



USER MANUAL

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1. INTRODUCTION

WPA-F / WRA-F magnetostrictive transducer implements Profinet IO communication. Profinet is a digital communication standard developed and maintained by PI (Profibus and Profinet International).

The digital communication allows the transfer of data between the Device (the WPA-F/WRA-F transducer) and the Master (PLC) through a network.

These data are:

- Process data, such as position, speed, status of the device
- Acyclic data, as parameterization, statistic, diagnostic data

Profinet standard provides a descriptor file called GSDML (General Station Description based on XML format).

This file allows a clear identification of the device and comprehension of data provided and exchanged.

Please refer to Gefran website for the download of GSDML files.

This manual is not designed to describe the “PROFINET” Fieldbus, as it is presumed the user is familiar with the same and will refer if any updates are required to the above-mentioned standard or the official PROFIBUS CONSORTIUM and PROFINET International website (PI), <http://www.profibus.com/>.

2. INSTALLATION AND ELECTRICAL CONNECTIONS

2.1. General precautions

The system must be used only in accordance with the required protection level.

The sensor must be protected against accidental knocks and used in accordance with the instrument's ambient characteristics.

The sensors must be powered with non-distributed networks.

2.2. Electrical installation

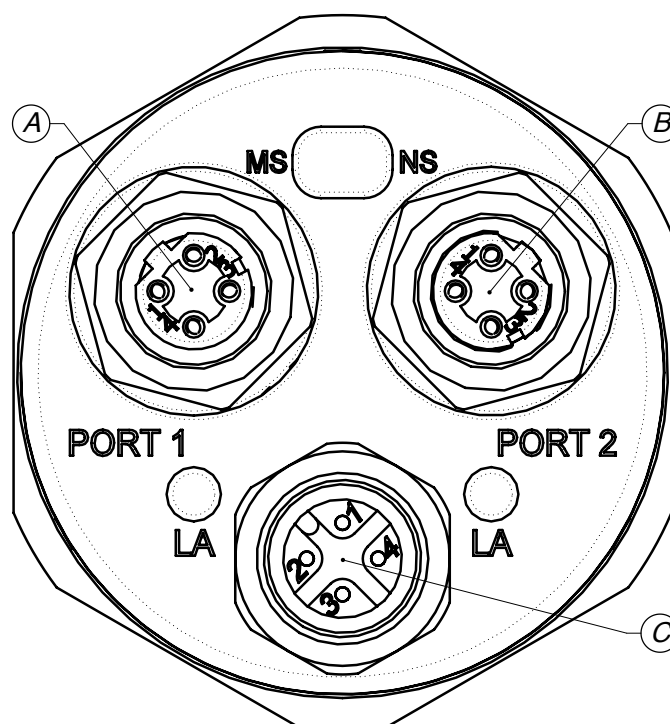
The transducer must be grounded (normally through the machine body or equipment it is installed on).

Connect cables shielding to ground at cabinet side (control equipment or PLC).

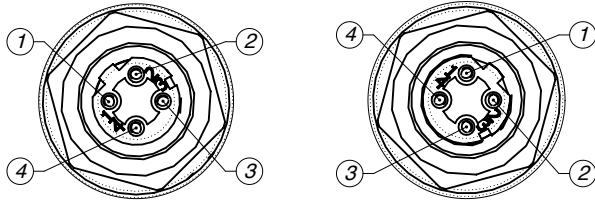
To prevent interference, separate the power cables from signal cables.

The WPA-F/WRA-F transducer provides 3 connectors on its head:

- 2x M12 Female 4 poles D coded for Fieldbus connection (A-B in the image below)
- 1x M12 Male 4 poles A coded for bringing Power Supply to the device (C in the image below)

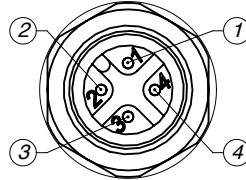


● Port1 - Port 2 M12 4P Female D-coded connector connection



M12 Female 4 poles D coded connector (Port1 – Port 2)	Pinout
1	Tx+
2	Rx+
3	Tx-
4	Rx-

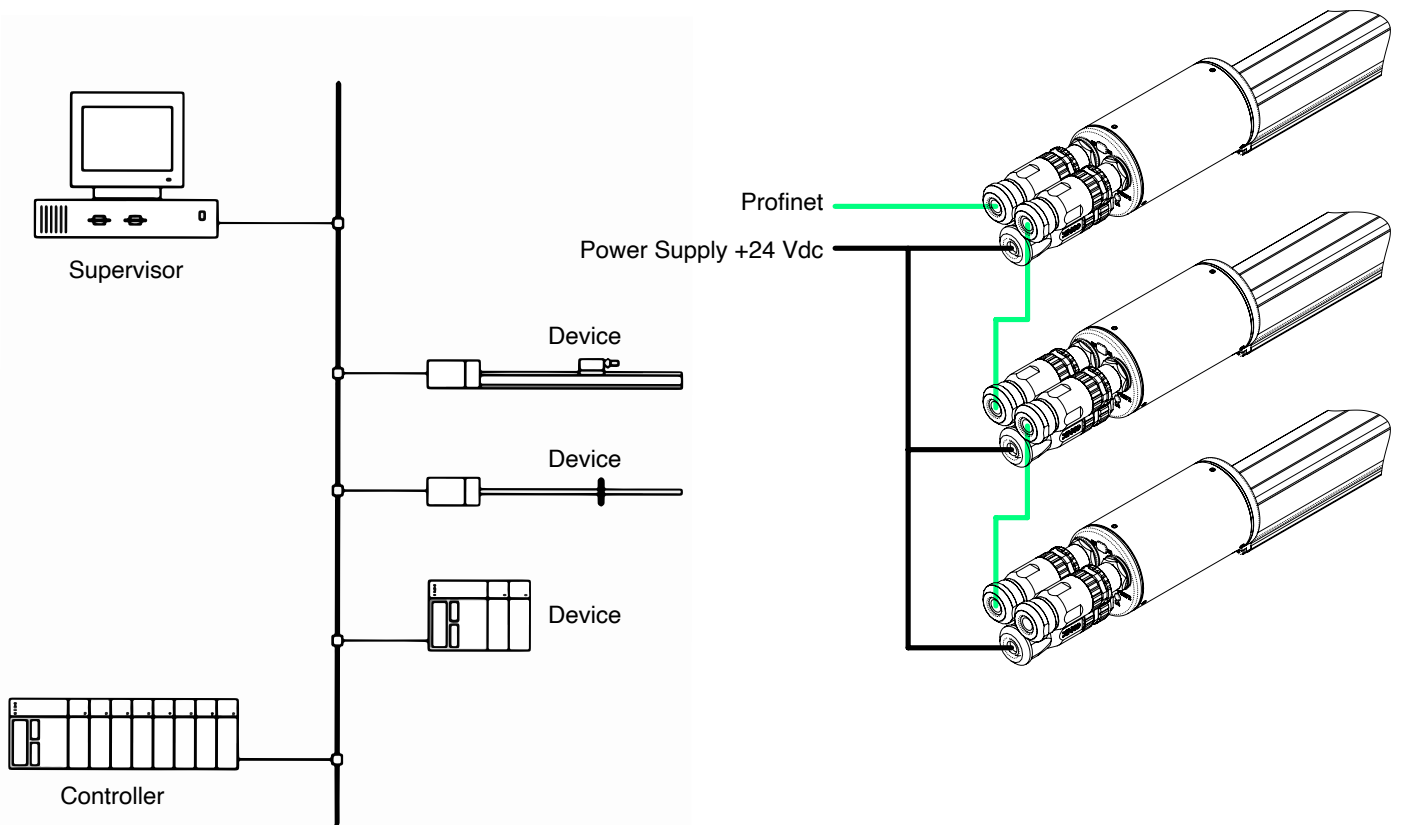
● Power Supply M12 4P Male A-coded connector connection



M12 Male 4 poles A coded connector (Power Supply)	Pinout
1	V+
2	NC
3	0V
4	NC

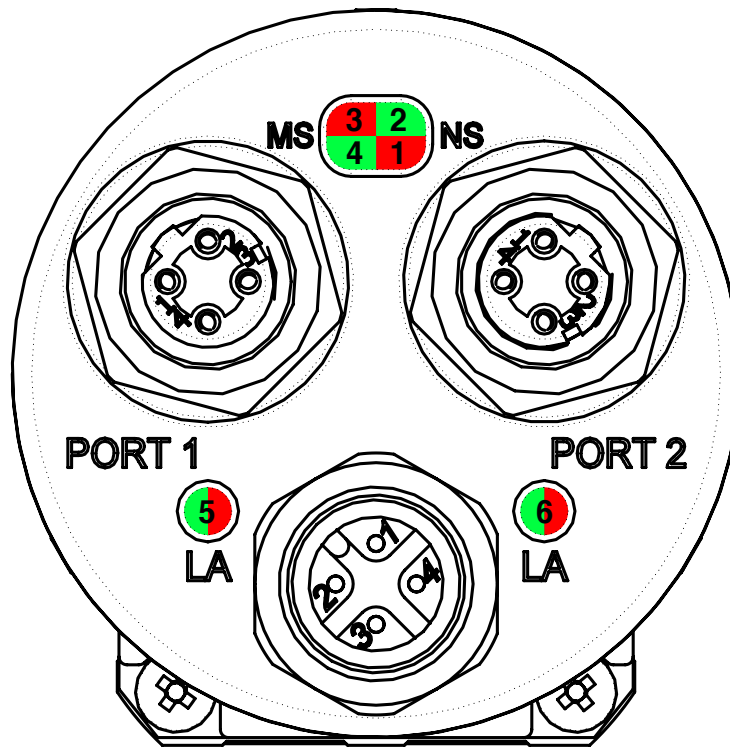
We recommend the use of a CAT5 Ethernet cable or above STP or UTP. The maximum distance between two Ethernet network nodes must be less than 100m.

For Power Supply use a shielded cable with metal connector and shield connected to connector case.



2.3. Status LEDS

The WPA-F/WRA-F provides leds on transducer head in order to give diagnostic information compliant with standard and with added manufacturer functionalities.



Led 1 (Red) Bus Fault	Function
OFF	No error on bus
ON	No connection to controller
Flashing	Waiting for parameterization

Led 2 (Green) System Fault + Signalling	Function
OFF	No system error
ON	Application error
Flashing	Signalling activated

Led 3 (Red) Application error	Function
OFF	No application error
ON Steady	Position error
Flashing 0,5 Hz	Power Supply error
Flashing 1 Hz	Parameterization error
Flashing 2 Hz	Temperature error
Flashing 4 Hz	Internal communication error

Led 4 (Green) Power Supply	Function
OFF	No Power Supply
ON	Power Supply ON

Led 5-6 (Red-Green) Link Activity	Function
OFF	No connection to next port
Green ON	Connection to next port established
Green ON + Red Flashing	Connection to next port established and communication active

3. MAIN COMMUNICATION FEATURES

Ethernet Baud Rate	Max 100 Mbit/s
Data Transport Layer	Ethernet II, IEEE 802.3
PNIO version	2.3
Real Time Communication	RT & IRT Class 3
Profile	General (Manufacturer) Profile or Encoder Profile v 4.2 Class 4
Min Device Interval	1 ms (RT) 250us (IRT)
Address	Discovery and Configuration Protocol (DCP)
Default IP	0.0.0.0
Default Name	“gefran-wxa-pn-gp” for General Profile “gefran-wxa-pn-ep” for Encoder Profile

The WPA-F/WRA-F is available with different Communication Profiles, according to ordering code:

- a standard IO profile, so called General Profile
- an Encoder Profile, compliant with v. 4.2 Class 4

Independently from profile the WPA-F/WRA-F is available with RT and IRT communication with min device interval up to 250 us (for IRT only).

The Isochronous communication can be set inside the network tool (TIA Portal as an example), following the menus related to “Real Time Settings”

4. GENERAL PROFILE

With this Profile up to 16 cursors are detectable and measured by the device.

4.1. Process Data Structure

The device WPA-F / WRA-F offers different process data and different configuration for process data.

The process variables available are:

Position (32 bit signed), for each of the cursors installed. For resolution refer to configuration options.

31..0
Position

Velocity (32 bit signed), for each of the cursors installed. For resolution refer to configuration options.

31..0
Velocity

Status (8byte), composed as following:

Voltage supply measured by device: 16bit (unsigned), 1mV resolution, 200mV sensitivity

Nr. of cursors detected: 8bit, change continuously according to nr. of cursors effectively detected

Bitmask of cursors configured: (5 byte), fixed bitmask of cursors set during configuration

63...48	47...40	39..0
Voltage supply	Nr. of cursors	Bitmask of cursors configured

4.2. Input modules

The device WPA-F/WRA-F provides different modules containing process data. These modules are selectable in the input modules catalog:

- Position: this module contains the position data of one cursor
- Velocity: this module contains the velocity data of one cursor
- Position and Velocity: this module contains the data of position and velocity of one cursor
- All Positions: this module contains the data of position of all the detectable cursors (16)
- All Velocities: this module contains the data of velocity of all the detectable cursors (16)
- Sensor Status: this module contains the data of status of the device (see process data structure)

4.3. Modules Parameterization

4.3.1. Slot0 Parameterization

In slot 0 the parameterization of the main module is present; herebelow the list of parameters available follows:

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
1024	Unsigned32	Version of device parameter	RO	2021/03/22
1025	Unsigned32	Resolution	RW	500 : 0.5 microns 1000: 1 micron 2000: 2 microns 5000: 5 microns 10000: 10 microns 50000: 50 microns 100000: 100 microns
1026	Unsigned8	Filter mode	RW	0: Filter type disabled 1: Filter type simple average (FIR) 2: Filter type endless response average (IIR)
1027	Unsigned8	Filter nr. of samples	RW	2..16
1028	Unsigned8	Velocity nr. of samples	RW	2.8.16
1029	Unsigned8	Velocity Unit	RW	0: Steps/1000 milliseconds 1: Steps/100 milliseconds 2: Steps/10 milliseconds 3: mm/s
1030	Unsigned8	Output Direction	RW	0: Forward 1: Reverse
1031	Unsigned8	Number of configured Cursors	RW	0..15: 1...16
1032	Unsigned8	Number of Cursors Alarm	RW	0: Number of cursors different than configured 1: Number of cursors higher than configured 2: Number of cursors lower than configured 3: Cursor alarm disabled
1033	Unsigned8	Voltage Supply Alarm	RW	0: Supply voltage higher or lower than limits 1: Supply voltage lower than limits 2: Supply voltage higher than limits 3: Voltage supply alarm disabled
1034	Integer32	Position offset of cursor 1 [um]	RW	0
1035	Integer32	Position offset of cursor 2 [um]	RW	0
1036	Integer32	Position offset of cursor 3 [um]	RW	0
1037	Integer32	Position offset of cursor 4 [um]	RW	0
1038	Integer32	Position offset of cursor 5 [um]	RW	0
1039	Integer32	Position offset of cursor 6 [um]	RW	0
1040	Integer32	Position offset of cursor 7 [um]	RW	0
1041	Integer32	Position offset of cursor 8 [um]	RW	0
1042	Integer32	Position offset of cursor 9 [um]	RW	0
1043	Integer32	Position offset of cursor 10 [um]	RW	0
1044	Integer32	Position offset of cursor 11 [um]	RW	0
1045	Integer32	Position offset of cursor 12 [um]	RW	0
1046	Integer32	Position offset of cursor 13 [um]	RW	0
1047	Integer32	Position offset of cursor 14 [um]	RW	0
1048	Integer32	Position offset of cursor 15 [um]	RW	0
1049	Integer32	Position offset of cursor 16 [um]	RW	0

Explanation:

- Version of device parameter: it's a read only tag which defines the version of the parameter set
- Resolution: it defines the resolution for the position data, values allowed are: 0,5, 1, 2, 5, 10, 50, 100 um
- Filter mode: different types of filters on process data can be set by user:
 - Disabled: no filter applied
 - Simple average (FIR): only the number of samples corresponding to parameter "Filter nr. of samples" are considered to define the process data; the filter method used on these samples is moving average
 - Endless response average (IIR): not only the number of samples corresponding to parameter "Filter nr. of samples" but also the previous data are considered to define the process output value
- Filter nr. of samples: it defines the number of samples used to filter the position data; values allowed are 2...16
- Velocity nr. of samples: it defines the number of position samples used to calculate velocity; values allowed are 2...16
- Velocity Unit: it defines the resolution of velocity data; values allowed are:
 - 0: steps/1000ms
 - 1: steps/100ms
 - 2: steps/10ms
 - 3: mm/s
- Output Direction: it defines the increasing direction of position and velocity data, values allowed are:
 - Forward: it means that values increase positively from sensor head to the end of stroke
 - Reverse: it means that values increase positively from sensor end of stroke towards the head
- Number of configured cursors: it defines the number of expected cursors on sensor stroke; this value will be responsible for Position failure alarm in respect to the real number of cursors detected by the sensor; values allowed are 0...15 (corresponding to cursors 1...16)
- Number of Cursors Alarm: it is possible to set an alarm referred to the number of cursors detected/configured; values allowed are:
 - 0: Number of cursors detected different than configured
 - 1: Number of cursors detected higher than configured
 - 2: Number of cursors detected lower than configured
 - 3: Cursor alarm disabled
- Voltage Supply Alarm: the device measures its Voltage supply; it is possible to set an alarm referred to its level; values allowed are:
 - 0: Supply voltage higher or lower than limits
 - 1: Supply voltage lower than limits
 - 2: Supply voltage higher than limits
 - 3: Voltage supply alarm disabled
- Position offset of cursor n: it is possible to define, for each of the possible 16 cursors, an offset value added to the position value; the offset value is always expressed in um as an Int32

4.3.2. Slot-n Parameterization

According to the module/s selected below module 0 (see input modules) , a few further parameters are available for each type of module:

- Position: it is possible to select which cursor position to measure (from 1 to 16)

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
1050	Unsigned8	PositionParam.MagnetToMeasure_SL1	RW	0..15: 1 ...16
1051	Unsigned8	PositionParam.MagnetToMeasure_SL2	RW	0..15: 1 ...16
1052	Unsigned8	PositionParam.MagnetToMeasure_SL3	RW	0..15: 1 ...16
1053	Unsigned8	PositionParam.MagnetToMeasure_SL4	RW	0..15: 1 ...16
1054	Unsigned8	PositionParam.MagnetToMeasure_SL5	RW	0..15: 1 ...16
1055	Unsigned8	PositionParam.MagnetToMeasure_SL6	RW	0..15: 1 ...16
1056	Unsigned8	PositionParam.MagnetToMeasure_SL7	RW	0..15: 1 ...16
1057	Unsigned8	PositionParam.MagnetToMeasure_SL8	RW	0..15: 1 ...16
1058	Unsigned8	PositionParam.MagnetToMeasure_SL9	RW	0..15: 1 ...16
1059	Unsigned8	PositionParam.MagnetToMeasure_SL10	RW	0..15: 1 ...16
1060	Unsigned8	PositionParam.MagnetToMeasure_SL11	RW	0..15: 1 ...16
1061	Unsigned8	PositionParam.MagnetToMeasure_SL12	RW	0..15: 1 ...16
1062	Unsigned8	PositionParam.MagnetToMeasure_SL13	RW	0..15: 1 ...16
1063	Unsigned8	PositionParam.MagnetToMeasure_SL14	RW	0..15: 1 ...16
1064	Unsigned8	PositionParam.MagnetToMeasure_SL15	RW	0..15: 1 ...16
1065	Unsigned8	PositionParam.MagnetToMeasure_SL16	RW	0..15: 1 ...16

- Velocity: it is possible to select which cursor velocity to measure (from 1 to 16)

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
1066	Unsigned8	VelocityParam.MagnetToMeasure_SL1	RW	0..15: 1 ...16
1067	Unsigned8	VelocityParam.MagnetToMeasure_SL2	RW	0..15: 1 ...16
1068	Unsigned8	VelocityParam.MagnetToMeasure_SL3	RW	0..15: 1 ...16
1069	Unsigned8	VelocityParam.MagnetToMeasure_SL4	RW	0..15: 1 ...16
1070	Unsigned8	VelocityParam.MagnetToMeasure_SL5	RW	0..15: 1 ...16
1071	Unsigned8	VelocityParam.MagnetToMeasure_SL6	RW	0..15: 1 ...16
1072	Unsigned8	VelocityParam.MagnetToMeasure_SL7	RW	0..15: 1 ...16
1073	Unsigned8	VelocityParam.MagnetToMeasure_SL8	RW	0..15: 1 ...16
1074	Unsigned8	VelocityParam.MagnetToMeasure_SL9	RW	0..15: 1 ...16
1075	Unsigned8	VelocityParam.MagnetToMeasure_SL10	RW	0..15: 1 ...16
1076	Unsigned8	VelocityParam.MagnetToMeasure_SL11	RW	0..15: 1 ...16
1077	Unsigned8	VelocityParam.MagnetToMeasure_SL12	RW	0..15: 1 ...16
1078	Unsigned8	VelocityParam.MagnetToMeasure_SL13	RW	0..15: 1 ...16
1079	Unsigned8	VelocityParam.MagnetToMeasure_SL14	RW	0..15: 1 ...16
1080	Unsigned8	VelocityParam.MagnetToMeasure_SL15	RW	0..15: 1 ...16
1081	Unsigned8	VelocityParam.MagnetToMeasure_SL16	RW	0..15: 1 ...16

- Position and Velocity: it is possible to select which cursor position+velocity to measure (from 1 to 16)

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
1082	Unsigned8	PosVelParam.MagnetToMeasure_SL1	RW	0..15: 1 ...16
1083	Unsigned8	PosVelParam.MagnetToMeasure_SL2	RW	0..15: 1 ...16
1084	Unsigned8	PosVelParam.MagnetToMeasure_SL3	RW	0..15: 1 ...16
1085	Unsigned8	PosVelParam.MagnetToMeasure_SL4	RW	0..15: 1 ...16
1086	Unsigned8	PosVelParam.MagnetToMeasure_SL5	RW	0..15: 1 ...16
1087	Unsigned8	PosVelParam.MagnetToMeasure_SL6	RW	0..15: 1 ...16
1088	Unsigned8	PosVelParam.MagnetToMeasure_SL7	RW	0..15: 1 ...16
1089	Unsigned8	PosVelParam.MagnetToMeasure_SL8	RW	0..15: 1 ...16
1090	Unsigned8	PosVelParam.MagnetToMeasure_SL9	RW	0..15: 1 ...16
1091	Unsigned8	PosVelParam.MagnetToMeasure_SL10	RW	0..15: 1 ...16
1092	Unsigned8	PosVelParam.MagnetToMeasure_SL11	RW	0..15: 1 ...16
1093	Unsigned8	PosVelParam.MagnetToMeasure_SL12	RW	0..15: 1 ...16
1094	Unsigned8	PosVelParam.MagnetToMeasure_SL13	RW	0..15: 1 ...16
1095	Unsigned8	PosVelParam.MagnetToMeasure_SL14	RW	0..15: 1 ...16
1096	Unsigned8	PosVelParam.MagnetToMeasure_SL15	RW	0..15: 1 ...16
1097	Unsigned8	PosVelParam.MagnetToMeasure_SL16	RW	0..15: 1 ...16

- Sensor status: no parameters

- All Positions: no parameters
- All Velocities: no parameters

4.4. Info and statistic parameters

The device WPA-F/WRA-F provides a list of parameters which is possible to readout in order to receive some information and useful statistic data from the device.

Index (dec)	DataFormat	Name	Access	UM	Range/Format
3073	Unsigned32	OperatingTimeCounter	RO	[0,1h]	
3075	Int16	Temperature	RO	[0,1°C]	
3076	Int16	TemperatureMax	RO	[0,1°C]	
4096	Unsigned32	NominalSpan	RO	[um]	0...4000000
4097	Unsigned32	SerialNumber	RO		YYWWNNNN
4098	Unsigned32	CalibrationDate	RO		YYYYMMDD
4099	Unsigned32	SensorSwVersion	RO		YYYYMMDD

Explanation:

- Operating time counter: the working time of the device is stored in non volatile memory since first power on or since last reset command (see par 4.5); this increasing counter has resolution 0,1h (6 min)
- Temperature: it's the temperature measured internally by electronics, with 0,1°C resolution; this value is volatile
- Temperature Max: it's the maximum temperature measured internally by electronics, with 0,1°C resolution, stored in non volatile memory, since first power on or since last reset command (see par 4.5)
- Nominal Span: it's the full range stroke of the device as defined in the ordering code, with 1um resolution
- Serial Number: it's the Serial Number as reported on device nameplate
- Calibration Date: it reports the date of calibration of device in the coding YYYYMMDD
- SensorSWVersion: SW version of the processor managing the measure

4.5. User commands

The device WPA-F/WRA-F provides a list of commands which the user can act in case of

Index (dec)	DataFormat	Name	Access	Data to Write
6144	Unsigned8	ResetUserStatisticsData	WO	1
6145	Unsigned8	StoreStatisticsDat	WO	1

Explanation:

- ResetUserStatisticsData: through this command the user can request the reset of following statistics data:
 - OperatingTimeCounter
 - TemperatureMax
- StoreStatisticsData: through this command the user can force an immediate storage of statistics parameters (OperatingTimeCounter and TemperatureMax), otherwise the auto saving happens every 6 min

4.6. Alarm values

In case of Diagnostics events the WPA-F / WRA-F communicates through Profinet alarm messages the following:

Alarm ID	Meaning
16	Parameterization Error
17	Supply Voltage Error
27	Number of cursors Error
5	Temperature Error
19	Internal Communication Error

Explanation:

- Parameterization Error: the device received an uncorrect parameterization
- Supply Voltage Error: the error rises according to the configuration of parameter "Voltage Supply Alarm"
- Number of cursors Error: the error rises according to the configuration of parameter "Number of Cursors Alarm"
- Temperature Error: the error rises if Electronics temperature overtakes the working temperature limit
- Internal Communication Error: the error rises if a failure in internal communication between processors happens

4.7. Reading IO through acyclic data (see par. 4.1)

Through acyclic communication it is possible to read out Process data as well

Address (dec)	Data Format	Name	Access	Value range
0	Integer32	HostProcessData.Position01	RO	
1	Integer32	HostProcessData.Position02	RO	
2	Integer32	HostProcessData.Position03	RO	
3	Integer32	HostProcessData.Position04	RO	
4	Integer32	HostProcessData.Position05	RO	
5	Integer32	HostProcessData.Position06	RO	
6	Integer32	HostProcessData.Position07	RO	
7	Integer32	HostProcessData.Position08	RO	
8	Integer32	HostProcessData.Position09	RO	
9	Integer32	HostProcessData.Position10	RO	
10	Integer32	HostProcessData.Position11	RO	
11	Integer32	HostProcessData.Position12	RO	
12	Integer32	HostProcessData.Position13	RO	
13	Integer32	HostProcessData.Position14	RO	
14	Integer32	HostProcessData.Position15	RO	
15	Integer32	HostProcessData.Position16	RO	
16	Integer32	HostProcessData.Speed01	RO	
17	Integer32	HostProcessData.Speed02	RO	
18	Integer32	HostProcessData.Speed03	RO	
19	Integer32	HostProcessData.Speed04	RO	
20	Integer32	HostProcessData.Speed05	RO	
21	Integer32	HostProcessData.Speed06	RO	
22	Integer32	HostProcessData.Speed07	RO	
23	Integer32	HostProcessData.Speed08	RO	
24	Integer32	HostProcessData.Speed09	RO	
25	Integer32	HostProcessData.Speed10	RO	
26	Integer32	HostProcessData.Speed11	RO	
27	Integer32	HostProcessData.Speed12	RO	
28	Integer32	HostProcessData.Speed13	RO	
29	Integer32	HostProcessData.Speed14	RO	
30	Integer32	HostProcessData.Speed15	RO	
31	Integer32	HostProcessData.Speed16	RO	
32	Unsigned16	PowerSupply	RO	
33	Unsigned8	NumberOfCursors	RO	
34	Unsigned8	BitMask[0]	RO	
35	Unsigned8	BitMask[1]	RO	
36	Unsigned8	BitMask[2]	RO	
37	Unsigned8	BitMask[3]	RO	
38	Unsigned8	BitMask[4]	RO	

5. ENCODER PROFILE

5.1. Process Data Structure

The device WPA-F / WRA-F with specific ordering code requested communicates as an Encoder device compliant to Profinet Encoder Profile ver 4.2 class 4.

With this Profile only one cursor is detectable and measured by the device.

With this Profile communication modules are standardized and called Telegrams; different telegrams are available for the WPA-F / WRA-F Encoder.

- Standard Telegram 81

This telegram foresees 4 bytes of output (Master to Device) and 12 bytes of input (Device to Master)

OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

INPUT DATA

Word Data	1		2		3		4		5		6	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11
Output value	ZSW2_ENC		G1_ZSW		G1_XIST1		G1_XIST2					
Meaning	Status word 2		Status word		Position value		Position value 2					

- Standard Telegram 82

This telegram foresees 4 bytes of output (Master to Device) and 14 bytes of input (Device to Master)

OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

INPUT DATA

Word Data	1		2		3		4		5		6		7	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Output value	ZSW2_ENC		G1_ZSW		G1_XIST1		G1_XIST2						NIST_A	
Meaning	Status word 2		Status word		Position value		Position value 2						Velocity	

- Standard Telegram 83

This telegram foresees 4 bytes of output (Master to Device) and 16 bytes of input (Device to Master)

OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

INPUT DATA

Word Data	1		2		3		4		5		6		7		8	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Output value	ZSW2_ENC		G1_ZSW		G1_XIST1		G1_XIST2		NIST_B							
Meaning	Status word 2		Status word		Position value		Position value 2		Velocity							

- Standard Telegram 84

This telegram foresees 4 bytes of output (Master to Device) and 20 bytes of input (Device to Master)

OUTPUT DATA

Word Data	1		2	
Byte Data	0	1	2	3
Output value	STW2_ENC		G1_STW	
Meaning	Encoder control word 2		Sensor control word	

INPUT DATA

Word Data	1		2		3		4		5		6		7		8		9		10	
Byte Data	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Output value	ZSW2_ENC		G1_ZSW		G1_XIST3		G1_XIST2		NIST_B											
Meaning	Status word 2		Status word		Position value		Position value 2		Velocity											

Definition of contents:

- STW2_ENC = Encoder control word 2

Bit	Function	Notes
0	XIST_PRESET_CONTROL	
1...6	Reserved for profile	
7	Fault Acknowledge	
8...9	Reserved for vendor specific extensions	Not used
10	Control by PLC	
11	Reserved for vendor specific extensions	Not used
12...15	Controller Sign-Of-Life	

- G1_STW = Sensor control word

Bit	Function	Notes
0...7	Function requests: Reference mark search, measurement on the fly	
8...10	Reserved	
11	Home position mode	
12	Request set/shift of home position	
13	Request absolute value cyclically	
14	Activate parking sensor	
15	Acknowledging a sensor error	

- ZSW2_ENC = Status word 2

Bit	Function	Notes
0	XIST_PRESET_ACK	
1	XIST_VALID	
2	NIST_VALID	
3	Fault Present / No Fault	
4...6	Reserved for profile	
7	Warning Present / No Warning	
8	Reserved for vendor specific extensions	
9	Control requested	
10,11	Reserved for vendor specific extensions	
12...15	Encoder Sign-Of-Life	

- G1_ZSW = Sensor status word

Bit	Function	Notes
0...7	Function status: Reference mark search, measurement on the fly	
8	Probe 1 deflected	
9	Probe 2 deflected	
10	Reserved, set to zero	
11	Requirement of error acknowledgement detected	
12	Set/shift of home position executed	
13	Transmit absolute value cyclically (absolute encoders only)	
14	Parking sensor active	
15	Sensor error	

- G1_XIST1 = Position value 1 (32bit)
- G1_XIST2 = Position value 2 (32bit)
- G1_XIST3 = Position value (64bit)
- NIST_A = Velocity (16bit)
- NIST_B = Velocity (32bit)

5.2. Modules Parameterization

With Encoder Profile Slot 0 and 1 are already selected; in Slot 1 a list of standard and manufacturer specific parameters is present

5.2.1. Standard Parameterization

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
65004.0	Bit type	Code Sequence	RW	0: CW (forward) 1: CCW (reverse)
65004.1	Bit type	Class 4 functionality	RW	1: Enable 0: Disable
65004.2	Bit type	G1_XIST1 Preset control	RW	0: Enable 1: Disable
65004.3	Bit type	Scaling function control	RW	1: Enable 0: Disable
65004.4	Bit type	Alarm channel control	RW	1: Enable 0: Disable

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
65004.5	Bit type	V3.1 Compatibility mode	RW	0: Enable 1: Disable
65006	Unsigned32	Measurement step	RW	500 : 0.5 microns 1000: 1 micron 2000: 2 microns 5000: 5 microns 10000: 10 microns 50000: 50 microns 100000: 100 microns
65007	Unsigned32	Measurement range	RW	
925	Unsigned8	Maximum master sign-of-life failures	RW	
60001	Unsigned8	Velocity Unit	RW	0: Steps/1000 milliseconds 1: Steps/100 milliseconds 2: Steps/10 milliseconds 3: mm/s 4: N2/N4 Normalised
60000	float32	Velocity reference value	RW	
65005	Unsigned16	Parameter Control	RW	

Explanation:

- Code Sequence: it defines the increasing direction of position and velocity data, values allowed are:
 - 0: Clockwise: it means that values increase positively from sensor head to the end of stroke
 - 1: CounterClockwise: it means that values increase positively from sensor end of stroke towards the head
- Class 4 functionality: this parameter enables/disables the use of parameters “Code sequence”, “G1_XIST1 preset control”, “Scaling function”, “measuring step”, “measuring range”, “velocity unit”. If this parameter is disabled the above mentioned parameters are not taken into account and the device by default measures with:
 - Clockwise
 - 1um resolution
 - No preset set

If “G1_XIST1 preset control” is activated this will affect G1_XIST1, G1_XIST2 and G1_XIST3

- G1_XIST1 Preset control: this parameter defines if preset for G1_XIST1 is active or not
- Scaling function control: this parameter defines if resolution of device can be changed or not
- Alarm channel control: this parameter defines if the alarm channel is active or not; it's available only in compatibility mode and can be activated only in compatibility mode
- V3.1 Compatibility mode: this parameter defines if the sensor works as a 3.1 compatible encoder or not; if this parameter is enabled the following parameters are affected:

Functions	V3.1 Compatibility mode enabled	V3.1 Compatibility mode disabled
STW2_ENC	Ignored	Supported
User parameter alarm channel control	Supported	Not supported
P965 Profile Version	31 (V3.1)	42 (V4.2)

- Measurement step: it defines the resolution for the position data, values allowed are: 0,5, 1, 2, 5, 10, 50, 100 um
- Measurement range: it defines the limit of measuring range in measuring steps, if “Scaling function” is activated
- Maximum Master Sign-of-Life failures: it defines the number of allowed failures of master sign-of-life; it can be used only in compatibility mode
- Velocity Unit: it defines the resolution of velocity data; values allowed are:
 - 0: steps/1000ms
 - 1: steps/100ms
 - 2: steps/10ms
 - 3: mm/s
 - 4: N2/N4 Normalised
- Velocity reference value: it defines the speed value for 100% for N2/N4 normalised speed signals (NIST). See also P60001
- The velocity units expressed as steps (0,1,2) – in accordance with Encoder Profile v 4.2 – reduce the measurement noise in speed calculation: more the time values (ms) selected in step units, less the noise and less the velocity update responsiveness
- Parameter Control: it controls the run-up initialization of the encoder parameters and the online access on the encoder parameters via the BMP parameter channel

5.2.2. Manufacturer Parameterization

Index (dec)	DataFormat	Name	Access	Values: meaning (bold default)
1026	Unsigned8	Filter mode	RW	0: Filter type disabled 1: Filter type simple average (FIR) 2: Filter type endless response average (IIR)
1027	Unsigned8	Filter nr. of samples	RW	2..16
1028	Unsigned8	Velocity nr. of samples	RW	2..8.16
1032	Unsigned8	Number of Cursors Alarm	RW	0: Number of cursors different than one 1: Number of cursors higher than one 2: Number of cursors lower than one 3: Cursor alarm disabled
1033	Unsigned8	Voltage Supply Alarm	RW	0: Supply voltage higher or lower than limits 1: Supply voltage lower than limits 2: Supply voltage higher than limits 3: Voltage supply alarm disabled

Explanation:

- Filter mode: different types of filters on process data can be set by user:
 - Disabled: no filter applied
 - Simple average (FIR): only the number of samples corresponding to parameter "Filter nr. of samples" are considered to define the process data; the filter method used on these samples is moving average
 - Endless response average (IIR): not only the number of samples corresponding to parameter "Filter nr. of samples" but also the previous data are considered to define the process output value
- Filter nr. of samples: it defines the number of samples used to filter the position data; values allowed are 2...16
- Velocity nr. of samples: it defines the number of position samples used to calculate velocity; values allowed are 2...16
- Number of Cursors Alarm: it is possible to set an alarm referred to the number of cursors detected; values allowed are:
 - 0: Number of cursors detected different than one
 - 1: Number of cursors detected higher than one
 - 2: Number of cursors detected lower than one
 - 3: Cursor alarm disabled
- Voltage Supply Alarm: the device measures its Voltage supply; it is possible to set an alarm referred to its level; values allowed are:
 - 0: Supply voltage higher or lower than limits
 - 1: Supply voltage lower than limits
 - 2: Supply voltage higher than limits
 - 3: Voltage supply alarm disabled

5.3. Info and statistic parameters

The device WPA-F/WRA-F provides a list of parameters which is possible to readout in order to receive some information and useful statistic data from the device.

Index (dec)	DataFormat	Name	Access	UM	Range / Format
3073	Unsigned32	OperatingTimeCounter	RO	[0,1h]	
3075	Int16	Temperature	RO	[0,1°C]	
3076	Int16	TemperatureMax	RO	[0,1°C]	
4096	Unsigned32	NominalSpan	RO	[µm]	0...4000000
4097	Unsigned32	SerialNumber	RO		YYWWNNNN
4098	Unsigned32	CalibrationDate	RO		YYYYMMDD
4099	Unsigned32	SensorSwVersion	RO		YYYYMMDD

Explanation:

- Operating time counter: the working time of the device is stored in non volatile memory since first power on or since last reset command (see par 5.4); this increasing counter has resolution 0,1h (6 min)
- Temperature: it's the temperature measured internally by electronics, with 0,1°C resolution; this value is volatile
- TemperatureMax: it's the maximum temperature measured internally by electronics, with 0,1°C resolution, stored in non volatile memory, since first power on or since last reset command (see par 5.4)
- Nominal Span: it's the full range stroke of the device as defined in the ordering code, with 1µm resolution

- Serial Number: it's the Serial Number as reported on device nameplate
- Calibration Date: it reports the date of calibration of device in the coding YYYYMMDD
- SensorSWVersion: SW version of the processor managing the measure

5.4. User commands

The device WPA-F/WRA-F provides a list of commands which the user can act in case of

Index (dec)	DataFormat	Name	Access	Data to Write
6144	Unsigned8	ResetUserStatisticsData	WO	1
6145	Unsigned8	StoreStatisticsData	WO	1

Explanation:

- ResetUserStatisticsData: through this command the user can request the reset of following statistics data:
 - OperatingTimeCounter
 - TemperatureMax
- StoreStatisticsData: through this command the user can force an immediate storage of statistics parameters (OperatingTimeCounter and TemperatureMax), otherwise the auto saving happens every 6 min

5.5. Alarm values

In case of Diagnostics events the WPA-F / WRA-F communicates through Profinet alarm messages the following:

Alarm ID	Meaning
36865	Supply Voltage Above limits
36866	Supply Voltage Below limits
36874	Number of cursors Error
36869	Temperature Error
36875	Internal Communication Error

Explanation:

- Supply Voltage Above limits: the error rises if the Voltage Supply increase above limits
- Supply Voltage Below limits: the error rises if the Voltage Supply falls below limits
- Number of cursors Error: the error rises according to the configuration of parameter "Number of Cursors Alarm"
- Temperature Error: the error rises if Electronics temperature overtakes the working temperature limit
- Internal Communication Error: the error rises if a failure in internal communication between processors happens

6. EXAMPLE OF PLC CONFIGURATION

In the following some examples of integration of WPA-F/WRA-F into a PLC system are given, both for General Profile and Encoder Profile, both RT and IRT communication. TIA Portal is taken as an example.

First of all the right GSDML file of device has to be installed into the catalog of TIA Portal:

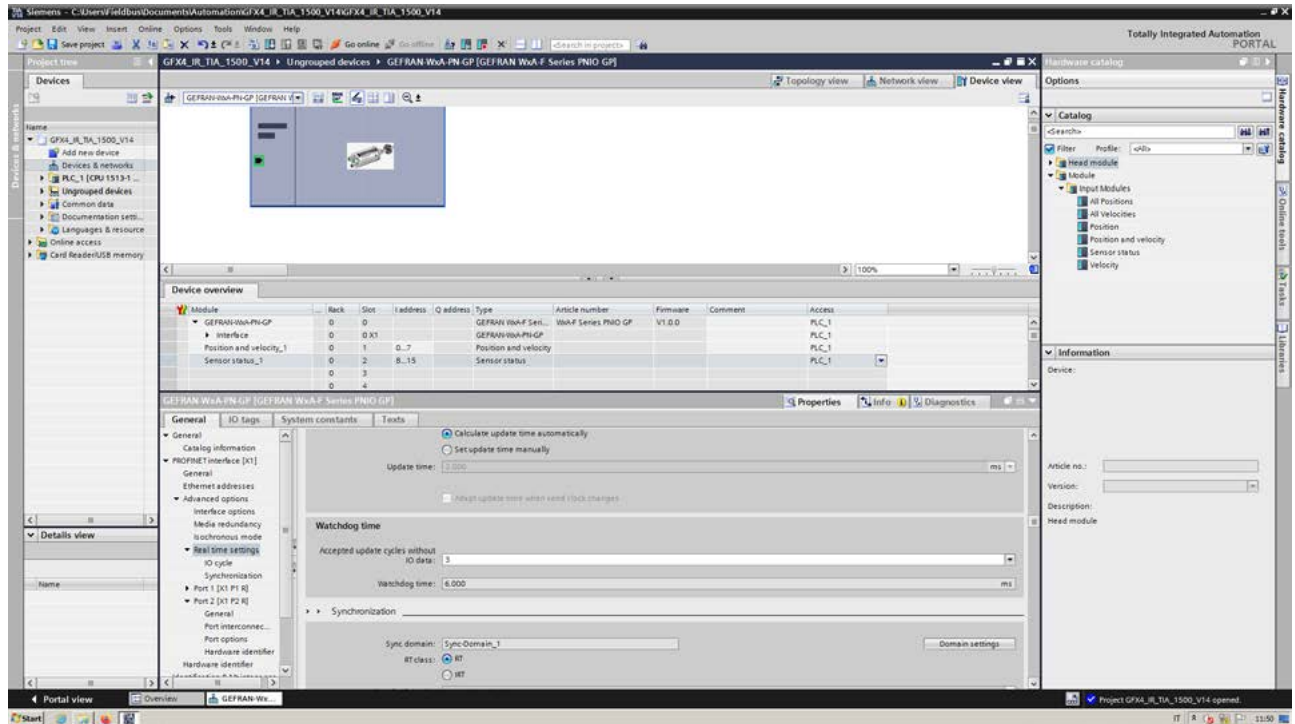
- GSDML-Vx.xx-GEFRAN-WxA_PN_GP-yyyymmdd : for General Profile
- GSDML-Vx.xx-GEFRAN-WxA_PN_EP-yyyymmdd : for Encoder Profile

6.1. General Profile configuration example

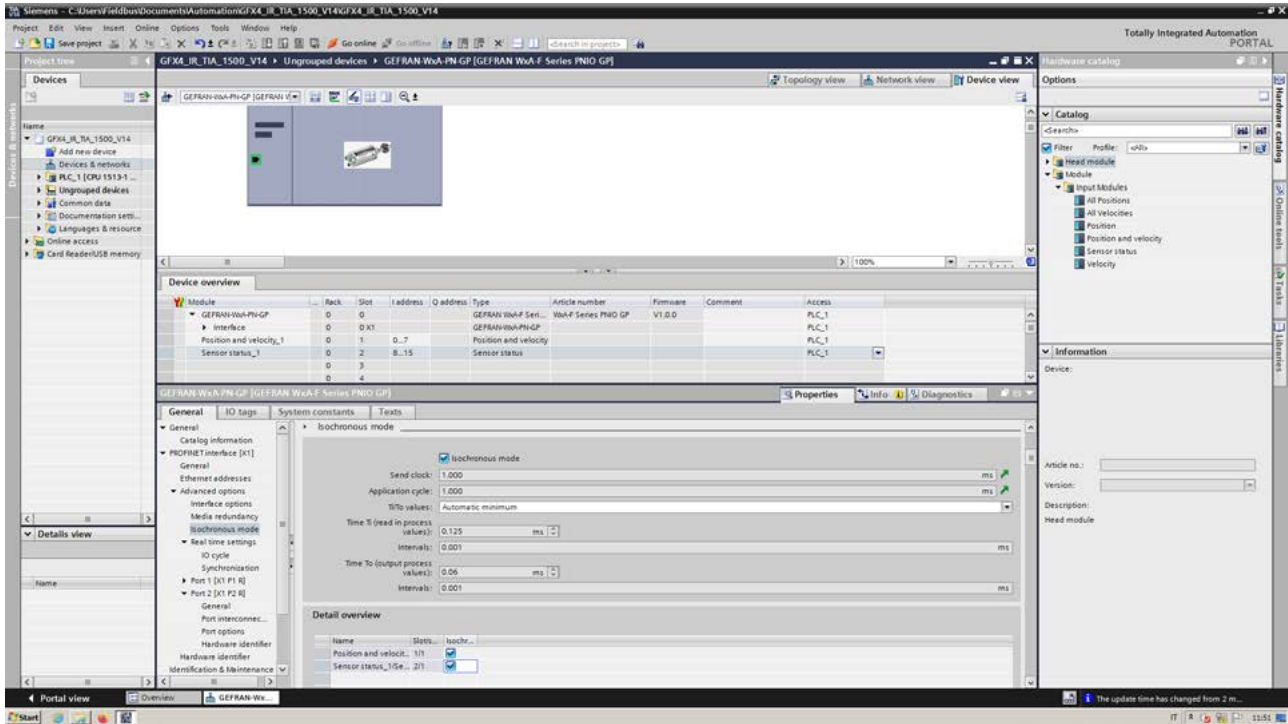
After having loaded the GSDML into the catalog, the device has the default name “gefran-wxa-pn-gp”; the user can change it according to his application.

It is possible to select and drag the desired module / modules related to position (1..16), velocity (1..16), all positions, all velocities, status.

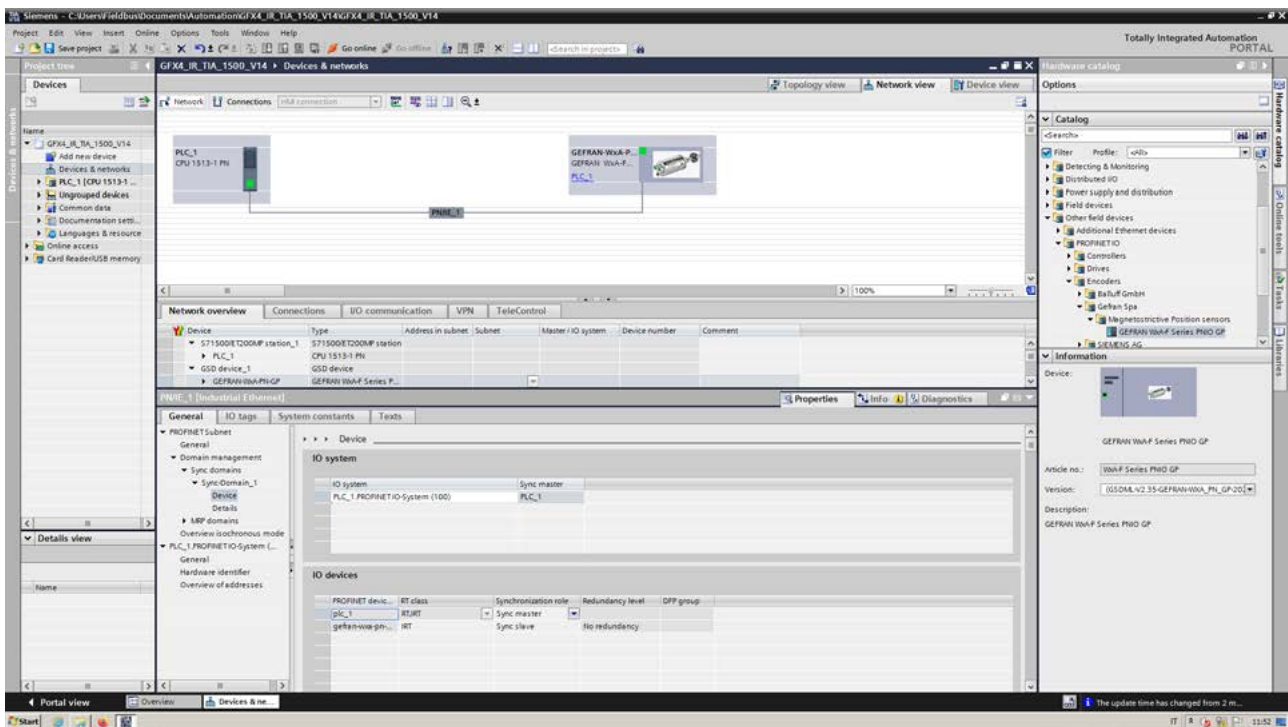
In Real time settings it is possible to set the RT class: RT or IRT



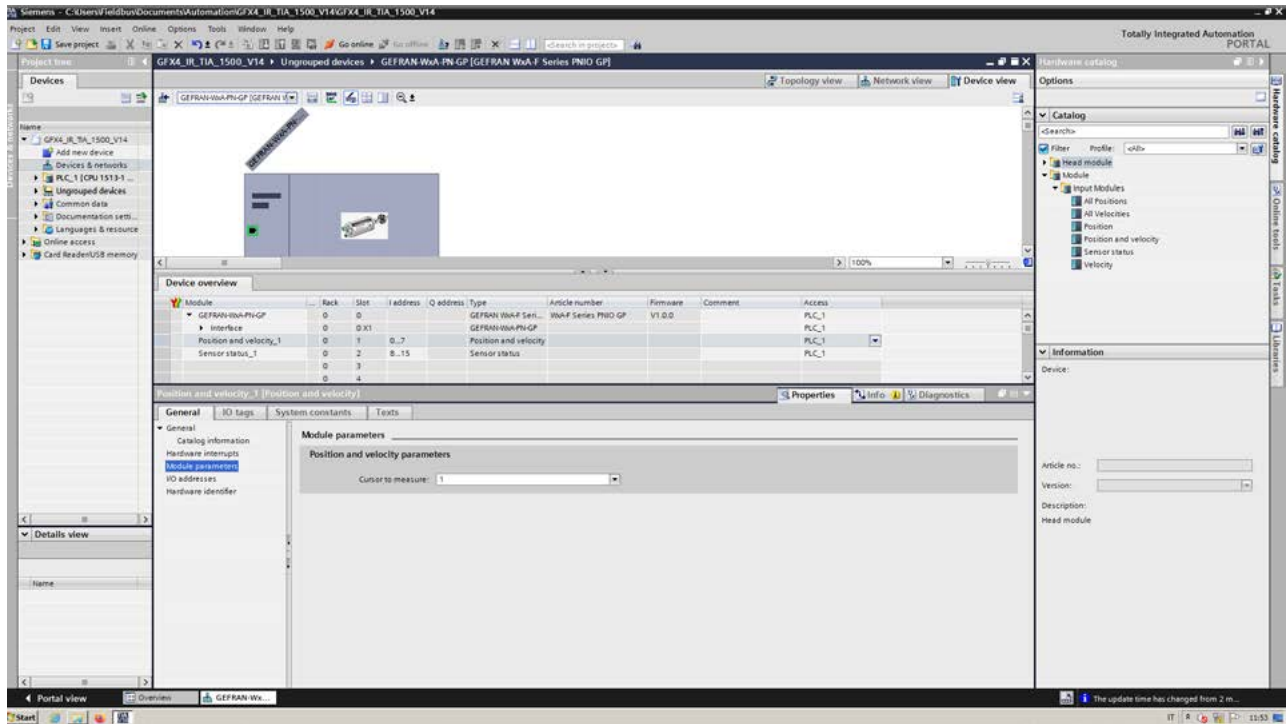
If IRT communication is selected the respective flag in Isochronous mode page must be checked



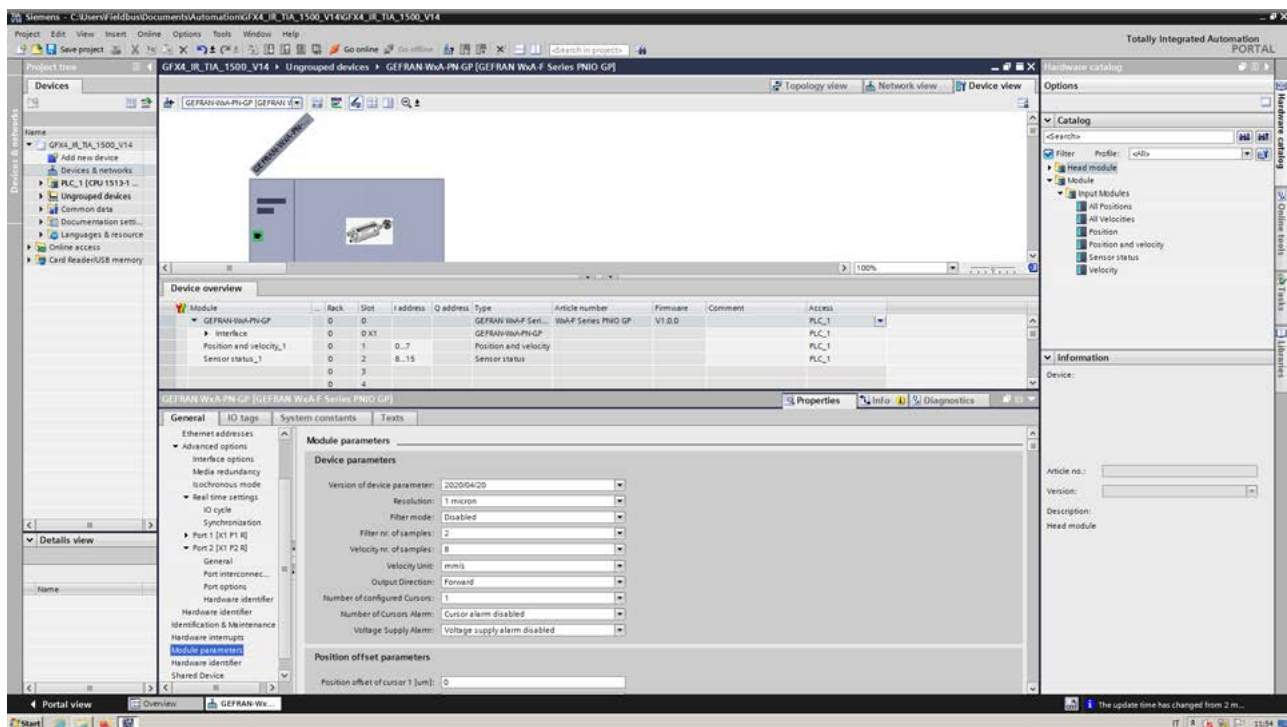
And the network topology must be arranged setting the Sync domain of the devices composing the network

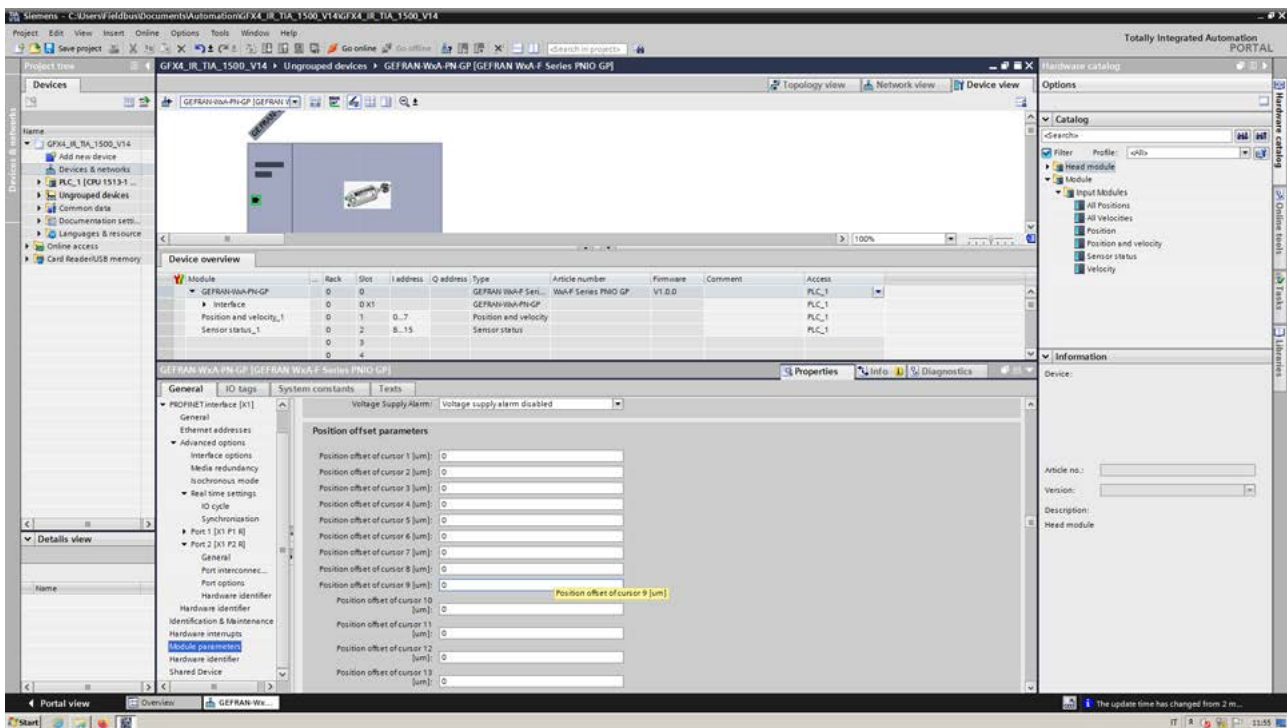


According to the loaded module/s it's needed to select the cursor to measure inside Module parameters.
 Modul Sensor status does not have parameters to select.



In module parameters of the main module (Slot 0) it's possible to select parameterization for the whole device, as well as setting of offset for each cursor



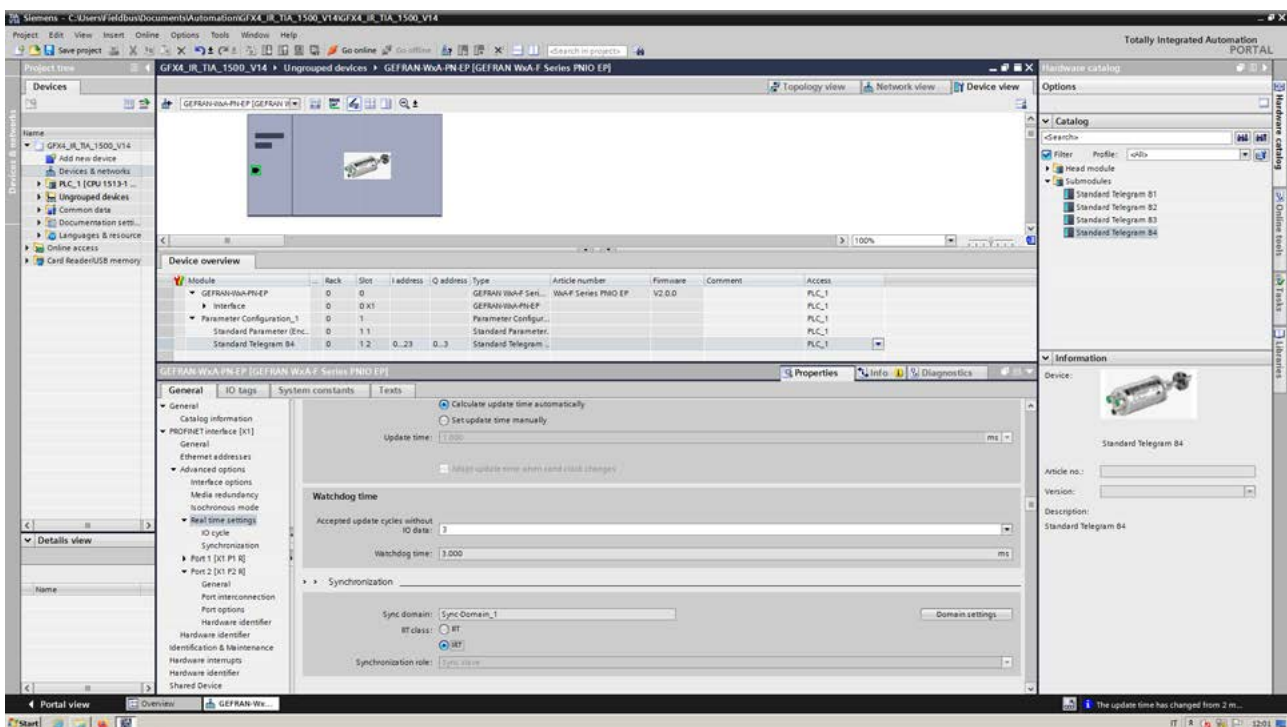


6.2. Encoder Profile configuration example

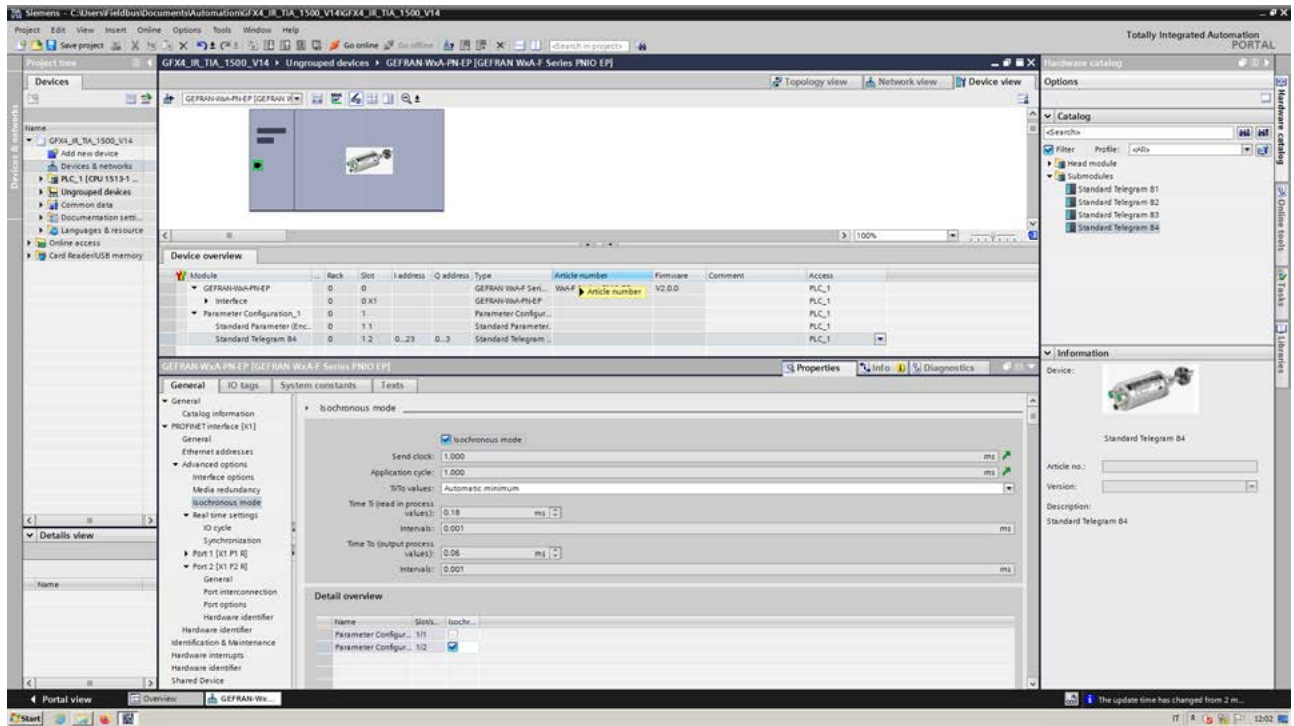
After having loaded the GSDML into the catalog, the device has the default name “gefran-wxa-pn-ep”; the user can change it according to his application.

It is possible to select and drag the desired module related to different telegrams available for the profile.

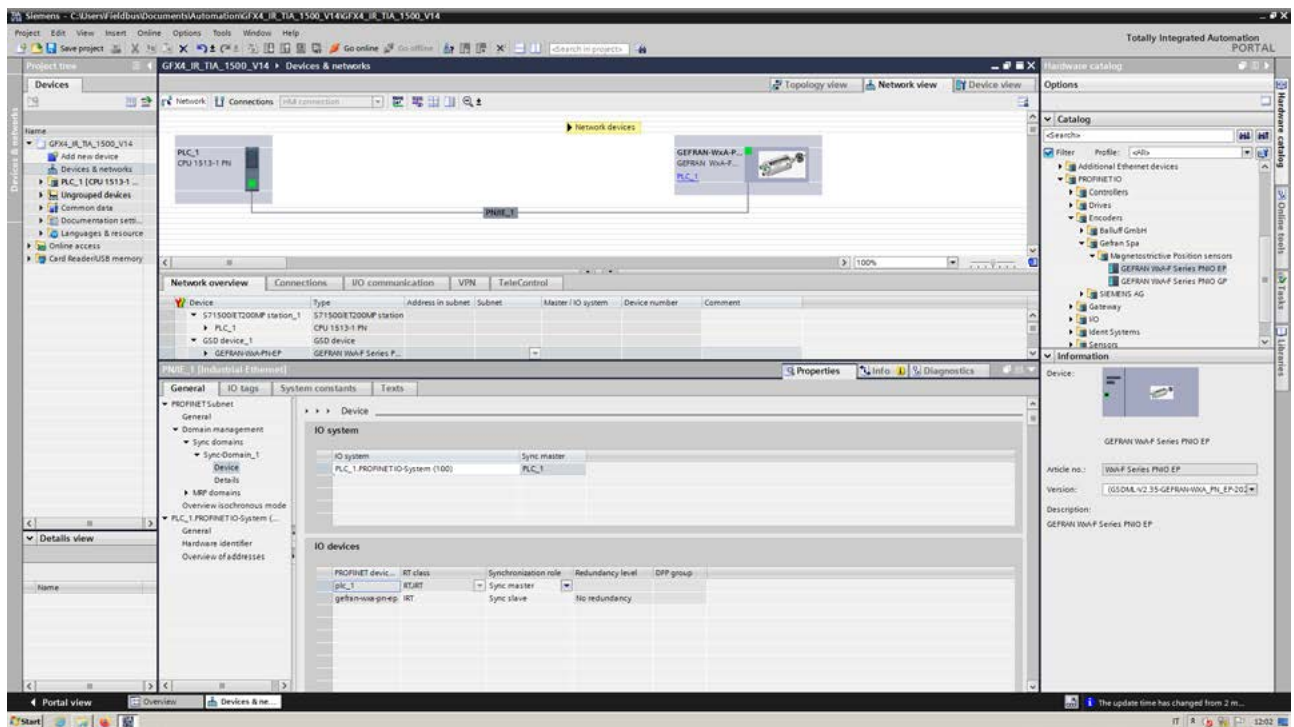
In Real time settings it is possible to set the RT class: RT or IRT



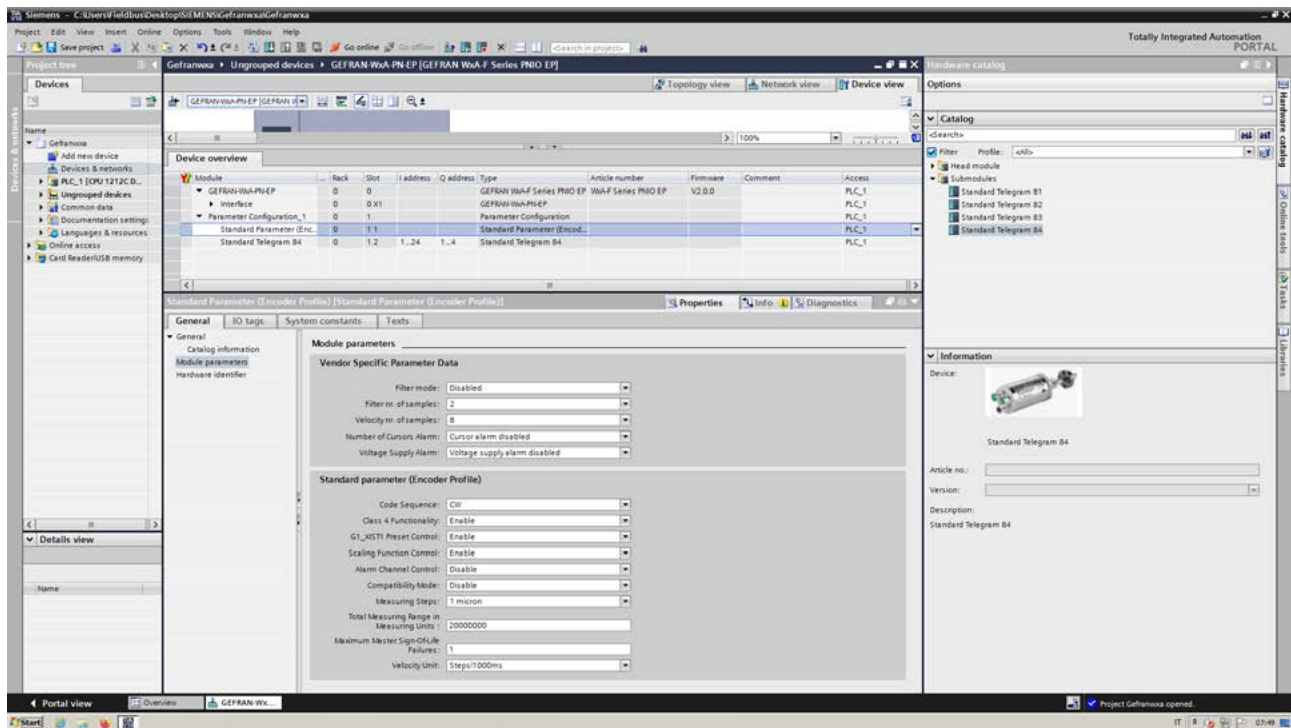
If IRT communication is selected the respective flag in Isochronous mode page must be checked



And the network topology must be arranged setting the Sync domain of the devices composing the network



With Encoder profile device no parameter is selectable inside the loaded module (Telegram), but in main module several parameters are available according to standard and to manufacturer features



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