





#### Before starting work read these instructions.

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## 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		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

C	CON	FENTS	
А	BOL	JT THIS DOCUMENTATION	5
I	MPO	RTANT HINTS	6
3.1	G	ROUNDING AND EQUIPOTENTIAL BONDING	6
E			
4.1	Ρ	ROFINET PORT 1 & PORT 2	8
4.2	P	OWER SUPPLY CONNECTOR	8
4.3	E	ECTRICAL DATA	9
S	OLEI	NOID NUMBER, OUTPUT POINT & VALVE STATION MAPPING	10
5.1	Μ	APPING RULES FOR VALVE STATIONS $\leq$ 12	10
5.2	М	APPING RULES FOR 12 < VALVE STATIONS $\leq$ 24	10
C	COM	MISSIONING	11
6.1	G	SDML FILE INSTALLATION	11
6.2	H	ARDWARE CONFIGURATION	12
6	5.2.1	Add Valve Island	13
6	5.2.2	Identifying Valve Islands in Network	15
6.3	P	ARAMETERIZATION	16
6	5.3.1	Open Load Diagnostics Setting	
6	5.3.2	Fail Safe State Setting	17
6	5.3.3	Voltage and Short Circuit Diagnostics	18
6	5.3.4	Cycle Counter Setting	19
6.4	G	O ONLINE AND MONITOR DATA	20
6	6.4.1	Compiling and Download	20
6	6.4.2	Cycle Counting Data Acquisition	20
6	6.4.3	Cycle Counter Resetting	22
С	DIAG	NOSTICS	
7.1	D	AGNOSTICS INFORMATION PORTAL	
7.2	0	VERALL STATUS DIAGNOSTICS	
7.3	С	HANNEL DIAGNOSTICS	
7	.3.1	Short Circuit Diagnostics	29
	A III 3.1 4.2 4.3 5.1 5.2 6.1 6.2 6 6.3 6 6 6.4 6 6 6 6 6 6 6 6 6 6 7.1 7.2 7.3	ABOU IMPO 3.1 G ELEC 4.1 PF 4.2 PC 4.3 EL SOLEN 5.1 M 5.2 M 6.2 H 6.2 H 6.2.1 6.2.2 6.3 P 6.2.1 6.2.2 6.3 P 6.3.1 6.3.2 6.3.3 6.3.4 6.4.3 0IAG 7.1 D 7.2 O	ELECTRICAL FEATURES         4.1       PROFINET PORT 1 & PORT 2         4.2       POWER SUPPLY CONNECTOR         4.3       ELECTRICAL DATA         SOLENOID NUMBER, OUTPUT POINT & VALVE STATION MAPPING         5.1       MAPPING RULES FOR VALVE STATIONS ≤ 12         5.2       MAPPING RULES FOR 12 < VALVE STATIONS ≤ 24





	7.3.2	Open Load Diagnostics	. 32
	7.3.3	Cycle Overrun Diagnostics	. 35
8	DIAGN	OSTICS & OUTPUTS MAPPING OBJECT	. 38
9	LED S	TATUS DESCRIPTION	. 40
10	PROFI	NET ERROR CODES	. 41
11	TECHN	NICAL DATA PROFINET INTERFACE	. 42
12	CUSTO	DMER SUPPORT	. 43





## **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 <a href="https://www.norgren.com/uk/en/technical-support/installation-maintenance-instructions/valves">https://www.norgren.com/uk/en/technical-support/installation-maintenance-instructions/valves</a>

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"
  - <u>https://www.profibus.com/download/profinet-installation-guidelines/</u>

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

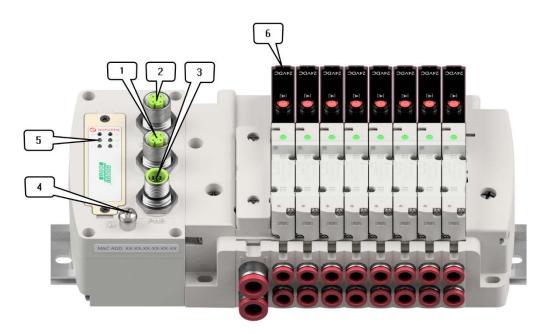
Proper grounding and equipotential bonding are very important to protect against electromagnetic interferences in PROFINET networks. In order to reduce potential impact, grounding of the PROFINET cable screen should be done at both ends of every cable (i.e. at each device). Equipotential bonding ensures 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



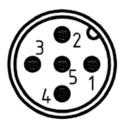


### 4.1 PROFINET PORT 1 & PORT 2

	M12 / 4 pins /	/ Female Connector / D-coded
$CO^2$	Pin No.	Function
പ്പ	1	Transmission Data + (TD +)
U Q	2	Receive Data + (RD +)
×40 <i>៕</i>	3	Transmission Data - (TD -)
	4	Receive Data - (RD -)

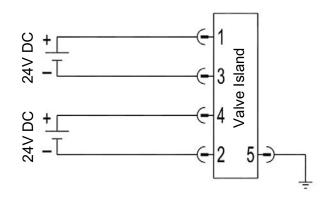
## 4.2 POWER SUPPLY CONNECTOR

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 $\leq$ 12

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

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

Detailed allocation is shown as below:

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 $\leq$ 24

- If 12 < valve stations ≤ 24, special rules are required since only 1 solenoid number is allocated to valve station with single solenoid:</p>
  - 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	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
(14 Solenoid)	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	Sol.02	Sol.04			Sol.08	Sol.10		Sol.13		Sol.16		Sol.19			Sol.23	
(12 Solenoid)	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).





## 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:

<u>"GSDML-Vxx-NORGREN-VR1X-JJJJMMDD.xml"</u>

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.

_	nage general station description files Installed GSDs GSDs in the project				×
s	ource path: C:\Users\Harrison\Desktop\GSL	ML-V2.35-1	ORGREN-VR1X-	20200916	
С	ontent of imported path				
	File	Version	Language	Status 🔺	Info
	GSDML-V2.35-NORGREN-VR1X-20200916.xml	V2.35	English	Not yet installed	VR1X-PN
<					>
			D	elete Install	Cancel

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

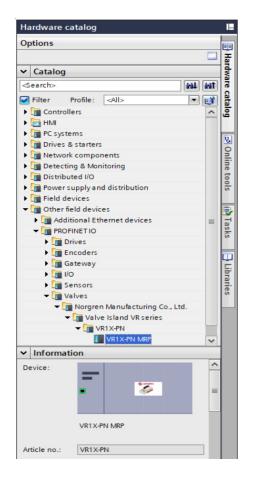
https://www.norgren.com/uk/en/technical-support/software





## 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

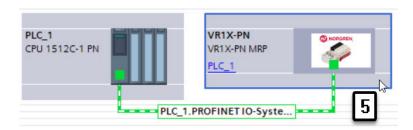
- Expand "Other field devices" -> "PROFINET IO" -> "Valves" -> "Norgren Manufacturing Co., Ltd." and find "VR1X-PN MRP" listed here. (Tag 1-2)
- Double click or drag "VR1X-PN MRP" to drop it into Network view. (Tag 3)
- Assign PLC to the valve island by clicking "Not assigned" button. (Tag 4)
- The PLC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

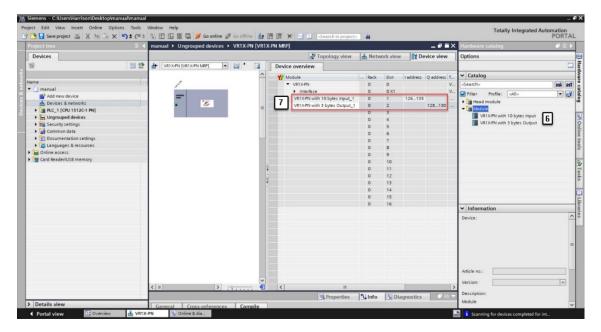
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Image: Seve project	→ U Search in project> A PORTAL
Devices	
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*	Pevice     Type     Catalog
Name     manual       P Add new device     Cultures & networks       P Add new device	
Cy Card Reader/USB memory  PLC_1  CPU 1512C-1 PN  PLC_1  PLC_1 PLC_	Information
	Pevice:
General Cross-references Compile	Contraction: Costine C
Details view	VR1X-PN_VR1X-PN_MRP, shared device
Portal view     Portal view     Deveniew     Devices & ne     Online & dia	i Scanning for devices completed for int





- 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.

			Type of the PG/PC interfa PG/PC interfa		Ethernet Connection	(4) I219-V 💌 🕐 🖸
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		vr1x-pn	VR1X-PN MRP	PN/IE	192.168.0.10	00-0E-CF-0D-D0-18
	Flash LED					Start search
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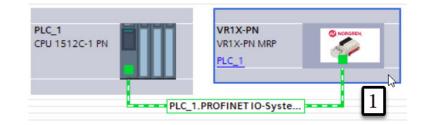


## 6.3 PARAMETERIZATION

#### 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.



Stemens - CAUSers Harrison Desktop manual in Project Edit View Insert Online Options 1			Totally Integrated Automation
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PLC_1 [CPU 1512C-1 PN]	VR1X-PN [VR1X-PN MRP]		Module
Ungrouped devices		🔨 Properties 🚺 Info 🚺 💆 Diagnostics	
Security settings	General IO tags	System constants Texts	
Gommon data	<ul> <li>General</li> </ul>	Module parameters	^
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Card Reader/USB memory	Shared Device	Output 0: DISABLE	
	shared bevice		
		ENABLE	
		Output 2: DISABLE	
		Output 3: DISABLE	
		Output 4: DISABLE	
		Output 5: DISABLE	
		Output 6: DISABLE	
		Output 7: DISABLE	
		Output 8: DISABLE	
		Output 9: DISABLE	
		Output 10: DISABLE	
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		Output 14: DISABLE	
		Output 15: DISABLE	
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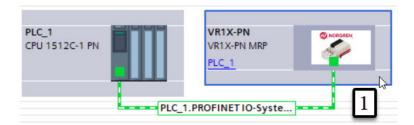




#### 6.3.2 Fail Safe State Setting

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.



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manual	D	VR1X-PN with 10 bytes Inpu 0 1 126135	VR1X-PN with Filter Profile: All>
Add new device		VR1X-PN with 3 bytes Outp 0 2 12813	VR1X-PN with V Head module
Devices & networks			> Module
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Security settings	General IO tags	system constants Texts	
Common data	) General	Output 23: 4294967295	
Documentation settings	PROFINET interface [X1]		
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		Output 3: Off	
		Output 4: Off	
		Output 5: Off	
		Output 6: Off	
		Output 7: Off	
		Output 8: Off	
		Output 9: Off	
		Output 10: Off	
		Output 11: Off	✓ Information
		Output 12: Off	Device:
		Output 13: Off	
		Output 14: Off	
		Output 15: Off	





#### 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.

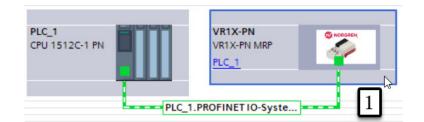


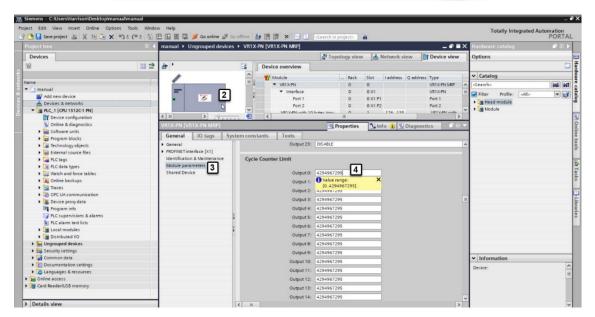


#### 6.3.4 Cycle Counter Setting

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.

me		Data type	Start value	Monitor value	Retain	Accessible f	Writa	Visible in	Setpoint	
Stat	tic									1
• (	Cycle counting	Array[095] 🔳 🔹								Π
•	Cycle counting[0]	Byte	16#0	16#B2		¥	<ul> <li>Image: A start of the start of</li></ul>	Image: A start and a start		
•	Cycle counting[1]	Byte	16#0	16#20		<ul> <li>Image: A start of the start of</li></ul>	<b>V</b>	Image: A start and a start		=
	Cycle counting[2]	Byte	16#0	16#00			<ul> <li>Image: A start of the start of</li></ul>	$\checkmark$		
•	Cycle counting[3]	Byte	16#0	16#00		<b>V</b>	<b>V</b>	$\checkmark$		
•	Cycle counting[4]	Byte	16#0	16#B1		¥	<b>V</b>	Image: A start and a start		
•	Cycle counting[5]	Byte	16#0	16#20		<b>V</b>	<b>V</b>	Image: A start of the start		
•	Cycle counting[6]	Byte	16#0	16#00			<b>V</b>	Image: A start and a start		
•	Cycle counting[7]	Byte	16#0	16#00		¥	<b>V</b>	Image: A start and a start		
	Cycle counting[8]	Byte	16#0	16#B2			<b>V</b>	Image: A start and a start		
	Cycle counting[9]	Byte	16#0	16#20		<b>V</b>	<b>V</b>	Image: A start and a start		
•	Cycle counting[10]	Byte	16#0	16#00		<b>V</b>		Image: A start and a start		
•	Cycle counting[11]	Byte	16#0	16#00		<b>V</b>	<b>V</b>	Image: A start and a start		
	1									
•	Cycle counting[88]	Byte	16#0	16#B2		<b>V</b>	<b>V</b>			
•	Cycle counting[89]	Byte	16#0	16#20		¥	<b>V</b>	Image: A start and a start		
	Cycle counting[90]	Byte	16#0	16#00		<b>V</b>	<ul> <li>Image: A start of the start of</li></ul>	Image: A start and a start		
•	Cycle counting[91]	Byte	16#0	16#00		<b>V</b>	<b>V</b>	1		
•	Cycle counting[92]	Byte	16#0	16#B1		¥	<b>v</b>			
•	Cycle counting[93]	Byte	16#0	16#20		<b>V</b>	<ul> <li>Image: A start of the start of</li></ul>	Image: A start and a start		
•	Cycle counting[94]	Byte	16#0	16#00			<ul> <li>Image: A start of the start of</li></ul>	Image: A start and a start		
	Cycle counting[95]	Byte	16#0	16#00			<b>V</b>	Image: A start and a start		
									>	
				d	Properties	🗓 Info 🔒	R Dia	gnostics	1 7 8	E
	Cross-reference	es Compile	Syntax	5	roperios		US DIG	9		





 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	Cycle counting [4]	Cycle counting [12] ~~~	Cycle counting [20] ~~~	Cycle counting [76] ~~~	Cycle counting [84] ~~~	Cycle counting [92] ~~~
[Byte]	Cycle counting [7]	Cycle counting [15]	Cycle counting [23]	 Cycle counting [79]	Cycle counting [87]	Cycle counting [95]

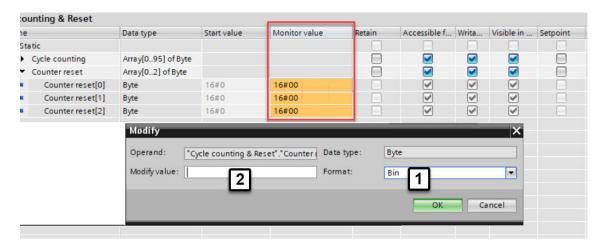
- The cycle counting value will be acquired after simple calculation on 4 bytes of each solenoid.
  - Calculation formula: Cycle counting value = Cycle counting [a] + Cycle counting [b]×2<sup>8</sup> + Cycle counting [g]×2<sup>16</sup> + Cycle counting [I]×2<sup>24</sup> (a < b < g < I)</li>
- The cycle 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			

			Coun	iter reset [2	] Byte	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 1 in front of valve island output module to open the diagnostics window. (Tag 2)



Devices											
1								🛃 Top	ology view	w 🔥 Network view	Device view
	1	WR1X-PN [VR1X-P		Device overview							
			^	Y Module	Fail-safe	Rack	Slot I a	address	Q address	Туре	Article number
ne				VR1X-PN		0	0			VR1X-PN MRP	VR1X-PN
🔄 manual	0 •	No. of Concession, No. of Conces		<ul> <li>Interface</li> </ul>		0	0 X1			VR1X-PN	
Add new device		*		VR1X-PN with 10 bytes Input_1		0	1 12	26135		VR1X-PN with 10 bytes Input	
h Devices & networks			2	VR1X-PN with 3 bytes Output_1		0	2	_	128130	VR1X-PN with 3 bytes Output	
• [1] PLC_1 [CPU 1512C-1 PN]	1	_		Error		0	3	_			
Generation of the second		_	Georgen	- Enor							
Security settings			3	77							
Common data				Displaying diagnostics status and	companso	n status	using icons				
Documentation settings						0	7				
Languages & resources Online access						0	8				
						0	9				
Card Reader/USB memory						0	10				
						0	11				
			-			0	12				
			•			0	13				
						0	14				
						0	15				
						0	16				





- 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)

	Diagnostic statu	e		
gnostics General	in the second second			
Diagnostic status 3	Status			
Channel diagnostics	Module exists			
ctions	Error			
	Standard dia	anostics		
	• Messa	ge voltage Valve Power Suppl		
	Unde	vorage varie romer sopp	1	
	Halo on ca	ected diagnostics row		
		ge Valve Power Supply		
				M
ial → Ungrouped di	vices > VR1X-PN [VR1	X-PN MRP] → VR1X-PI	(with 3 bytes Output_1	v - 1
al 🕨 Ungrouped de	vices + VR1X-PN [VR1	X-PN MRP] → VR1X-PI	I with 3 bytes Output_1	ليسا
gnostics	Π		I with 3 bytes Output_1	ليسا
gnostics Seneral	vvices + VR1X-PN [VR1 Channel diagno		i with 3 bytes Output_1	ليسا
gnostics Seneral Diagnostic status	Channel diagno		4 with 3 bytes Output_1	ليسا
gnostics Seneral Diagnostic status Channel diagnostics	Channel diagno	stics	Error	ليسا
gnostics Seneral Diagnostic status Channel diagnostics	Channel diagno	stics el type Channel no. t 23	Error Wire break	ليسا
nostics ieneral liagnostic status hannel diagnostics	Channel diagno	stics el type Channel no. t 23	Error	ليسا
nostics ieneral liagnostic status hannel diagnostics	Channel diagno	stics el type Channel no. t 23	Error Wire break	ليسا
nostics eneral iagnostic status hannel diagnostics	Channel diagno	stics el type Channel no. t 23	Error Wire break	ليسا
nostics ieneral liagnostic status hannel diagnostics	Channel diagno	stics el type Channel no. t 23	Error Wire break	ليسا
nostics ieneral liagnostic status hannel diagnostics	Channel diagno	stics el type Channel no. t 23 t 22	Error Wire break	ليسا
	1 Channel diagno	el type Channel no. t 23 t 22 ected diagnostics row uuses for encoders:	Error Wire break	
gnostics General Diagnostic status Channel diagnostics	Channel diagno	ettype Channel no. t 23 t 22 ected diagnostics row uuses for encoders: o the encoder is broken.	Error Wire break	ليسا
gnostics General Diagnostic status Channel diagnostics	Channel diagno	etted diagnostics row uses for encoders: tetne coders.	Error Wire break Short-circuit	
gnostics General Diagnostic status Channel diagnostics	Channel diagno	ettype Channel no. t 23 t 22 ected diagnostics row tuses for encoders: the encoder is broken. the encoder is broken. the encoder type set in param encoder type set in param	Error Wire break Short-circuit	
gnostics General Diagnostic status Channel diagnostics	Channel diagno	ettype Channel no. t 23 t 22 ected diagnostics row tuses for encoders: the encoder is broken. xternal circuit encoder type set in param mnel is not used (open) g resistor is too high uses for actuators:	Error Wire break Short-circuit	
gnostics Seneral Diagnostic status Channel diagnostics	Channel diagno	ettype Channel no. tt 23 tt 22 ected diagnostics row suses for encoders: o the encoder is broken. sternal circuit encoder type set in param nnel is not used (open) ig resistor is too high	Error Wire break Short-circuit	





## 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:

manual 🕨 Ungrouped device	es    VR1X-PN [VR1X-PN MRP]    VR1X-PN with 3 bytes Output_1	_ ₪ ■ ×
<ul> <li>Diagnostics</li> <li>General</li> </ul>	Diagnostic status	
General Diagnostic status	Status	
Channel diagnostics	Status	
Functions	Module exists.	
	Error	
	Standard diagnostics	
	• Message	
	Overvoltage Power Supply	
	Overvoltage Valve Power Supply	
	Help on selected diagnostics row	
	Overvoltage Power Supply	~
		~





- 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	40//04		₩° % % ₩ % % % ₩ 0 00000 %
Abbreviation: OV-VA	16#01	"VA" LED, red	
Under voltage diagnostics for valve power	40#00		2° 5 5 2 <b>0</b> 0000 <sup>6</sup>
Abbreviation: UV-VA	16#02	"VA" LED, flashing red	
Over voltage diagnostics for electronic power	40404		N B O O O O O C U
Abbreviation: OV-VB	16#04	"VB" LED, red	
Under voltage diagnostics for electronic power	16#08	"\/D"   ED fleebing red	
Abbreviation: UV-VB	16#08	"VB" LED, flashing red	
Cycle overrun diagnostics	16#10		Count cycles are beyond
Abbreviation: COR	16#10		count limit
Short circuit diagnostics	16#20	"CF"   FD fleebing red	
Abbreviation: SC	16#20	"SF" LED, flashing red	
Open load diagnostics			
	16#40	"SF" LED, flashing red	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Abbreviation: OC			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:

manual 🕨 Ungrouped dev	ces  ▶ VR1X-PN [VR1X-PN MRP]  ▶ VR1X-PN with 3 bytes Output_1	_ E = ×
<ul> <li>Diagnostics</li> <li>General</li> <li>Diagnostic status</li> <li>Channel diagnostics</li> </ul>	Channel diagnostics	
▶ Functions	Channel type Channel no. Error Output 6 Short-circuit	
	Help on selected diagnostics row	
	Possible causes: A short-circuit in the encoder power supply or at the or encoder is defective. An incorrect encoder type was set in the parameter overloaded. Solution: Check the possible causes and remedy the fault.	





- 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
	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
Input Byte 1	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
Input Byte 2	Sol.12	16#08
input Byte 2	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
Input Byte 3	Sol.20	16#08
input byte o	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:

Diagnostics General Diagnostic status	Chanı	nel diagnostics			
Channel diagnostics Functions		Channel type Output	Channel no. 15	Error Wire break	
		Help on selected diag Possible causes for - A cable to the enco	encoders: oder is broken.		<u>^</u>
		Fault in external cii     Defective encoder     Incorrect encoder 1     Input channel is no     Measuring resistor     Possible causes for     A cable to the actu	r type set in paramo ot used (open) r is too high actuators:	eters	=





- 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
	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
Input Byte 4	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
Input Byte 5	Sol.12	16#08
input Dyte e	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
Input Byte 6	Sol.20	16#08
input Dyte o	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:

manual > Ungrouped device	es ► VR12	X-PN [VR1X-PN MF	RP] ► VR1X-PN	I with 3 bytes Output_1	_ II II ×		
<ul> <li>Diagnostics</li> <li>General</li> </ul>	Chanr	nel diagnostics					
Diagnostic status							
Channel diagnostics							
Functions		Channel type	Channel no.	Error			
		Output	11	High limit exceeded			
	1						
		Help on colocted dia	apostics row				
	2	Help on selected diagnostics row For sensors: The measured value exceeds the measuring range.					
		For actors: The outp	ut value exceeds	eos the measuring range. a high limit value. en the module and the sensor or actuator.			





- 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
	Sol.01	16#01
	Sol.02	16#02
	Sol.03	16#04
Input Byte 7	Sol.04	16#08
	Sol.05	16#10
	Sol.06	16#20
	Sol.07	16#40
	Sol.08	16#80
	Sol.09	16#01
	Sol.10	16#02
	Sol.11	16#04
Input Byte 8	Sol.12	16#08
input Lyte e	Sol.13	16#10
	Sol.14	16#20
	Sol.15	16#40
	Sol.16	16#80
	Sol.17	16#01
	Sol.18	16#02
	Sol.19	16#04
Input Byte 9	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				Inpu	ut Byte 0					
status diagnostics	Fault type		ос	SC	COR	UV-VB	OV-VB	UV-VA	OV-VA	
ulagnostics	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
		Input Byte 1								
	Solenoid Bit	Sol.08 Bit 7	Sol.07 Bit 6	Sol.06 Bit 5	Sol.05 Bit 4	Sol.04 Bit 3	Sol.03 Bit 2	Sol.02 Bit 1	Sol.01 Bit 0	
Short				Inpu	ut Byte 2					
circuit diagnostics	Solenoid Bit	Sol.16 Bit 7	Sol.15 Bit 6	Sol.14 Bit 5	Sol.13 Bit 4	Sol.12 Bit 3	Sol.11 Bit 2	Sol.10 Bit 1	Sol.09 Bit 0	
		2	2.11 0		ut Byte 3	Dire				
	Solenoid Bit	Sol.24	Sol.23	Sol.22	Sol.21	Sol.20	Sol.19	Sol.18	Sol.17	
	DIL	Bit 7	Bit 6	Bit 5	Bit 4 ut Byte 4	Bit 3	Bit 2	Bit 1	Bit 0	
	Solenoid									
	Bit	Sol.08 Bit 7	Sol.07 Bit 6	Sol.06 Bit 5	Sol.05 Bit 4	Sol.04 Bit 3	Sol.03 Bit 2	Sol.02 Bit 1	Sol.01 Bit 0	
Open load	Input Byte 5									
diagnostics	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	
				inpu	ut Byte 6					
	Solenoid Bit	Sol.24 Bit 7	Sol.23 Bit 6	Sol.22 Bit 5	Sol.21 Bit 4	Sol.20 Bit 3	Sol.19 Bit 2	Sol.18 Bit 1	Sol.17 Bit 0	
			Dit U		ut Byte 7	Dit 3	Dit 2	Dit 1	Dit U	
	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	
Cycle				Inpu	ut Byte 8					
overrun diagnostics	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	
				Inpu	ut 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		
	Off	PROFINET Software is not initialized		
BF	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		
	Off	Device is not initialized		
SF	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		
	Off	Link connection not established		
P2	Flashing green / yellow	Link connection established		
	Yellow / green on	Link communication active		
VA	Green on	Voltage OK		
	Flashing red	Undervoltage		
(Valve Power Supply)	Red	Overvoltage		
VB	Green on	Voltage OK		
	Flashing red	Undervoltage		
(Electronics Power Supply)	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

Spe	Specification					
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					



## 12 CUSTOMER SUPPORT

Norgren operates four global centres of technical excellence and a sales and service network in 50 countries, as well as manufacturing capability in the USA, Germany, China, UK, Switzerland, Czech Republic, Mexico and Brazil.

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