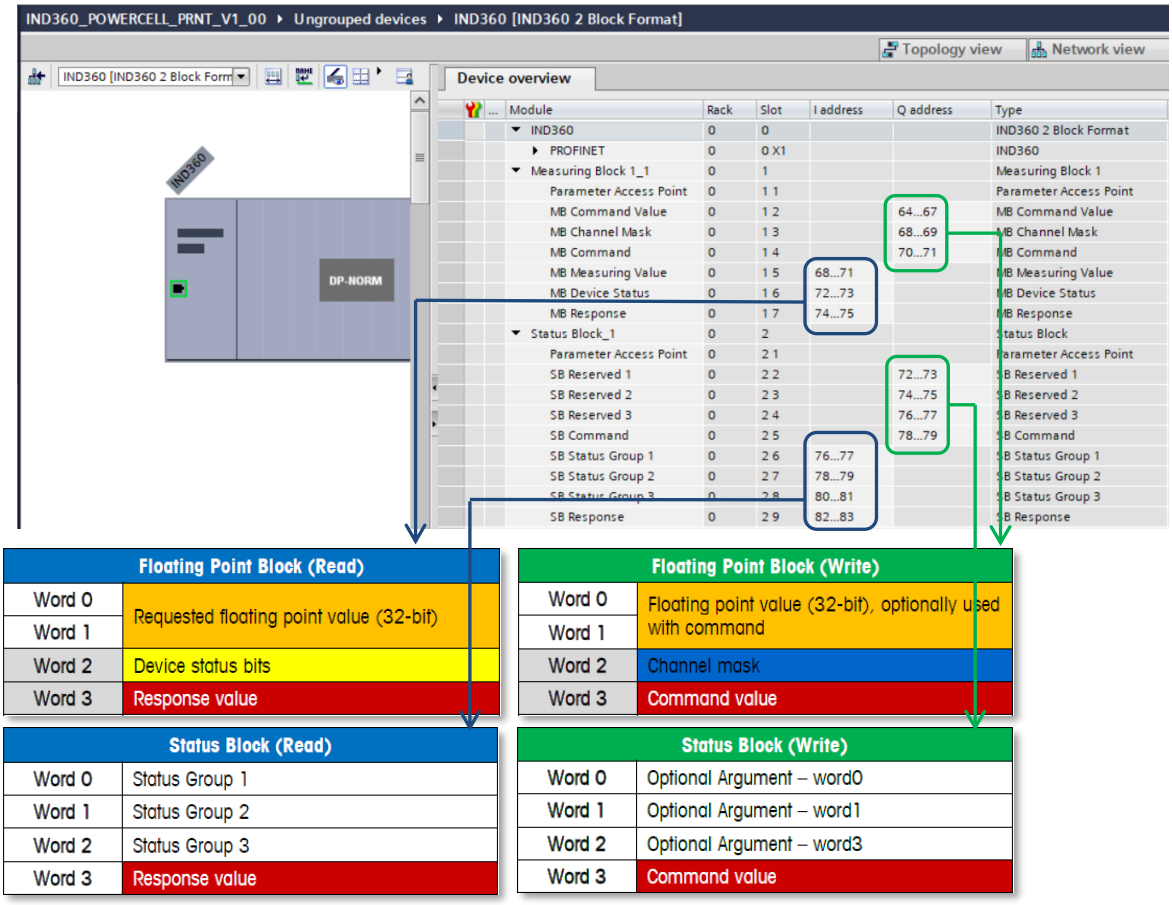


Figure 3-2： SAI Data Structure as shown in the Device Overview

The I and Q addresses above will be used as input parameters in 4. Function Blocks

4. Function Blocks

About the "ID" input parameter for all the acyclic communication function blocks:

For all the function blocks which involve acyclic communication between the PLC and the weighing transmitter, the "ID" input parameter is required. Examples of function block with acyclic communication are zero adjustment, span adjustment and condition monitoring etc.

For an S7-300, ID can be found under the Device overview -> Diagnostics Address of Rack 0, Slot 0. In the example below the ID is "2043".

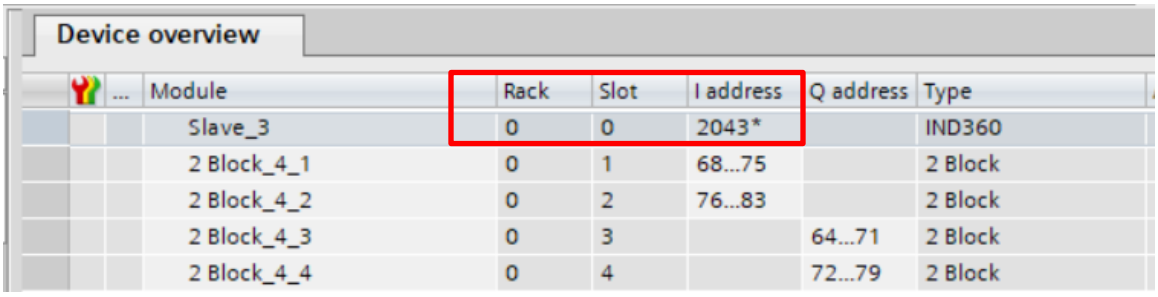


Figure 4-1: the ID parameter for S7-300

For S7-1200 and S7-1500 PLCs, the ID is the Hardware Identifier which can be identified in the Device overview. In this case the Hardware Identifier is "265".

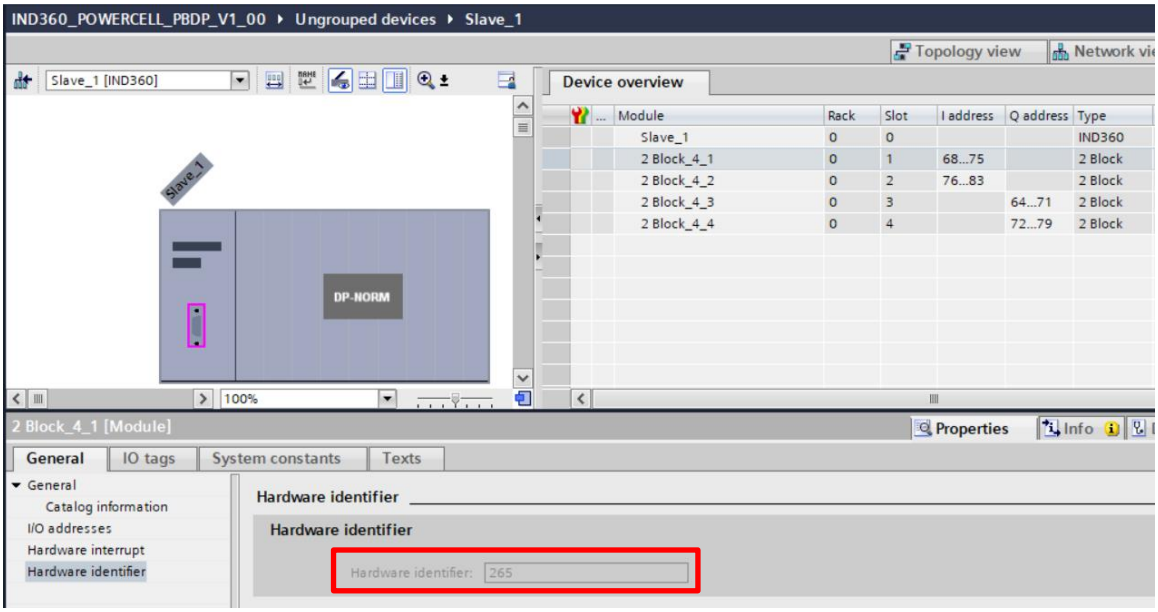


Figure 4-2: the ID parameter for S7-1200 and 1500

In the PLC programming, the IND360's Hardware Identifier can be referenced as "Slave_1~2_Block_4_1", as shown below.

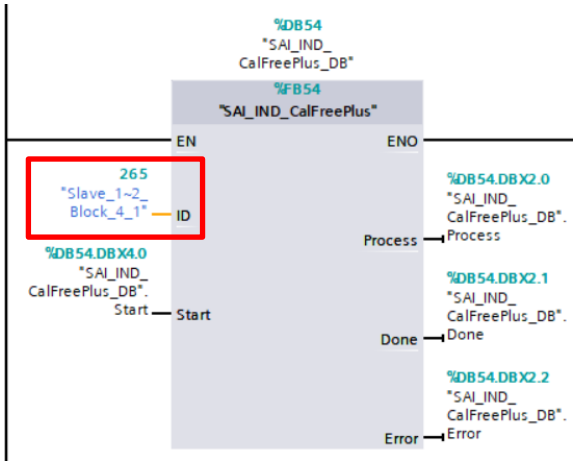


Figure 4-3: the ID parameter for acyclic communication

4.1. Cyclic Weight Data Processing

This function block reads in all the important real-time, cyclical weighing data such as weight value, Data OK bit, Motion bit, Net mode bit and critical alarm bit.

Set the scale command bit one at a time to trigger different commands such as tare stable, zero stable, tare immediate, zero immediate, preset tare and clear tare. A successful execution of a scale command will set the Done bit on, else the Error bit will be set on instead.

The cyclic weight data can be reported automatically right after any scale command. The type of weight data (gross, net, or tare) being reported depends on the setting for WeightCmd. By default, the WeightCmd is decimal "3" and the function block will return a net weight value right after any scale command such as tare or zero. Similarly, if the WeightCmd parameter is configured as decimal "0" or "1" the function block will then return a gross weight after any scale command.

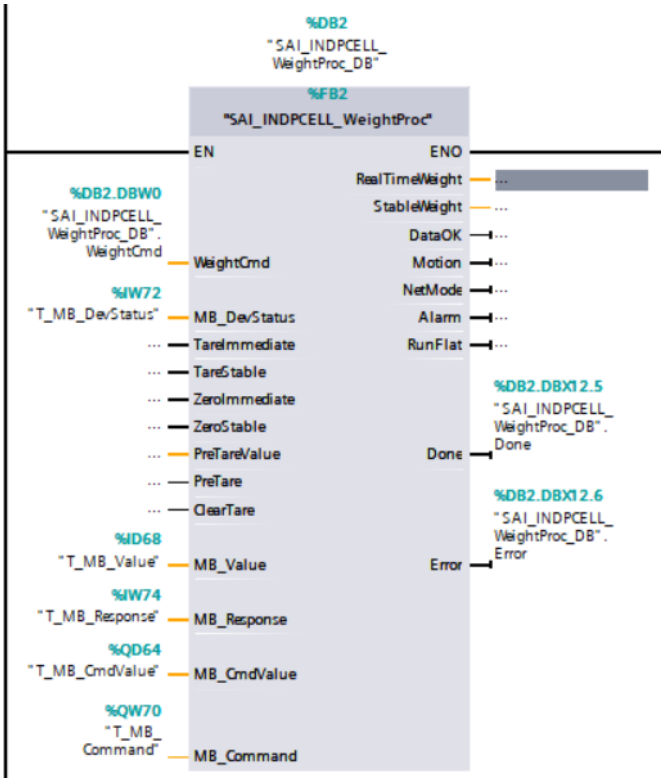


Figure 4-3: SAI_INDPCELL_WeightProc Function Block

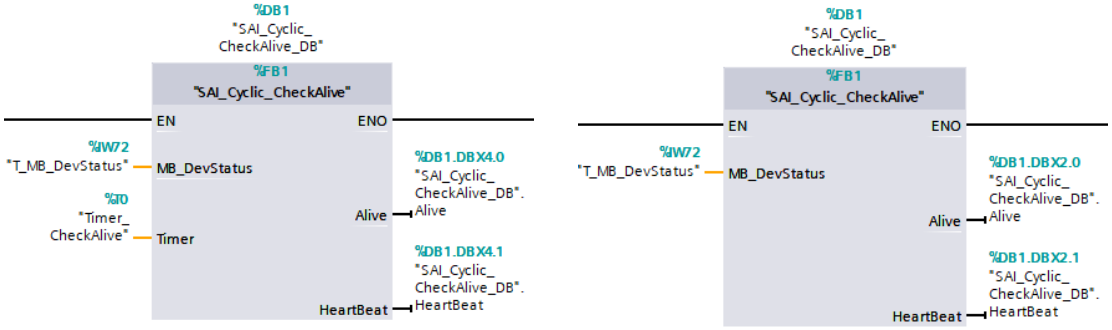
Table 4-1: SAI_INDPCELL_WeightProc Function Block Parameters

Input Parameters	Data Type	Values	Description
WeightCmd	Word	0, 1	Report gross weight value
		2	Report tare weight value
		3 (default)	**Report net weight value**
		5	Report gross weight value (with internal resolution)
		6	Report tare weight value (with internal resolution)
		7	Report net weight value (with internal resolution)
MB_DevStatus	Word		Refer to Device Overview, input address of MB Device Status
TareImmediate	Bool		Trigger this bit to perform immediate tare command. This tare command doesn't check for stability criteria. Upon completion of this command, the input bit will be reset.
TareStable	Bool		Trigger this bit to perform stable tare command. This tare command requires the weight value to remain stable within the stability criteria (+-1d within 0.3 second) for a predefined timeout range (3 seconds by default), failing which, the command will return an error. Upon completion of this command, the input bit will be reset.
ZeroImmediate	Bool		Trigger this bit to perform immediate zero command. The zero command can only be executed when the weight value is within the zero range (+-2% by default). Else, the command will return an error. Upon completion of this command, the input bit will be reset.
ZeroStable	Bool		Trigger this bit to perform a stable zero command. This zero command requires the weight value to remain stable within the stability criteria (+-1d within 0.3 second) for a predefined timeout

			range (3 seconds by default). Furthermore the weight value has to be in the zero range to trigger this command, failing either condition; the command will return an error. Upon completion of this command, the input bit will be reset.
PreTareValue	Real		The preset tare value which has to be configured before issuing the PreTare command. Valid PreTare value is between scale's zero point up to maximum capacity.
PreTare	Bool		Trigger this bit to perform a preset tare command. The PreTareValue has to be configured prior to issuing this PreTare command. Upon completion of this command, the input bit will be reset.
ClearTare	Bool		Trigger this bit to perform a clear tare command. This command removes the tare and brings the scale into gross mode. Upon completion of this command, the input bit will be reset.
MB_Value	Real		Refer to Device Overview, input address of MB Measuring Value
MB_Response	Word		Refer to Device Overview, input address of MB Response
MB_CmdValue	Real		Refer to Device Overview, output address of MB Command Value
MB_Command	Word		Refer to Device Overview, output address of MB Command
Output Parameters	Data Type	Values	Description
RealTimeWeight	Real		Real-time weight value, can be gross, tare or net weight
StableWeight	Real		Stable weight value, the last real-time weight during Motion = 0
DataOK	Bool	0	This bit gets set to 0 when the device is still operational but the value being reported cannot be guaranteed to be valid. The following conditions cause the Data Okay bit to be set to 0: • Device is powering up • Device is in setup mode • Device is in test mode • Over capacity condition occurs - When the A/D converter is at its limit - Product dependent over capacity that occurs when the device determines it cannot trust the weight • Under capacity condition occurs - When the A/D converter is at its limit - Product dependent under capacity that occurs when the device determines it cannot trust the weight
		1	Weight data is normal, valid
Motion	Bool	0	Weight value is stable
		1	Weight value is in motion
NetMode	Bool	0	Weighing is in gross mode
		1	Weighing is in net mode
Alarm	Bool	0	No alarm
		1	Also called the RedAlert alarm. If this bit is true it is an indication that the control device should stop until the source of the alarm is evaluated and corrected. The control system should use a Field Value command or evaluate the RedAlert status block to determine the nature of the alarm.
RunFlat	Bool	0	RunFlat is inactive
		1	RunFlat is active
Done	Bool	0	Zero, tare or clear tare command is in process, or failed
		1	Zero, tare or clear tare command is successful
Error	Bool	0	Zero, tare or clear tare command is in process, or succeeded
		1	Zero, tare or clear tare command is not completed due to error

4.2. Device Heart Beat Monitoring

This function block monitors the Heart Beat bit of the weighing transmitter and outputs an "Alive" flag.



S7-300 S7-1200 和 S7-1500

Figure 4-4: SAI_Cyclic_CheckAlive Function Block

Table 4-2: SAI_Cyclic_CheckAlive Function Block Parameters

Input Parameters	Data Type	Values	Description
MB_DevStatus	Word		Refer to Device Overview, input address of MB Device Status
Timer (S7-300)	Timer		Timer, use independent timer for each function block, do not replicate.
Output Parameters	**Data Type**	**Values**	**Description**
Alive	Bool	0	Device has lost communication
		1	Device is communicating OK
HeartBeat	Bool		To insure that the device is working as expected and updating data in Words 0, 1 and 2, this heart beat bit is toggled between off and on states. The frequency is dependent on the specific device's ability to cycle this bit. For example, a 1 second heart beat would be sufficient for most applications.

4.3. Diagnostic Status Monitoring

This function block reads in all the critical real-time diagnostic data from POWERCELL® load cells.

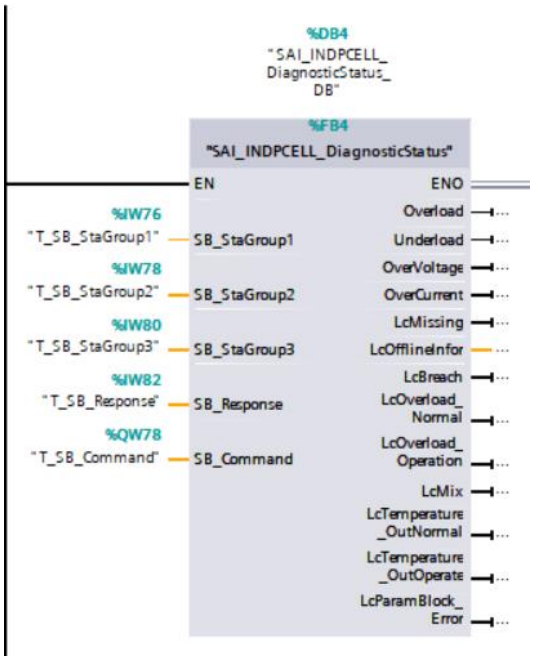


Figure 4-5: SAI_INDPCELL_DiagnosticStatus Function Block

Table 4-3: SAI_INDPCELL_DiagnosticStatus Function Block Parameters

Input Parameters	Data Type	Values	Description
SB_StaGroup1	Word		Refer to Device Overview, input address of SB Status Group 1
SB_StaGroup2	Word		Refer to Device Overview, input address of SB Status Group 2
SB_StaGroup3	Word		Refer to Device Overview, input address of SB Status Group 3
SB_Response	Word		Refer to Device Overview, input address of SB Response
SB_Command	Word		Refer to Device Overview, output address of SB Command
Output Parameters	Data Type	Values	Description
Overload	Bool	0	Scale is not overload
		1	The weight is equal to or greater than a "customer-programmed" limit either on the scale (multi-sensor system) or individual sensor's capacity
Underload	Bool	0	Scale is not underload
		1	The weight is under the "customer-programmed" limit on the scale / sensor (under zero but still within A/D range)
OverVoltage	Bool	0	Operating voltage is normal
		1	Operating voltage out of range
OverCurrent	Bool	0	Operating current is normal
		1	Operating current is out of range
LcMissing	Bool	0	All load cells are communicating normally
		1	One or multiple load cell has lost communication
LcOfflineInfor	Word		A word of 16 bits, each bit represents the communication status of the Powercell™ load cell. Bit status "1" means the load cell has lost communication, while status "0" means no comm. lost. The IND360 POWERCELL™ supports up to 14 digital load cells hence only 14 bits (bit 0 – bit 13) are relevant in this Word. Word: 00XX XXXX XXXX XXXX

			|.....| LC#14 LC#1
LcBreach	Bool	0	No load cell enclosure breach
		1	the sensors enclosure has been compromised and therefore vulnerable to outside influences such as moisture / water – in most cases a failure will occur if the breach is not corrected or the sensor replaced
LcOverload _Normal	Bool	0	The load cell's individual weight is not within 101%-150% of its Rated Capacity
		1	The load cell's individual weight falls within 101%-150% of its Rated Capacity
LcOverload _Operation	Bool	0	The load cell's individual weight has not exceeded 150% of its Rated Capacity
		1	The load cell's individual weight exceeds 150% of its Rated Capacity
LcMix	Bool	0	All the connected load cells are of the same model
		1	There is at least a mix of different load cell model in a scale
LcTemperature _OutNormal	Bool	0	Load cell temperature is normal
		1	Load cell temperature is out of compensated range
LcTemperature _OutOperate	Bool	0	Load cell temperature is within the operating range
		1	Load cell temperature is out of operating range
LcParamBlock _Error	Bool	0	Load cell parameters are normal
		1	At least one of the load cell parameters has error

4.4. Read Scale Adjustment Settings

This function block reads the current scale capacity and increment values from the connected weighing transmitter. Set the "Read" input parameter on to start the reading process. Upon completion of the read process, this "Read" bit will be reset.

It is useful to know the current scale settings before performing any scale adjustment procedure.

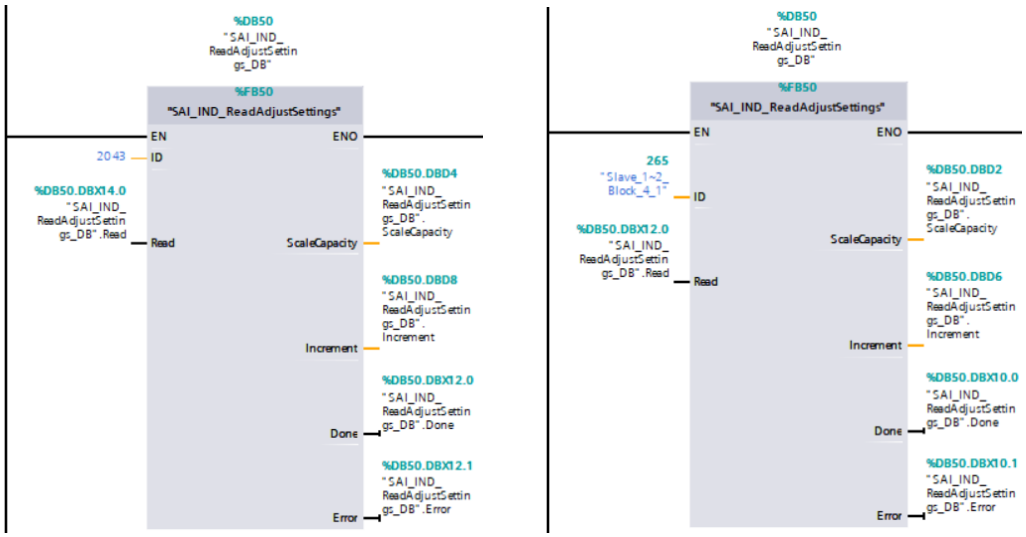


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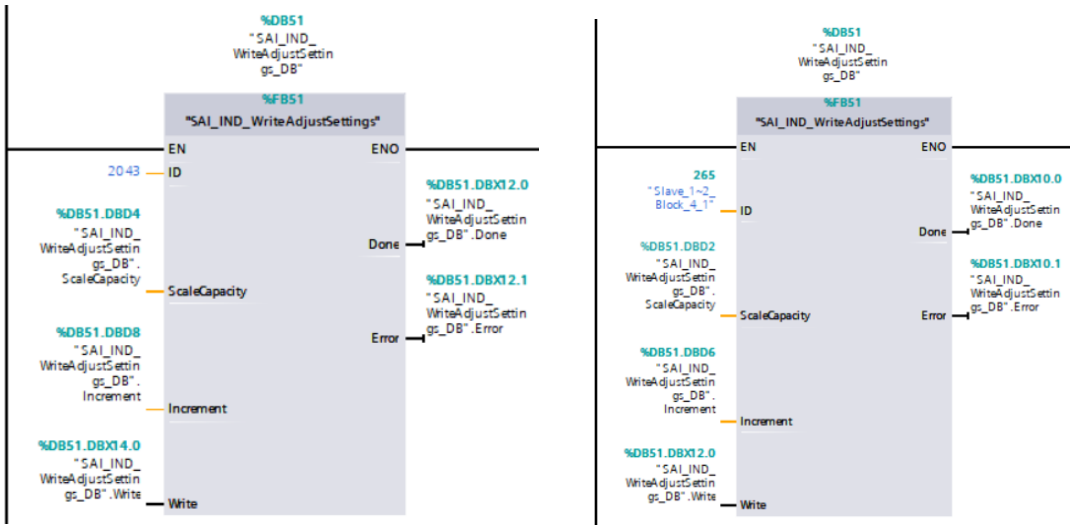
Figure 4-6: SAI_IND_ReadAdjustSettings Function Block

Table 4-4: SAI_IND_ReadAdjustSettings parameter descriptions

Input Parameters	Data Type	Values	Description
ID (for S7-1200 and S7-1500)	HW_IO	"265"	ID parameter to select the module for which a data record is to be written. Use only the hardware identifier (HW ID) of the module for the ID parameter. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 0 Hardware Identifier.
ID (S7-300)	DWORD	"2043"	
Read	Bool	1, 0	Trigger this input bit to start the reading process.
Output Parameters	**Data Type**	**Values**	**Description**
ScaleCapacity	REAL (32 bits)	Example: "3000.0"	Current scale capacity value
Increment	REAL (32 bits)	Example: "0.1"	Current scale increment value
Done	Bool	1	Read process is completed successfully
		0	Read process is not completed
Error	Bool	1	An error has occurred during the read process
		0	No error

4.5. Write Scale Adjustment Settings

This Function Block configures the new settings of scale capacity and increment value onto the weighing transmitter. Even though all IND360 weighing transmitters now support scale configuration through its built-in web server, the PLC can also overwrite these scale settings.
The scale resolution (scale capacity/ increment) has to be within the range of 500 – 100 000.



S7-300 **S7-1200 & S7-1500**

Figure 4-7: SAI_IND_WriteAdjustSettings Function Block

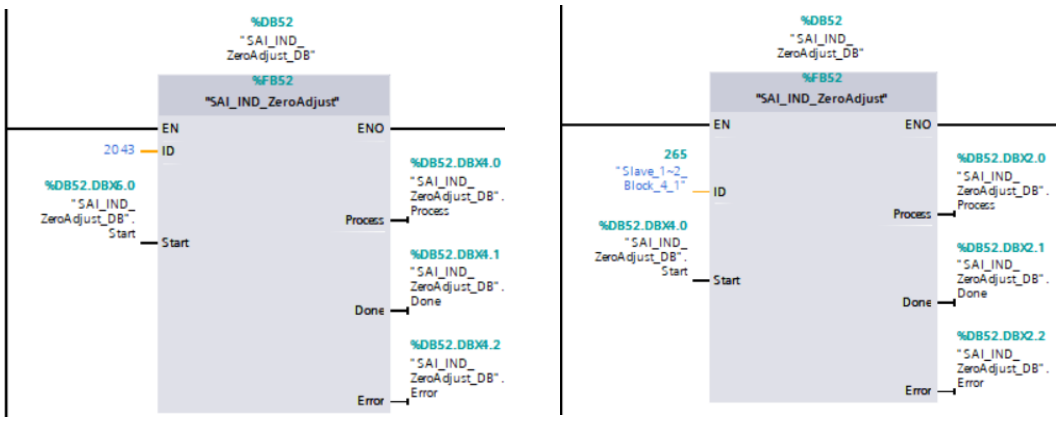
Table 4-5: SAI_IND_WriteAdjustSettings parameter descriptions

Input Parameters	Data Type	Values	Description
ID (for S7-1200 and S7-1500)	HW_IO	Example: "265"	ID parameter to select the module for which a data record is to be written. Use only the hardware identifier (HW ID) of the module for the ID parameter. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 0 Hardware Identifier.
ID (S7-300)	DWORD	"2043"	
ScaleCapacity	REAL (32 bits)	Example: "3000.0"	New scale capacity value
Increment	REAL (32 bits)	Example: "0.1"	New scale increment value
Write	Bool	1, 0	Trigger this input bit to start the writing process.
Output Parameters	Data Type	Values	Description
Done	Bool	1	Write process is completed successfully
		0	Write process is not completed
Error	Bool	1	An error has occurred during the write process
		0	No error

4.6. Zero Adjustment

Zero calibration has to be performed first before CalFree+ or span calibration. Make sure the scale is empty before starting this zero calibration procedure.

Trigger the "Start" input bit to start the zero adjustment process. Upon completion of the adjustment process, this "Start" bit will be reset.



S7-300 **S7-1200 & S7-1500**

Figure 4-7: SAI_IND_ZeroAdjust Function Block

Table 4-5: SAI_IND_ZeroAdjust Function Block Parameters

Input Parameters	Data Type	Values	Description
ID (for S7-1200 and S7-1500)	HW_IO	Example: "IND360~Head"	ID parameter to select the module for which a data record is to be written. Use only the hardware identifier (HW ID) of the module for the ID parameter. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 0 Hardware Identifier.
ID (S7-300)	DWORD	"2042"	
Start	Bool	1, 0	Trigger this input bit to start the calibration process.
Output Parameters	Data Type	Values	Description
Process	Bool	1	Adjustment is started and in process
		0	Adjustment is not started
Done	Bool	1	Adjustment is completed successfully
		0	Adjustment is in process or in error state
Error	Bool	1	Adjustment failed due to error
		0	No error

4.7. Span Adjustment

Perform this linearity span adjustment after the zero adjustment.

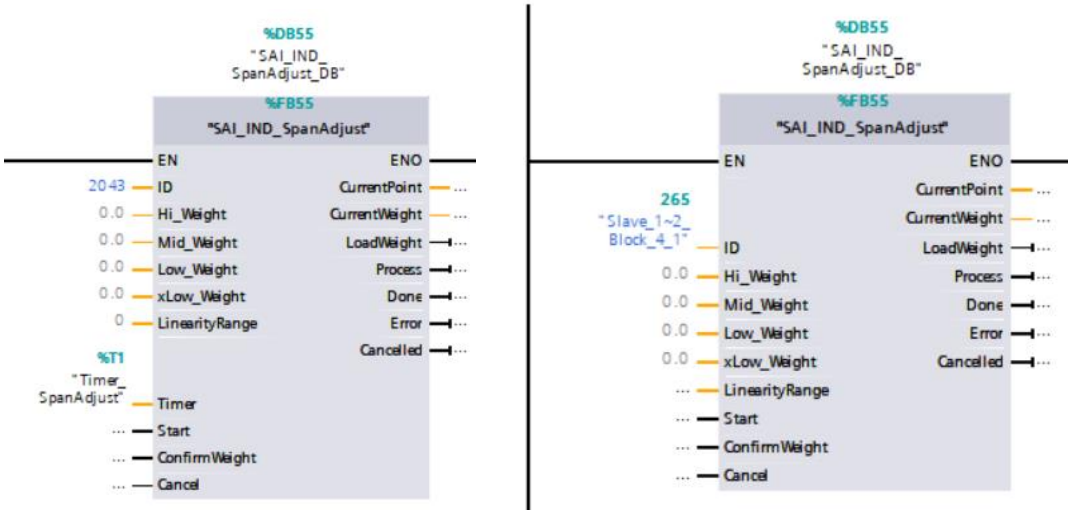


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Figure 4-8: SAI_IND_SpanAdjust Function Block

If only 2 points adjustment (zero, span) is required, only configure the highest reference weight (span) into this Function Block. In this case, the span is the second linearity point.
The first reference point is always the zero reference which has to be adjusted prior to this.

If linearity adjustment is required, up to 4 points can be set-up. The table below shows all the possible selection of linearity adjustment and the required input parameters for this Function Block.

LinearityRange settings:	Required reference weight(s), cannot be zero:
"0", 2-point (zero, span)	Hi_Weight
"1", 3-point linearity	Hi_Weight, Mid_Weight
"2", 4-point linearity	Hi_Weight, Mid_Weight, Low_Weight
"3", 5-point linearity	Hi_Weight, Mid_Weight, Low_Weight, xLow_Weight

Table 4-7: SAI_IND_SpanAdjust Linearity Range Settings

Notes:

- The Function Block will return an error if the reference weights are not configured according to the linearity range setting.
- The Function Block will return an error if the required reference weight(s) is zero or not in the correct ascending order when starting the adjustment process.

The flow chart below explains the linearity adjustment process flow according to different selection of linearity range:

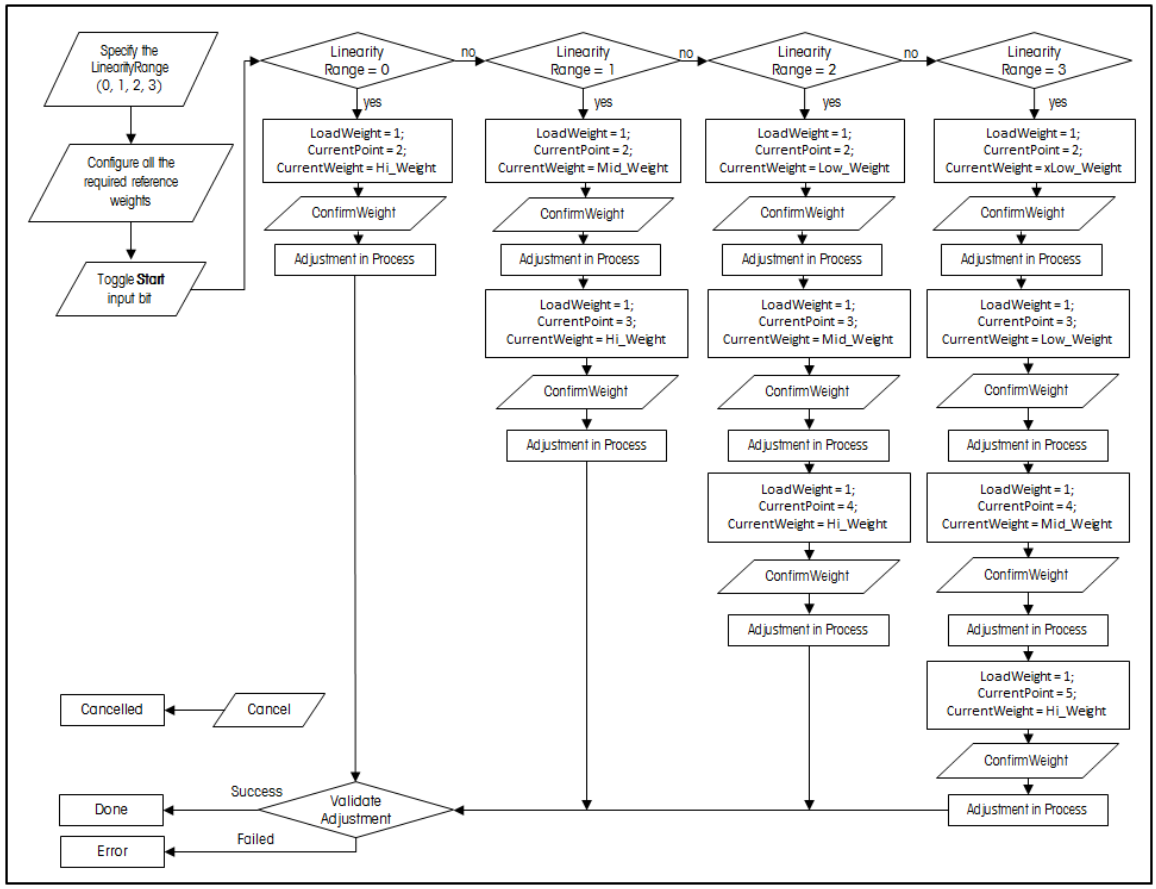


Figure 4-10: SAI_IND_SpanAdjust Flow Chart

Configure the required Linearity Range and all the respective reference weights. Set the Start bit on to run the adjustment process. Wait for the LoadWeight output bit to turn on and then load the reference weight according to CurrentWeight value. After the new reference weight has been loaded, set the ConfirmWeight bit on to proceed with adjustment. Repeat the same sequence for the rest of the reference weights until the adjustment process is completed. The adjustment process can be cancelled at any point of time after started.

Table 4-8: SAI_IND_SpanAdjust Function Block Parameters

Input Parameters	Data Type	Values	Description
ID (for S7-1200 and S7-1500)	HW_IO	Example: "IND360~Head"	ID parameter to select the module for which a data record is to be written. Use only the hardware identifier (HW ID) of the module for the ID parameter. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 0 Hardware Identifier.
ID (S7-300)	DWORD	"2042"	
Hi_Weight	REAL (32 bits)	Example: "800.00"	The highest reference weight in linearity calibration. For a 2-point calibration, this is the span value.
Mid_Weight	REAL (32 bits)	Example: "600.00"	For a 5-point calibration, this is the 4th reference point. For a 3-point calibration, this is the 2nd reference point.
Low_Weight	REAL (32 bits)	Example: "400.00"	For a 5-point calibration, this is the 3rd reference point. For a 4-point calibration, this is the 2nd reference point.

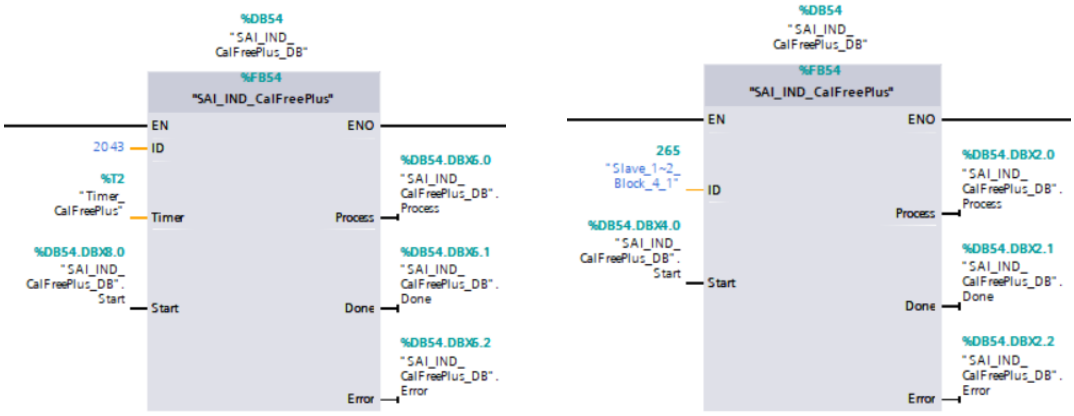
xLow_Weight	REAL (32 bits)	Example: "200.00"	The lowest reference weight value in linearity calibration. Only used when the linearity range is configured to "3" – 5-point linearity.
LinearityRange	INT	0, 1, 2, 3	Decimal "0" – 2-point; Decimal "1" – 3-point; Decimal "2" – 4-point; Decimal "3" – 5-point
Start	Bool	1, 0	Trigger this input bit to start the calibration process.
ConfirmWeight	Bool	1, 0	User has to trigger this input bit after loading the "CurrentWeight" onto the scale. This bit serves as an acknowledgement flag for the Function Block to proceed to next steps. The Function Block will reset this bit automatically.
Cancel	Bool	1, 0	Trigger this input bit to cancel/ abort the calibration process after being started.
Output Parameters	Data Type	Values	Description
CurrentPoint	INT	Example: "2"	The Function Block updates the current reference point here.
CurrentWeight	REAL (32 bits)	Example: "400.00"	The Function Block updates the required reference weight here.
LoadWeight	Bool	1	User has to load a new reference weight according to the value displayed in CurrentWeight.
		0	No action required from the user
Process	Bool	1	Adjustment is started and in process
		0	Adjustment is not started
Done	Bool	1	Adjustment is completed successfully
		0	Adjustment is in process or in error state
Error	Bool	1	Adjustment failed due to error
		0	No error
Cancelled	Bool	1	Adjustment is cancelled successfully
		0	No cancellation

4.8. CalFree+

The IND360 POWERCELL transmitter provides a method to calibrate a scale without using test weights. This is based on the POWERCELL load cell rated capacity and count value. This method can be used for initial check-out and testing of systems or when a large structure is used as the weighing vessel and it is not possible to apply test weights to the structure.

METTLER TOLEDO highly recommends that the test weights or RapidCal™ method be used whenever possible as these methods provide the most accurate calibration accuracy.

Set the Start bit on to run the CalFree+ adjustment. Upon completion of the adjustment process, this Start bit will be reset.



S7-300 **S7-1200 & S7-1500**

Figure 4-11: SAI_IND_CalFreePlus Function Block

Table 4-9: SAI_IND_CalFreePlus Function Block Parameters

Input Parameters	Data Type	Values	Description
ID (for S7-1200 and S7-1500)	HW_IO	Example: "IND360~Head"	ID parameter to select the module for which a data record is to be written. Use only the hardware identifier (HW ID) of the module for the ID parameter. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 0 Hardware Identifier.
ID (S7-300)	DWORD	"2042"	
Start	Bool	1, 0	Trigger this input bit to start the calibration process. Upon completion of the calibration (succeeded or failed) this input bit will be reset by the Function Block itself.
Output Parameters	**Data Type**	**Values**	**Description**
Process	Bool	1	Adjustment is started and in process
		0	Adjustment is not started
Done	Bool	1	Adjustment is completed successfully
		0	Adjustment is in process or in error state
Error	Bool	1	Adjustment failed due to error
		0	No error

4.9. Read Individual Load Cell Weight Value (gross or net)

S7-300 **S7-1200 & S7-1500**

Figure 4-13: SAI_INDPCELL_LoadCellWeight Function Block

Only in a POWERCELL® scale, the control system is able to read individual load cell weight value.
The availability of these individual load cell weight values can be used to monitor the tank/ platform load distribution. Uneven load distribution might be caused by permanent feeder and machinery attached to the scale or when weighing powder or granules. Nonetheless, the load distribution for each load cell should not differ too much from the others. When huge disparity of load distribution is detected, there could be mechanical structure failure on the scale.

Input Parameters	Data Type	Description
ID	HW_IO	ID parameter to select the module for which a data record is to be written. In this sample program, the ID parameter of the device can be found under Device Properties > Slot 2 Hardware Identifier.
ID (S7-300)	DWORD	
Read	Bool	Trigger this input bit to start the read process.
Net	Bool	Net = 0; Read individual load cell gross weight Net = 1; Read individual load cell net weight
Output Parameters	**Data Type**	**Description**
TotalWeight	REAL (32 bits)	The total gross or net weight of all the load cells combined
CellWeight1	REAL (32 bits)	The load cell #1's gross or net weight
CellWeight2	REAL (32 bits)	The load cell #2's gross or net weight
CellWeight3	REAL (32 bits)	The load cell #3's gross or net weight
CellWeight4	REAL (32 bits)	The load cell #4's gross or net weight
CellWeight5	REAL (32 bits)	The load cell #5's gross or net weight
CellWeight6	REAL (32 bits)	The load cell #6's gross or net weight
CellWeight7	REAL (32 bits)	The load cell #7's gross or net weight
CellWeight8	REAL (32 bits)	The load cell #8's gross or net weight

CellWeight9	REAL (32 bits)	The load cell #9's gross or net weight
CellWeight10	REAL (32 bits)	The load cell #10's gross or net weight
CellWeight11	REAL (32 bits)	The load cell #11's gross or net weight
CellWeight12	REAL (32 bits)	The load cell #12's gross or net weight
CellWeight13	REAL (32 bits)	The load cell #13's gross or net weight
CellWeight14	REAL (32 bits)	The load cell #14's gross or net weight
Done	Bool	1; The read process is completed successfully
		0; The read process is in process or there is an error
Error	Bool	1; There is an error during the read process
		0; No error

Table 4-11: SAI_INDPCELL_LoadCellWeight Function Block Parameters

5. Sample Code Migration

5.1. Hardware Configurations

1) Under Devices & networks > Network view, add (or drag over) an IND360.

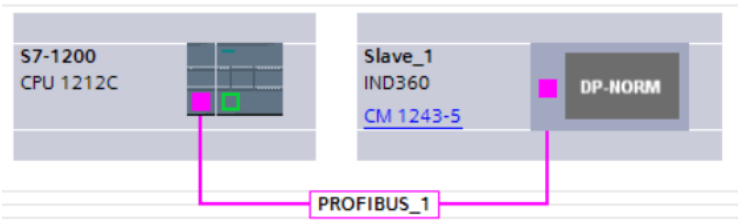


Figure 5-1: Add a Profibus device in the Network view

2) Under Devices & networks > Device view, select the 2 Block data structure from the Hardware Catalog.

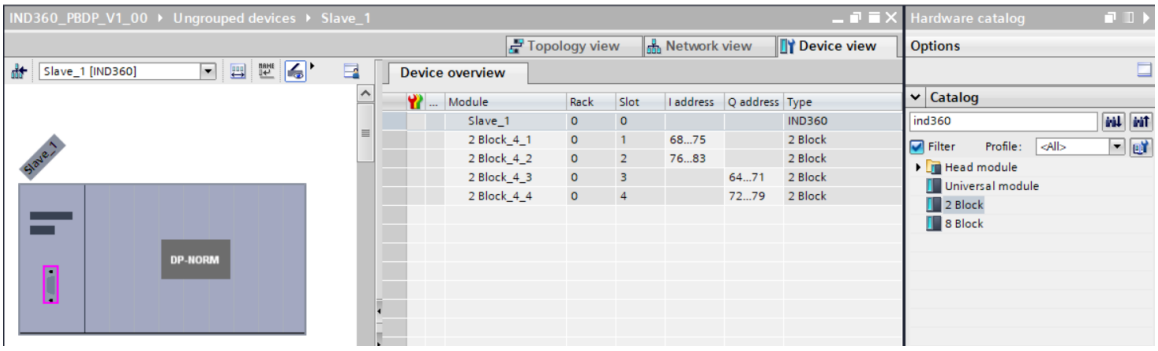


Figure 5-2: Select the 2 Block data structure

3) Assign the Profibus Node Address for the IND360.

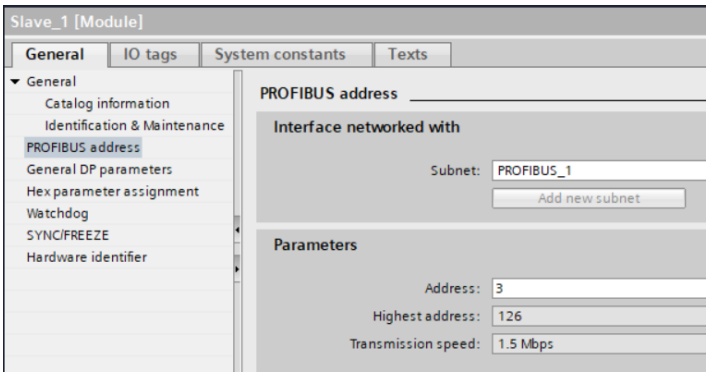
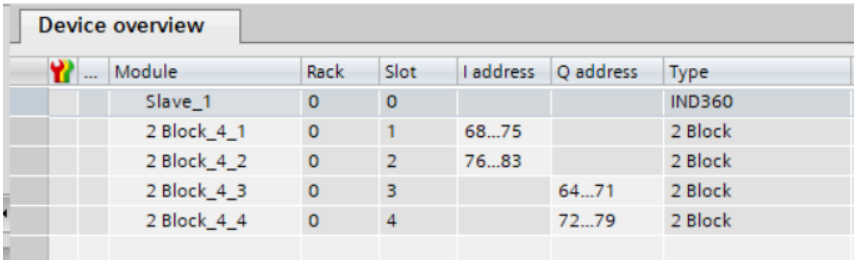


Figure 5-3: Assign the Profibus Node Address

4) The sample code is following the default I and Q addresses assignment as shown below. To minimize the modification to the code, consider sticking to the same I and Q address assignment.



...	Module	Rack	Slot	I address	Q address	Type
	Slave_1	0	0			IND360
	2 Block_4_1	0	1	68...75		2 Block
	2 Block_4_2	0	2	76...83		2 Block
	2 Block_4_3	0	3		64...71	2 Block
	2 Block_4_4	0	4		72...79	2 Block

Figure 5-4: The Profibus Device I and Q Addresses

5.2. PLC Settings

1) Under the PLC device properties > System and clock memory, tick "Enable the use of system memory byte" (this feature is not available in the S7-300 series PLC).

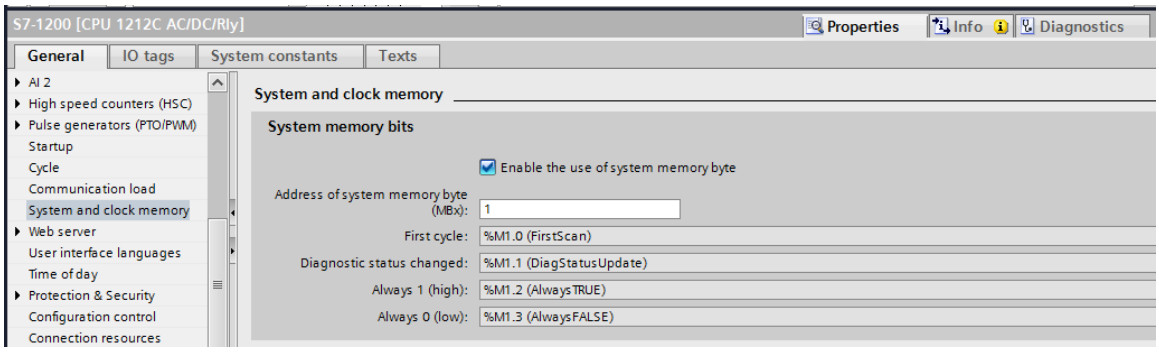


Figure 5-5: PLC Properties – Enable the use of system memory byte

5.3. Duplicate Programming Files

1) The required program blocks:

a) MT_IND_Application (FC)

b) SAI_Copy (FC) （for S7-1200 and S7-1500， not for S7-300）

c) SAI_IND_WeightProc (FB), SAI_IND_WeightProc_DB (DB)

d) SAI_Cyclic_CheckAlive (FB), SAI_Cyclic_CheckAlive_DB (DB)

e) SAI_INDPCELL_DiagnosticStatus (FB), SAI_INDPCELL_DiagnosticStatus_DB (DB)

f) SAI_Buffer (DB), **do not modify this Data Block's number as other Function Blocks are referring directly to its DB number.**

The function blocks below are used to perform scale adjustment from the PLC. Scale adjustment procedures can also be started from the IND360's setup menu.

a) SAI_IND_CalFreePlus (FB), SAI_ IND_CalFreePlus_DB (DB)

b) SAI_ IND_ZeroAdjust (FB), SAI_ IND_ZeroAdjust_DB (DB)

c) SAI_ IND_SpanAdjust (FB), SAI_ IND_SpanAdjust_DB (DB)

d) SAI_ IND_WriteAdjustSettings (FB), SAI_ IND_WriteAdjustSettings_DB (DB),

e) SAI_ IND_ReadAdjustSettings (FB), SAI_ IND_ReadAdjustSettings_DB (DB)

The other function blocks can be added into the programming if required.

For S7-300, need to add COMPLETE RESTART(OB100) and error handle programs as below, to support PROFIBUS auto reconnection feature.

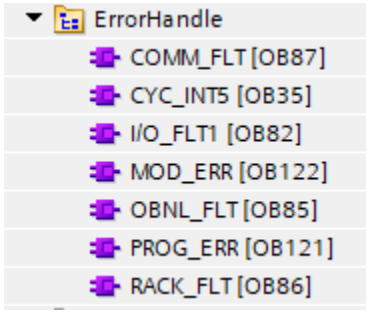


Figure 5-6: Error handle programs of S7-300

2) Delete the other unused program blocks in MT_ IND_Application.

3) Duplicate the "ACT" under the PLC tags.

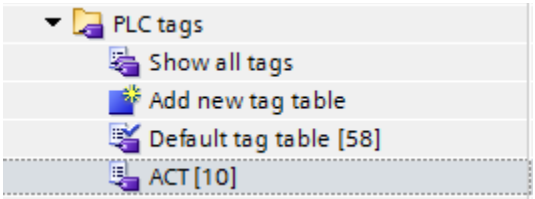


Figure 5-7: Duplicate the PLC tags

4) Duplicate all the PLC data types.

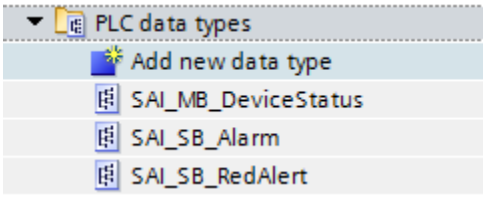


Figure 5-8: Duplicate the PLC data types

5) Lastly, in the Main (OB1) call up the function "MT_ IND_Application".

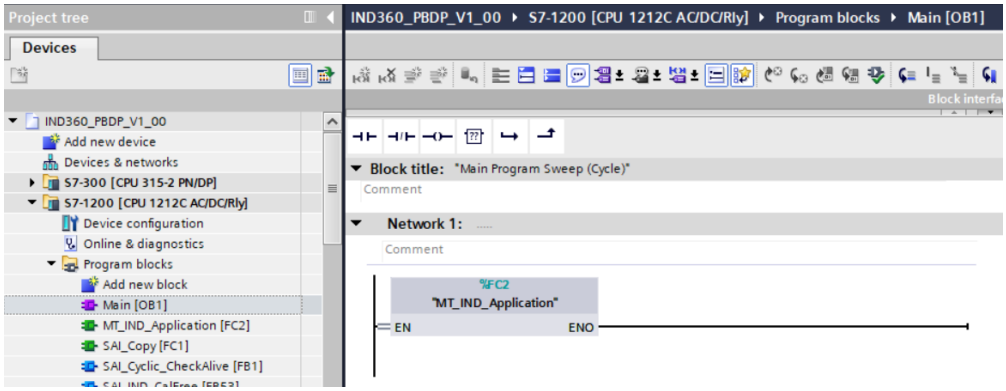


Figure 5-10: Call up "MT_ IND_Application" in the Main OB

6. Add New IND360 POWERCELL

All the devices in a PROFIBUS subnet must have different Node Address. Only when all the modules in a subnet have different addresses and your actual structure matches that of the network configuration produced, should you load the settings across the network.

Reserve the PROFIBUS address "0" for a main controller or DP master. Allocate a unique PROFIBUS address between 1 and 126 for each DP slave or other DP master in the network.

1) On the IND360, press the ENTER key for 3 seconds to access the device menu. Go to Communication > PROFIBUS DP > Node Address, configure the Node Address.

   The Profibus DP node address can also be configured in the web browser as shown below:

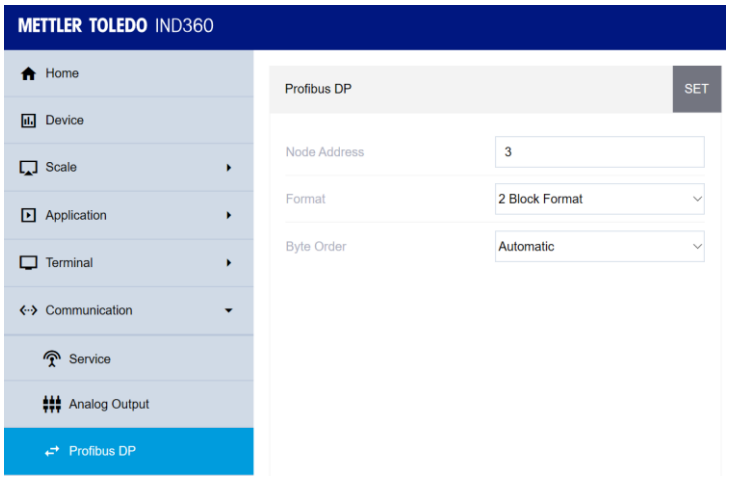


Figure 6-1: Change the PROFIBUS Node Address In Web Browser

2) At Devices & networks, add another IND360 from the Hardware Catalog.

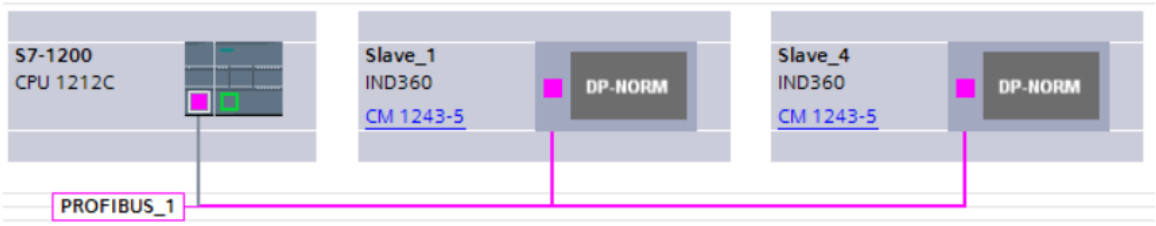


Figure 6-2: Add a new IND360

3) At Devices & networks > Device view, select the 2 Block data structure.

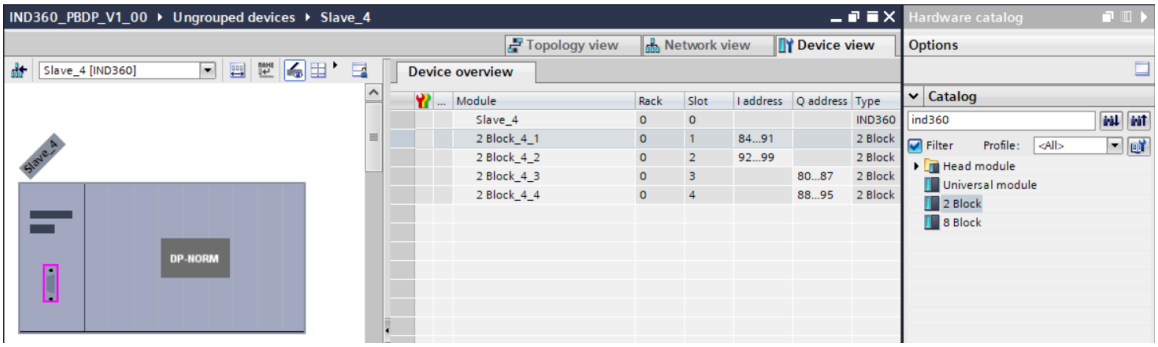


Figure 6-3: Select the 2 Block data structure

4) Assign a different PROFIBUS Node Address in ascending order.

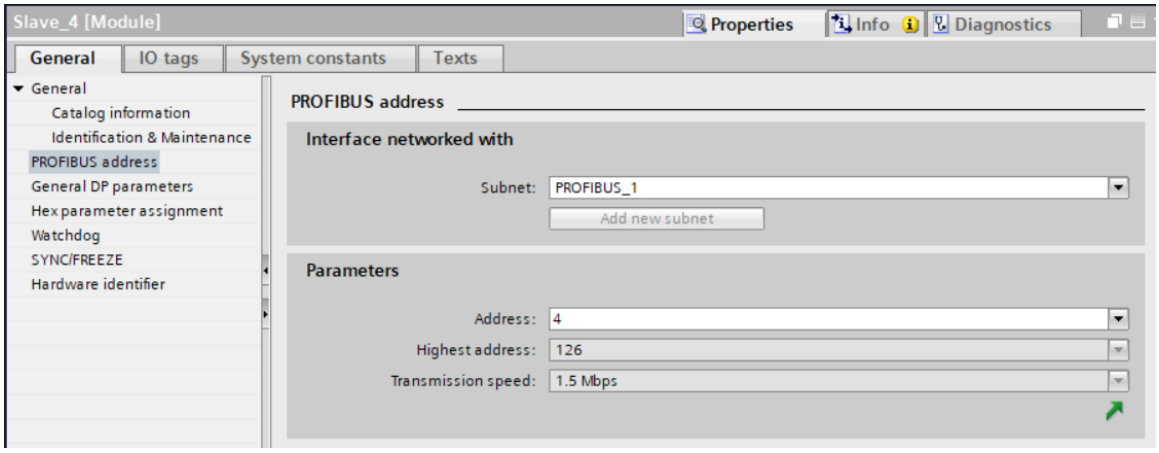


Figure 6-4: Allocate the PROFIBUS Node Address

5) When necessary, edit the automatically allocated I and Q addresses of the PROFIBUS device.

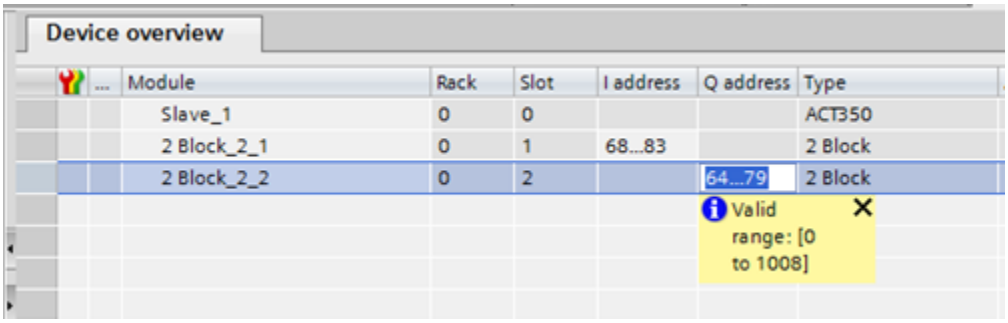


Figure 6-5: Allocate the I and Q addresses for the new device

6) Duplicate the function blocks, and configure all the required input and output parameters. Each function block FB must have an independent data block DB. As shown below, there are two SAI_IND_WeightProc function blocks but both FBs are assigned with different DBs which are SAI_IND_WeightProc_DB (DB2) and SAI_IND_WeightProc_DB_1 (DB5)

A small trick can be used here to add adjacent function block, drag the function block from the Project Tree side window into the destination network.

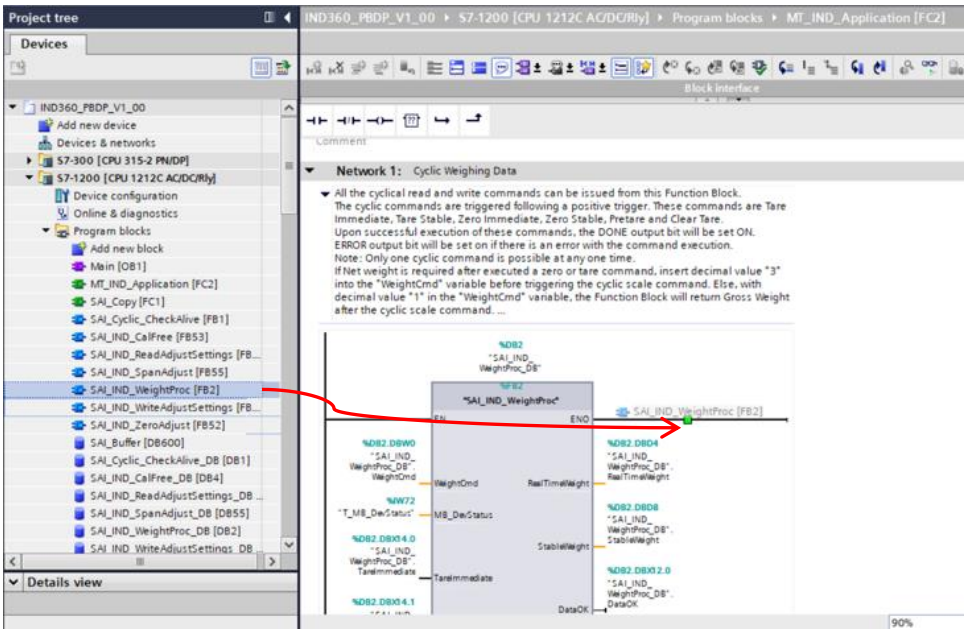


Figure 6-6: Duplicate function block for additional device

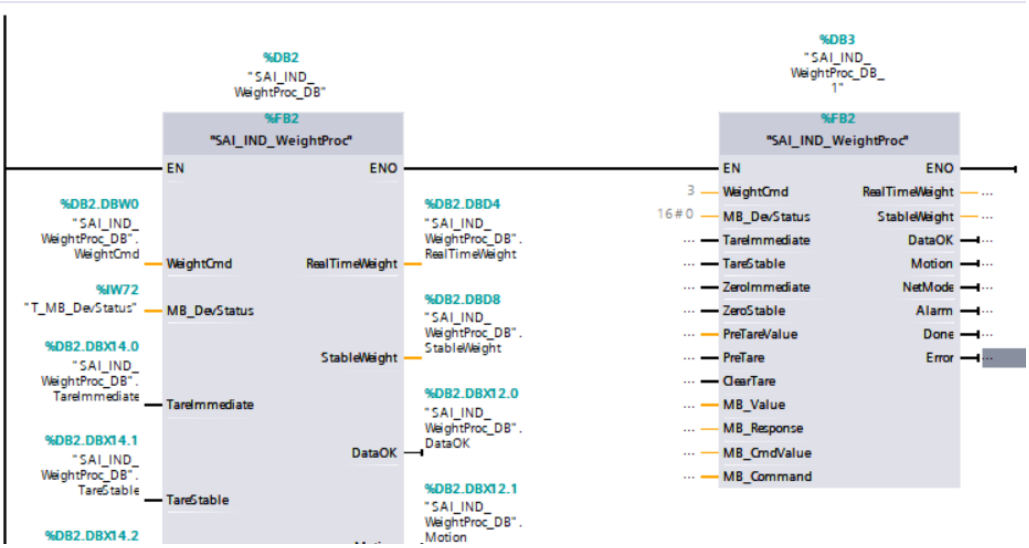


Figure 6-6: Two function blocks of the same type, but different data blocks

7) Repeat steps 1 – 5, until all the new IND360s have been integrated into the PROFIBUS network.

7. Frequently Asked Questions

1. Q: I have duplicated the SAI_INDPCELL_WeightProc function block and SAI_INDPCELL_WeightProc_DB data block into another project, but I was not able to read the weight data.

   A: Make sure the device I and Q addresses are assigned accordingly between the Device overview and the function block assignment. If it is an S7-300 PLC, there is a need to edit the default cyclic data range (128 byte) to cover the device I and Q address range. In this sample code, the PLC's cyclic data range has been configured to 512 bytes.

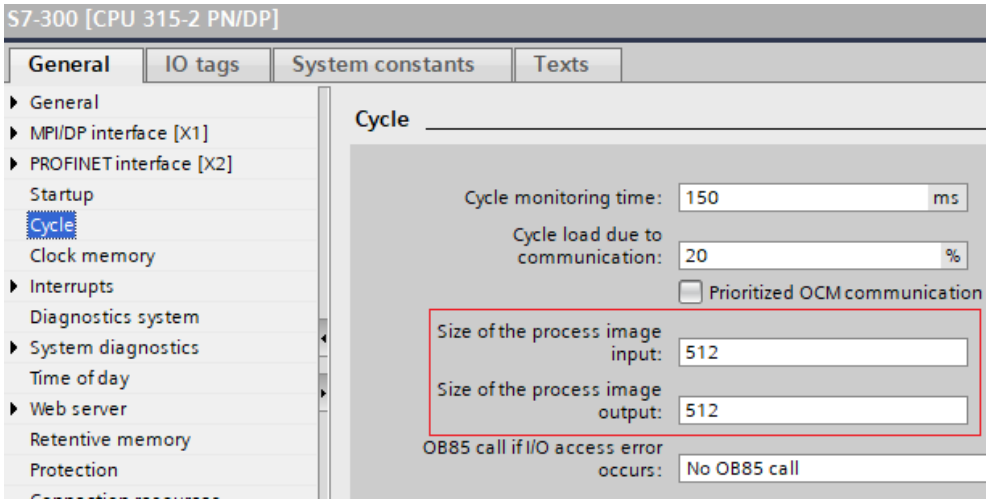


Figure 7-1: Edit the S7-300 PLC cyclic data range

2. Q: How to read the gross, tare or net weight?

   A: The PLC command to read gross weight is decimal "0" or "1", decimal "2" to read tare weight and decimal "3" to read net weight. Insert one of these decimal command values into the "WeightCmd" input parameter of SAI_INDPCELL_WeightProc function block, after a tare or zero command the function block will then return the required weight data accordingly.

3. Q: How to know when the scale is overloaded or underloaded?

   A: Refer to the Overload and Underload bits of SAI_INDPCELL_DiagnosticStatus function block.

4. Q: Some new functions are only supported by the latest firmware, how to upgrade the device firmware?

   A: Follow the steps below to upgrade the IND360's firmware using web browser.

   i. Check the existing device's firmware under the Information Recall device menu, go to Main S/W Version.

   ii. If the firmware version shown is older, the device needs a firmware upgrade.

   iii. Get the latest IND360 firmware from METTELR TOLDEO.

iv. Connect an Ethernet cable in between the IND360 and PC.

v. Open a web browser (Internet Explorer, Google Chrome etc.) and type the IND360's IP address in the address bar. This IP Address can be configured under Communication > Service Ethernet.

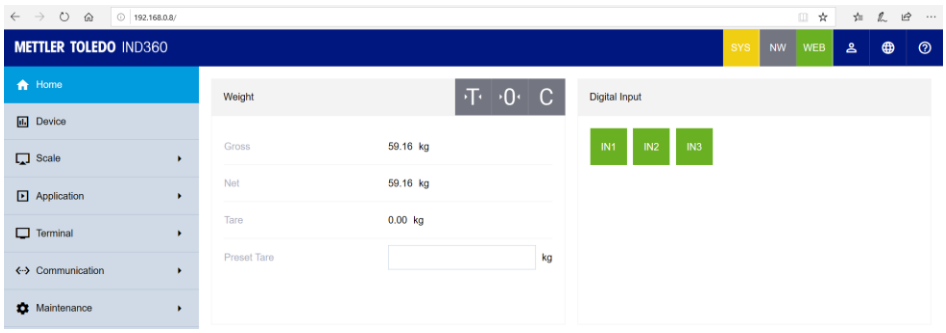


Figure 7-2: Web Browser for IND360 Configuration

vi. Go to Maintenance > Update & Backup

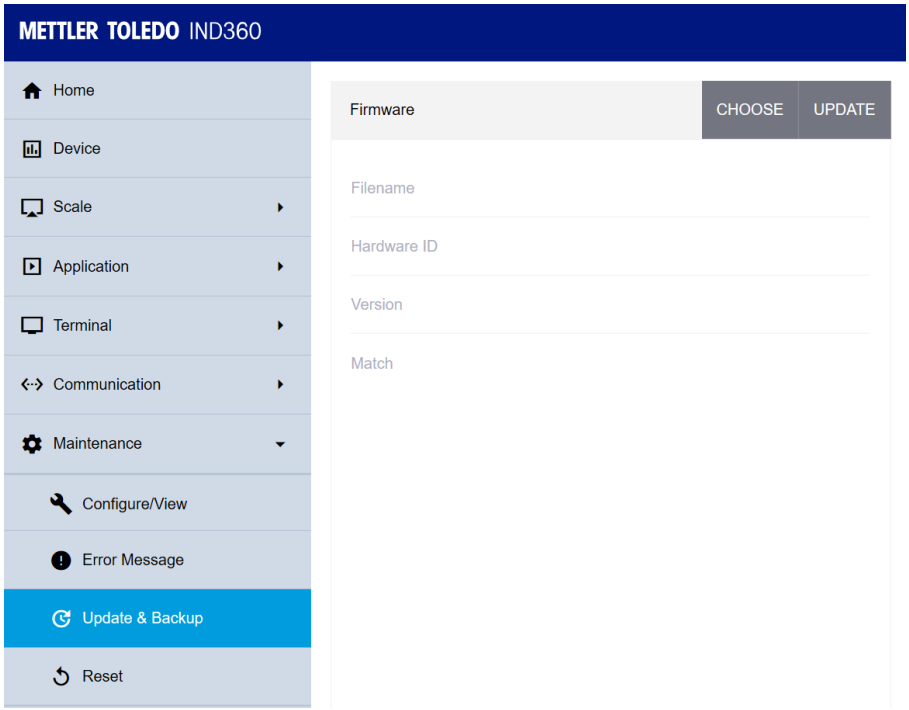


Figure 7-3: Web Browser: Firmware Upgrade

vii. Browse for the device firmware file location by clicking "CHOOSE" button. Then click Start to download the firmware. The upgrade is only allowable if the chosen firmware matches the device type.

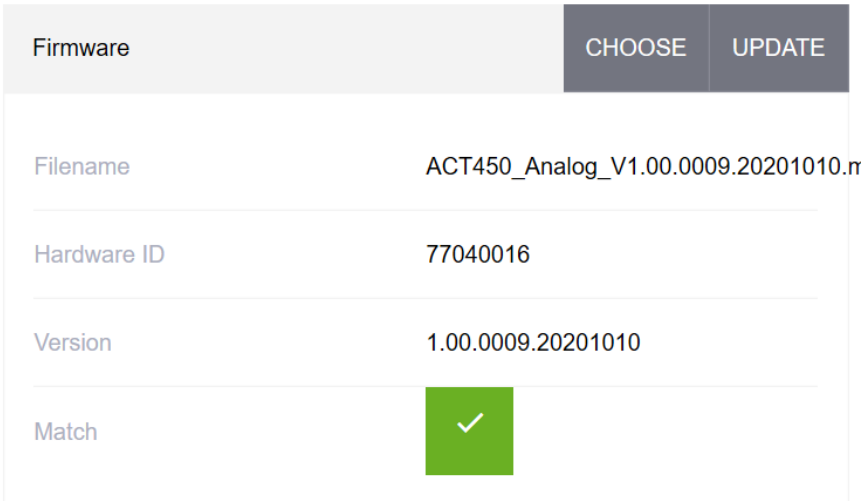


Figure 7-4: Web Browser: Firmware Matches the Device Type

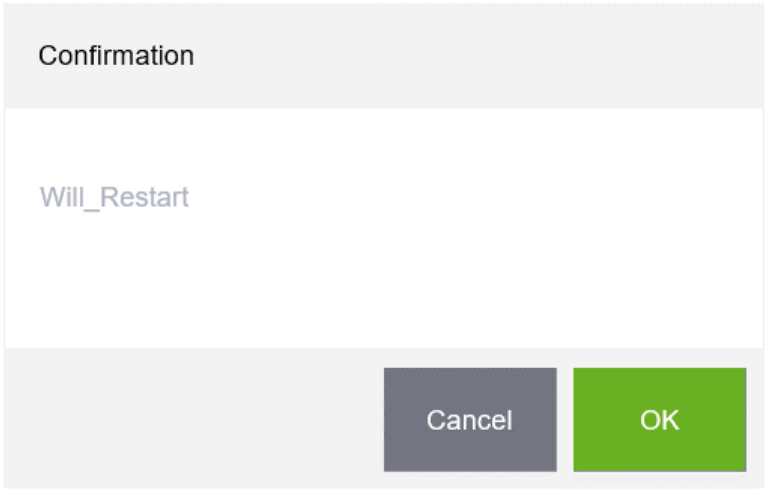


Figure 7-5: Web Browser: Device will restart after downloading the firmware

Note:
Don't forget to back up the device's configuration before performing the firmware upgrade. Use the configuration backup/ restore functions to save and then restore the device's configurations.

The firmware upgrade process may take several minutes to complete. Do not turn off the device power supply during this procedure.

Once the firmware upgrade process is completed, the IND360 will execute a self-reboot. After the reboot, check the new firmware version in the Information Recall menu.