Software manual

ITKP-40-01-12-21-EN

PROFINET

Communication Protocol:
MW-01-A4 Mass Converter

radwag.com

Scan the QR code to view additional scientific material that may be of interest to you.
There you will find more useful information in an accessible format!

DECEMBER 2021

CONTENTS

1. MASS CONVERTER SETTINGS AND CONFIGURATION

To configure MW-01-A mass converter settings for communication via PROFINET protocol, run **MwManager** PC software and go to **<Parameters / Communication / Additional modules>**. For detailed description of configuration read **MWManager** user manual.

2. DATA STRUCTURE

All registers are 2-byte type (WORD). Floating point data (such as mass and tare) are stored in two consecutive registers and are FLOAT-type data. If the first register consists of two AB bytes and the other of two CD bytes, then FLOAT value is HEX ABCD.

2.1. Input Address

Input variables:

Variable	Offset	Length [WORD]	Data type
Platform mass	0	2	float
Platform tare	4	2	float
Platform unit	8	1	word
Platform status	10	1	word
Platform LO threshold	12	2	float
Process status	64	1	word
Input status	66	1	word
Min	68	2	float
Max	72	2	float
Fast dosing threshold	76	2	float
Slow dosing threshold	80	2	float
Adjustment status	100	1	word

2.1.1. Input Registers

Platform mass – returns platform net mass in a current unit.

Example:
The read register with offset 0 has a hex value of 0x43E28000, after converting to float we get 453.0 which is the current indication of the load mass.

<u>Platform tare</u> – returns platform tare in an adjustment unit.

<u>Platform unit</u> – determines a current (displayed) net mass unit of the platform.

Unit bits	
0	Gram [g]
1	Kilogram [kg]
2	Carat [ct]
3	Pound [lb]
4	Ounce [oz]
5	Newton [N]

Example:

Read HEX value: 0x02. Binary form:

B1/7	B1/6	B1/5	B1/4	B1/3	B1/2	B1/1	B1/0	B0/7	B0/6	B0/5	B0/4	B0/3	B0/2	B0/1	B0/0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

The mass unit is kilogram [kg].

<u>Platform status</u> – determines status of a weighing platform.

Status bits	
0	Measurement correct (the scale does not report any error)
1	Measurement stable
2	Scale indicates zero
3	Scale tared
4	Scale in II weighing range
5	Scale in III weighing range
6	Scale reports NULL error
7	Scale reports LH error
8	Scale reports FULL error

Example:

Read HEX value: 0x13

B1/7	B1/6	B1/5	B1/4	B1/3	B1/2	B1/1	B1/0	B0/7	B0/6	B0/5	B0/4	B0/3	B0/2	B0/1	B0/0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1

The scale does not report any error, measurement stable in weighing range II.

LO threshold – returns value of platform's LO threshold in an adjustment unit.

Process status – determines status of the dosing\formulation process:

HEX value	Description
0x00	Process disabled
0x01	Process started
0x02	Process aborted
0x03	Process finished

Input state – bitmask of mass converter inputs. Three least significant bits represent the mass converter inputs state.

Example:

Read HEX value: 0x0005

B1/7	B1/6	B1/5	B1/4	B1/3	B1/2	B1/1	B1/0	B0/7	B0/6	B0/5	B0/4	B0/3	B0/2	B0/1	B0/0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Inputs number 1 and 3 of the weighing terminal take HI state.

MIN – returns **MIN** threshold value in an adjustment unit.

MAX – returns **MAX** threshold value in an adjustment unit.

Fast dosing threshold - returns fast dosing threshold value in an adjustment unit.

Slow dosing threshold - returns slow dosing threshold value in an adjustment unit.

Adjustment status – determines adjustment process status.

HEX value	Description
0x00	Process finished correctly
0x01	Start mass/adjustment coefficient determination in progress
0x02	Range exceeded
0x03	Time exceeded
0x04	Process aborted
0x05	Awaiting for data

2.2. Output Address

Output variables list:

Variable	Offset	Length [WORD]	Data type
Basic command	0	1	word
Command with parameter	2	1	word
Tare	6	2	float
LO threshold	10	2	float
Outputs state	14	1	word
Min	16	2	float
Max	20	2	float
Fast dosing threshold	24	2	float
Slow dosing threshold	28	2	float

2.2.1. Output Registers

Basic command – writing a respective value triggers direct performance of a given task, see the table:

Bit No.	Operation
0	Zero platform
1	Tare platform
5	Process start
6	Process stop

Example:

Writing the register with value 0x02.

B1/7	B1/6	B1/5	B1/4	B1/3	B1/2	B1/1	B1/0	B0/7	B0/6	B0/5	B0/4	B0/3	B0/2	B0/1	B0/0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

This causes scale taring.

⚠	***A command is executed once upon detecting that its bit has been set. If the command is to be executed more than once, it is necessary to zero the bit first, and reset it to the required value next.***

Complex command (with parameter) – setting a respective value triggers performance of a given task, see the table:

Bit No.	Operation
0	Setting tare value for a platform
1	Setting LO threshold value for a platform
2	Setting outputs state
3	Setting MIN threshold value
4	Setting MAX threshold value
5	Setting fast dosing threshold
6	Setting slow dosing threshold

⚠	***Complex command requires setting a respective parameter (offset from 6 to 28 – refer to output registers table).***
⚠	***A command with a parameter is executed once when its bit setting is detected. If the command is to be executed more than once, it is necessary to zero the bit first, and reset it to the required value next.***

Example:

Sending tare of 1.0 value to the scale.

Performance of the command requires writing of 2 registers:

offset 2 – command with a parameter - value 0x01 – i.e. tare setting.

offset 6 – tare value in float format - 1.0.

Tare – complex command parameter: tare value (in an adjustment unit).

LO threshold – complex command parameter: LO threshold value (in an adjustment unit).

Output state – complex command parameter: state of mass converter outputs.

Example:

Setting high state for output 1 and 3 of the mass converter.

Output mask:

B1/7	B1/6	B1/5	B1/4	B1/3	B1/2	B1/1	B1/0	B0/7	B0/6	B0/5	B0/4	B0/3	B0/2	B0/1	B0/0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Upon conversion to HEX the result is 0x05

Performance of the command requires record of 2 registers:

offset 2 – command with parameter - value 0x04 – i.e. output state record.

offset 14 – output mask 0x05.

As a result, outputs number 1 and 3 take high state.

MIN – complex command parameter: MIN threshold value (in an adjustment unit).

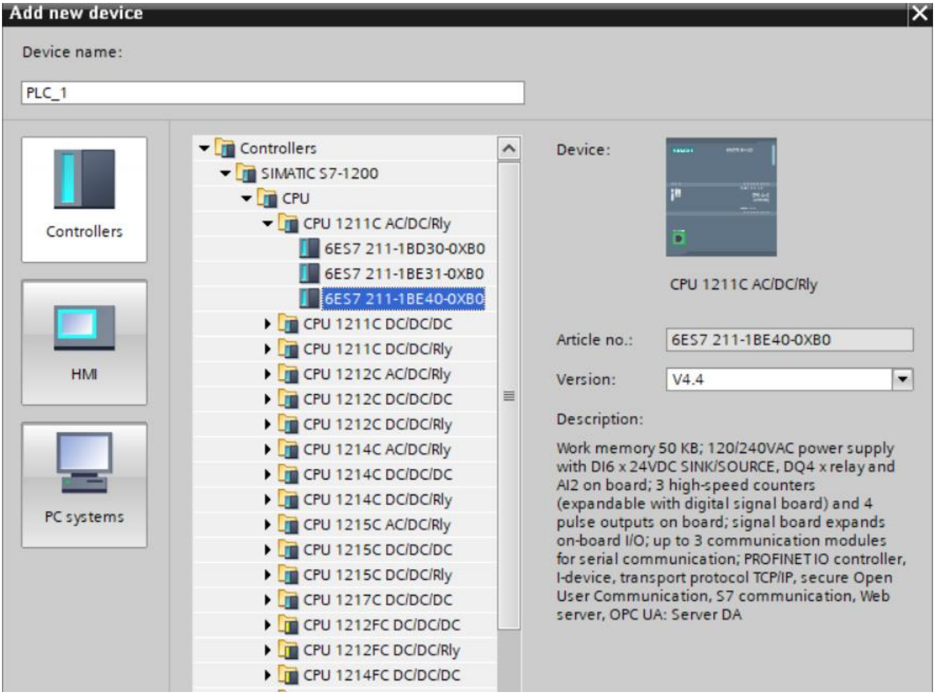
MAX – complex command parameter: MAX threshold value (in an adjustment unit).

Fast dosing threshold - complex command parameter: fast dosing threshold value (in adjustment unit).

Slow dosing threshold - complex command parameter: fine dosing threshold value (in adjustment unit).

3. CONFIGURATION OF THE PROFINET MODULE IN TIA PORTAL V16 ENVIRONMENT

Start operation in the environment by setting up a new project, where topology of PROFINET network with MASTER controller will be specified, in this case the MASTER controller is SIEMENS controller of S7-1200 series.



Add new device

Device name: PLC_1

Device: CPU 1211C AC/DC/Rly

Article no.: 6ES7 211-1BE40-0XB0

Version: V4.4

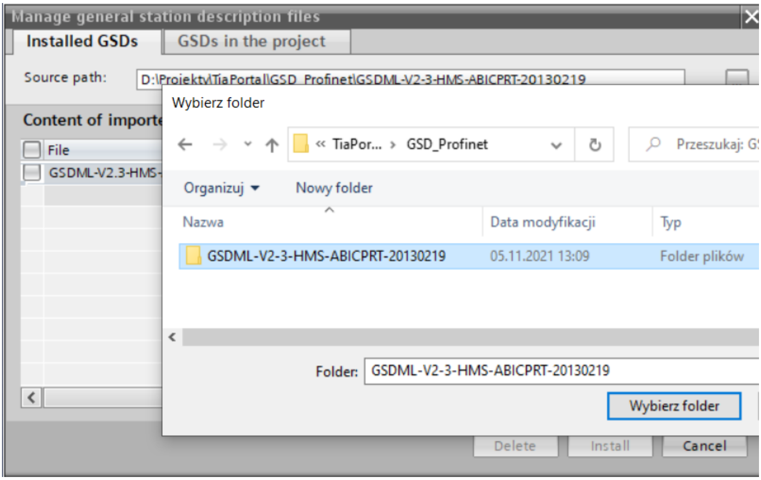
Description:

Work memory 50 KB; 120/240VAC power supply with DI6 x 24VDC SINK/SOURCE, DQ4 x relay and AI2 on board; 3 high-speed counters (expandable with digital signal board) and 4 pulse outputs on board; signal board expands on-board I/O; up to 3 communication modules for serial communication; PROFINET IO controller, I-device, transport protocol TCP/IP, secure Open User Communication, S7 communication, Web server, OPC UA: Server DA

3.1. Import GSD

Using a delivered configuration file (GSD), add a new device to the environment.

Open OPTIONS tab, next click MANAGE GENERAL STATION DESCRIPTION FILES (GSD) entry and select access path to the GSD file.



Manage general station description files

Installed GSDs | GSDs in the project

Source path: D:\Projekty\TiaPortal\GSD_Profinet\GSDML-V2-3-HMS-ABICPRT-20130219

Content of importe

□ File

□ GSDML-V2.3-HMS-

Wybierz folder

« TiaPor... › GSD_Profinet

Przeszukaj: G

Organizuj ▾ Nowy folder

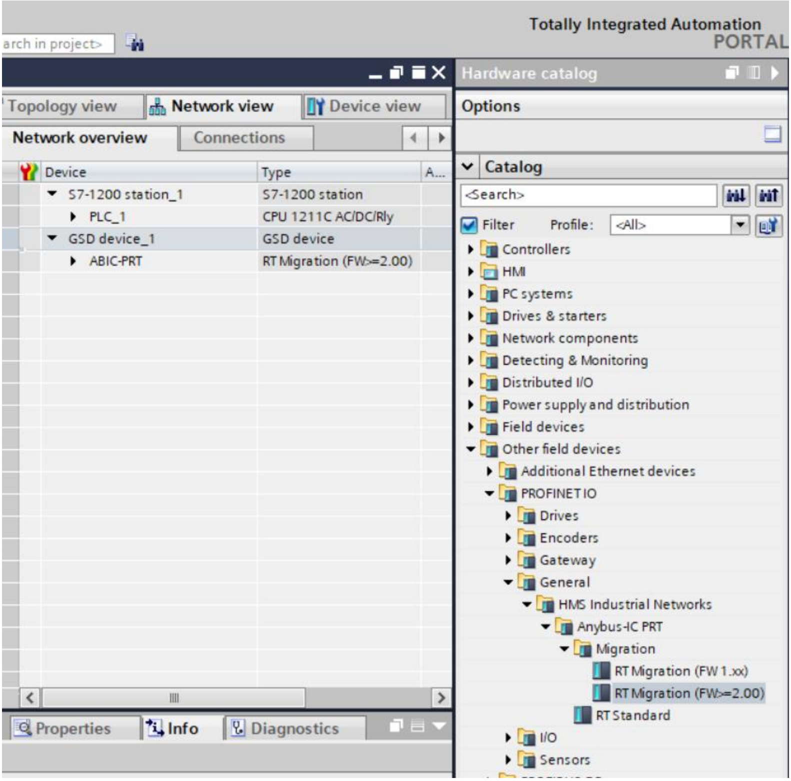
Nazwa	Data modyfikacji	Typ
GSDML-V2-3-HMS-ABICPRT-20130219	05.11.2021 13:09	Folder plików

Folder: GSDML-V2-3-HMS-ABICPRT-20130219

Wybierz folder

Delete | Install | Cancel

With the file successfully added, the ABIC-PRT module is displayed on the list of devices:



Totally Integrated Automation PORTAL

arch in project>

Topology view | Network view | Device view

Network overview | Connections

Device	Type	A...
▾ S7-1200 station_1	S7-1200 station	
▸ PLC_1	CPU 1211C AC/DC/Rly	
▾ GSD device_1	GSD device	
▸ ABIC-PRT	RT Migration (FW>=2.00)	

Properties | Info | Diagnostics

Hardware catalog

Options

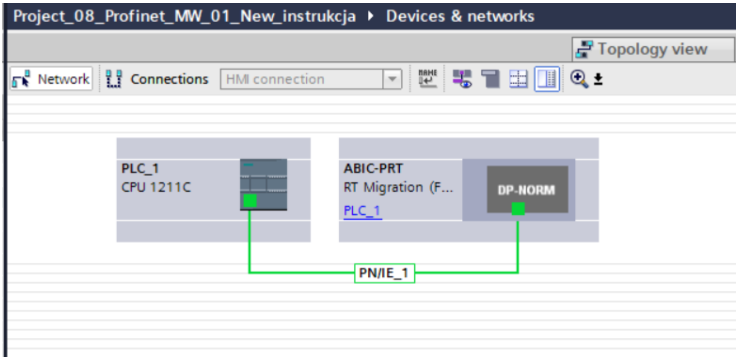
Catalog

<Search>

☑ Filter Profile: <All>

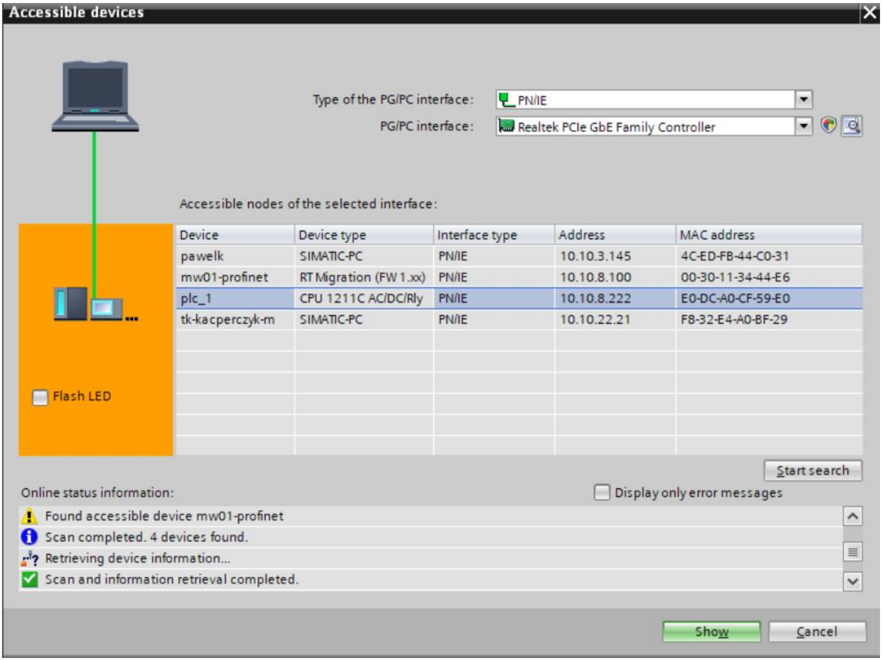
- ▸ Controllers
- ▸ HMI
- ▸ PC systems
- ▸ Drives & starters
- ▸ Network components
- ▸ Detecting & Monitoring
- ▸ Distributed I/O
- ▸ Power supply and distribution
- ▸ Field devices
- ▾ Other field devices
  - ▸ Additional Ethernet devices
  - ▾ PROFINET IO
    - ▸ Drives
    - ▸ Encoders
    - ▸ Gateway
    - ▾ General
      - ▾ HMS Industrial Networks
        - ▾ Anybus-IC PRT
          - ▾ Migration
            - RT Migration (FW 1.xx)
            - RT Migration (FW>=2.00)
          - RT Standard
    - ▸ I/O
    - ▸ Sensors

Now, it is possible to make a network comprising a MASTER controller and a newly added SLAVE module:



3.2. Module Configuration

At this stage, it is necessary to create a network consisting of MASTER controller and SLAVE device (MW-01-A mass converter). With the power supply on, you can use ACCESSIBLE DEVICES function to search for a given device in the environment. The list should display both the MASTER and the SLAVE:



Type of the PG/PC interface: PN/IE

PG/PC interface: Realtek PCIe GbE Family Controller

Accessible nodes of the selected interface:

Device	Device type	Interface type	Address	MAC address
pawelk	SIMATIC-PC	PN/IE	10.10.3.145	4C-ED-FB-44-C0-31
mw01-profinet	RT Migration (FW 1.xx)	PN/IE	10.10.8.100	00-30-11-34-44-E6
plc_1	CPU 1211C AC/DC/Rly	PN/IE	10.10.8.222	E0-DC-A0-CF-59-E0
tk-kacperczyk-m	SIMATIC-PC	PN/IE	10.10.22.21	F8-32-E4-A0-BF-29

Online status information:

□ Display only error messages

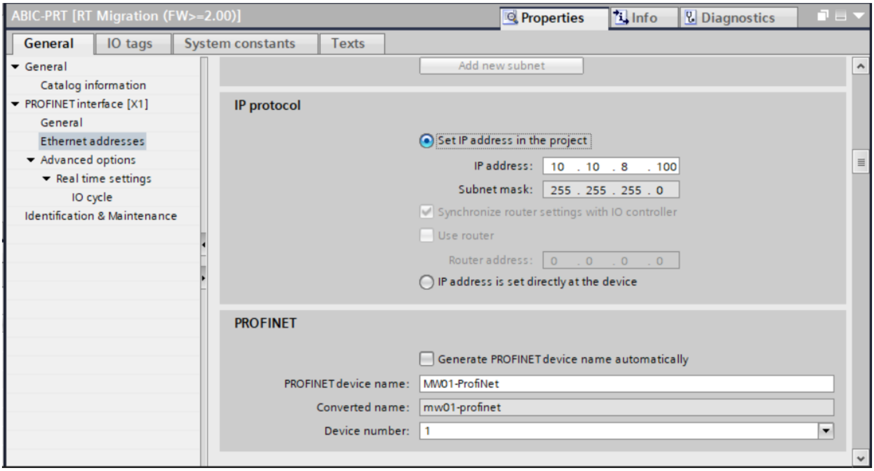
Found accessible device mw01-profinet

Scan completed. 4 devices found.

Retrieving device information...

Scan and information retrieval completed.

Next, specify the IP address of the module and its name in PROFINET network. To do it, select the module, in PROPERTIES tab find PROFINET INTERFACE submenu, click it and enter the IP address and name. Make sure that these settings are accordant with parameters set in the MW-01 mass converter. Remember that the SLAVE IP address and MASTER address must come from the same subnet.



IP protocol

● Set IP address in the project

IP address: 10 . 10 . 8 . 100

Subnet mask: 255 . 255 . 255 . 0

☑ Synchronize router settings with IO controller

□ Use router

Router address: 0 . 0 . 0 . 0

○ IP address is set directly at the device

PROFINET

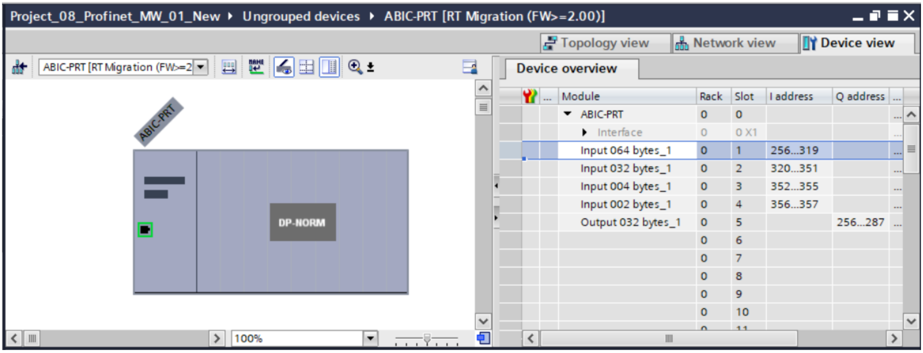
□ Generate PROFINET device name automatically

PROFINET device name: MW01-ProfiNet

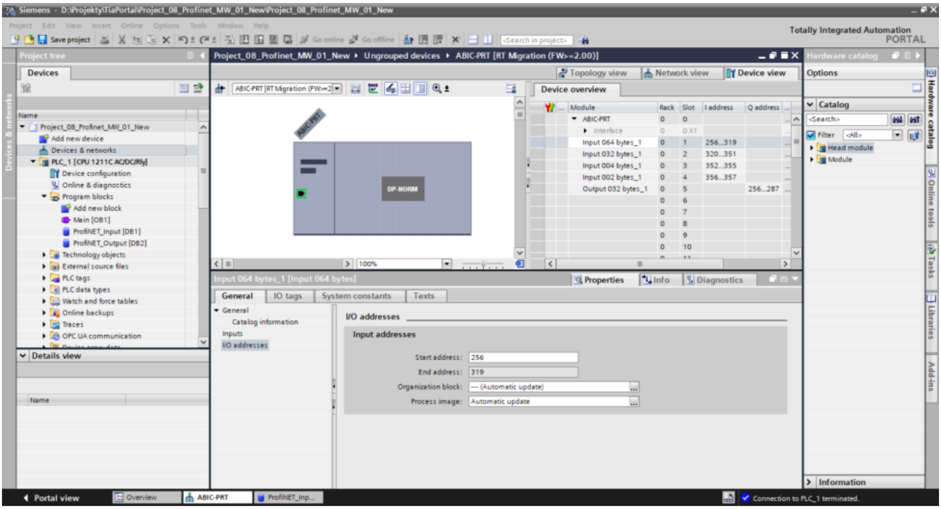
Converted name: mw01-profinet

Device number: 1

Next, configure the module. First, specify input and output registers size, define their start addresses. From the list of available INPUT and OUTPUT modules select such modules as presented in the picture below. Maximum size of input data is 102 bytes, maximum size of output data is 52 bytes. The project uses the default starting addresses: 256 for INPUT and 256 for OUTPUT with a size of 102 bytes for input data and 32 bytes for output data, as presented below:


Project_08_Profinet_MW_01_New ▸ Ungrouped devices ▸ ABIC-PRT [RT Migration (FW>=2.00)]
Topology view
Network view
Device view
ABIC-PRT [RT Migration (FW>=2
ABIC-PRT
DP-NORM
100%
Device overview

Module	Rack	Slot	I address	Q address
ABIC-PRT	0	0		
Interface	0	0 X1		
Input 064 bytes_1	0	1	256...319	
Input 032 bytes_1	0	2	320...351	
Input 004 bytes_1	0	3	352...355	
Input 002 bytes_1	0	4	356...357	
Output 032 bytes_1	0	5		256...287
	0	6		
	0	7		
	0	8		
	0	9		
	0	10		



Siemens - D:\Projekty\TiaPortal\Project_08_Profinet_MW_01_New\Project_08_Profinet_MW_01_New

Project_08_Profinet_MW_01_New ▸ Ungrouped devices ▸ ABIC-PRT [RT Migration (FW>=2.00)]

Device overview

Module	Rack	Slot	I address	Q address
ABIC-PRT	0	0		
Interface	0	0 X1		
Input 064 bytes_1	0	1	256...319	
Input 032 bytes_1	0	2	320...351	
Input 004 bytes_1	0	3	352...355	
Input 002 bytes_1	0	4	356...357	
Output 032 bytes_1	0	5		256...287
	0	6		
	0	7		
	0	8		
	0	9		
	0	10		

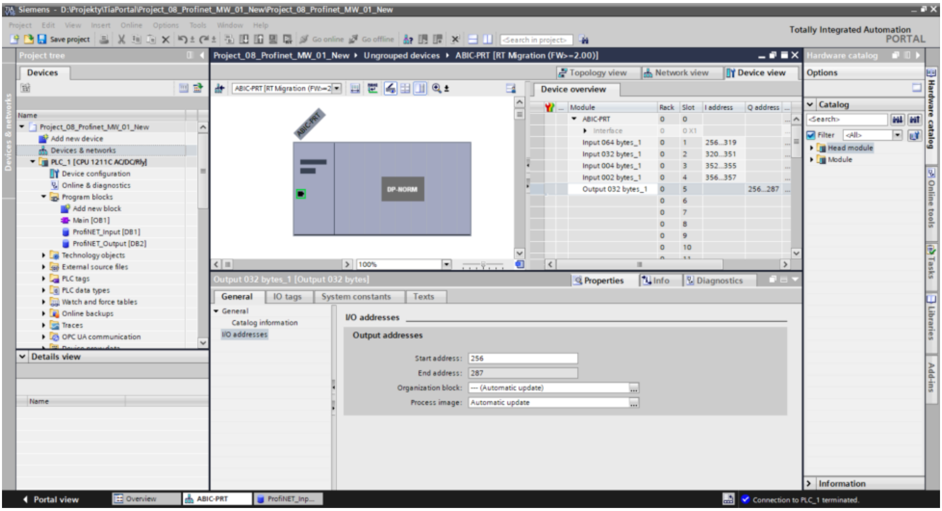
Input 064 bytes_1 [Input 064 bytes]

I/O addresses

Input addresses

Start address: 256
End address: 319
Organization block: --- (Automatic update)
Process image: Automatic update

Connection to PLC_1 terminated.



Project_08_Profinet_MW_01_New ▸ Ungrouped devices ▸ ABIC-PRT [RT Migration (FW>=2.00)]

Output 032 bytes_1 [Output 032 bytes]

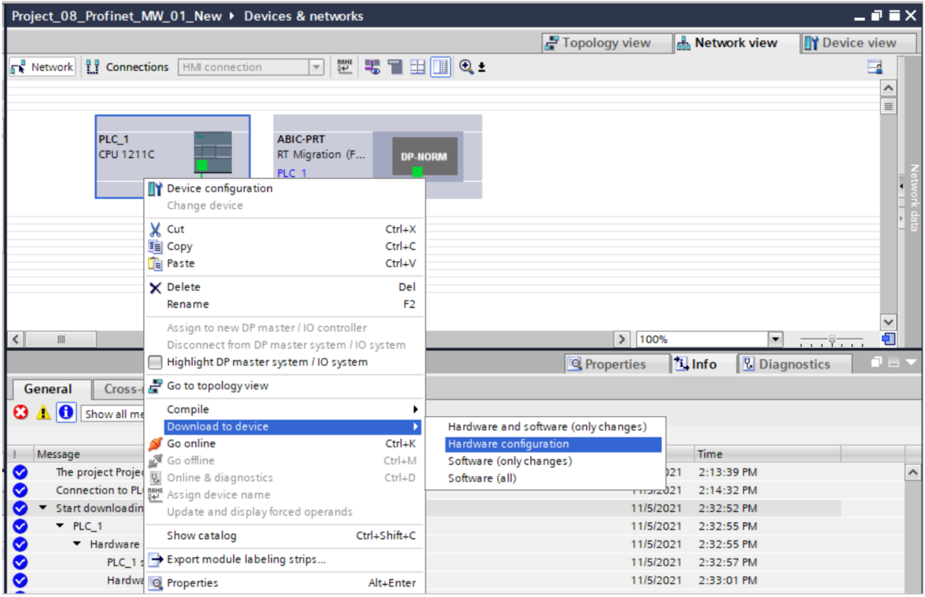
I/O addresses

Output addresses

Start address: 256
End address: 287
Organization block: --- (Automatic update)
Process image: Automatic update

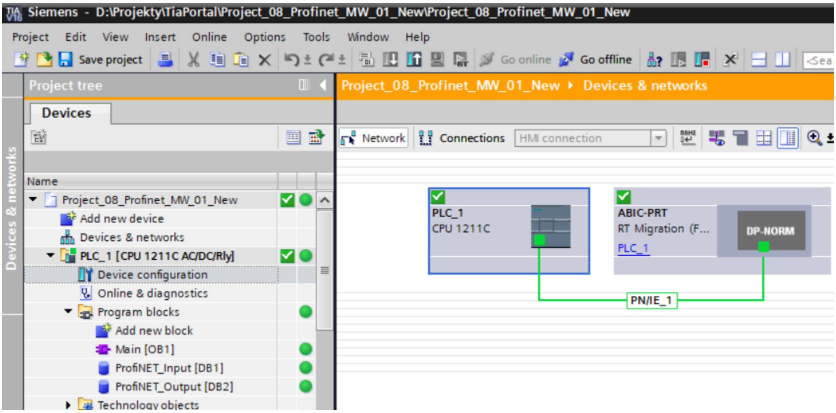
Connection to PLC_1 terminated.

At this stage, it is possible to upload the hardware configuration into the controller:



!	Message	Date	Time
	The project Proje	…21	2:13:39 PM
	Connection to PL	…/2021	2:14:32 PM
	Start downloadin	11/5/2021	2:32:52 PM
	PLC_1	11/5/2021	2:32:55 PM
	Hardware	11/5/2021	2:32:55 PM
	PLC_1 s	11/5/2021	2:32:57 PM
	Hardwa	11/5/2021	2:33:01 PM

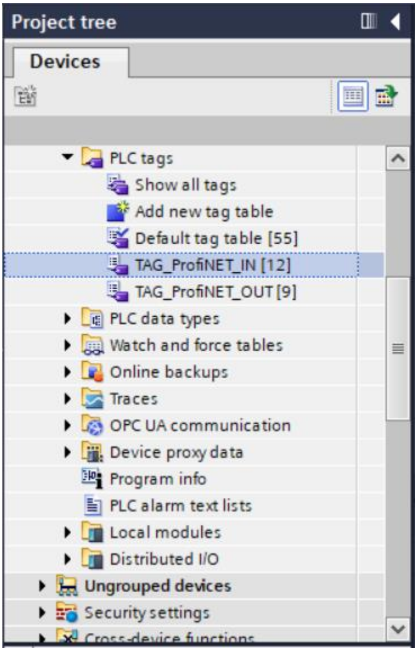
Upon successful compilation and code reading, the MASTER and SLAVE shall establish communication. It can be verified via ONLINE connection. The result should be as presented below.



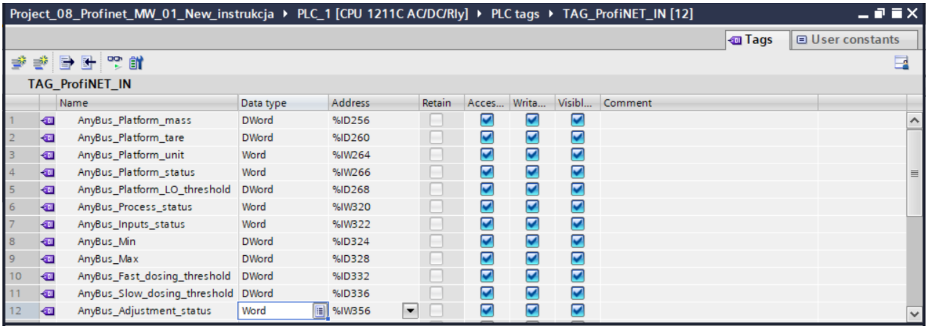
Now, proceed to the process of program code making.

4. DIAGNOSTICS APP

Start creating the app by defining names of symbolic input and output registers. For this purpose, use a branch of the PLC TAGS tree. For the purpose of this example, tag tables have been created as presented below:

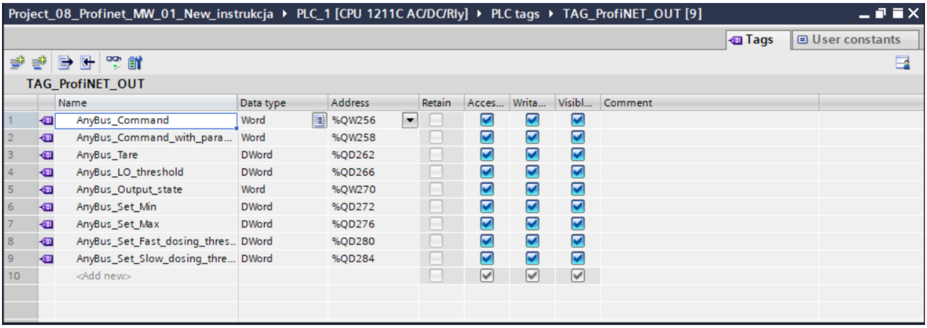


PROFINET input and output registers are specified in TAG_ProfiNET_IN and TAG_ProfiNET_OUT tables. The below screenshots present symbolic names and addresses:


Project_08_Profinet_MW_01_New_instrukcja ▸ PLC_1 [CPU 1211C AC/DC/Rly] ▸ PLC tags ▸ TAG_ProfiNET_IN [12]
Tags
User constants

TAG_ProfiNET_IN

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Comment
1	AnyBus_Platform_mass	DWord	%ID256	☐	☑	☑	☑	
2	AnyBus_Platform_tare	DWord	%ID260	☐	☑	☑	☑	
3	AnyBus_Platform_unit	Word	%IW264	☐	☑	☑	☑	
4	AnyBus_Platform_status	Word	%IW266	☐	☑	☑	☑	
5	AnyBus_Platform_LO_threshold	DWord	%ID268	☐	☑	☑	☑	
6	AnyBus_Process_status	Word	%IW320	☐	☑	☑	☑	
7	AnyBus_Inputs_status	Word	%IW322	☐	☑	☑	☑	
8	AnyBus_Min	DWord	%ID324	☐	☑	☑	☑	
9	AnyBus_Max	DWord	%ID328	☐	☑	☑	☑	
10	AnyBus_Fast_dosing_threshold	DWord	%ID332	☐	☑	☑	☑	
11	AnyBus_Slow_dosing_threshold	DWord	%ID336	☐	☑	☑	☑	
12	AnyBus_Adjustment_status	Word	%IW356	☐	☑	☑	☑	



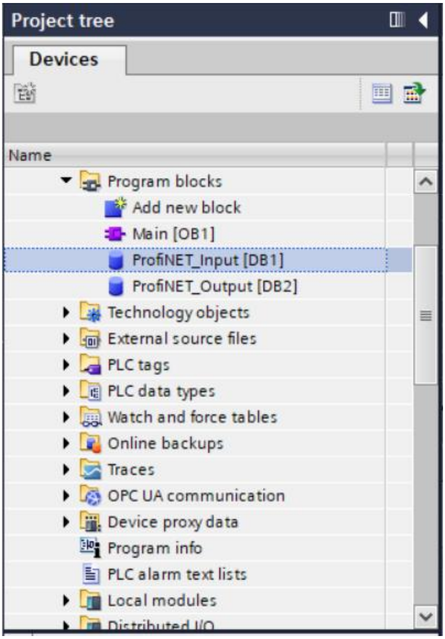
Project_08_Profinet_MW_01_New_instrukcja ▸ PLC_1 [CPU 1211C AC/DC/Rly] ▸ PLC tags ▸ TAG_ProfiNET_OUT [9]

Tags | User constants

TAG_ProfiNET_OUT

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Comment
1	AnyBus_Command	Word	%QW256	□	☑	☑	☑	
2	AnyBus_Command_with_para...	Word	%QW258	□	☑	☑	☑	
3	AnyBus_Tare	DWord	%QD262	□	☑	☑	☑	
4	AnyBus_LO_threshold	DWord	%QD266	□	☑	☑	☑	
5	AnyBus_Output_state	Word	%QW270	□	☑	☑	☑	
6	AnyBus_Set_Min	DWord	%QD272	□	☑	☑	☑	
7	AnyBus_Set_Max	DWord	%QD276	□	☑	☑	☑	
8	AnyBus_Set_Fast_dosing_thres...	DWord	%QD280	□	☑	☑	☑	
9	AnyBus_Set_Slow_dosing_thre...	DWord	%QD284	□	☑	☑	☑	
10	<Add new>			□	☑	☑	☑	

So as not to work directly on the physical inputs/outputs of the module, it is recommended to create data blocks comprising representations of these registers, and "copy" values between them. For this purpose, define data blocks as follows:



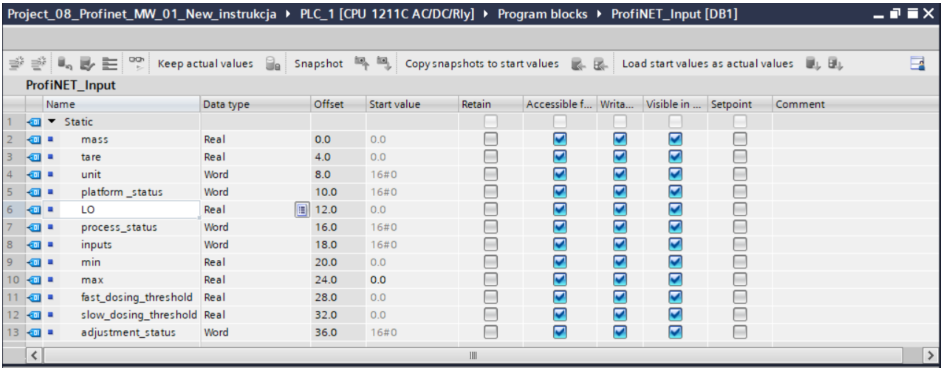
Project tree

Devices

Name

- Program blocks
  - Add new block
  - Main [OB1]
  - ProfiNET_Input [DB1]
  - ProfiNET_Output [DB2]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Traces
- OPC UA communication
- Device proxy data
- Program info
- PLC alarm text lists
- Local modules
- Distributed I/O

ProfiNET_Input and ProfiNET_Output blocks represent input/output registers of the MW-01-A mass converter's PROFINET module. See the screenshots below:

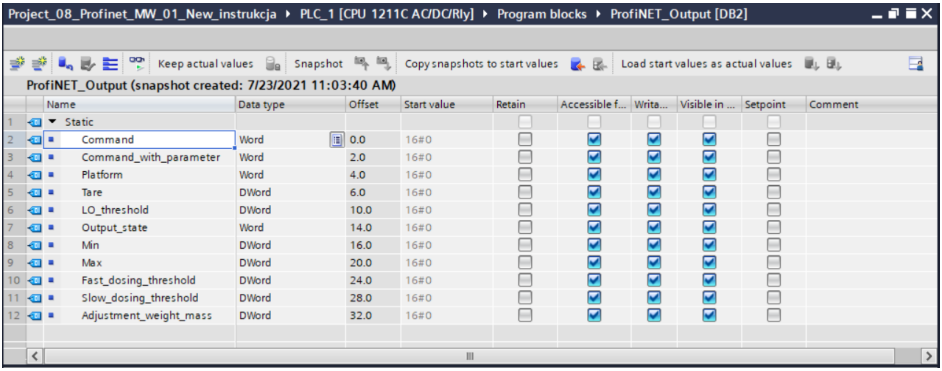


Project_08_Profinet_MW_01_New_instrukcja ▸ PLC_1 [CPU 1211C AC/DC/Rly] ▸ Program blocks ▸ ProfiNET_Input [DB1]

Keep actual values
Snapshot
Copy snapshots to start values
Load start values as actual values

ProfiNET_Input

	Name	Data type	Offset	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	▼ Static				□	□	□	□	□	
2	mass	Real	0.0	0.0	□	☑	☑	☑	□	
3	tare	Real	4.0	0.0	□	☑	☑	☑	□	
4	unit	Word	8.0	16#0	□	☑	☑	☑	□	
5	platform _status	Word	10.0	16#0	□	☑	☑	☑	□	
6	LO	Real	12.0	0.0	□	☑	☑	☑	□	
7	process_status	Word	16.0	16#0	□	☑	☑	☑	□	
8	inputs	Word	18.0	16#0	□	☑	☑	☑	□	
9	min	Real	20.0	0.0	□	☑	☑	☑	□	
10	max	Real	24.0	0.0	□	☑	☑	☑	□	
11	fast_dosing_threshold	Real	28.0	0.0	□	☑	☑	☑	□	
12	slow_dosing_threshold	Real	32.0	0.0	□	☑	☑	☑	□	
13	adjustment_status	Word	36.0	16#0	□	☑	☑	☑	□	



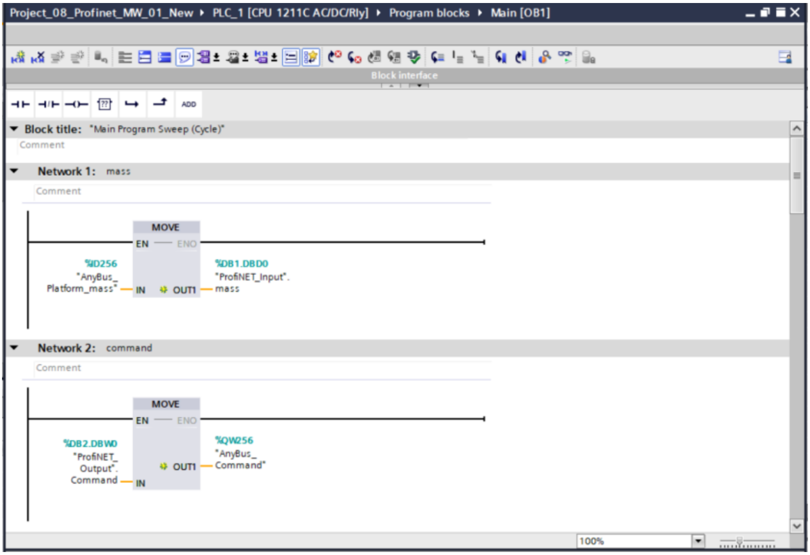
Project_08_Profinet_MW_01_New_instrukcja ▸ PLC_1 [CPU 1211C AC/DC/Rly] ▸ Program blocks ▸ ProfiNET_Output [DB2]

Keep actual values
Snapshot
Copy snapshots to start values
Load start values as actual values

ProfiNET_Output (snapshot created: 7/23/2021 11:03:40 AM)

	Name	Data type	Offset	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	▼ Static				□	□	□	□	□	
2	Command	Word	0.0	16#0	□	☑	☑	☑	□	
3	Command_with_parameter	Word	2.0	16#0	□	☑	☑	☑	□	
4	Platform	Word	4.0	16#0	□	☑	☑	☑	□	
5	Tare	DWord	6.0	16#0	□	☑	☑	☑	□	
6	LO_threshold	DWord	10.0	16#0	□	☑	☑	☑	□	
7	Output_state	Word	14.0	16#0	□	☑	☑	☑	□	
8	Min	DWord	16.0	16#0	□	☑	☑	☑	□	
9	Max	DWord	20.0	16#0	□	☑	☑	☑	□	
10	Fast_dosing_threshold	DWord	24.0	16#0	□	☑	☑	☑	□	
11	Slow_dosing_threshold	DWord	28.0	16#0	□	☑	☑	☑	□	
12	Adjustment_weight_mass	DWord	32.0	16#0	□	☑	☑	☑	□	

A MOVE instruction, for example, can be used to rewrite values between the physical inputs/outputs of the module and the registers in the data blocks:



Project_08_Profinet_MW_01_New ▸ PLC_1 [CPU 1211C AC/DC/Rly] ▸ Program blocks ▸ Main [OB1]

Block interface

Block title: "Main Program Sweep (Cycle)"

Comment

Network 1: mass

Comment

MOVE
EN — ENO
%ID256 "AnyBus_Platform_mass" — IN
OUT1 — %DB1.DBD0 "ProfiNET_Input".mass

Network 2: command

Comment

MOVE
EN — ENO
%DB2.DBW0 "ProfiNET_Output".Command — IN
OUT1 — %QW256 "AnyBus_Command"

100%

Upon compilation and upload of the program to the controller in data block, it is possible to read input registers (MONITOR ALL) and to record output registers (e.g. by changing START VALUE and LOAD START VALUES AS ACTUAL) of the SLAVE module.

RADWAG®