NORGREN

Operation & Service Manual

VR10 / VR15
With PROFINET Interface

PROFINET

Before starting work read these instructions.

IMI

Change history:

The change history reflects all changes of the Operation & Service Manual, which were done after the initial release.

Index	Chapters	Change description	Date	Name
001	All	New Release	27-Nov-2020	GG
002	All	Minor changes about pictures and texts	25-Jan-2021	GG
003	All	Minor changes to text	23-Mar-2021	RL

This Operation & Service Manual makes no claims of being complete as it does not cover all variants of the VR10 / VR15 valve islands.

Therefore, this document is subject to extensions or changes.

1 CONTENTS

2 ABOUT THIS DOCUMENTATION

This User Guide contains the information to set up and operate VR10 / VR15 valve island with PROFINET Interface and to detect and resolve problems.

Note:

In addition to the specific information for the PROFINET variants, all data sheets and VR10 / VR15 PROTOCOL / MULTIPOLE SERIES IP65 VERSION Operation & Service Manual are applicable and remain valid.

Refer also to the data sheets on the following web link:

- https://www.norgren.com

Refer also to the valve island installation instruction in the following document:

- "VR10 / VR15 PROTOCOL / MULTIPOLE SERIES IP65 VERSION Operation & Service Manual"
  - This manual can be found on https://www.norgren.com/uk/en/technical-support/installation-maintenance-instructions/valves

Basic information about PROFINET could be found in the following documents:

- "PROFINET System Description - Technology and Application"
  - https://www.profibus.com/download/profinet-technology-and-application-system-description

Installation guideline and diagnosis manual about PROFINET could be found in the following documents:

- "PROFINET_Assembling_8072_V28_Sep19.pdf"
  - https://www.profibus.com/download/profinet-installation-guidelines/
- "PROFINET_Commissioning_8082_V144_Sep19.pdf"
  - https://www.profibus.com/download/profinet-installation-guidelines/

Further information about PROFINET is available on PI websites:

- https://www.profibus.com
- https://www.profibus.com/technology/profinet
- https://www.profibus.com/download

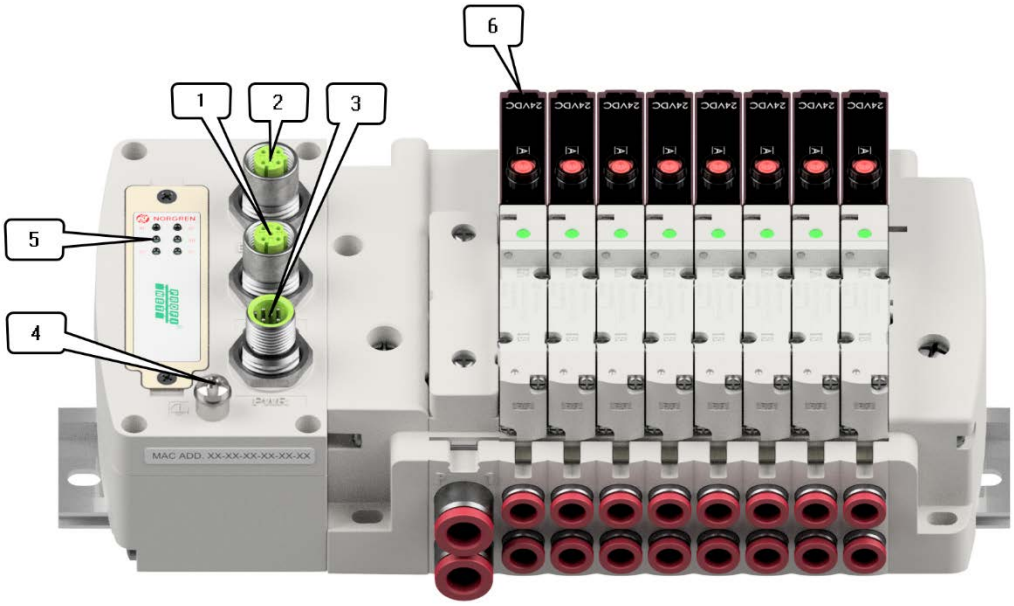
3 IMPORTANT HINTS

3.1 GROUNDING AND EQUIPOTENTIAL BONDING

Proper grounding and equipotential bonding are very important to protect against electromagnetic interferences in PROFINET networks. In order to reduce potential impact, grounding of the PROFINET cable screen should be done at both ends of every cable (i.e. at each device). Equipotential bonding ensures that the ground potential is identical throughout the entire PROFINET network and is essential to avoid equipotential bonding currents, which could otherwise flow through the PROFINET cable screen. Please refer for further details to the “PROFINET_Assembling_8072_V28_Sep19.pdf” provided by the PROFINET user organization PI (https://www.profibus.com/download/profinet-installation-guidelines/).

For proper grounding please use the earth screw (M4) on the upper side of the valve island. For easy reference see item 4 in chapter 4.

4 ELECTRICAL FEATURES



1- Port 1 for PROFINET

(M12 x 1 | Female | 4 – pin | D – coded)

2- Port 2 for PROFINET

(M12 x 1 | Female | 4 – pin | D – coded)

3- PWR: Power Supply

(M12 x 1 | Male | 5 – pin | A – coded)

4- Earth screw (M4)

5- Status LEDs

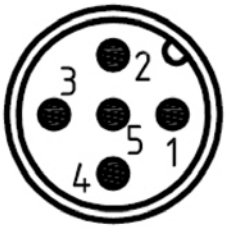
6- Valve status LEDs

4.1 PROFINET PORT 1 & PORT 2

M12 / 4 pins / Female Connector / D-coded	
Pin No.	Function
1	Transmission Data + (TD +)
2	Receive Data + (RD +)
3	Transmission Data - (TD -)
4	Receive Data - (RD -)

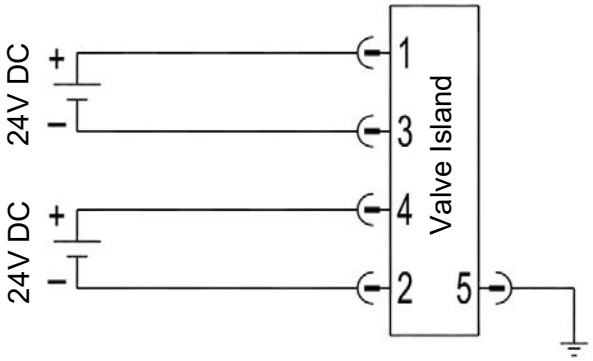
4.2 POWER SUPPLY CONNECTOR

- Pin allocating of power supply connector



M12 / 5 pins / Male Connector / A-coded	
Pin No.	Function
1	L1 (VB +) 24V electronics power supply
2	N2 (VA -) 0V valves power supply
3	N1 (VB -) 0V electronics power supply
4	L2 (VA +) 24V valves power supply
5	FE (functional earth)

- Power supply connector wiring diagram



Notes:

- Make sure electronics power, valves power and their polarities are connected to correct pins respectively before switching on.
- Select the appropriate cables to mate with the connectors mounted on the control module.
- Connect the earth screw to ground.

4.3 ELECTRICAL DATA

Specification		Remark
Valve voltage range (VA)	24VDC +10%/-5%	PELV
Electronics voltage range (VB)	24VDC +/-10%	PELV
Maximum currents	VA: n × 40 mA VB: < 100 mA	n = number of solenoids
Voltages are galvanic decoupled	Yes	---
Protection against polarity reversal	Yes	---
Overcurrent protection VB, VA	Irreversible	---
Output polarity	PNP	---

5 SOLENOID NUMBER, OUTPUT POINT & VALVE STATION MAPPING

5.1 MAPPING RULES FOR VALVE STATIONS ≤ 12

- If valve stations ≤ 12, 2 solenoid numbers are always reserved for each valve station. *

Detailed allocation is shown as below:

Station	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12
Solenoid A (14 Solenoid)	Sol.01	Sol.03	Sol.05	Sol.07	Sol.09	Sol.11	Sol.13	Sol.15	Sol.17	Sol.19	Sol.21	Sol.23
	Output 0	Output 2	Output 4	Output 6	Output 8	Output 10	Output 12	Output 14	Output 16	Output 18	Output 20	Output 22
Solenoid B (12 Solenoid)	Sol.02	Sol.04	Sol.06	Sol.08	Sol.10	Sol.12	Sol.14	Sol.16	Sol.18	Sol.20	Sol.22	Sol.24
	Output 1	Output 3	Output 5	Output 7	Output 9	Output 11	Output 13	Output 15	Output 17	Output 19	Output 21	Output 23

Notes:
*** For valve station with single solenoid, only Solenoid A (14 Solenoid) is connected. Consider the one which is closest to control module as 1st station (Station #1)**

5.2 MAPPING RULES FOR 12 < VALVE STATIONS ≤ 24

- If 12 < valve stations ≤ 24, special rules are required since only 1 solenoid number is allocated to valve station with single solenoid:
  - Sequence all solenoids following the rules below by starting from 1st station which is the station closest to control module:
    - If 1st station is with double solenoids, sequence solenoid A as Sol.01, solenoid B as Sol.02, following 2nd station solenoid A as Sol.03, solenoid B as Sol.04……
    - If 1st station is with single solenoid, sequence solenoid A as Sol.01, following 2nd station solenoid A as Sol.02, solenoid B as Sol.03……
    - If a station is originally configured as blank, always 2 solenoid numbers are allocated.
    - The rest of stations should also adhere to the sequence rules above.
  - A 16-station 24 solenoids valve island example is shown below:

	Double Solenoids	Double Solenoids	Single Solenoid	Single Solenoid	Double Solenoids	Double Solenoids	Single Solenoid	Double Solenoids	Single Solenoid	Double Solenoids	Single Solenoid	Double Solenoids	Single Solenoid	Single Solenoid	Double Solenoids	Single Solenoid
Station	**#1**	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**#12**	**#13**	**#14**	**#15**	**#16**
Solenoid A (14 Solenoid)	Sol.01	Sol.03	Sol.05	Sol.06	Sol.07	Sol.09	Sol.11	Sol.12	Sol.14	Sol.15	Sol.17	Sol.18	Sol.20	Sol.21	Sol.22	Sol.24
	Output 0	Output 2	Output 4	Output 5	Output 6	Output 8	Output 10	Output 11	Output 13	Output 14	Output 16	Output 17	Output 19	Output 20	Output 21	Output 23
Solenoid B (12 Solenoid)	Sol.02	Sol.04	--*	--*	Sol.08	Sol.10	--*	Sol.13	--*	Sol.16	--*	Sol.19	--*	--*	Sol.23	--*
	Output 1	Output 3			Output 7	Output 9		Output 12		Output 15		Output 18			Output 22	

Note:
*** For valve station with single solenoid, only Solenoid A (14 Solenoid) is allocated & connected. Consider the one which is closest to control module as 1st station (Station #1).**

Construction & Design is subject to change (A1743-OPM-PN / Rev.002)

6 COMMISSIONING

Notes:

1. The method of PROFINET module installation strongly depends on the configuration software. Please refer to the configuration software manual, all examples in this document are made with Siemens PLC S7-1512C-1 PN and TIA Portal V15.1.

6.1 GSDML FILE INSTALLATION

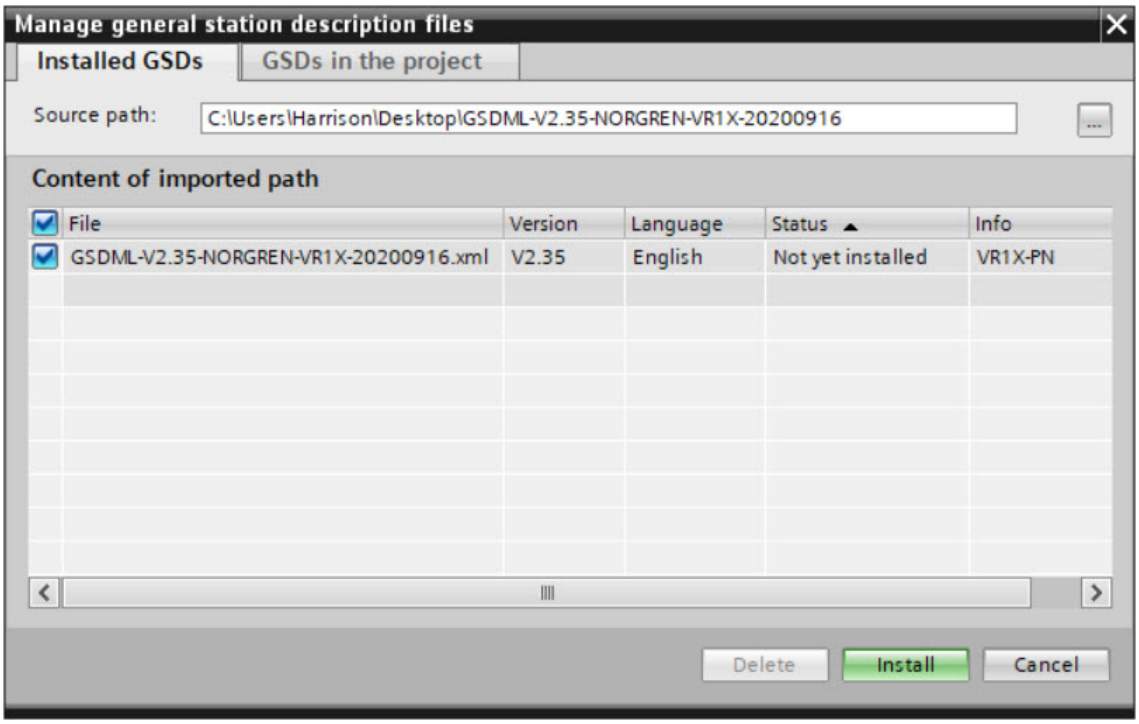
A device description file is needed for configuration of valve island. The GSDML file is an XML based file and could be used for all variants VR10 / VR15:

- "GSDML-Vxx-NORGREN-VR1X-JJJJMMDD.xml"

Note: "JJJJMMDD" (JJJJ-year, MM-month, DD-day) is date of release, "Vxx" is version number of the file.

The GSDML file must be installed inside the engineering tool of the PROFINET controller:

- Click "Options" -> "Manage general station description files (GSD)".
- Select source path where GSDML file is stored, tick the GSDML file and install.

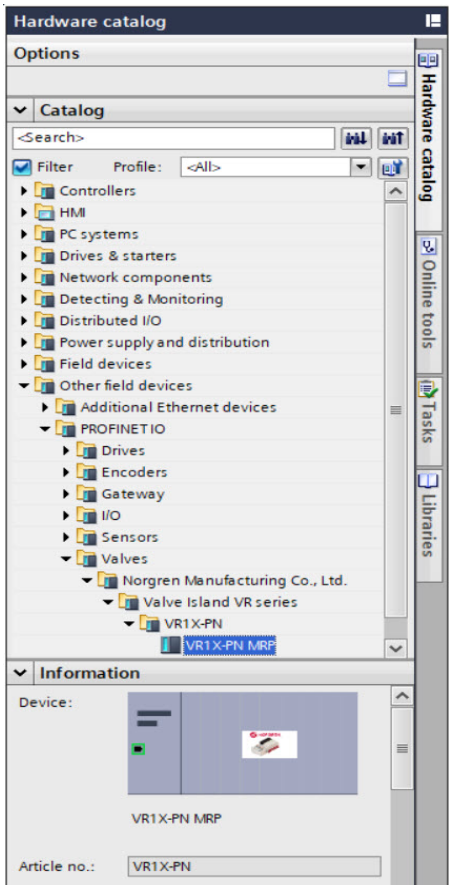


The GSDML file is provided by NORGREN and can be downloaded from the following web link:

- https://www.norgren.com/uk/en/technical-support/software

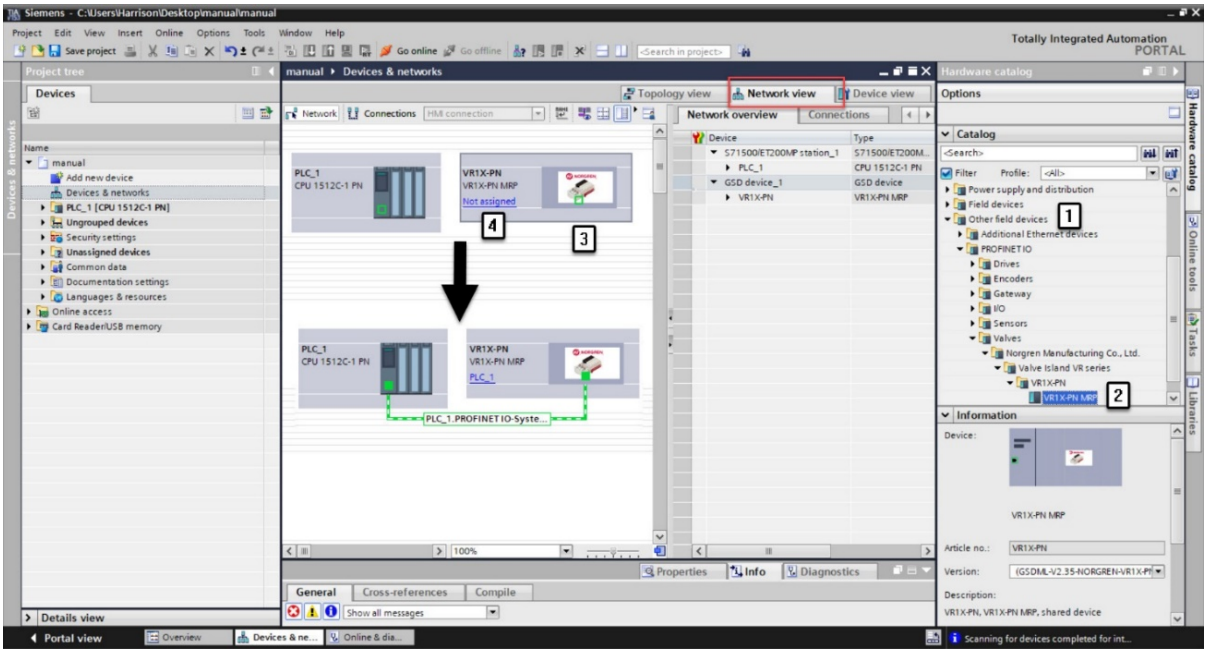
6.2 HARDWARE CONFIGURATION

After the successful installation of the GSDML file the VR10 / VR15 is listed in the hardware catalogue.

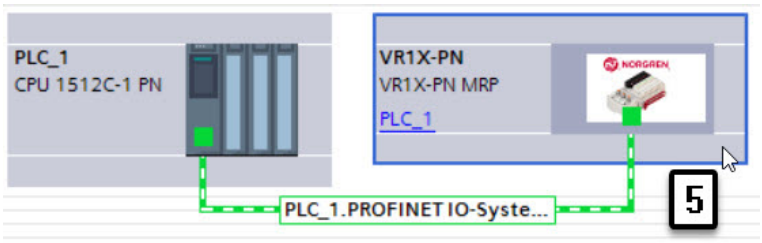


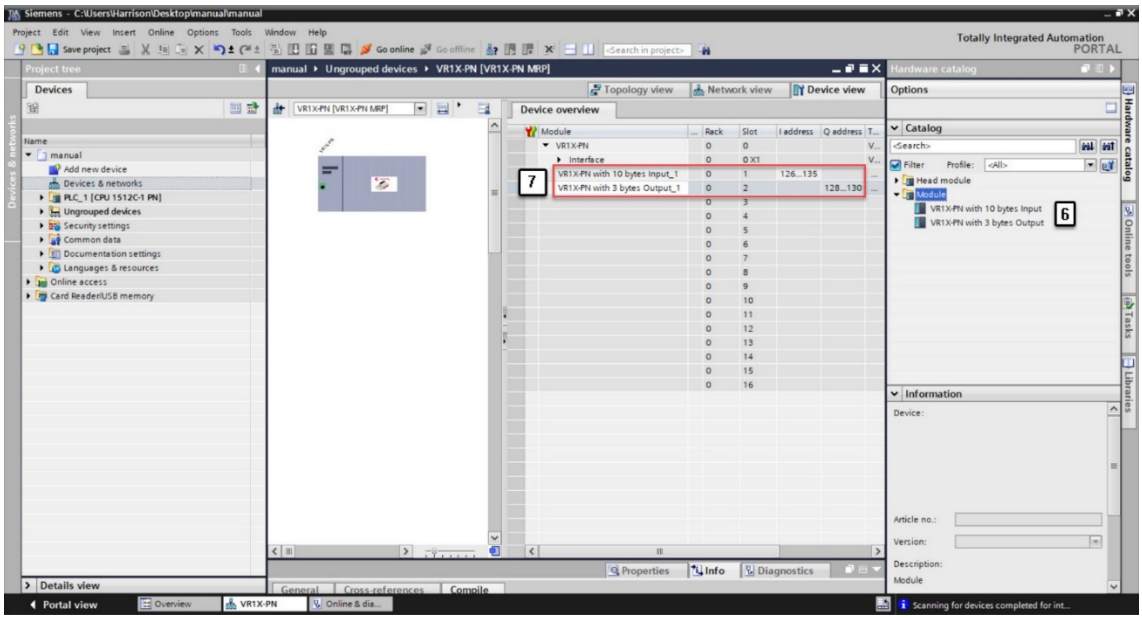
6.2.1 Add Valve Island

- Expand “Other field devices” -> “PROFINET IO” -> “Valves” -> “Norgren Manufacturing Co., Ltd.” and find “VR1X-PN MRP” listed here. (Tag 1-2)
- Double click or drag “VR1X-PN MRP” to drop it into Network view. (Tag 3)
- Assign PLC to the valve island by clicking “Not assigned” button. (Tag 4)
- The PLC controller and the valve island will be connected via green line.



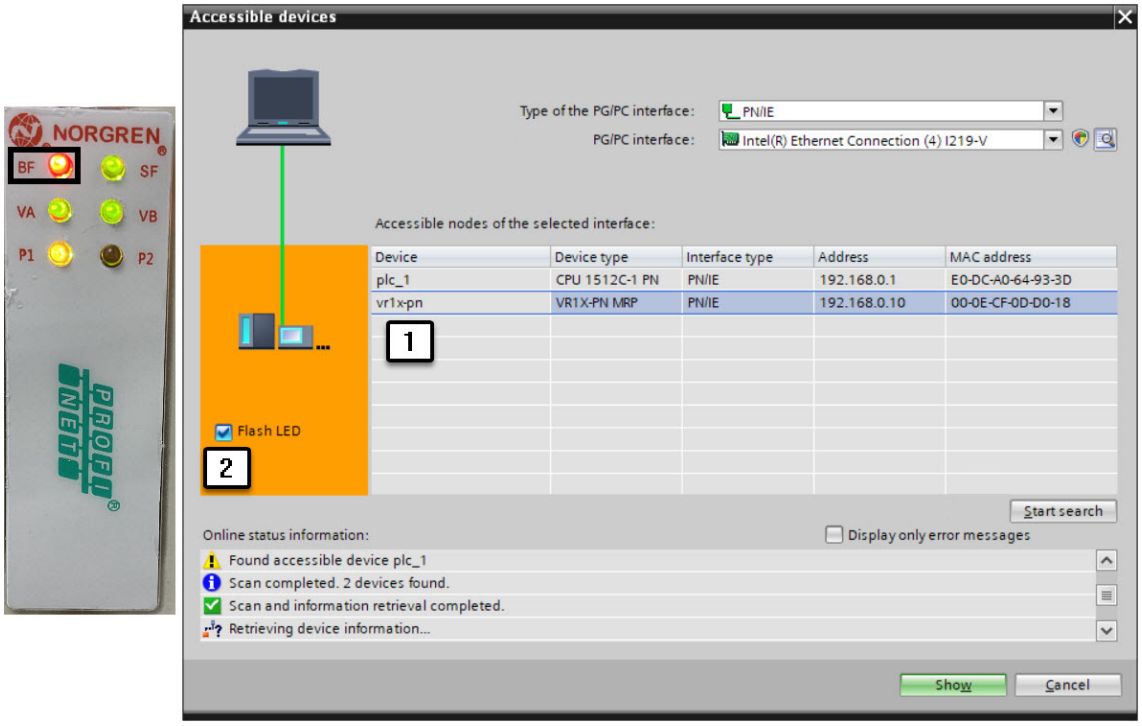
- Double click the added valve island in Network view to switch to Device view. (Tag 5)
- Expand “Module” then double click “VR1X-PN with 10 bytes Input” module and “VR1X-PN with 3 bytes Output” module in hardware catalogue. (Tag 6)
- 10 bytes Input are used for diagnostics, from input byte 0 to input byte 9.
- 3 bytes Output are allocated to 24 solenoids, from output byte 0 to output byte 2.
- In this way the valve island input & output modules are put into matched slots automatically and “I address” “Q address” are automatically allocated. (Tag 7)





6.2.2 Identifying Valve Islands in Network

- Blink Test
  - Blinking BF LED can help to identify valve islands in the network.
  - Select the valve island you want to identify then tick “Flash LED” in the left pane. (Tag 2)
  - BF LED will be blinking slowly, and this identifies the valve island.
  - Repeat the steps to identify other valve islands.

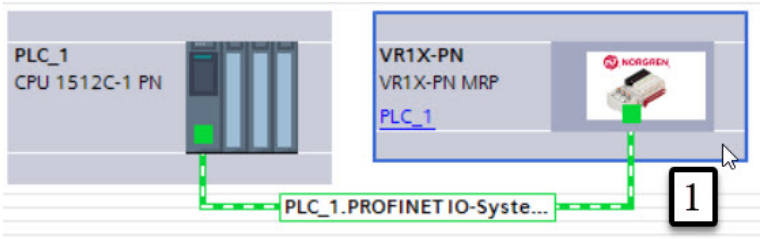


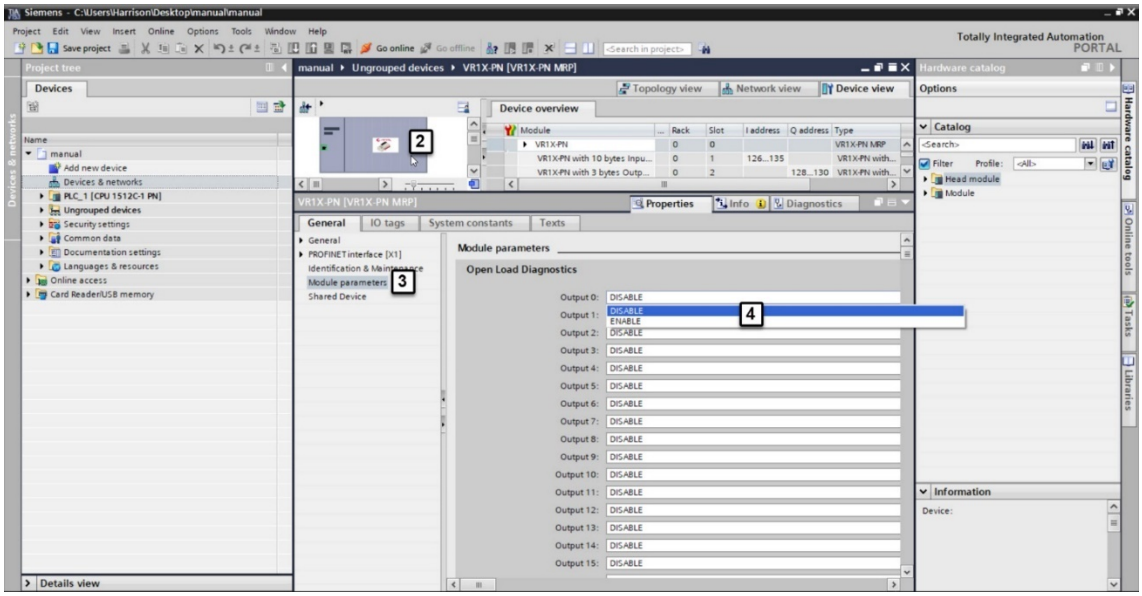
6.3 PARAMETERIZATION

6.3.1 Open Load Diagnostics Setting

It is possible for VR10 / VR15 valve island to enable / disable the open load diagnostics for each solenoid. If disabled, no PROFINET open load diagnostic error appears. Otherwise a PROFINET channel diagnostic with error description and channel number appears and SF LED on the valve island changes colour from green to red colour.

- Double click the added valve island in Network view to switch to Device view. (Tag 1)
- Double click the added valve island in Device view. (Tag 2)
- Select “Module parameters” option in General tag. (Tag 3)
- Select “DISABLE / ENABLE” options for each solenoid to set open load diagnostics function. (Tag 4)
- Solenoid number and output point mapping relation is shown in Chapter 5.





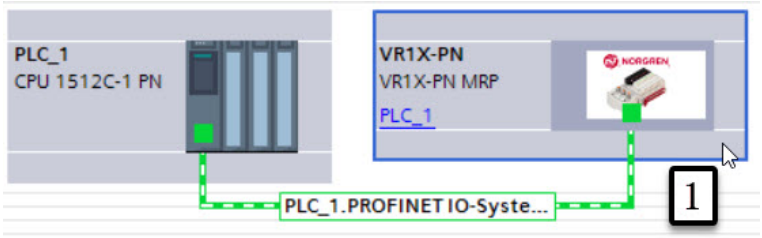
6.3.2 Fail Safe State Setting

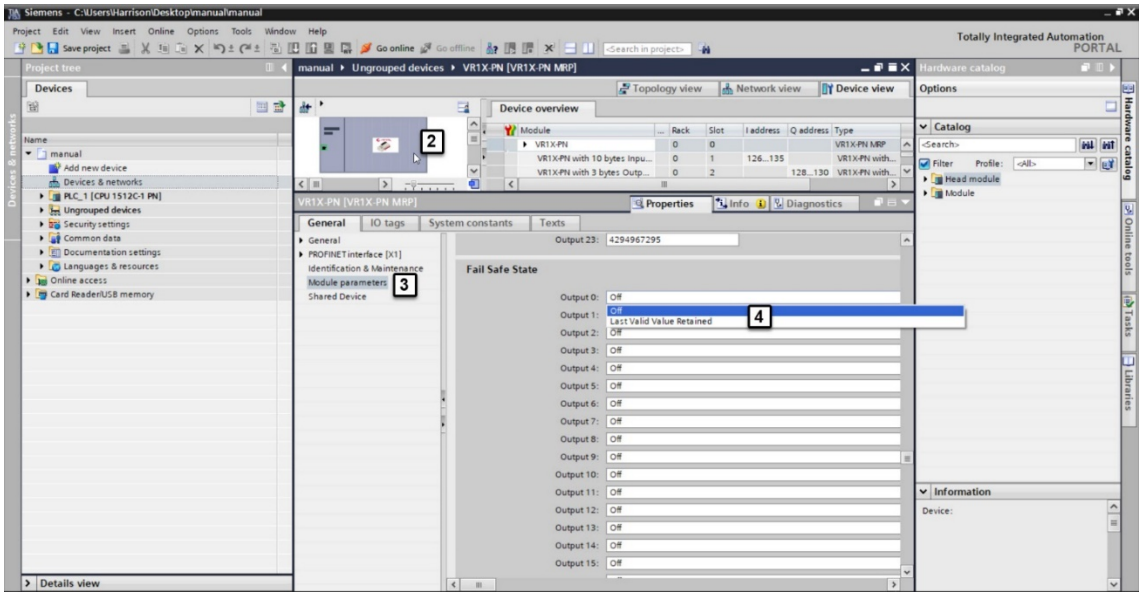
It is possible to define the behaviour of the outputs in case of broken PROFINET communication or “IOPS = Bad” (PLC stopped). The following two states could be defined by the outputs:

1) Output — Off

2) Output — Last Valid Value Retained

- Double click the added valve island in Network view to switch to Device view. (Tag 1)
- Double click the added valve island in Device view. (Tag 2)
- Select “Module parameters” option in General tag. (Tag 3)
- Select “Off / Last Valid Value Retained” options for each solenoid to set fail safe state. (Tag 4)
- Solenoid number and output point mapping relation is shown in Chapter 5.





6.3.3 Voltage and Short Circuit Diagnostics

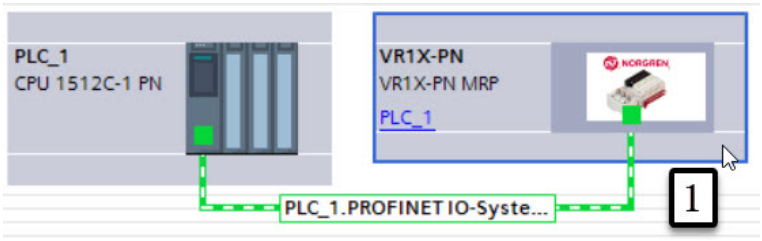
VR10 / VR15 valve island supports voltage diagnostics for both electronic power and valve power and short circuit diagnostics for each solenoid. These two diagnostic functions cannot be disabled.

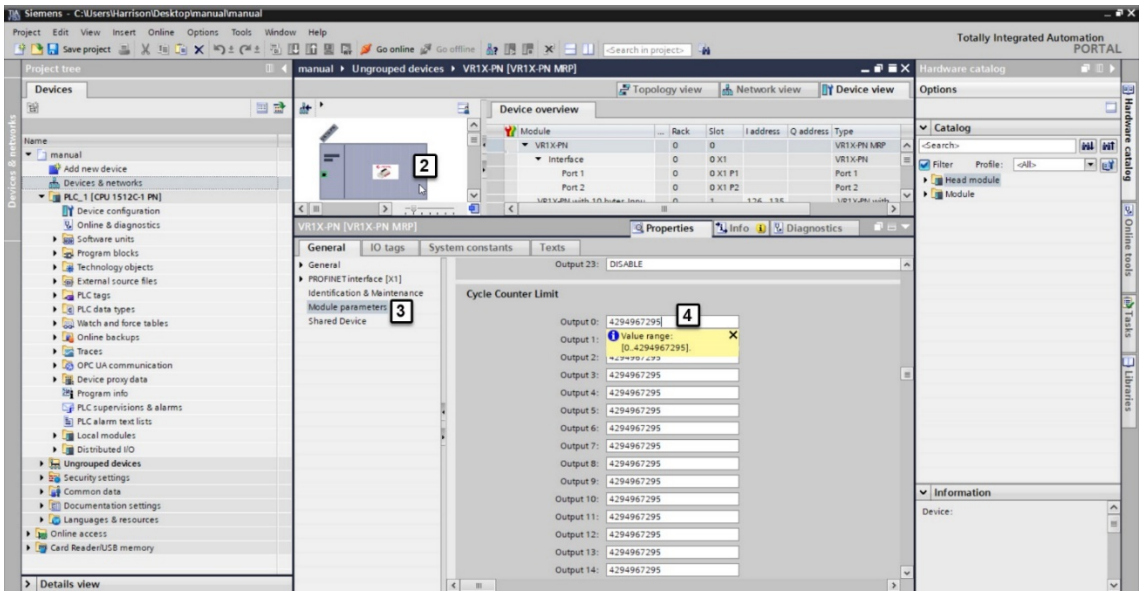
- In case of over / under voltage a PROFINET module diagnostic with error description appears and the related LEDs on the valve island change colour from green to red.
- In case of short circuit a PROFINET channel diagnostic with error description and channel number appears and SF LED on the valve island changes colour from green to red.

6.3.4 Cycle Counter Setting

VR10 / VR15 valve island supports cycle counting, count limit set, and counter reset for each solenoid. Cycle counting and counter reset can be achieved by programming.

- Count limit set
  - Double click the added valve island in Network view to switch to Device view. (Tag 1)
  - Double click the added valve island in Device view. (Tag 2)
  - Select “Module parameters” option in General tag. (Tag 3)
  - Input the cycle counter limit in decimal for each solenoid. (Tag 4)
  - The maximum limit value is 2^{32}-1.
  - Solenoid number and output point mapping relation is shown in Chapter 5.





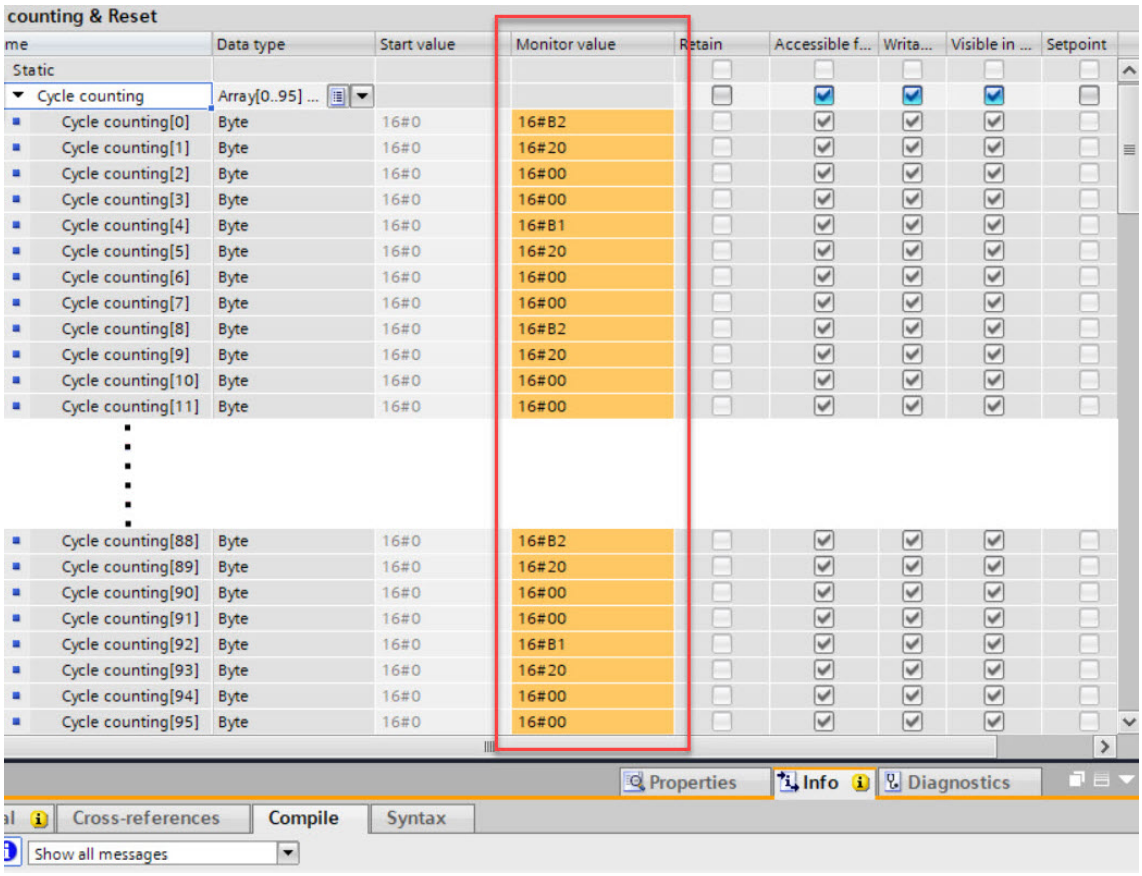
6.4 GO ONLINE AND MONITOR DATA

6.4.1 Compiling and Download

After finished configuration, compile the project, and download it to PROFINET controller (PLC).

6.4.2 Cycle Counting Data Acquisition

- Monitor the “96-byte data array”, the cycle counting data will be displayed after each byte in “Monitor value” column.



- Always 4 adjacent bytes are allocated to each solenoid, 96 bytes will assign to 24 solenoids, from Sol.01 to Sol.24.

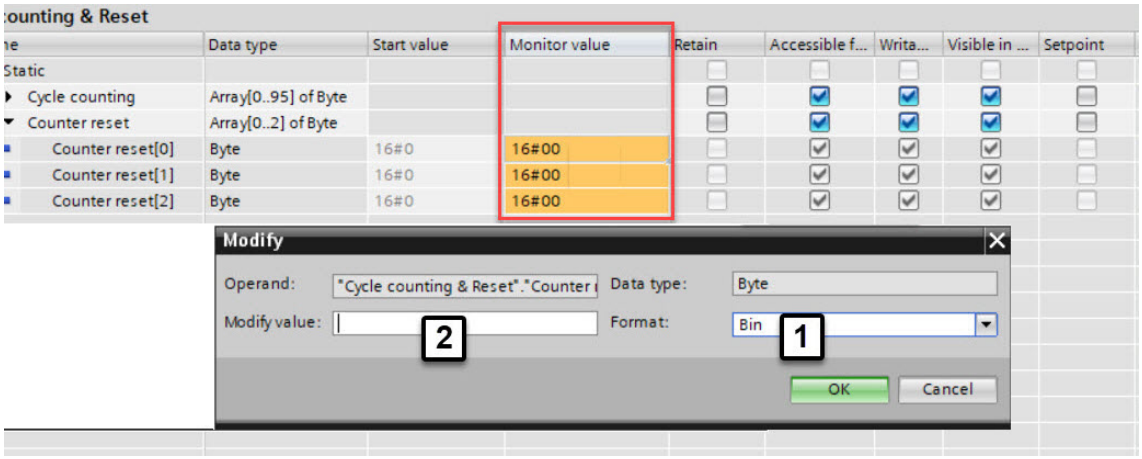
Detailed allocation is shown as below:

Solenoid	Sol.01	Sol.03	Sol.05	……	Sol.19	Sol.21	Sol.23
Cycle counting [Byte]	Cycle counting [0] ~~~ Cycle counting [3]	Cycle counting [8] ~~~ Cycle counting [11]	Cycle counting [16] ~~~ Cycle counting [19]	……	Cycle counting [72] ~~~ Cycle counting [75]	Cycle counting [80] ~~~ Cycle counting [83]	Cycle counting [88] ~~~ Cycle counting [91]
Solenoid	**Sol.02**	**Sol.04**	**Sol.06**	**……**	**Sol.20**	**Sol.22**	**Sol.24**
Cycle counting [Byte]	Cycle counting [4] ~~~ Cycle counting [7]	Cycle counting [12] ~~~ Cycle counting [15]	Cycle counting [20] ~~~ Cycle counting [23]	……	Cycle counting [76] ~~~ Cycle counting [79]	Cycle counting [84] ~~~ Cycle counting [87]	Cycle counting [92] ~~~ Cycle counting [95]

- The cycle counting value will be acquired after simple calculation on 4 bytes of each solenoid.
  - Calculation formula:
    Cycle counting value = Cycle counting [**a**] + Cycle counting [**b**]$\times 2^{8}$ + Cycle counting [**g**]$\times 2^{16}$ + Cycle counting [**l**]$\times 2^{24}$
    (**a** < **b** < **g** < **l**)
- The cycle counting data storage mode is little-endian.
- Little-endian means that the least significant byte is stored at the lowest memory address and the most significant byte is stored at the highest memory address.

6.4.3 Cycle Counter Resetting

- Each counter reset byte addresses the cycle counters for 8 solenoids, with each bit referring to a solenoid as shown in the tables below.
- Writing a 0 to the bit will reset the associated solenoid counter. Writing a 1 to a bit will leave the counter unchanged.
- For example, to reset the cycle counter for solenoid 3 only, write a 0 to bit 2 of counter reset byte[0]. This value in binary is 2#11111011. Converted to decimal this is 251.
- Input specific binary value in “Modify value” for the “3-byte data array”. (Tag 1)
- Be careful to input the correct binary values for each solenoid & each byte before executing following reset step, otherwise the cycle counting data will be erased improperly. (Tag 2)



- Binary code and solenoid number mapping relation is shown in table below.

Counter reset [0] Byte								
Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary code	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Counter reset [1] Byte								
Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary code	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

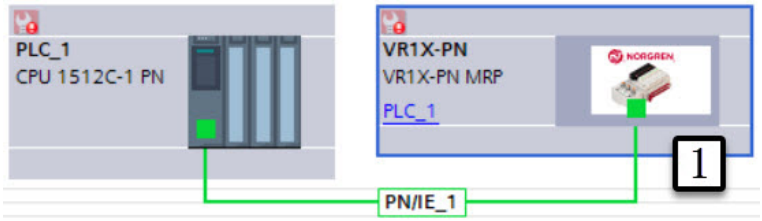
Counter reset [2] Byte								
Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17

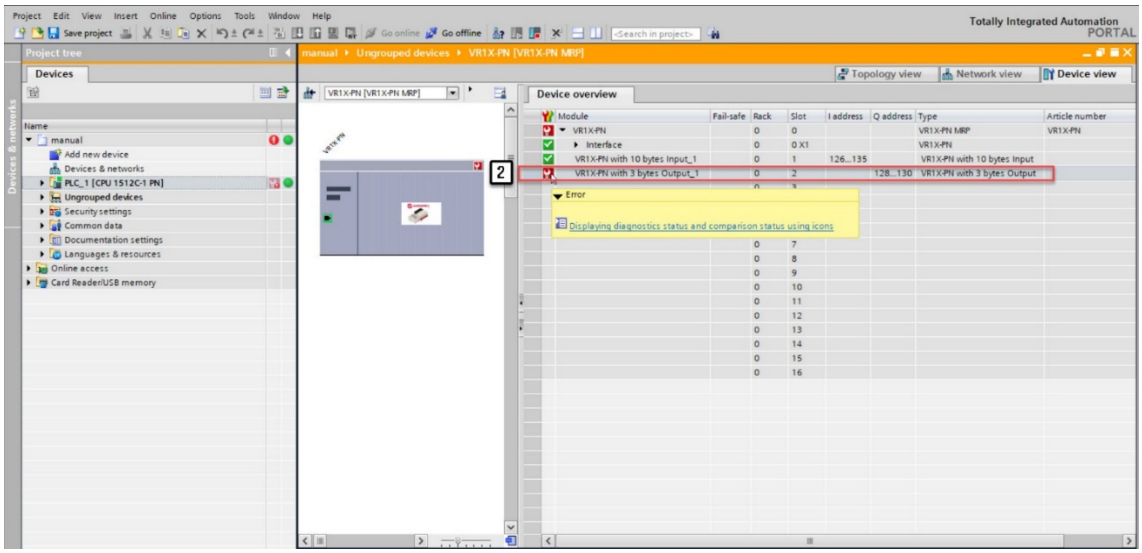
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary code	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

7 DIAGNOSTICS

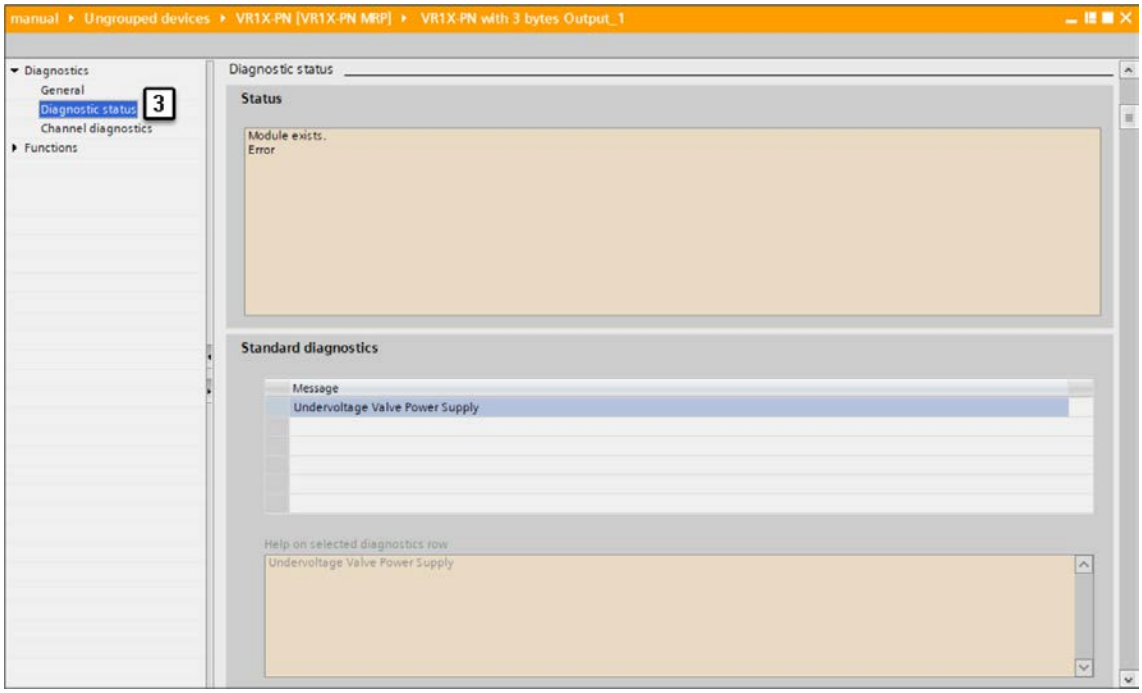
7.1 DIAGNOSTICS INFORMATION PORTAL

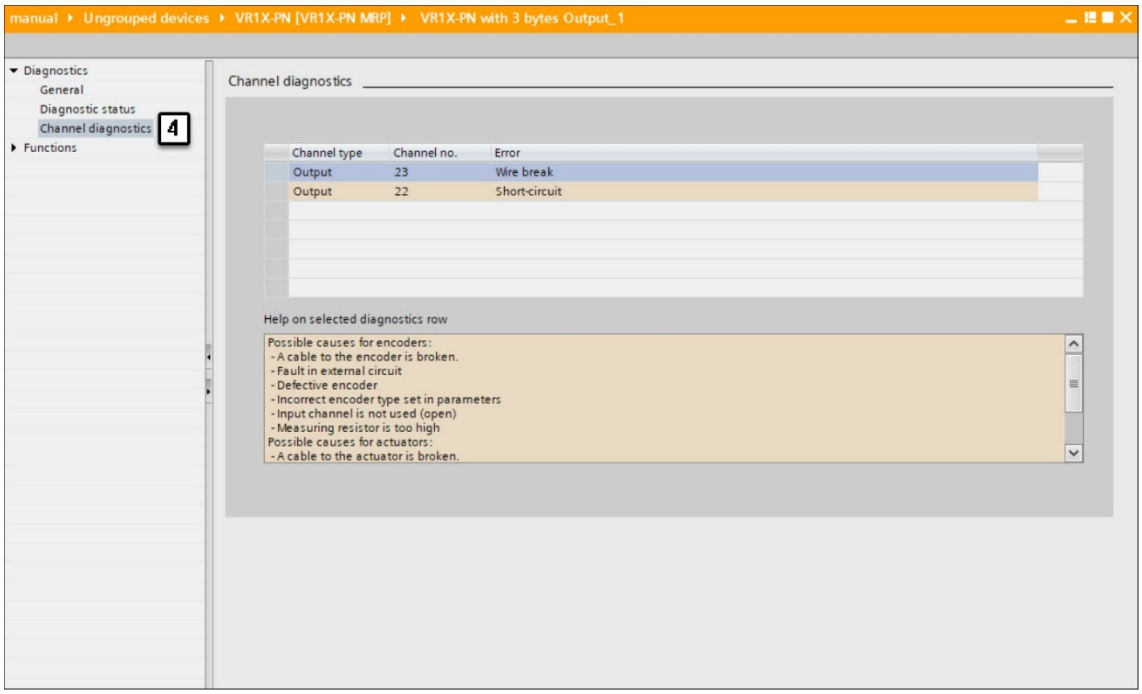
- Click “Go online” button to make PLC, valve island and PC online.
- When error alarm symbol appears, double click the indicated valve island in Network view to switch to Device view. (Tag 1)
- Double click alarm symbol in front of valve island output module to open the diagnostics window. (Tag 2)





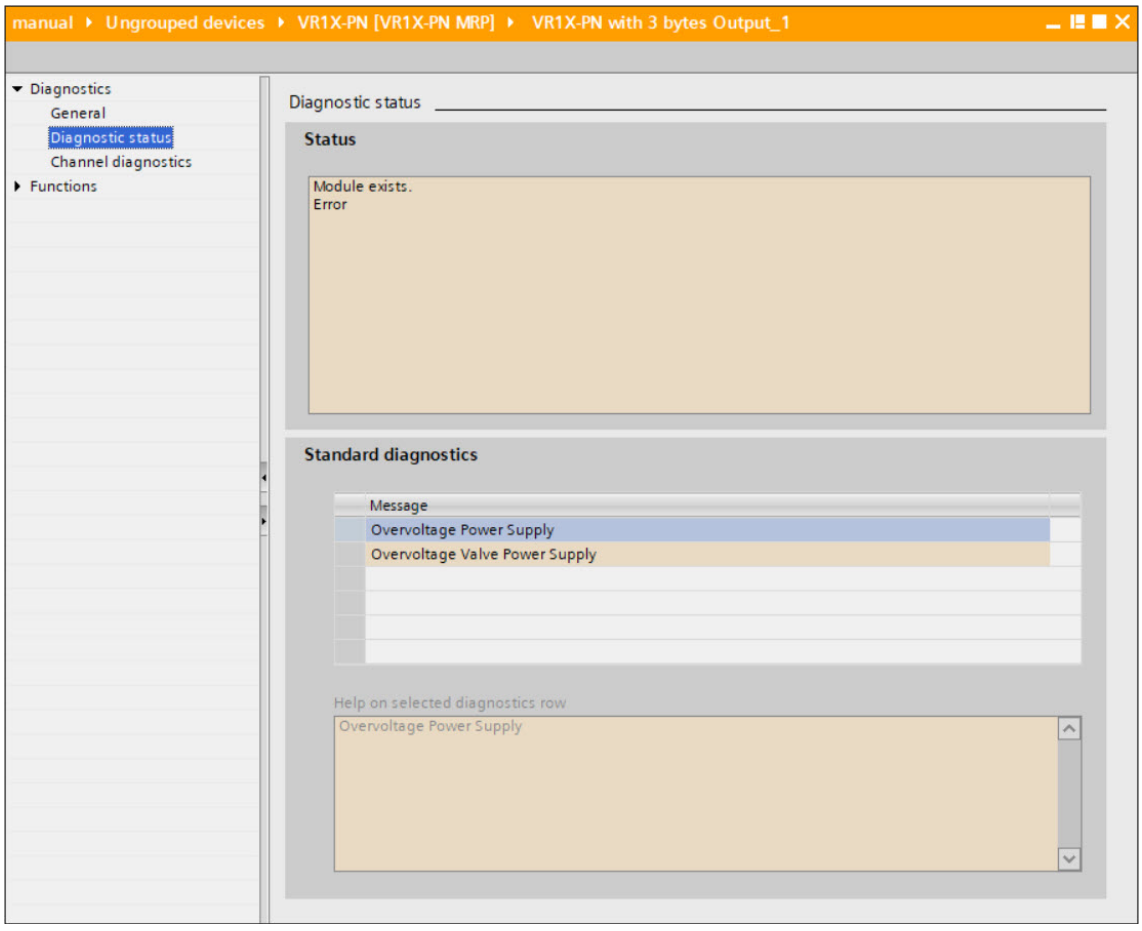
- Click “Diagnostic status” in diagnostics window to find the valve island module error details. (Tag 3)
- Click “Channel diagnostics” in diagnostics window to find each solenoid error details. (Tag 4)





7.2 OVERALL STATUS DIAGNOSTICS

- VR10 / VR15 valve island module status will be shown in real-time.
- The diagnostic module status includes:
  - Over voltage diagnostics for valve power
  - Under voltage diagnostics for valve power
  - Over voltage diagnostics for electronic power
  - Under voltage diagnostics for electronic power
  - Cycle overrun diagnostics (cycles beyond the count limit)
  - Short circuit diagnostics
  - Open load diagnostics (e.g. wire break of solenoid)
- For over / under voltage fault, TIA Portal module diagnostic status will display the error description as shown below:



- Fault error codes will be reported by "**Input Byte 0**".
- Fault error codes are displayed in hexadecimal.
- Common fault error codes are shown below:

Fault type	Error code	Associated LED & Remark	
Over voltage diagnostics for valve power *Abbreviation: OV-VA*	16#01	"VA" LED, red	
Under voltage diagnostics for valve power *Abbreviation: UV-VA*	16#02	"VA" LED, flashing red	
Over voltage diagnostics for electronic power *Abbreviation: OV-VB*	16#04	"VB" LED, red	
Under voltage diagnostics for electronic power *Abbreviation: UV-VB*	16#08	"VB" LED, flashing red	
Cycle overrun diagnostics *Abbreviation: COR*	16#10	---	Count cycles are beyond count limit
Short circuit diagnostics *Abbreviation: SC*	16#20	"SF" LED, flashing red	
Open load diagnostics *Abbreviation: OC*	16#40	"SF" LED, flashing red	 Need to enable open load diagnostics

- Binary code and fault type mapping relation is shown in table below. 0 is no fault, 1 is fault found.

Input Byte 0								
Fault type		OC	SC	COR	UV-VB	OV-VB	UV-VA	OV-VA
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary code	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

7.3 CHANNEL DIAGNOSTICS

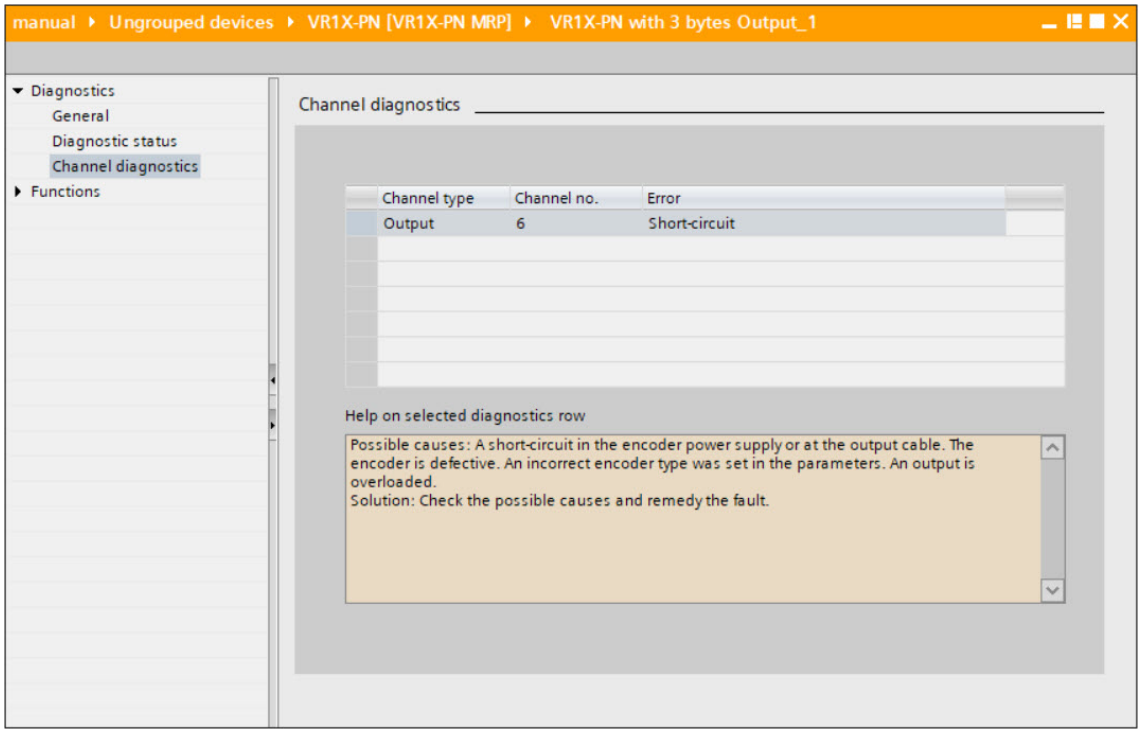
- VR10 / VR15 valve island channel status will be shown in real-time in input bytes 1-9.
- The diagnostic channel status includes:
  - Short circuit diagnostics per solenoid
  - Open load diagnostics per solenoid (e.g. wire break of solenoid)
  - Cycle overrun diagnostics per solenoid (cycles beyond the count limit)

Detailed allocation between channel and solenoid is shown below:

Solenoid	Sol.01	Sol.03	Sol.05	Sol.07	Sol.09	Sol.11	Sol.13	Sol.15	Sol.17	Sol.19	Sol.21	Sol.23
Channel	0	2	4	6	8	10	12	14	16	18	20	22
Solenoid	Sol.02	Sol.04	Sol.06	Sol.08	Sol.10	Sol.12	Sol.14	Sol.16	Sol.18	Sol.20	Sol.22	Sol.24
Channel	1	3	5	7	9	11	13	15	17	19	21	23

7.3.1 Short Circuit Diagnostics

- TIA Portal channel diagnostics will report a short circuit as shown below:



- Short circuit fault error codes will be reported by "**Input Byte 1**", "**Input Byte 2**" and "**Input Byte 3**".
- Fault error codes are displayed in hexadecimal.
- Common short circuit fault error codes are shown in table:

Byte	Solenoid	Error code
Input Byte 1	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
Input Byte 2	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
	Sol.12	16#08
	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
Input Byte 3	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
	Sol.20	16#08
	Sol.21	16#10
	Sol.22	16#20
	Sol.23	16#40
	Sol.24	16#80

- Binary value and solenoid number mapping relationship is shown in the table below. 0 is no fault, 1 is fault found.

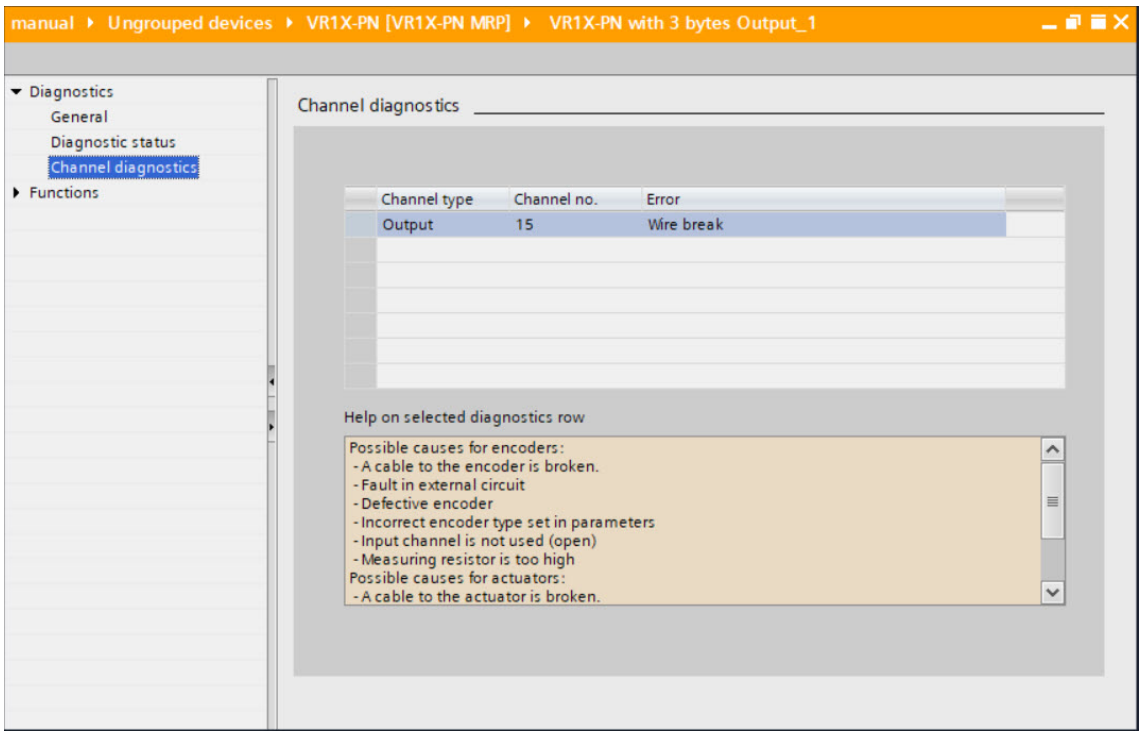
Input Byte 1								
Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 2								
Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 3								
Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

7.3.2 Open Load Diagnostics

- TIA Portal channel diagnostics will report an open load as shown below:



- Open load fault error codes will be reported by “**Input Byte 4**”, “**Input Byte 5**” and “**Input Byte 6**”.
- Fault error codes are displayed in hexadecimal.
- Need to enable open load diagnostics.
- Common open load fault error codes are shown in the table:

Byte	Solenoid	Error code
Input Byte 4	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
Input Byte 5	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
	Sol.12	16#08
	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
Input Byte 6	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
	Sol.20	16#08
	Sol.21	16#10
	Sol.22	16#20
	Sol.23	16#40
	Sol.24	16#80

- Binary value and solenoid number mapping relationship is shown in the table below. 0 is no fault, 1 is fault found.

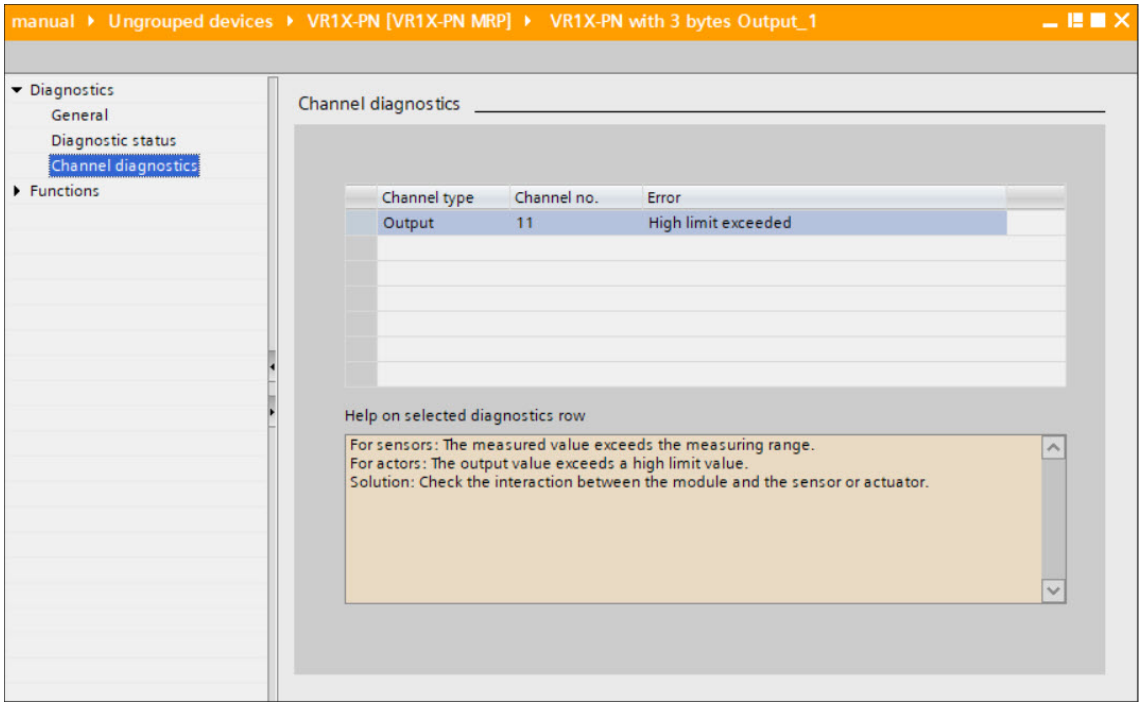
Input Byte 4								
Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 5								
Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 6								
Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

7.3.3 Cycle Overrun Diagnostics

- TIA Portal channel diagnostics will report cycle overruns as shown below:



- Cycle overrun fault error codes will be reported by “**Input Byte 7**”, “**Input Byte 8**” and “**Input Byte 9**”.
- Fault error codes are displayed in hexadecimal.
- Need to set valid count limit so that this diagnostic function is effective.
- Common cycle overrun fault error codes are shown in table:

Byte	Solenoid	Error code
Input Byte 7	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
Input Byte 8	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
	Sol.12	16#08
	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
Input Byte 9	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
	Sol.20	16#08
	Sol.21	16#10
	Sol.22	16#20
	Sol.23	16#40
	Sol.24	16#80

- Binary value and solenoid number mapping relationship is shown in the table below. 0 is no fault, 1 is fault found.

Input Byte 7								
Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 8								
Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

Input Byte 9								
Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Binary value	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1	0 / 1

8 DIAGNOSTICS & OUTPUTS MAPPING OBJECT

- Programming languages comply with IEC 61131-3:2013.

Overall status diagnostics	**Input Byte 0**								
	Fault type		OC	SC	COR	UV-VB	OV-VB	UV-VA	OV-VA
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Short circuit diagnostics	**Input Byte 1**								
	Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 2								
	Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 3								
	Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Open load diagnostics	**Input Byte 4**								
	Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 5								
	Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 6								
	Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Cycle overrun diagnostics	**Input Byte 7**								
	Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 8								
	Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Input Byte 9								
	Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Output Byte 0								
Solenoid	Sol.08	Sol.07	Sol.06	Sol.05	Sol.04	Sol.03	Sol.02	Sol.01
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output Byte 1								
Solenoid	Sol.16	Sol.15	Sol.14	Sol.13	Sol.12	Sol.11	Sol.10	Sol.09
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output Byte 2								
Solenoid	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17
Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

9 LED STATUS DESCRIPTION

Symbol	LED Status	Description
BF	Off	PROFINET Software is not initialized
	Red on	Device is offline
	Flashing red	Hardware configuration and parameterization is not plausible
	Triple flashing red	IOPS = BAD (PLC stopped)
	Green on	No error
SF	Off	Device is not initialized
	Red on	Hardware confirmation is not plausible
	Flashing red	Short circuit fault or open load fault
	Double flashing red	Error, internal communication
	Triple flashing red	Fatal error
	Green on	No error
P1	Off	Link connection not established
	Flashing green / yellow	Link connection established
	Yellow / green on	Link communication active
P2	Off	Link connection not established
	Flashing green / yellow	Link connection established
	Yellow / green on	Link communication active
VA **(Valve Power Supply)**	Green on	Voltage OK
	Flashing red	Undervoltage
	Red	Overvoltage
VB **(Electronics Power Supply)**	Green on	Voltage OK
	Flashing red	Undervoltage
	Red	Overvoltage

10 PROFINET ERROR CODES

Error code (Hexadecimal)	Error description	Associated LED
0×00	OK, no errors	“SF” LED, green
0×01	Solenoid, short circuit	“SF” LED, quickly flashing red
0×06	Solenoid, open circuit	“SF” LED, slowly flashing red
0×07	Solenoid, cycle overrun	None
0×100	Undervoltage VB electronic supply	“VB” LED, flashing red
0×101	Overvoltage VB electronic supply	“VB” LED, red
0×102	Undervoltage VA valve supply	“VA” LED, flashing red
0×103	Overvoltage VA valve supply	“VA” LED, red

11 TECHNICAL DATA PROFINET INTERFACE

Specification		Remark
Number of ports	2	---
Transfer speed	100Mbit/s	---
Duplex mode	Full Duplex	---
RT mode	Supported	Real Time Protocol
IRT mode	Supported	Isochronous Real Time Protocol
MRP mode	Supported	Media Redundancy Protocol (Possible to switch between redundant transmission paths)
PROFINET (Certification by PI Association)	Version 2.3, conformance Class CC-C Compliant to IEC61158, conformance Class C according to IEC61784	---
Addressing mode	DCP, LLDP + SNMP (Device exchange by the same topology)	---
GSDML Language	EN	---

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