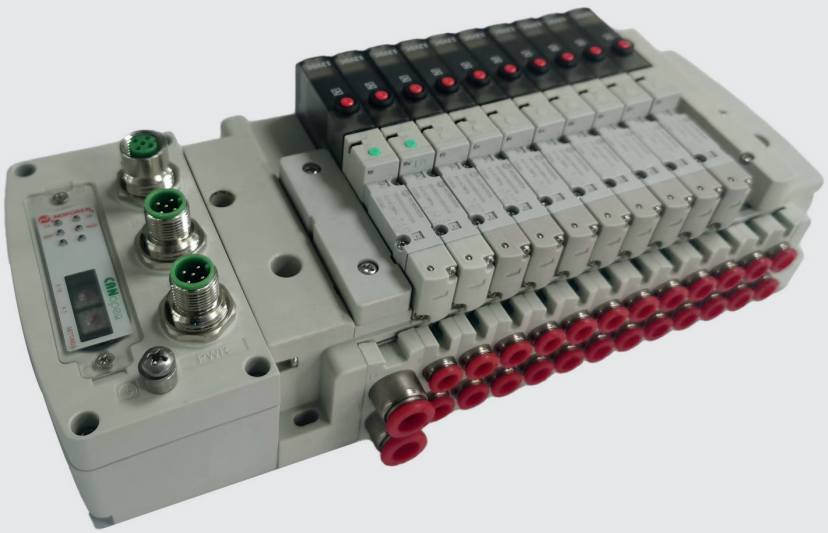
NORGREN

Operation & Service Manual

VR10 / VR15
With CANopen Interface



CANopen

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	1,2,3,4,6,7,8,9	Changes of content	3-Apr-2023	Cong, JSensor
2	All	First review	24/04/23	RL
3	4.3, 3.1	Removed overcurrent protection line Removed reference to CiA in section 3.1	26/04/23	RL
4	All	Second review	29/06/23	RL
5	All	User test changes, new connectors, +	04/10/23	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.

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1. Contents

2. About this Documentation

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

Note:

In addition to the specific information for the CANopen 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 CANopen could be found in the following documents:

- CAN knowledge: https://www.can-cia.org/can-knowledge/
- Specifications: https://can-cia.org/groups/specifications/

Further information about CANopen is available on following websites:

- https://www.can-cia.org/

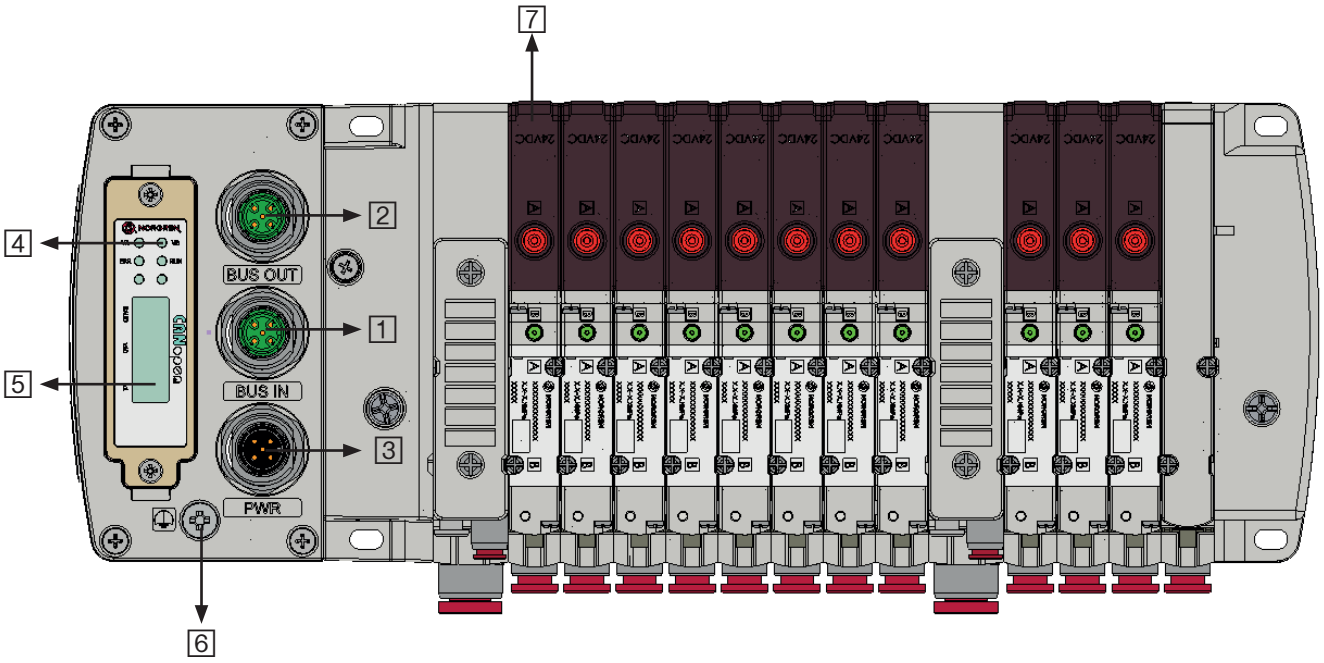
3. Important Hints

3.1. Grounding and Equipotential Bonding

Proper grounding and equipotential bonding are very important to protect against electromagnetic interference in CANopen networks. To reduce potential impact, grounding of the CANopen 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 CANopen network and is essential to avoid equipotential bonding currents, which could otherwise flow through the CANopen cable screen.

For proper grounding please use the earth screw (M4) on the upper side of the valve island. For easy reference see item 6 in chapter 4.

4. Electrical Components



1- Port 1 for BUS IN
(M12 x 1 | Male | 5 – pin | A – coded | green insert)

2- Port 2 for BUS OUT
(M12 x 1 | Female | 5 – pin | A – coded | green insert)

3- PWR: Power supply connector
(M12 x 1 | Male | 5 – pin | A – coded | black insert)

4- Status LEDs

5- Bit rate and node-ID switches

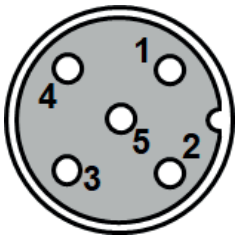
6- Earth screw (M4)

7- Valve status LEDs

NOTE: VR1X supports up to 24 solenoids. A valve station can contain 1 or 2 solenoids.

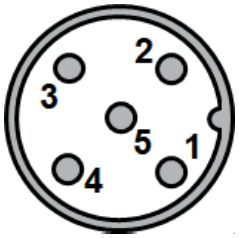
4.1. CANopen BUS OUT and BUS IN – green insert

BUS OUT



M12 / 5 pins / (BUS OUT) Female Connector / A-coded		
Pin No.	**Name**	**Function**
1	Drain	
2		
3	V-	GND
4	CAN_H	SIGNAL
5	CAN_L	SIGNAL

BUS IN



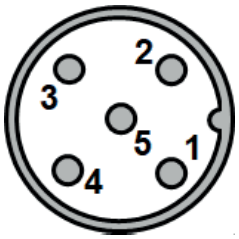
M12 / 5 pins / (BUS IN) Male Connector / A-coded		
Pin No.	**Name**	**Function**
1	Drain	
2		
3	V-	GND
4	CAN_H	SIGNAL
5	CAN_L	SIGNAL

Note that V- should be connected to GND to provide correct CAN operation.

The device does not include a bus termination resistor.

4.2. POWER SUPPLY CONNECTOR – black insert

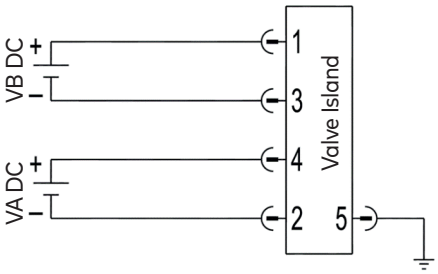
▸ Pin allocation of power supply connector



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

WARNING!
Observe the voltage of the valve island carefully!
Do NOT connect 24V to a 12V product!
Over-voltage may cause irreversible damage and excess heating of the product.
Risk of fire! Risk of burns!

▸ 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%	12VDC ±10%	PELV
Electronics voltage range VB	24VDC ±30%	12VDC ±30%	PELV
Maximum current VA	1A (24 solenoids)	2A (24 solenoids)	
Maximum current VB	50mA	100mA	
Voltages are galvanic decoupled	Yes		---
Protection against polarity reversal	Yes		---
Output polarity	PNP		---
Bus termination resistor	No termination included		---

5. Solenoid Number, Output Point & Valve Station Mapping

VR1X only supports 24 solenoids. A valve station can contain 1 or 2 solenoids.

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 VALVE STATIONS ≤ 12

▸ 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:
  - o 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.....
  - o 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.....
  - o If a station is originally configured as blank, please make sure whether they are configured "single solenoid" or "double solenoid" and follow the rules above accordingly.
  - o 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).

6. Commissioning

Notes:

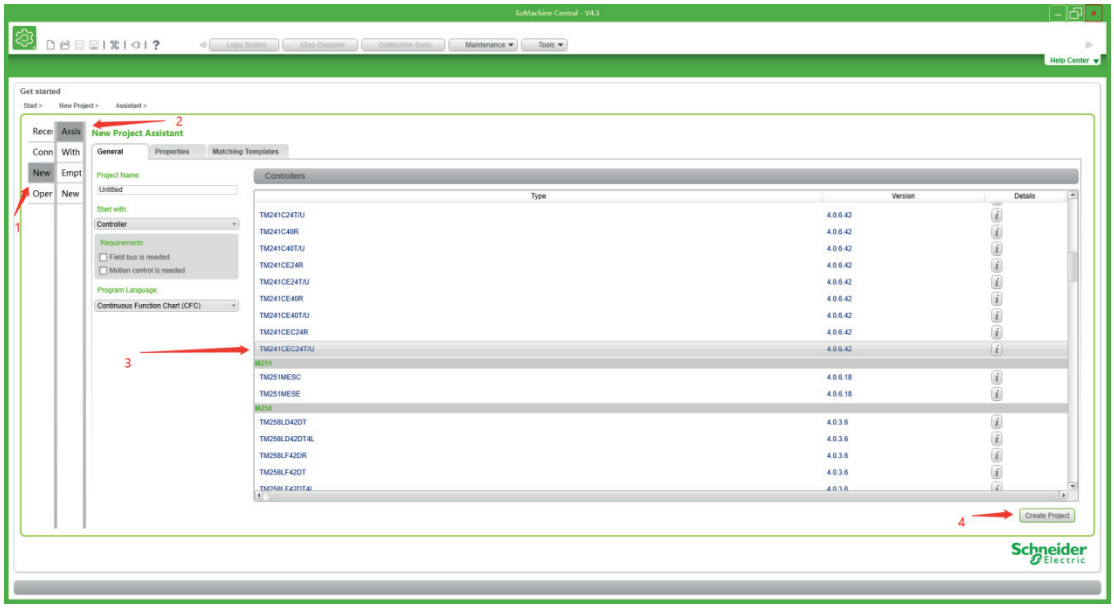
1. The method of module installation strongly depends on the configuration software. Please refer to the configuration software manual.
2. All examples in this document are made with following tools,
   Hardware: Schneider Electric PLC M421 TM241CEC24U.
   Software (Schneider Electric): SoMachine V4.3.

6.1. Prepare

Open the Software to choose a recent project or create a new project or open an existing project.

6.1.1. Create a Project

- Click New Project, then Assistant and then the controller you are using



6.1.2. Install EDS File

A device description file is needed for configuration of valve island. The Electronic Data Sheet (EDS) file is provided by Norgren and can be downloaded from the following web link:

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

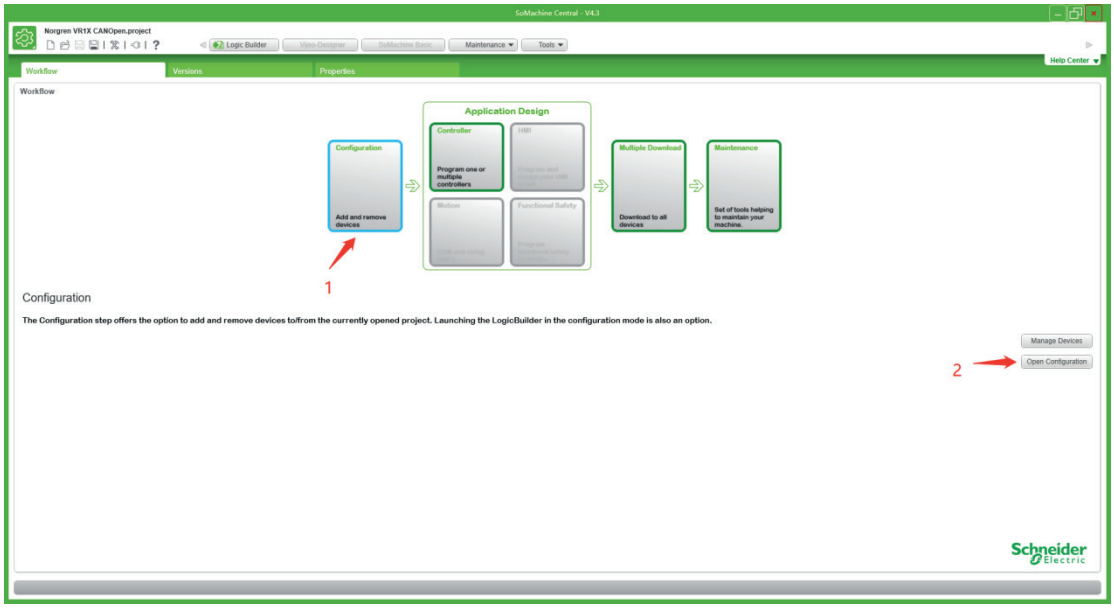
The EDS (Electronic Data Sheet) file has different variants for 12V and 24V variants:

- NORGREN-VR1X-12V-CANOPEN-VX.X-YYYYMMDD.eds
- NORGREN-VR1X-24V-CANOPEN-VX.X-YYYYMMDD.eds

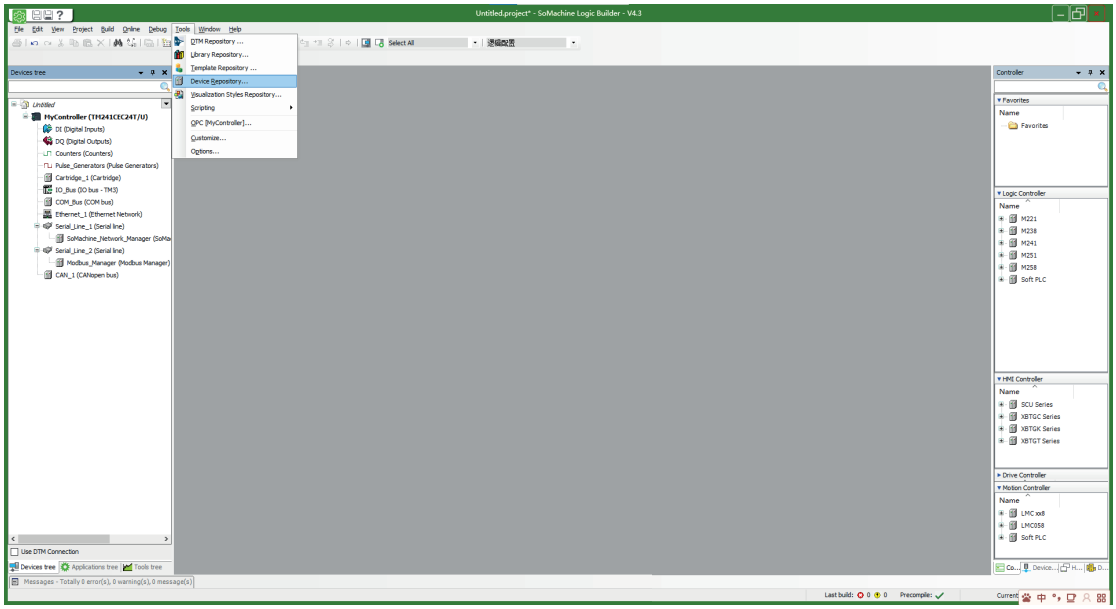
Note: "X.X" is software version; "YYYYMMDD" (YYYY-year, MM-month, DD-day) is date of release.

The EDS file can be installed inside the engineering tool by the following steps in SoMachine V4.3.

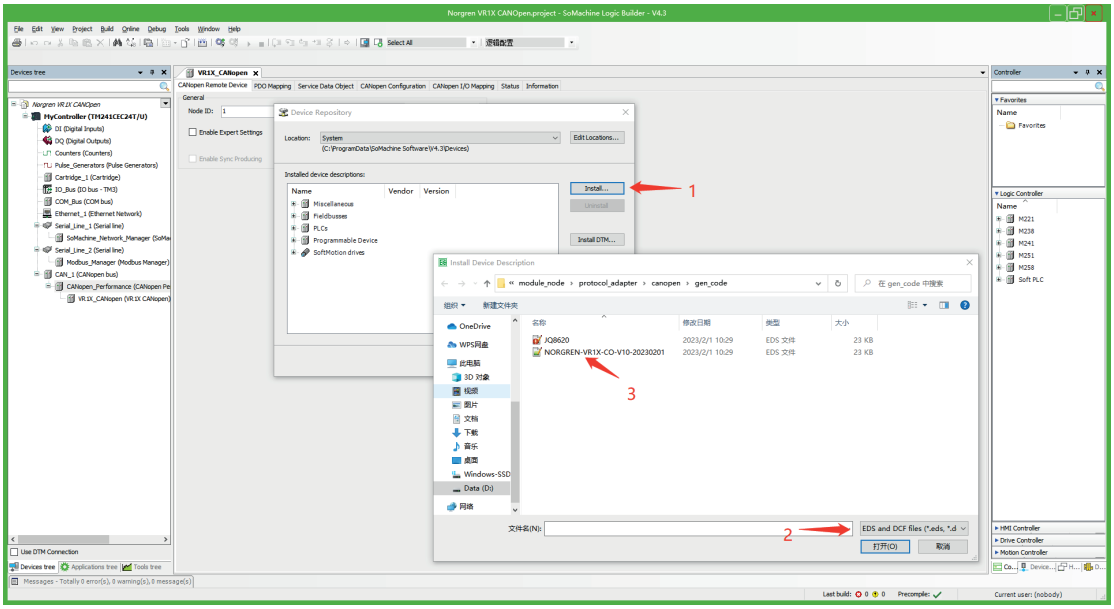
- Open Configuration of the project



- Click "Tools" menu then click "Device Repository".



- Click the "Install" button in dialog box then change the file type to "EDS and DCF files" and open the eds file we used.



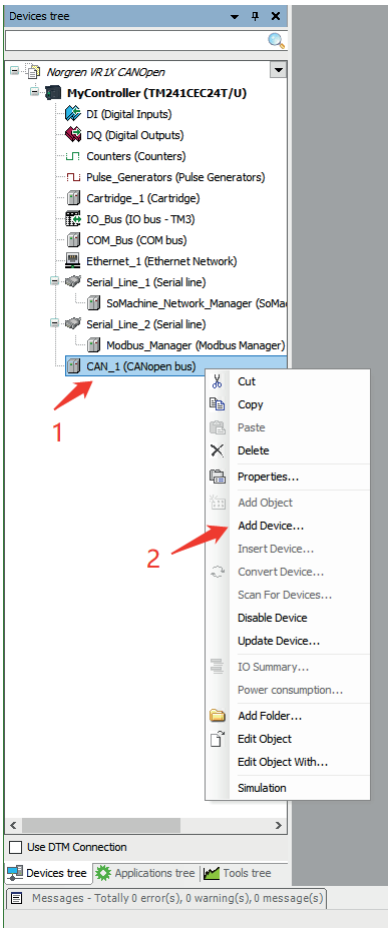
After the successful installation the device is listed in the tree "Fieldbuses → CANopen → Remote Device".

6.2. Hardware Configuration

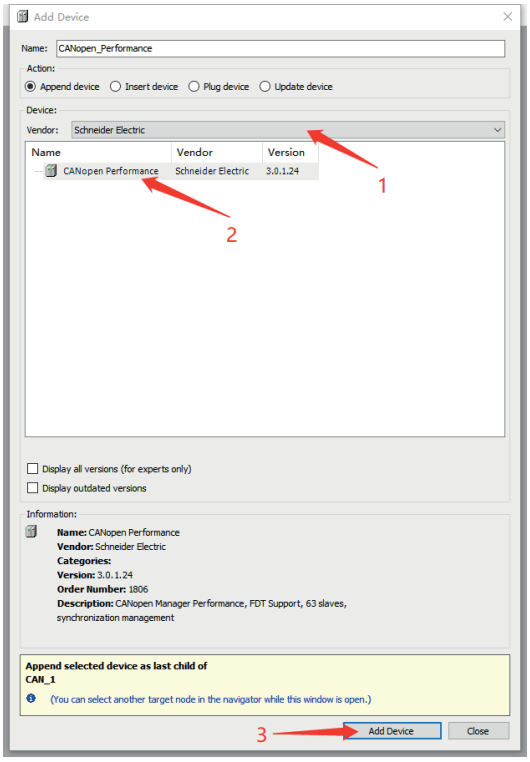
Note: please create a new project or open an existing project before configuring any hardware.

6.2.1 Add Device Application

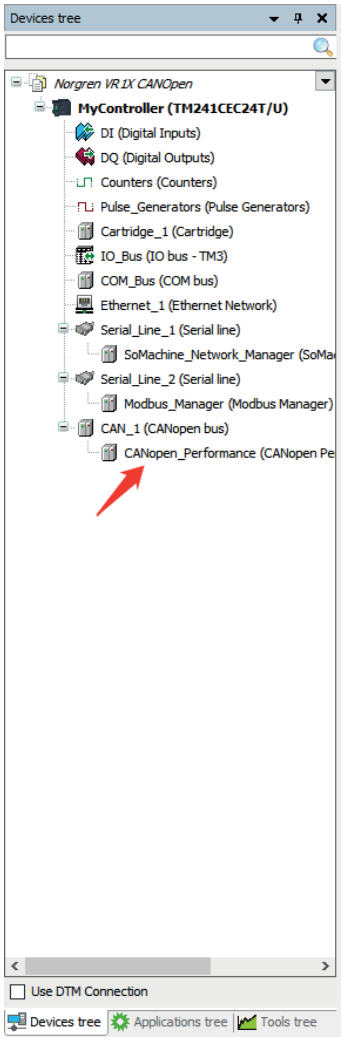
- Right click the "CAN_1 (CANopen bus)" listed in the Device tree, then click the item "Add Device".



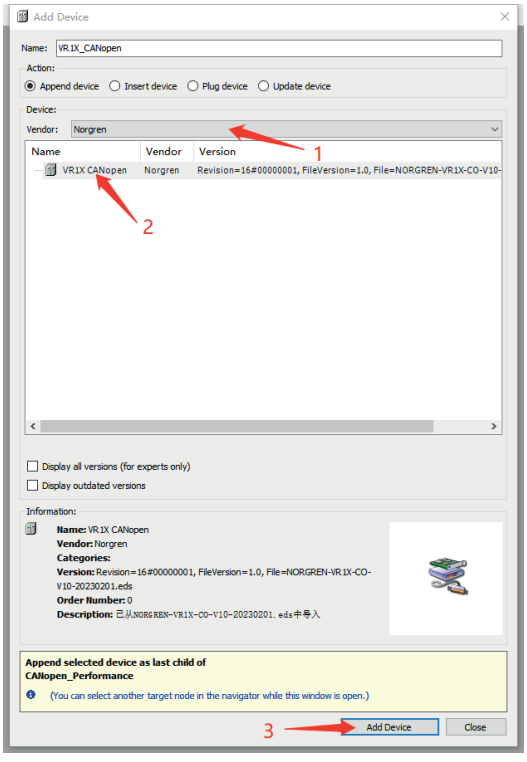
- Select "Schneider Electric" in Vendor list, then click device "CANopen Performance" and click "Add Device" button.



- After the successful addition the new device "CANopen Performance" will be listed in the Device tree.



- Right click the "CANopen_Performance" and click "Add Device". Select "Norgren" in Vendor list, then click device "VR1X CANopen" and click "Add Device" button.

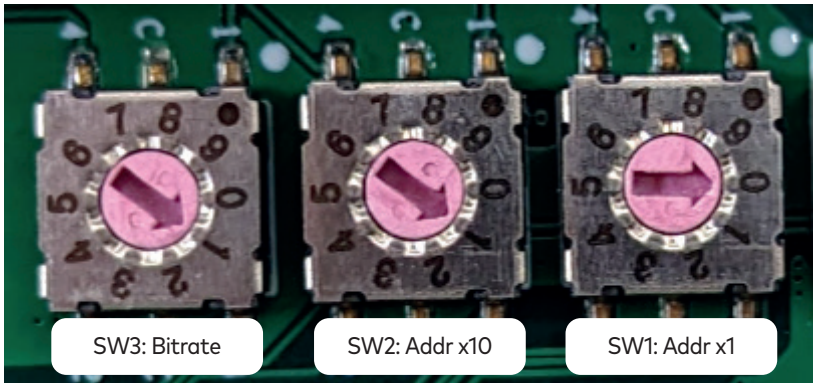


6.2.2. Configure CANopen node-id and bit rate

VR10/VR15 supports setting the bit rate by static (switches), object dictionary (SDO), autodetect or LSS methods. VR10/15 supports setting of the node-id by static (switches), object dictionary (SDO) or LSS methods. When setting node-id and bit rate the device should be reset for the new settings to take effect. See section 9 for further information.

- Remove the window to set the rotary switch with a 2mm slotted screwdriver during power off.
- Refer to standard CiA 305 v3.0.0 for LSS details

The detailed functions of the switches are shown as below:



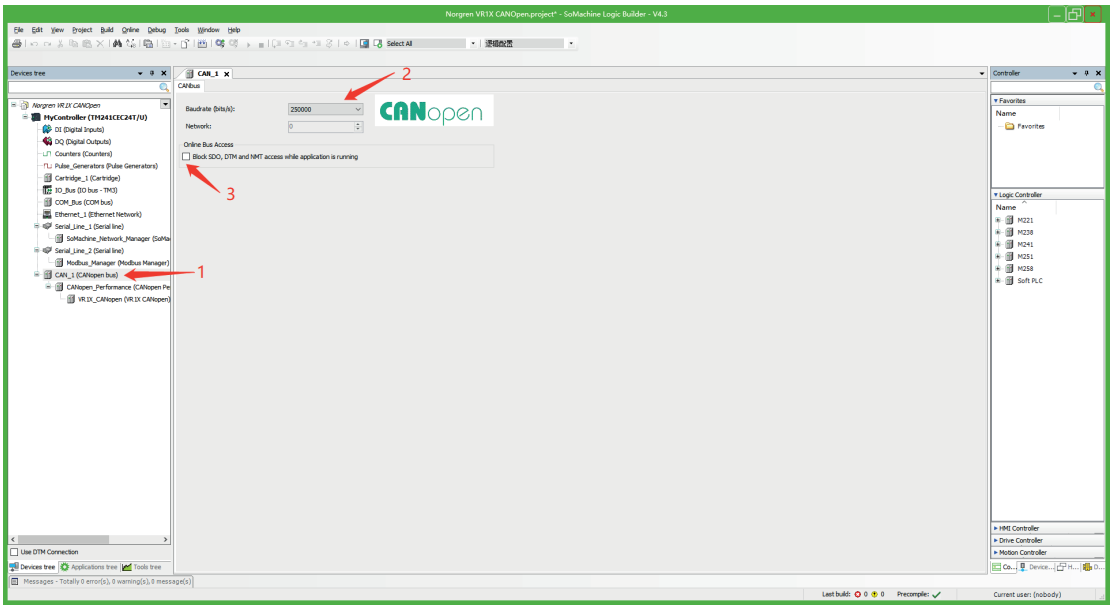
Bit rate setting SW3

Bit rate switch value	Function
0	Set bit rate by object dictionary (SDO) or LSS
1	1000kbps
2	800kpbs
3	500kpbs
4	250kpbs
5	125kbps
6	50kbps
7	20kpbs
8	10kbps
9	AUTOBAUD

Node-ID setting rangeSW2 and SW1

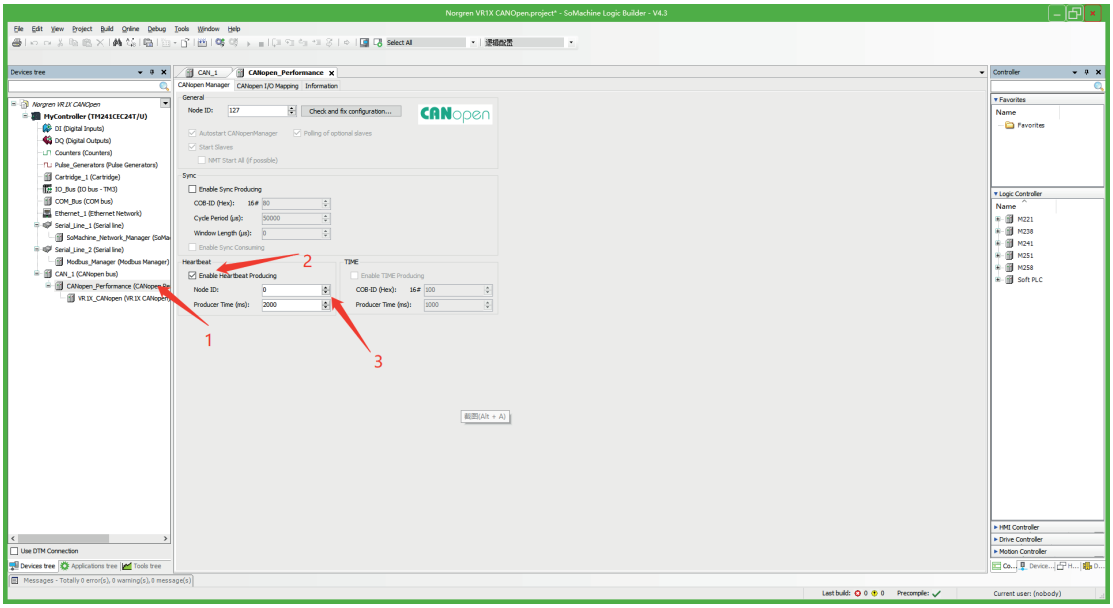
Node-ID switches value	Function
00	Set node-ID by object dictionary (SDO) or LSS
1 - 99	Node-ID

- Double click "CAN_1(CANopen bus)" in Devices tree, then select the "Baudrate(bits/s)" as dial panels setting and deselect "Block SDO, DTM and access while application is running".



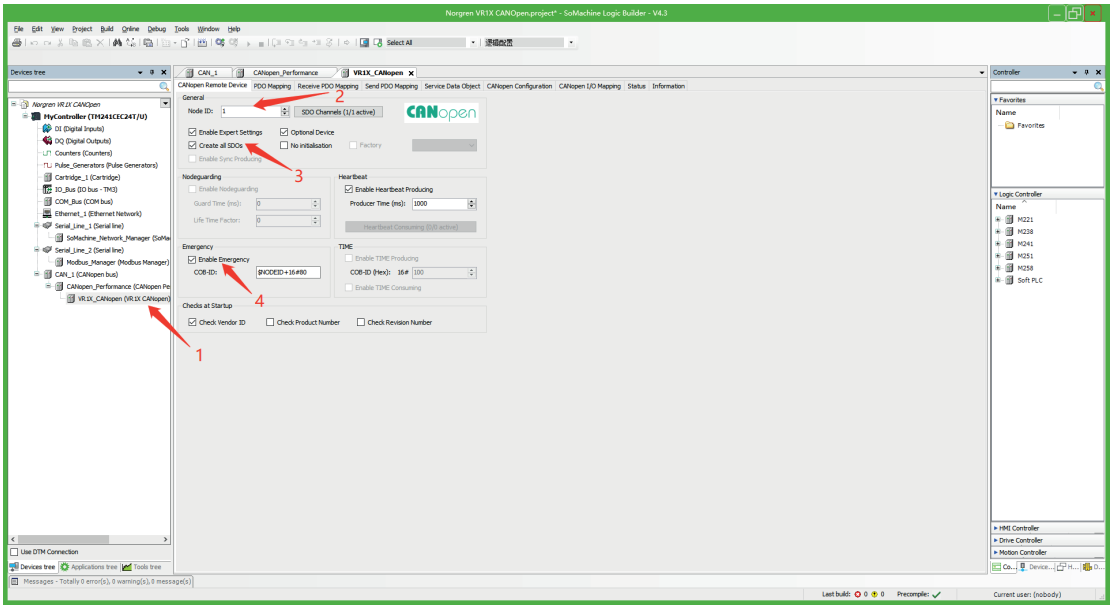
6.2.3. Configure CANopen Performance - Heartbeat

- Double click "CANopen_Performance" in Devices tree, then select the "Enable Heartbeat Producing" and set the "Node ID" as 0. The "Producer Time(ms)" should be setting no longer than 2000.



6.2.4. Configure Slave Device

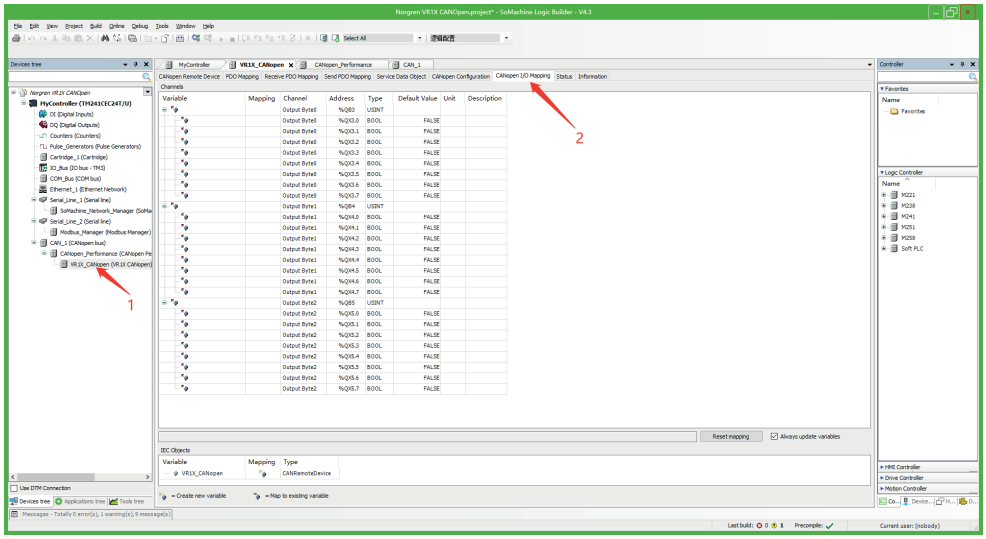
Double click "VR1X_CANopen" in Devices tree, set the "Node ID" as dial panels setting on Module, select "Enable Expert Settings", "Create all SDOs", "Optional Device" and "Enable Emergency".



6.3. Digital Outputs Data

In EDS file, the digital outputs data is defined as "RPDO" and "SDOs Index: 0x2000, Subindex: 0x01~0x03".

- VR10 / VR15 valve island channel outputs will be real-time monitored & displayed.
- Channel outputs process codes will be reported by "Output Byte0", "Output Byte1" and "Output Byte2".
- The digital outputs data can be found as following capture.
  - o Double click "VR1X_CANopen".
  - o Select "CANopen I/O Mapping".
  - o Expand "Variable".



Outputs Value and solenoid number mapping relationships are shown in table below.

- The bit is "TRUE" means the output is active on that solenoid.
- The bit is "FALSE" means no output.
- Outputs positioning to valve station follow the mapping rules stated in Chapter 5.

Output Byte0								
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
Value	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE
Output Byte1								
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
Value	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE
Output Byte2								
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
Value	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE	FALSE/TRUE

6.4. Diagnostics

In EDS file, the diagnostics data is defined as "Emergency" and "SDOs Index: 0x2004, Subindex: 0x01~0x0A". For the format of the Emergency message (EMCY) see CiA3.01 v4.20.

Note that all SDO read messages have a DLC (data length code) of 8 and all unused bytes are padded with zeroes.

The diagnostics data reflect diagnostic status, it includes four parts:

1) Overall status diagnostics

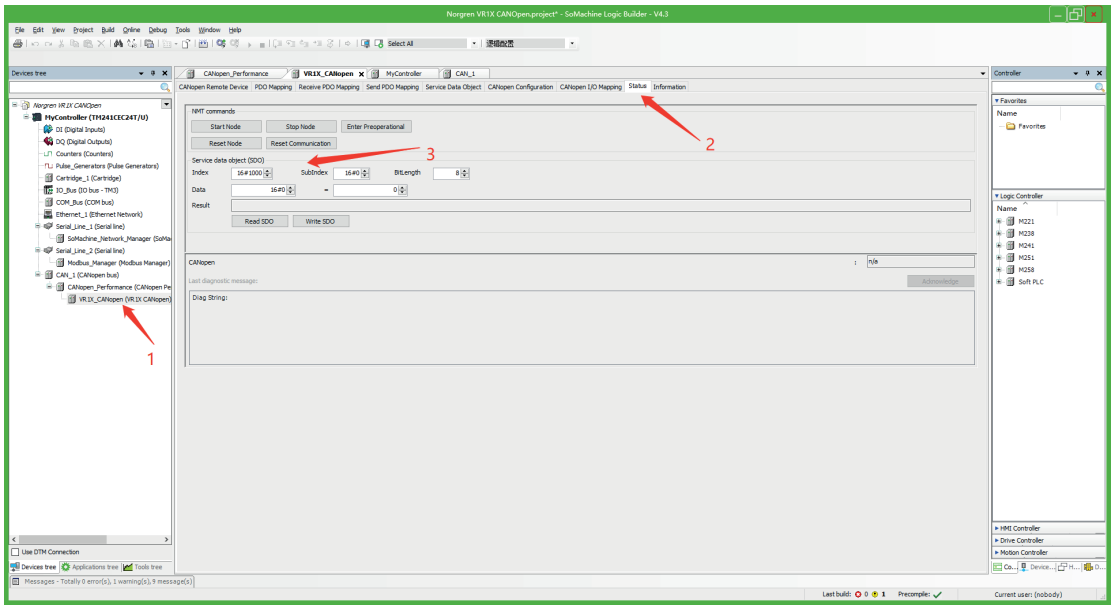
2) Short circuit diagnostics per solenoid

3) Open load diagnostics per solenoid (e.g., wire break of solenoid)

4) Cycle overrun diagnostics per solenoid (cycles beyond the count limit)

The diagnostics data can be found as following capture.

- Double click "VR1X_CANopen".
- Select "Status".
- Set "Service data object (SDO)" and click "Read SDO".



Index	Subindex	EDS name									
0x2004	0x01	Overall Status Diagnostics	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
	0x02	Short Circuit Diagnostics Byte0	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
	0x03	Short Circuit Diagnostics Byte1	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
	0x04	Short Circuit Diagnostics Byte2	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
	0x05	Open Load Diagnostics Byte0	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
	0x06	Open Load Diagnostics Byte1	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
	0x07	Open Load Diagnostics Byte2	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
	0x08	Cycle Overrun Diagnostics Byte0	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
	0x09	Cycle Overrun Diagnostics Byte1	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
	0x0a	Cycle Overrun Diagnostics Byte2	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

6.4.1. Overall Status Diagnostics 0x2004 subindex 0x1

The overall status diagnostic includes:

- Over voltage diagnostics for valve power OV-VA
- Under voltage diagnostics for valve power UV-VA
- Over voltage diagnostics for electronic power OV-VB
- Under voltage diagnostics for electronic power UV-VB
- Cycle overrun overall diagnostics (cycles beyond the count limit) COR
- Short circuit overall diagnostics SC
- Open load overall diagnostics (e.g. wire break of solenoid) OC

Binary value and fault type mapping relationships are shown in table below. 0 is no fault, 1 is fault found.

SDOs Index:0x2004, Subindex:0x01								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

Common fault errors are shown below:

LED	Status	Descriptions
VA (Valve Power Supply)	Green on	Voltage OK
	Flashing red	Under voltage UV-VA
	Red	Over voltage OV-VA
VB (Electronics Power Supply)	Green on	Voltage OK
	Flashing red	Under voltage UV-VB
	Red	Over voltage OV-VB

See Section 7 for detailed LED description.

6.4.2. Short Circuit Diagnostics 0x2004 subindex 0x02, 0x03, 0x04

Binary value and solenoid mapping relationships are shown in table below. 0 is no fault, 1 is fault found. An EMCY message is generated with error code 0x2000 current error.

SDOs Index:0x2004, Subindex:0x02								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x03								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x04								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

6.4.3. Open Load Diagnostics 0x2004 subindex 0x05, 0x06, 0x07

Binary value and solenoid mapping relationships are shown in table below. 0 is no fault, 1 is fault found. An EMCY message is generated with error code 0x1000 generic error.

SDOs Index:0x2004, Subindex:0x05								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x06								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x07								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

6.4.4. Cycle Overrun Diagnostics 0x2004 subindex 0x08, 0x09, 0x0A

Binary value and solenoid mapping relationships are shown in table below. 0 is no fault, 1 is fault found. AN EMCY message is generated with error code 0x1000 generic error.

Note: Need to set valid count limit so that this diagnostic function is effective.

SDOs Index:0x2004, Subindex:0x08								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x09								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
SDOs Index:0x2004, Subindex:0x0A								
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
Value	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

6.4.5 Emergency (EMCY) messages

See CiA3.01 v4.20 for the EMCY protocol. The Norgren specific parts of the message (bytes 3-7) are detailed below.

Byte 0~Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Error code	Error register	Status bits	Module NO.	Channel NO.	Error NO.	Additional error info

The codes that Norgren uses are as follows:

Byte0~Byte1	Error code	0x0000	Error reset or no error	
		0x1000	Generic Error	
		0x2000	Current Error	
		0x3000	Voltage Error	
Byte2	Error register	Bit0	generic error	
		Bit1	current	
		Bit2	voltage	
		Bit3	temperature	
		Bit4	communication error (overrun, error state)	
		Bit5	device profile specific	
		Bit6	Reserved (always 0)	
		Bit7	manufacturer specific	
Byte3	Status bits	Bit0	Error at Valve	
		Bit1	Error at Digital	
		Bit2	Error at Analogue	
		Bit3	Error at Function	
		Bit4	Undervoltage/Overvoltage	
		Bit5	Short circuit/Overload	
		Bit6	Wire break	
		Bit7	Other error	
Byte4	Module NO.	Node-id		
Byte5	Channel NO.	channel which error appeared/disappeared (only available for channel emergency message, 0xFF for module emergency message).		
Byte6	Error NO.	Module Emergency	0x01	System/Sensor Power Under Voltage.
			0x02	System/Sensor Power Over Voltage.
			0x03	Output/Valve Power Under Voltage.
			0x04	Output/Valve Power Over Voltage.
			0x05	Parameters Error.
			0x06	Address Conflict.
			0x07~0x7F Reserved	
			0x80	Reserved.
		Channel Emergency	0x81 – 0x82	Not Available For This Product.
			0x83	Channel Valve/Digital Output Short Circuit.
			0x84	Channel Valve/Digital Output Open Load.
			0x85- 0x88	Not Available For This Product.
			0x89	Channel Valve Cycle Overrun.
			0x8A~0xFE	Reserved
			0xFF	Reserved
Byte7	Additional error info	Reserved , 0xFF.		

Below is an example of a cycle overrun EMCY message.

Byte #	Name	Value	Meaning
0,1	Error code	0x1000	Generic Error
2	Error register	0x11	Generic error + communication error (overrun, error state)
3	Status bits	0x82	Error at digital + Other error
4	Module No.	0x0c	Device address 12
5	Channel No.	0x00	Sol. 1 (value 0~23 corresponding Sol.1~24)
6	Error No.	0x89	Channel valve cycle overrun
7	Additional error info	0xff	reserved

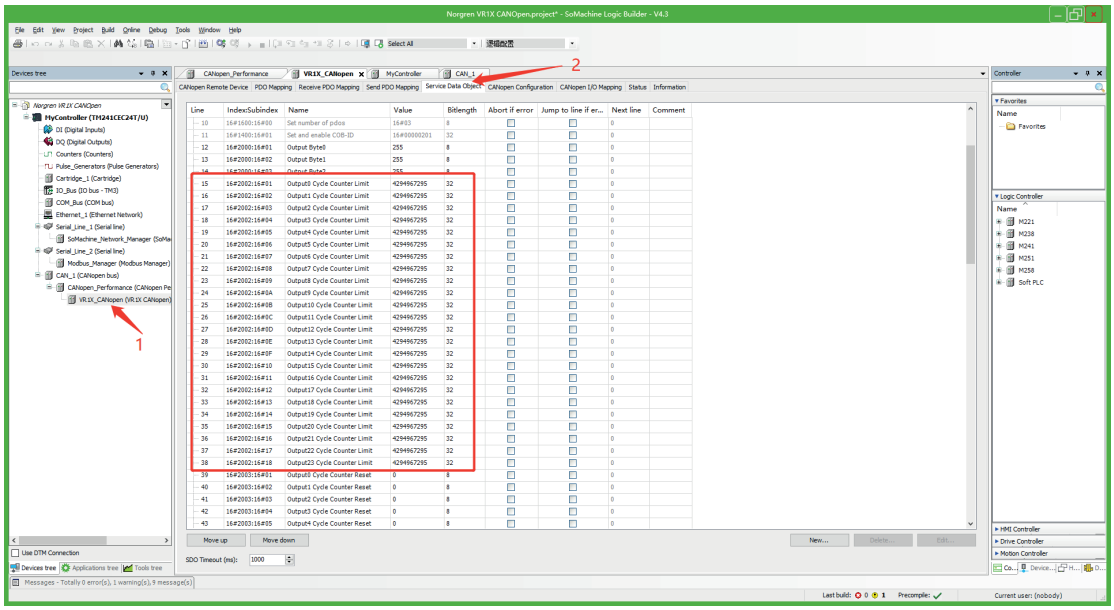
6.5. Parameterization

All the parameterization data must be downloaded after setting.

6.5.1. Cycle Counter Limit 0x2002 subindex 0x01 – 0x18

It is possible for VR10 / VR15 valve island to set cycle counter limit for each solenoid. When the cycle count limit is reached an EMCY message, with error code 0x1000 generic error, is generated.

- Double click "VR1X_CANopen".
- Select "Service data object".
- Set the counter limit value for each solenoid. The default value for each solenoid is 4294967295, the maximum limit value.



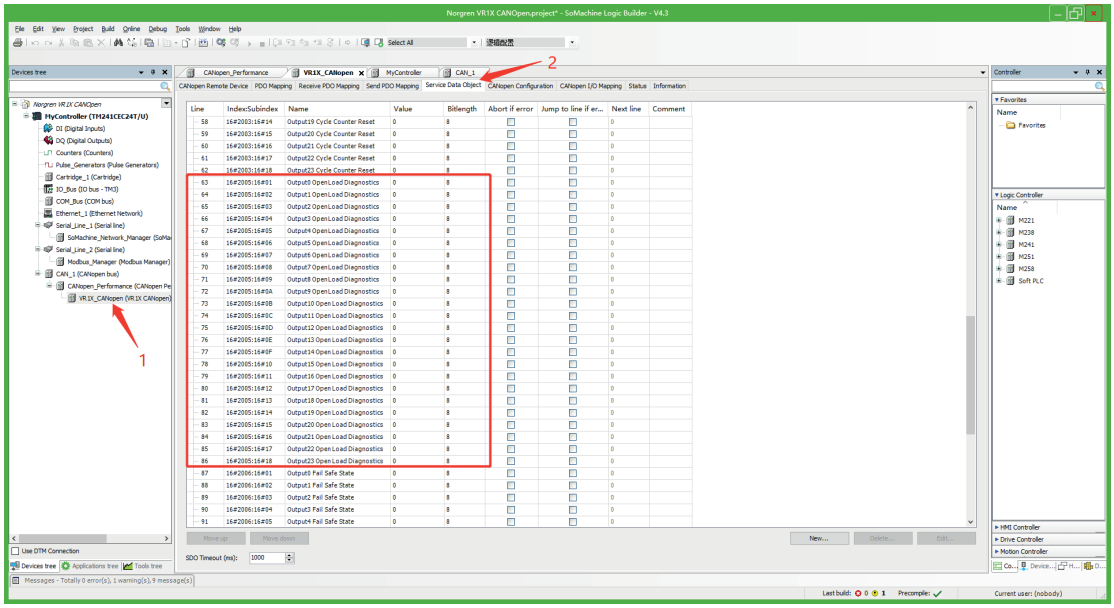
- Variable name and solenoid number mapping relation is shown in table below.
- The range of counter limit for each solenoid between 0 and 4294967295.
- Solenoid number and output point mapping relationships are shown in Chapter 5.

Cycle Count Limit Mapping, SDO index 0x2002, for solenoids x (x=1 to 24)			
Variable Name	**Solenoid**	**Subindex**	**Value Range**
Output(x-1) cycle counter limit	Sol. x	x	0~4294967295

6.5.2 Open Load Diagnostics Setting 0x2005 subindex 0x01 – 0x18

It is possible for VR10 / VR15 valve island to enable / disable the open load diagnostics for each solenoid. If disabled, no open load diagnostic error appears.

- Double click "VR1X_CANopen".
- Select "Service data object".
- Set "0" or "1" for each solenoid to enable or disable open load diagnostics function. The default value for each solenoid is "0", it means open load diagnostic is disabled as default.



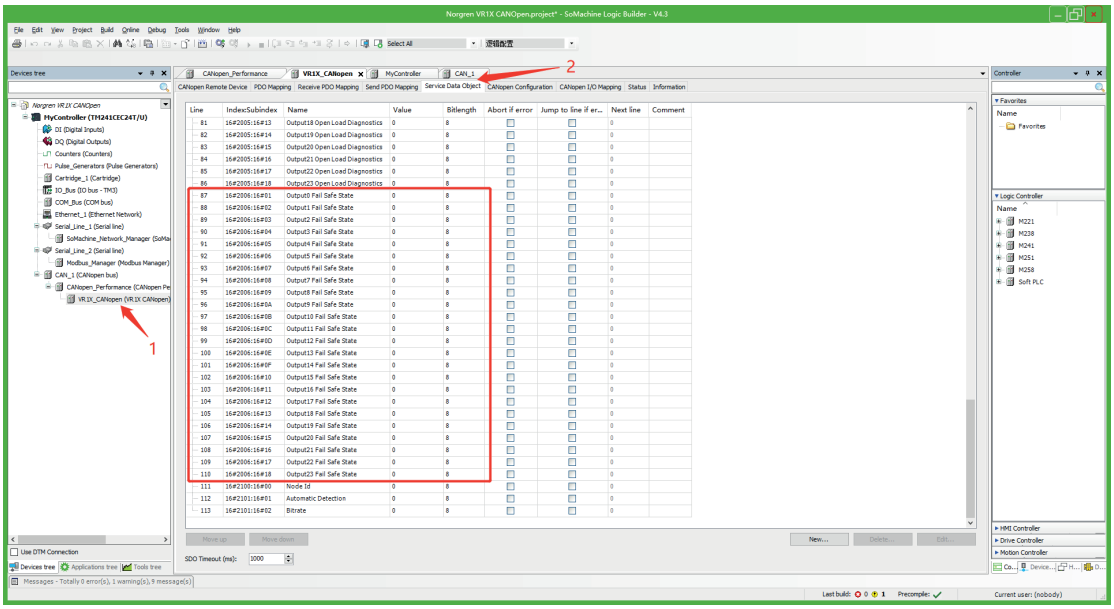
- Value and solenoid number mapping relationships are shown in table below.
- The bit that is set to "1" means enable open load diagnostics function of that solenoid.
- The bit that is set to "0" means disable open load diagnostics function of that solenoid.
- Solenoid number and output point mapping relationships are shown in Chapter 5.

Open Load Diagnostics Setting, SDO index 0x2005, for solenoids x (x=1 to 24)			
Variable Name	**Solenoid**	**Subindex**	**Value Range**
Output(x-1) open load diagnostics	Sol. x	x	0/1

6.5.3. Failsafe State Setting 0x2006 subindex 0x01 – 0x18

It is possible to define the behaviour of the outputs in case of broken CANopen communication or PLC stopped. Failsafe settings are set 3 seconds after the last communication from the PLC is received. See section 6.2.3.

- Double click "VR1X_CANopen".
- Select "Service data object".
- Set "0" or "1" for each solenoid to define the behaviour of the outputs in case of broken CANopen communication or PLC stopped. The default value for each solenoid is "0", it means no output of that solenoid in case of broken CANopen communication or PLC stopped as default.



- Value and solenoid number mapping relationships are shown in table below.
- The bit that is set to "1" means last valid value of that solenoid is retained in case of broken CANopen communication or PLC stopped.
- The bit that is set to "0" means no output of that solenoid in case of broken CANopen communication or PLC stopped.
- Solenoid number and output point mapping relationships are shown in Chapter 5.

Fail Safe State Setting, SDO index 0x2006, for solenoids x (x=1 to 24)			
Variable Name	**Solenoid**	**Subindex**	**Value Range**
Output(x-1) Fail Safe State Setting	Sol. x	x	0/1

6.5.4. Voltage and Short Circuit Diagnostics Setting

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 the related LEDs on the valve island change colour from green to red.

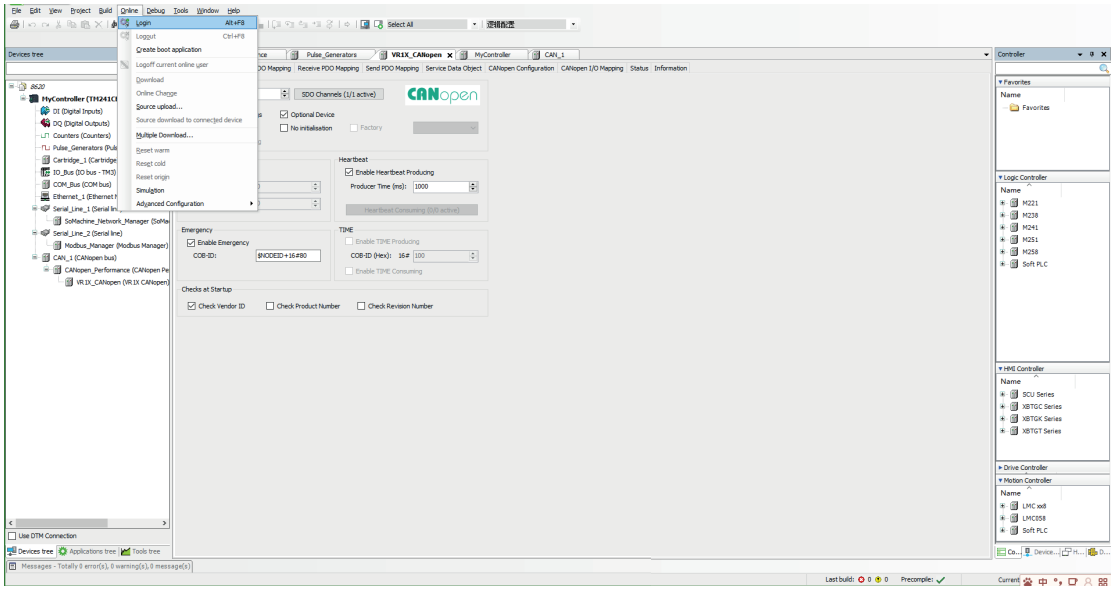
See section 6.4, 6.4.1 and 7.

6.6. Cycle Counting Data Acquisition 0x2001 Subindex 0x01 – 0x18

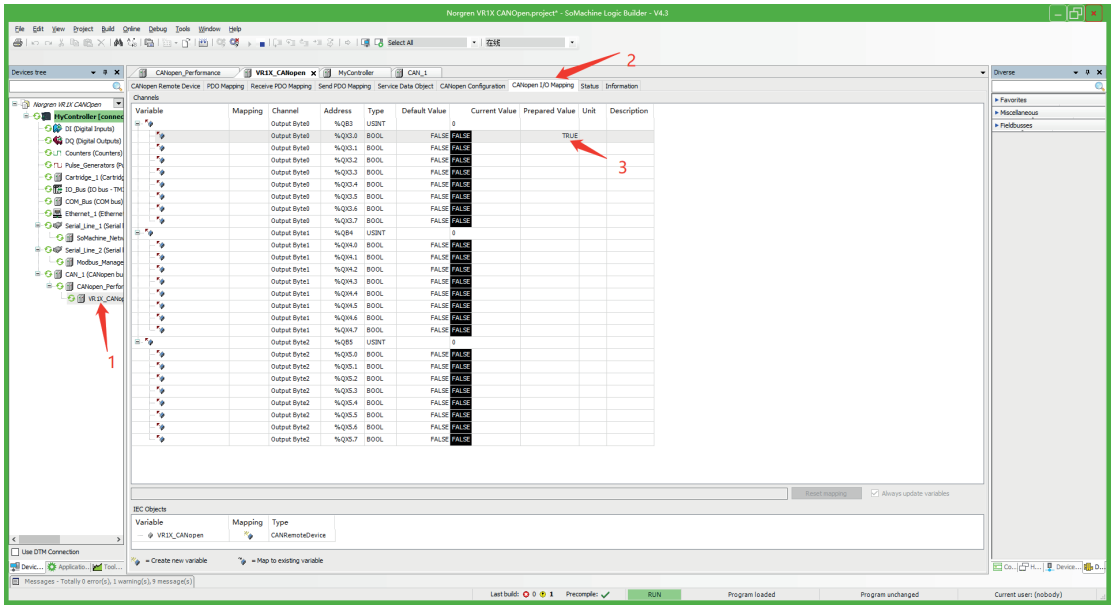
VR10 / VR15 valve island supports cycle counting for each solenoid.

The following steps give a brief instruction to get data from VR10/VR15.

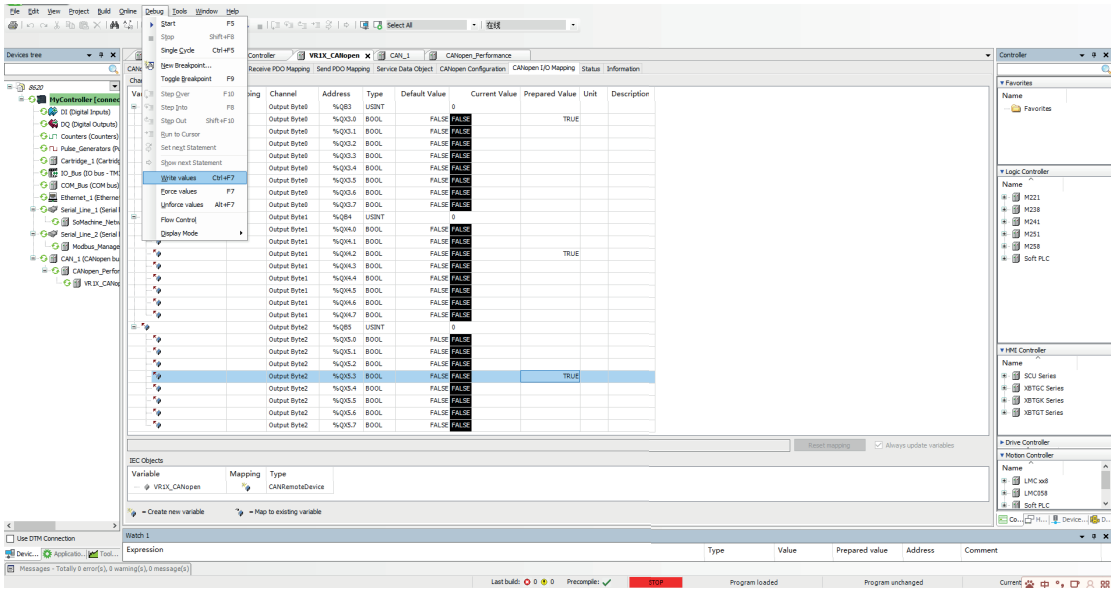
- Click the "Online" page and click the "Login" item.

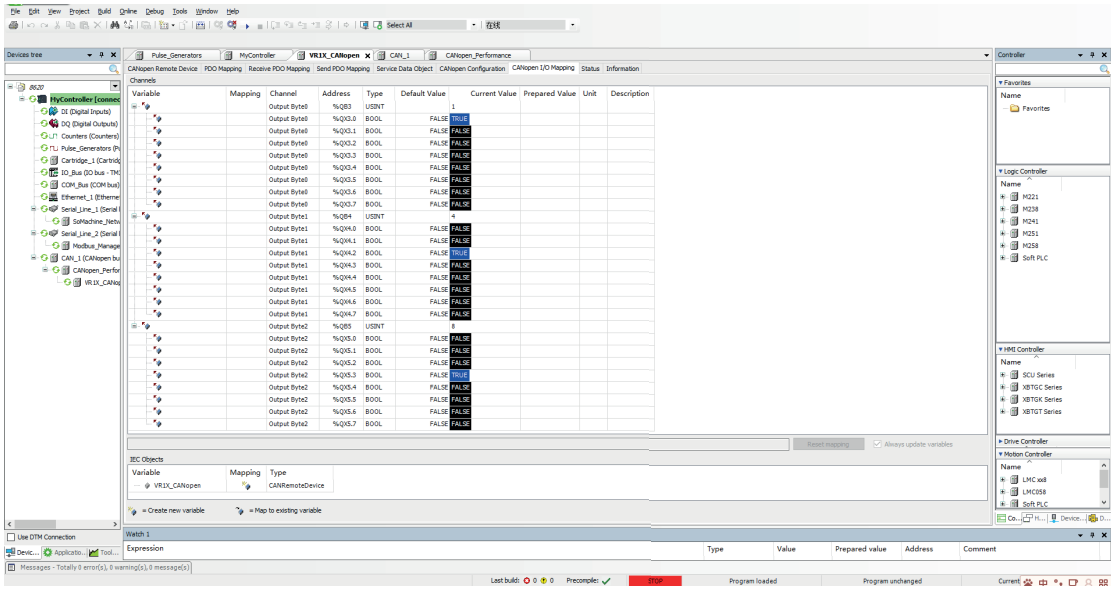


- Click the "Debug" menu and click "Start" to run the PLC.
- Double click "VR1X_CANopen", and select "CANopen I/O Mapping" page.
- Double click the cell in column "Prepared Value" to switch the value of outputs.

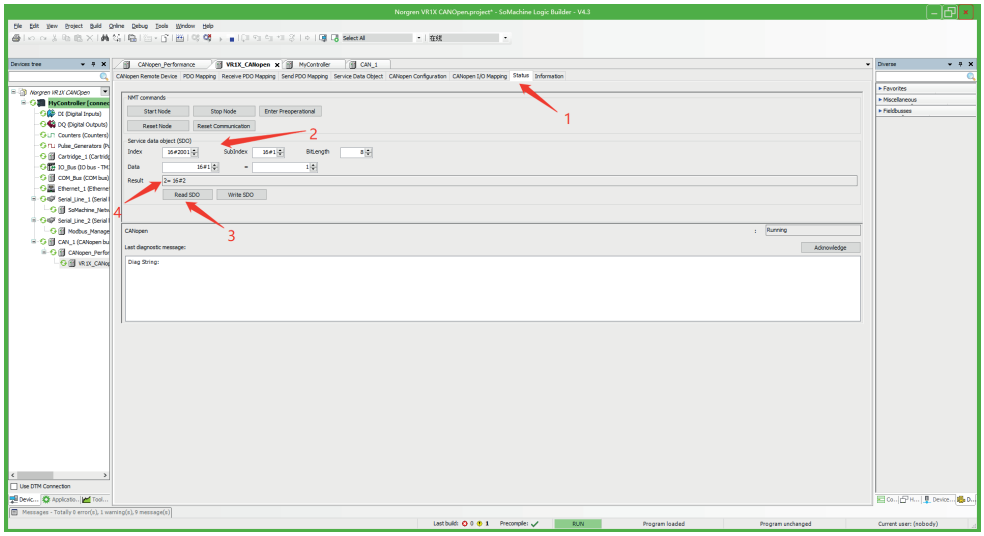


- Click the "Debug" menu and click "Write values" to enable the prepared value.





- Select "Status" and set "Service data object(SDO)".
- Click "Read SDO" to show the value in "Result".



- Variable name and solenoid number mapping relation is shown in table below.
- Solenoid number and output point mapping relationships are shown in Chapter 5.

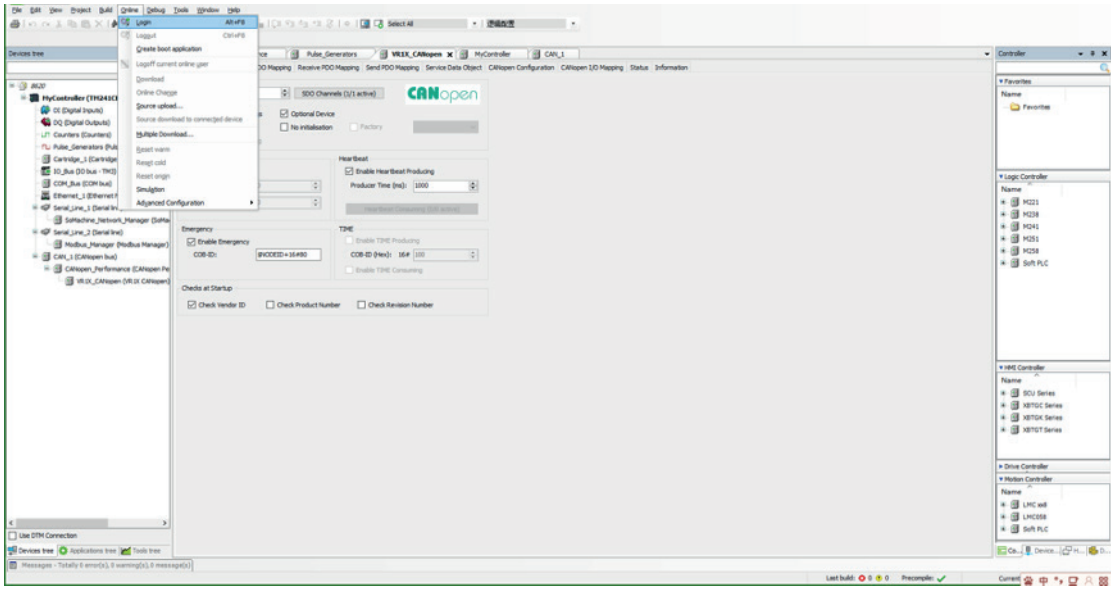
Output Switching Cycles, SDO index 0x2001, for solenoids x (x=1 to 24)			
Variable Name	**Solenoid**	**Subindex**	**Value Range**
Output(x-1) Output Switching Cycles	Sol. x	x	0~4294967295

6.7. Cycle Counter Resetting 0x2003 subindex 0x01 – 0x18

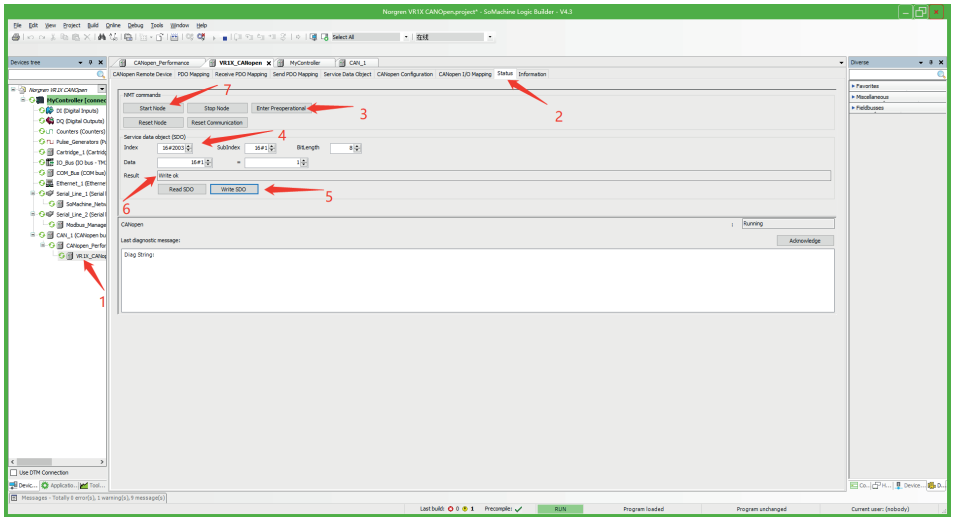
VR10 / VR15 valve island supports cycle counter reset for each solenoid.

The following steps give a brief instruction to reset cycle counter data of VR10/VR15.

- Click the "Online" page and click the "Login" item.



- Click the "Debug" menu and click "Start" to run the PLC.
- Double click "VR1X_CANopen", and select "Status" page.
- Click "Enter Preoperational".
- Set "Service data object(SDO)".
- Click "Write SDO" and check "Result" is "Write ok".
- Click "Start Node".



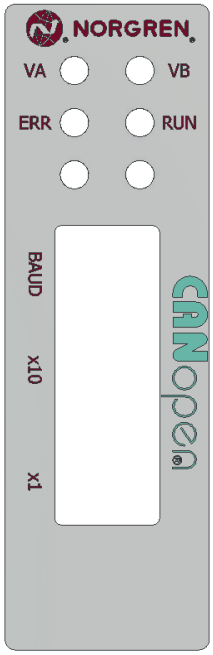
Value and solenoid number mapping relationships are shown in table below.

- Value and solenoid number mapping relationships are shown in the table below.
- The bit that is set to "1" means to clear & reset cycle counting value of that solenoid.
- The bit that is set to "0" means no action of clear & reset.

Solenoid number and output point mapping relationships are shown in Chapter 5.

Output Cycle Counter Reset, SDO index 0x2003, for solenoids x (x=1 to 24)			
Variable Name	**Solenoid**	**Subindex**	**Value Range**
Output(x-1) Output Cycle Counter Reset	Sol. x	x	0~4294967295

7. LED Status Description



ERROR LED(RED)	LED Status	Description
Off	No error	The device is in working condition
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
Double flash	Error control event	A guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer) has occurred
Off	No error	The device is in working condition
RUN LED(GREEN)	**LED Status**	**Description**
Flickering	AutoBitrate/LSS	The auto-bit rate detection is in progress or LSS services are in progress (alternately flickering with error LED)
Blinking	PRE-OPERATIONAL	The device is in state PRE-OPERATIONAL
Single flash	STOPPED	The device is in state STOPPED
On	OPERATIONAL	The device is in state OPERATIONAL
PWR LED	**LED Status**	**Description**
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

8. Object Dictionary Summary

Index	SubIndex	EDS name	Datatype	Access	Default Value
0x1000	0x00	Device Type	UNSIGNED32	ro	131473
0x1001	0x00	Error Register	UNSIGNED8	rw	0
0x1005	0x00	COB ID SYNC	UNSIGNED32	rw	128
0x1008	0x00	Manufacturer device name	VISIBLE_STRING	rw	VR1X CANopen
0x1009	0x00	Manufacturer hardware version	VISIBLE_STRING	rw	V0.1
0x100a	0x00	Manufacturer software version	VISIBLE_STRING	rw	V0.1
0x1014	0x00	COB ID EMCY	UNSIGNED32	rw	0
0x1017	0x00	Producer Heartbeat Time	UNSIGNED16	rw	1000
0x1018	0x00	Identity Object Number of entries	UNSIGNED8	ro	4
	0x01	Identity Object Vendor Id	UNSIGNED32	ro	0x76
	0x02	Identity Object Product Code	UNSIGNED32	rw	34336
	0x03	Identity Object Revision number	UNSIGNED32	rw	1
	0x04	Identity Object Serial number	UNSIGNED32	rw	0
0x1200	0x00	SDO server parameter Highest sub-index supported	UNSIGNED8	const	2
	0x01	SDO server parameter COB-ID client to server	UNSIGNED32	const	0
	0x02	SDO server parameter COB-ID server to client	UNSIGNED32	ro	0
0x1400	0x00	Receive PDO Communication Parameter Highest sub-index supported	UNSIGNED8	ro	2
	0x01	Receive PDO Communication Parameter COB ID	UNSIGNED32	rw	0
	0x02	Receive PDO Communication Parameter Transmission Type	UNSIGNED8	rw	254
0x1600	0x00	Receive PDO Mapping Parameter Highest sub-index supported	UNSIGNED8	rw	3
	0x01	Receive PDO Mapping Parameter Mapping Entry 1	UNSIGNED32	rw	536871176
	0x02	Receive PDO Mapping Parameter Mapping Entry 2	UNSIGNED32	rw	536871432
	0x03	Receive PDO Mapping Parameter Mapping Entry 3	UNSIGNED32	rw	536871688
0x2000	0x00	Output Highest sub-index supported	UNSIGNED8	ro	3
	0x01	Output Byte0	UNSIGNED8	rw	0
	0x02	Output Byte1	UNSIGNED8	rw	0
	0x03	Output Byte2	UNSIGNED8	rw	0
0x2001	0x00	Cycle Counter Highest sub-index supported	UNSIGNED8	ro	24
	0x01~0x18	Cycle Counter Output0~23 Switching Cycles	UNSIGNED32	ro	0
0x2002	0x00	Cycle Counter Limit Highest sub-index supported	UNSIGNED8	ro	24
	0x01~0x18	Cycle Counter Limit Output0~23 Cycle Counter Limit	UNSIGNED32	rw	0xFFFFFFFF
0x2003	0x00	Cycle Counter Reset Highest sub-index supported	UNSIGNED8	ro	24
	0x01~0x18	Cycle Counter Reset Output0~23	BOOLEAN	rw	0
0x2004	0x00	Diagnostics Highest sub-index supported	UNSIGNED8	ro	10
	0x01	Diagnostics Overall Status Diagnostics	UNSIGNED8	ro	0
	0x02	Diagnostics Short Circuit Diagnostics Byte0	UNSIGNED8	ro	0
	0x03	Diagnostics Short Circuit Diagnostics Byte1	UNSIGNED8	ro	0
	0x04	Diagnostics Short Circuit Diagnostics Byte2	UNSIGNED8	ro	0
	0x05	Diagnostics Open Load Diagnostics Byte0	UNSIGNED8	ro	0
	0x06	Diagnostics Open Load Diagnostics Byte1	UNSIGNED8	ro	0
	0x07	Diagnostics Open Load Diagnostics Byte2	UNSIGNED8	ro	0
	0x08	Diagnostics Cycle Overrun Diagnostics Byte0	UNSIGNED8	ro	0
	0x09	Diagnostics Cycle Overrun Diagnostics Byte1	UNSIGNED8	ro	0
	0x0a	Diagnostics Cycle Overrun Diagnostics Byte2	UNSIGNED8	ro	0
0x2005	0x00	Open Load Diagnostics Highest sub-index supported	UNSIGNED8	ro	24
	0x01~0x18	Open Load Diagnostics Output0~23	BOOLEAN	rw	0
0x2006	0x00	Fail Safe State Highest sub-index supported	UNSIGNED8	ro	24
	0x01~0x18	Fail Safe State Output0~23	BOOLEAN	rw	0
0x2100	0x00	EEPROM node ID	UNSIGNED8	rw	0
0x2101	0x00	Bit rate Highest sub-index supported	UNSIGNED8	rw	2
	0x01	Autobaud enable	UNSIGNED8	rw	1
	0x02	Bit rate	UNSIGNED8	rw	3
0x2102	0x00	Password Highest sub-index supported	UNSIGNED8	ro	2
	0x01	Node ID Write enable	UNSIGNED32	rw	0
	0x02	Bit rate Write enable	UNSIGNED32	rw	0

9. Setting NODE-ID and BIT RATE - additional information

9.1. Overview

See section 6.2.2 for basic information and rotary switch information.

The VR1X CANopen support three methods of setting the node-id and bit rate.

- Static - uses the values set on the rotary switches
- SDO – uses the values set in the object dictionary (0x2100, 0x2101) and requires a password (0x2102).
- LSS – layer setting service protocol. See CiA 305 Version 3.0.0.

The static method always takes priority.

NOTES:

1. Passwords:

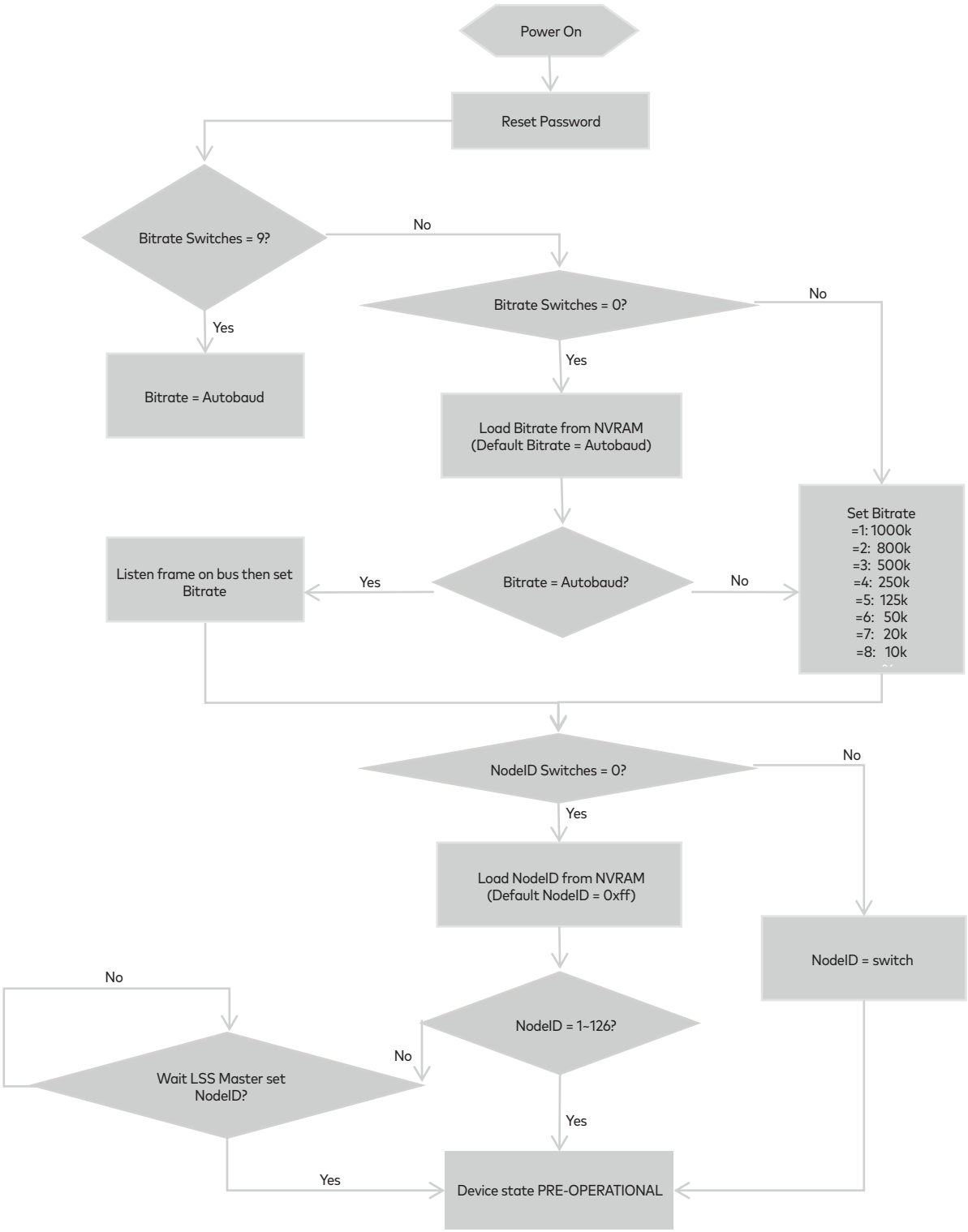
Protected setting			**Password**		
Setting	**Index**	**Subindex**	**Index**	**Subindex**	**Value to write**
Node ID	0x2100	0x00	0x2102	0x01	0x77774444
Bitrate	0x2101	0x02		0x02	0x42424242
Autobaud enable		0x01			

2. Rotary switch values are read at device start-up.
3. Node-ID or bitrate cannot be changed in software unless the relevant rotary switch is set to 0.
4. RUN/ERR LEDs will flash red/green to indicate the device is trying to establish the bit rate for connection (autobaud) OR that the device is in LSS mode.
5. The bit rate password must be written when changing 0x2101 01h (autobaud enable) OR 0x2101 02h (bit rate)
6. Changing bit rate via LSS will update the autobaud enable flag in 0x2101 01h

For more information see the flow charts in section 9.2 and 9.3.

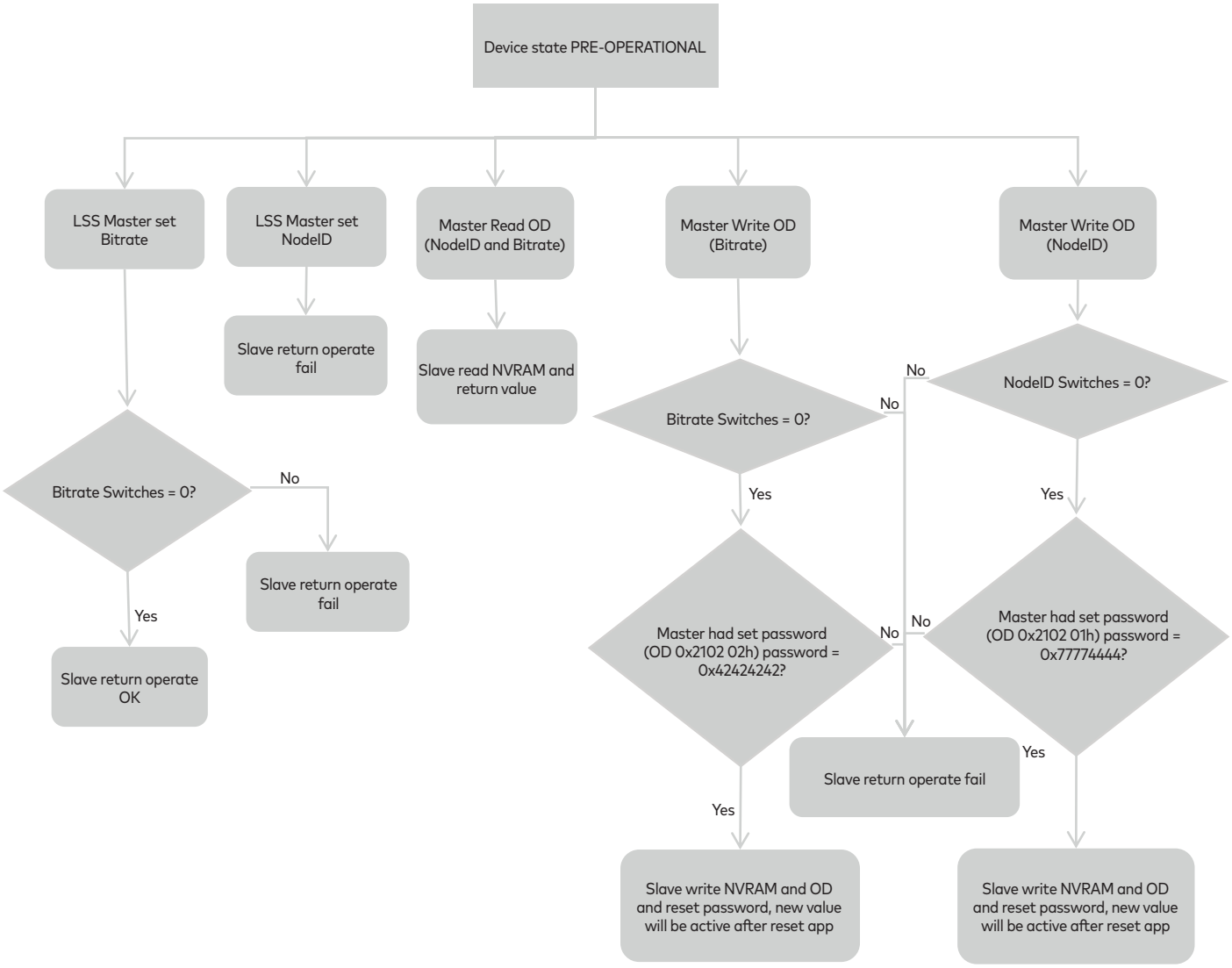
9.2. Obtaining a node-id and bit rate

On start up the device will go through these steps to set a node-id and bit rate



9.3. Setting a node-id and bit rate

Once the device is PRE-OPERATIONAL, the following steps can be used to set the node-id and bit rate. The device must be reset for new settings to be applied. OD = object dictionary



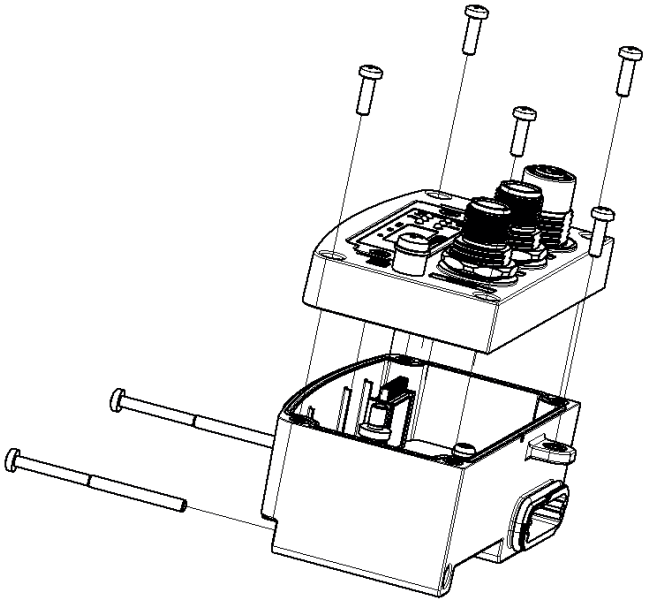
10. RECYCLING INFORMATION

Device composition

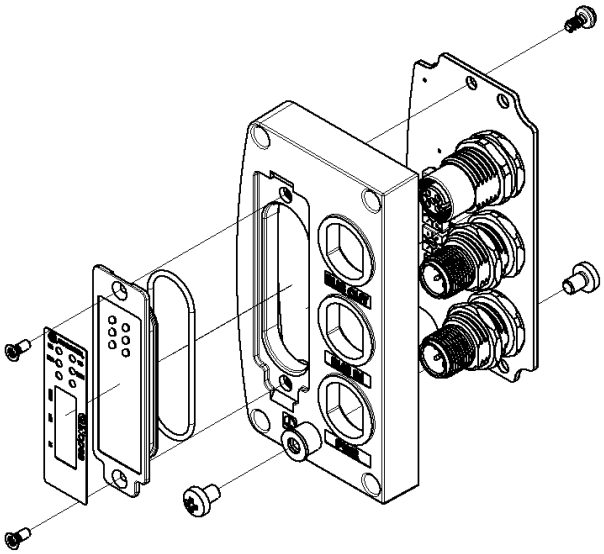
Enclosures	PBT+ASA 20% GF
Overlay, labels	PET
PCB	Various, dispose of according to WEEE
Gaskets	Nitrile
Screws and connectors	Carbon steel / Stainless steel
Window	TR55 LX

Removing the circuit boards

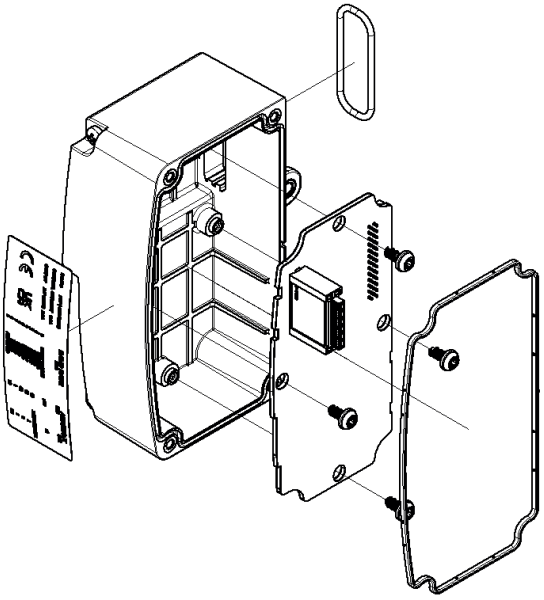
1. Remove bus node from valve island
2. Remove top assembly from bottom assembly



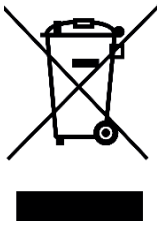
3. Remove circuit board 1 from top assembly



4. Remove circuit board 2 from bottom assembly



11. Waste electrical and electronic equipment



Disposal of this product is regulated by the EU WEEE Directive for waste electrical and electronic equipment. Dispose of the product properly and not as part of the normal waste stream. Observe the regulations of the respective country: information can be obtained from the national authorities.

The data specified above only serve to describe the product.

No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of exercising judgment and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

Subject to change without notice.

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