IMI NORGREN

Valve island VM10 with EtherNet/IP Interface 8, 10, 12 or 16 stations

Engineering GREAT Solutions

EtherNet/IP™

Operation & Service Manual

IMI Precision Engineering

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	Set up initial version	08/02/2017	
002	All	Modifications have been updated	28/02/2017	
003	2	New chapter added	20/07/2017	
004	3	Added chapter: static IP address setting	31/07/2017	
005	All	Additional minor comments implemented	21/09/2017	
006	All	Additional amendments made	19/07/2018	

This Operation & Service Manual makes no claims of being complete as it doesn't cover all variants of the VM10 valve islands series at the moment.

Therefore this document is subject to extensions or changes.

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Content

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1. About this documentation

This Operation & Service Manual contains the information to set up and operate the VM10 valve islands with EtherNet/IP interface and to detect and resolve problems.

Note
In addition to the specific information for the EtherNet/IP variants, all data sheets for the VM10 valve island series are applicable and remain valid. No changes in valve size and flow. Diffence on connection and parameters.

Refer also to the datasheet on the following weblink:

➲ *http://cdn.norgren.com/pdf/en_5_1_100_VM10.pdf*

Refer also to the installation video on the following weblink:

➲ *https://player.vimeo.com/video/256919223*

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2. Important hints

2.1 Grounding and equipotential bonding

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

For proper grounding please use the terminal for functional earth (M4) on the upper side of the valve island. For easy reference see position 4 in chapter 3.

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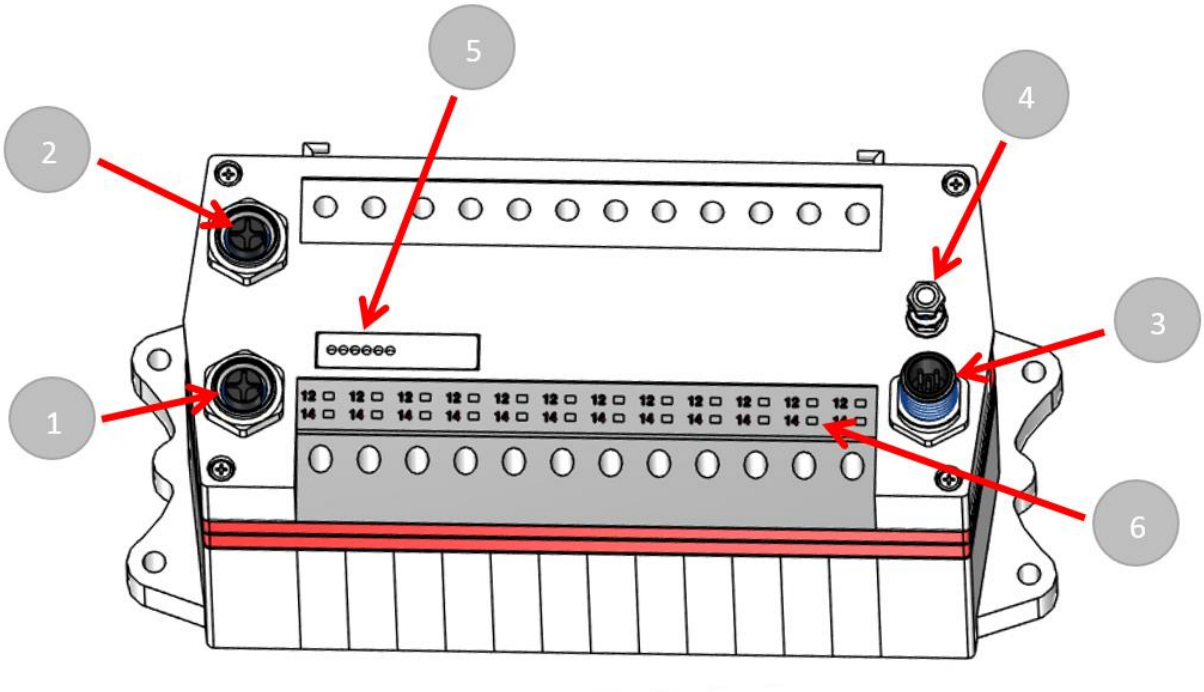
3. Electrical Connections of the VM10 valve islands



1. Port 1 bus connector for EtherNet/IP

   (4 pins M12 D-coded female connector)

2. Port 2 bus connector for EtherNet/IP

   (4 pins M12 D-coded female connector)

3. Power supply connector

   (5-pins M12 A-coded male connector)

4. Terminal for functional earth (M4)

5. Status LEDs

6. Valve status LEDs

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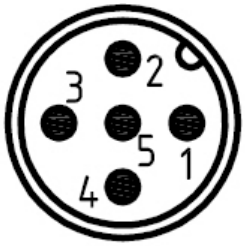
3.1 EtherNet/IP - Bus connectors PORT 1 & PORT 2

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 -)
Earth screw	FE (functional earth)

3.2 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)

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4. Commisioning

The configuration of the EtherNet/IP valve island is done via inclusion of the device description file (EDS file) „002A002B1XXXX0100.EDS“. The device description file is required to be included for the configuration of the corresponding EtherNet/IP - Controller.

The following steps are necessary.

Note:
XXXX = ‘1000’ -> VM10 with 8 Stations, ‘1100’ -> VM10 with 10 Stations,‘1200’ -> VM10 with 12 Stations, ‘1300’ -> VM10 with 16 Stations.

Note: All explanations in this manual are based on Rockwell Automations “Studio 5000”.

4.1 EDS File Installation

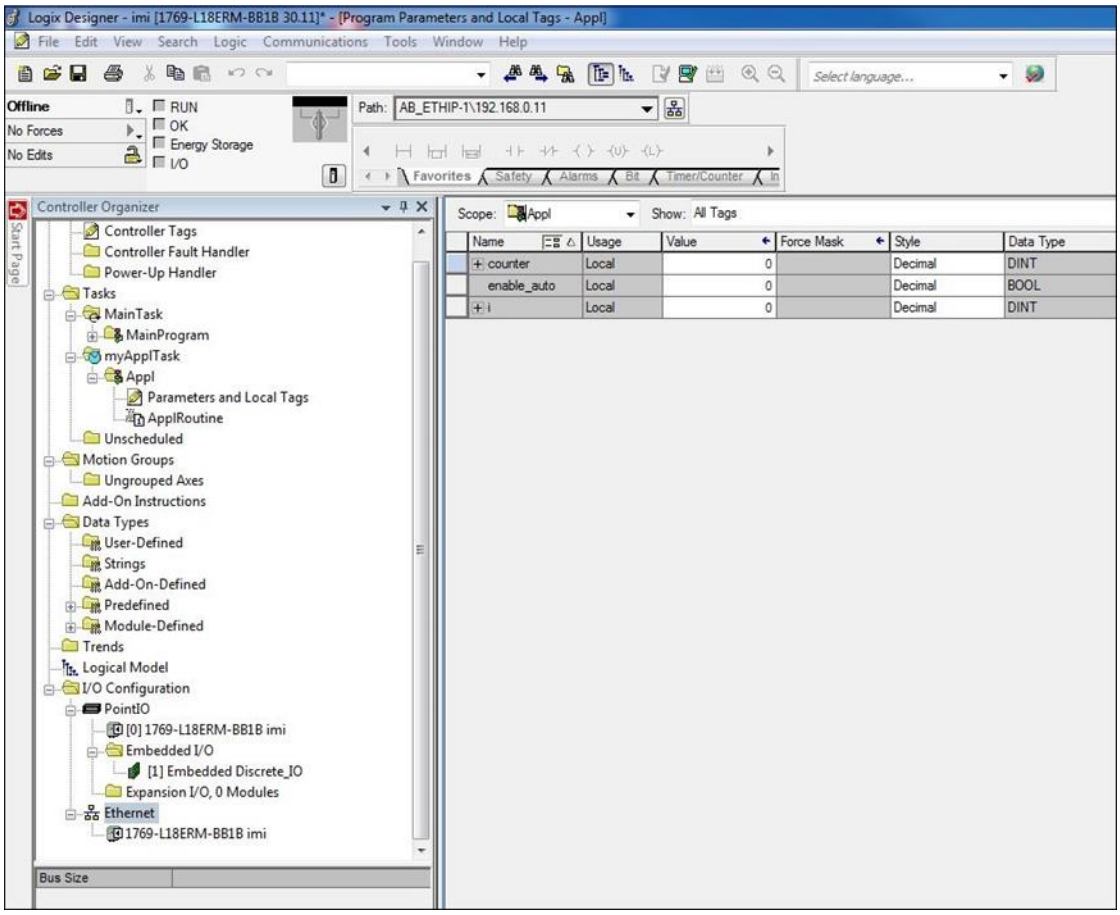
The EDS file is required to configure the VM10 valve island. A symbol file is necessary to display an icon in the engineering tool.

EDS files are provided by the module vendor and can be downloaded from:

➲ *https://www.imi-precision.com/us/en/technical-support/software*

Note: The method of module installation strongly depends on the configuration software. Please refer to the configuration software manual.

The following picture shows Startup image of Rockwell Automations “Logix Designer”.



In menu “Tool -> EDS Hardware Installation Tool” start the Installation Wizard. Follow the installation steps described in the wizard.

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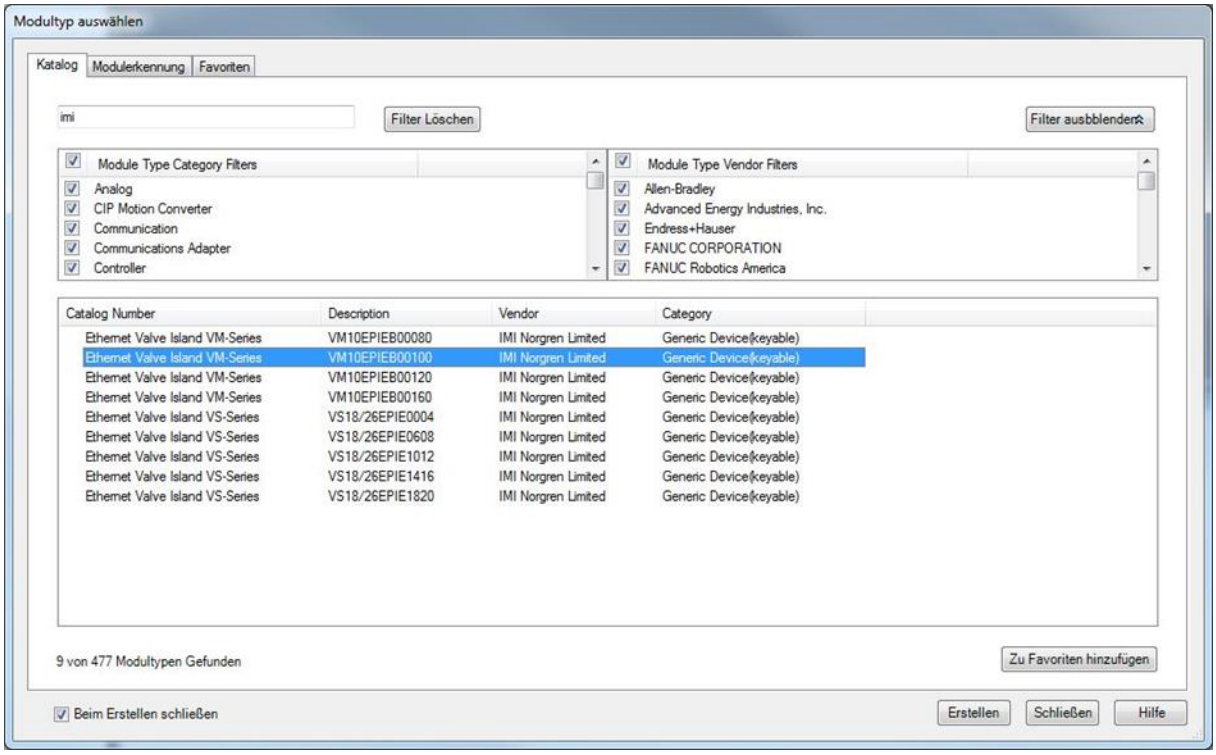
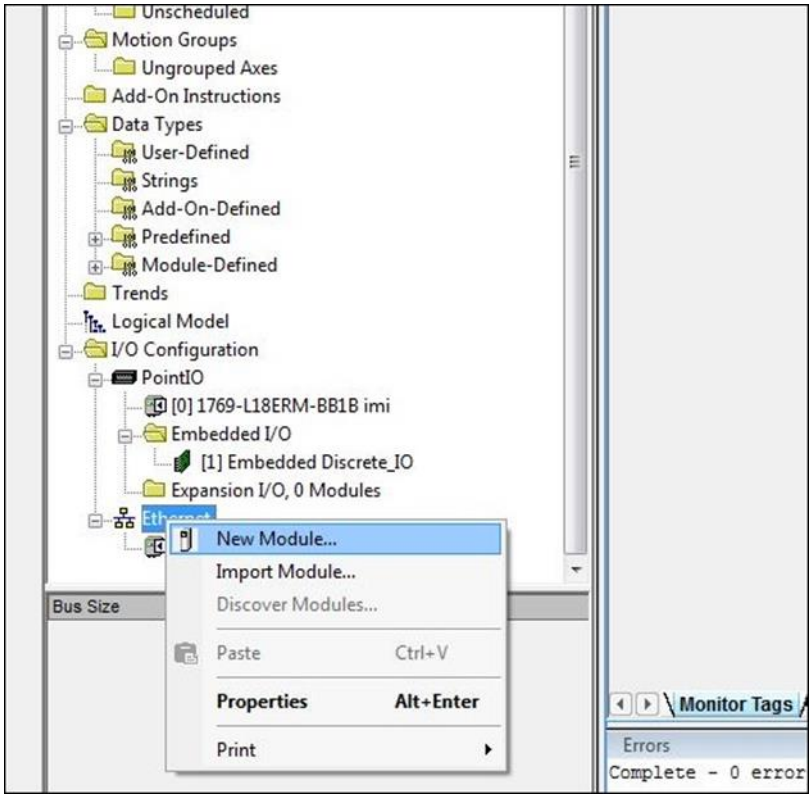
After the installation the new module is shown in the catalogue.



4.2 Hardware configuration: Select valve island

After the successful installation of the EDS file, the module configuration is needed. In context menu choose “New Module” after right-clicking on “Ethernet”.



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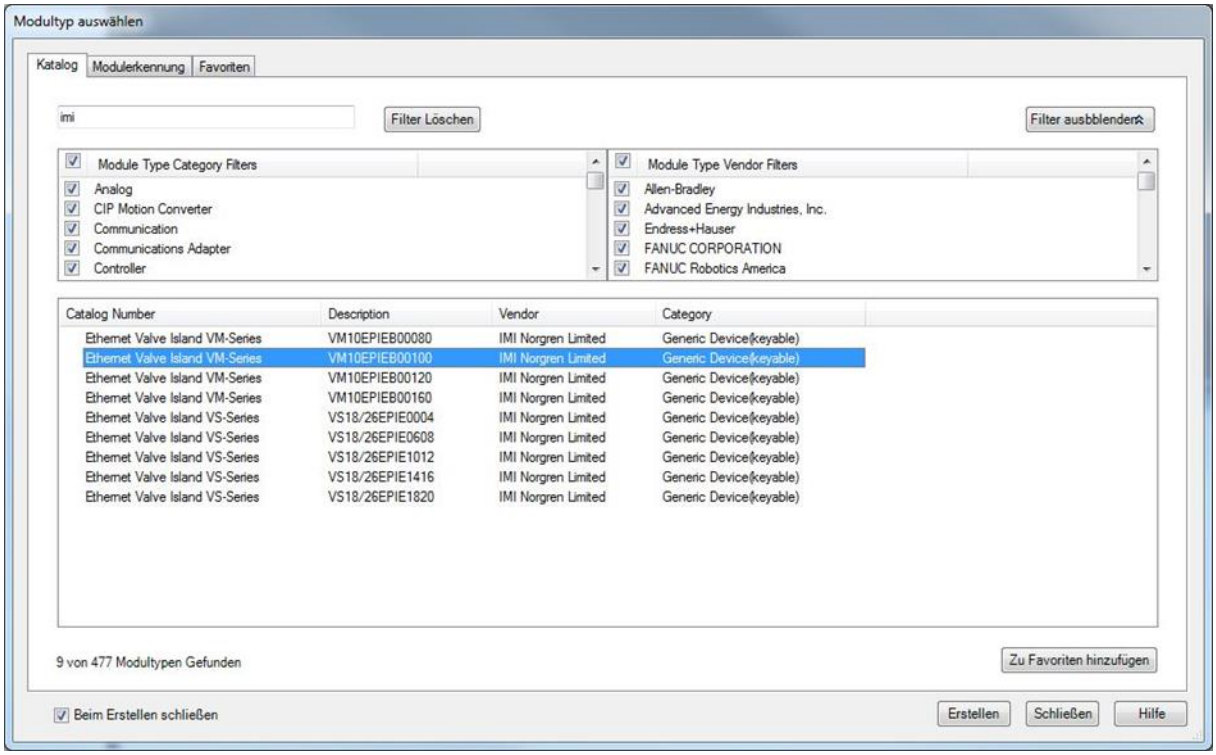
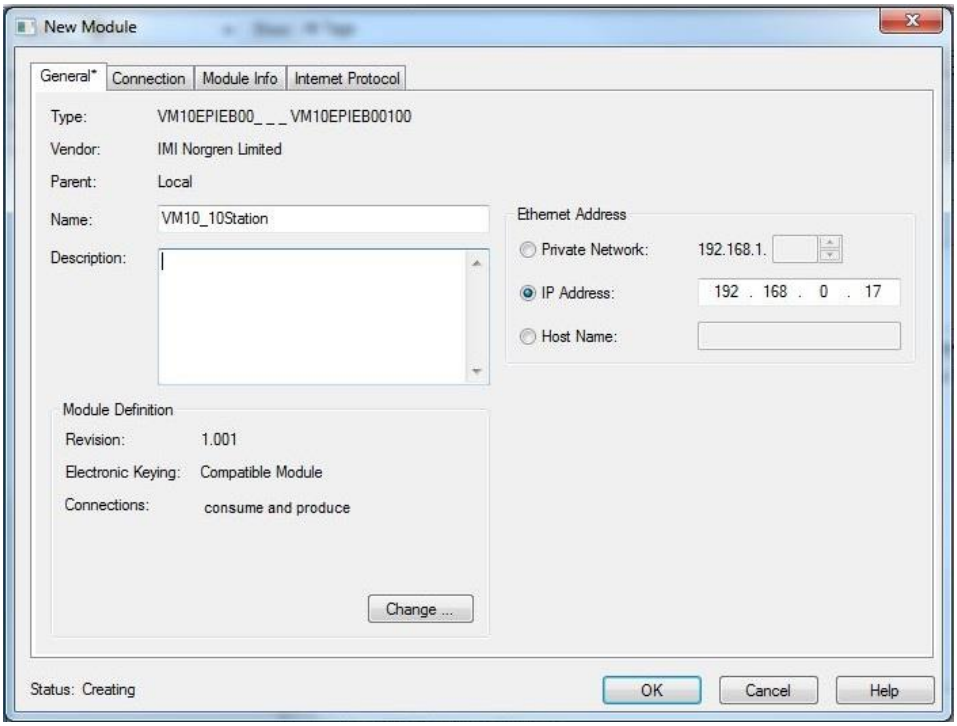
In the module catalog choose the corresponding VM10 valve island and click on „Create“.

The picture bellow shows “Select Module Type” – Dialog



In the following dialogue tab “General” set the “Name” and the correct “IP Address” of the module.



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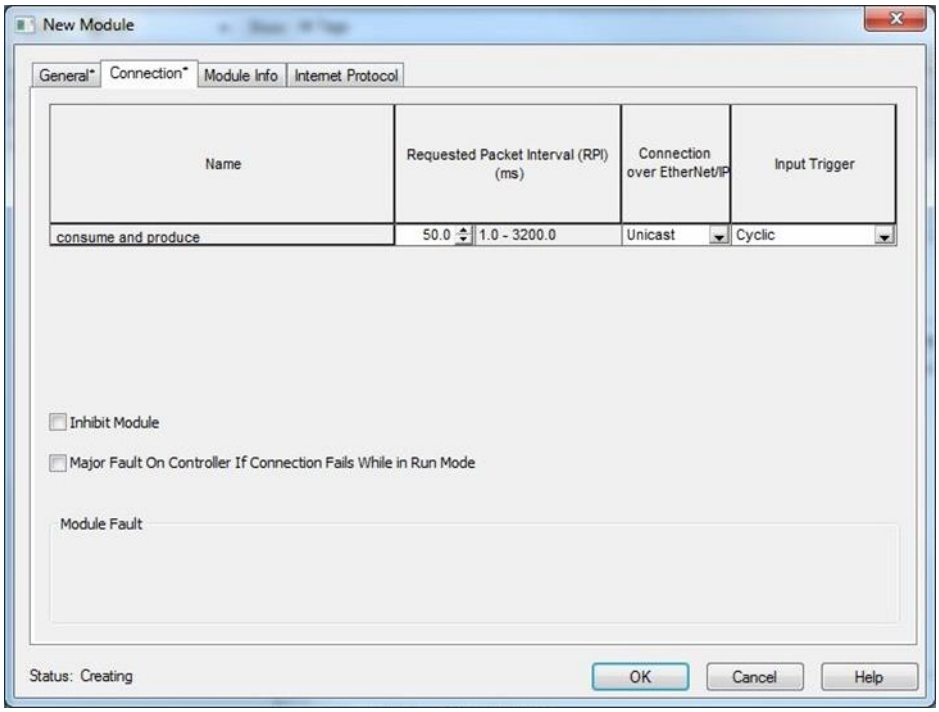
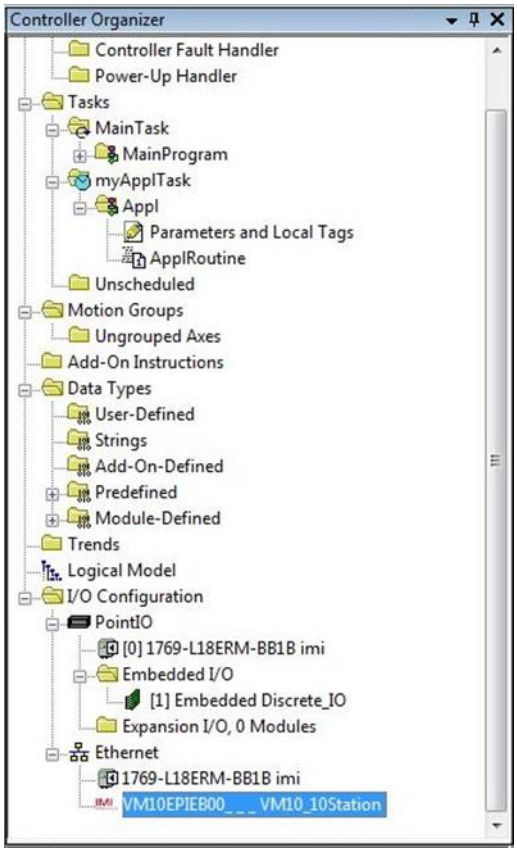
In dialogue tab “Connection” change “Requested Packet Interval (RPI)” greater than or equal to 10 ms and click “OK”. The RPI times has a direct impact to the busload.

Note: The lower the cycle times, the higher the busload.



The picture bellow shows module tree with the new added module.



After successful configuration please perform download by clicking „Download“ in the menu item „Communication“.

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4.3 Set up IP Address

4.3.1 Using a DHCP Server

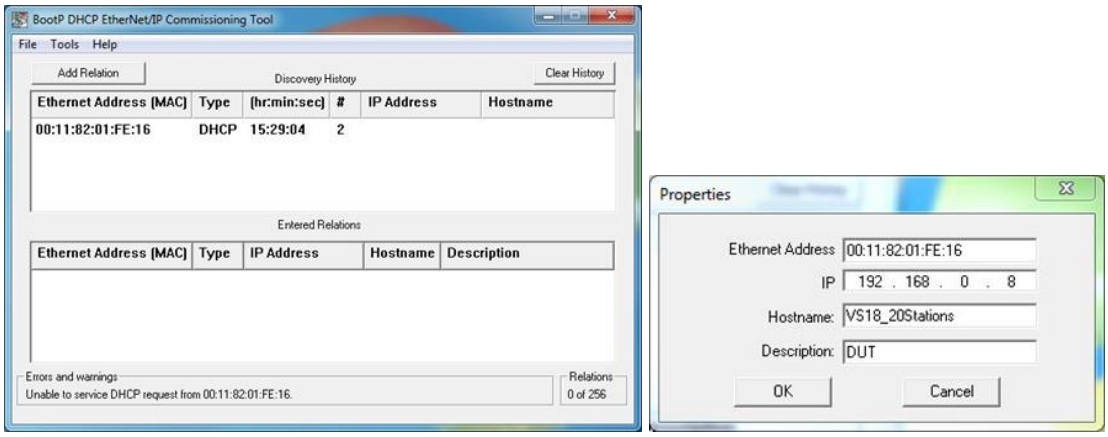
As default the VM10 valve island is set up as a DHCP client. In this mode IP Address has to be assigned using a DHCP server or a similar tool. This has to be repeated after each power cycle.

The following example shows the IP Address assignment using Rockwell Automations BOOTP_DHCP Tool.

It is important to ensure that the network adapter set up in the “Network Settings” of the tool is the one, which is connected physically to the VM10 valve island.

Menu: “Tools” -> “Network Settings”

The VM10 valve island should then appear in the “Discovery History” list. Double clicking the MAC Address opens the dialog used to set up the IP Address.



The IP Address settings are transferred into the “Discovery History” if they are valid and confirmed with the “OK” button. Pushing the “Enable BOOTP/DHCP” Button enables the IP Address assignment for the chosen entry. The VM10 valve island will appear with assigned IP Address in “Discovery History” list if address assignment was successful.

4.3.2 Static IP Address assignment using TCP/IP Interface Object

Configuration method of the IP Address could also to be set up as a static value. The interface configuration is saved to NV storage. This has to be done once and is valid after a power cycle.

The Read/Write access to the TCP/IP Interface Object is done via the Explicit Messages communication method.

The configuration method is set up with the bits0-3 in attribute 3. Please use the statically-assigned IP configuration set up value “0” for those bits.

Bit(s):	Called:	Definition	
0-3	Configuration Method	Determines how the device shall obtain its IP-related configuration	0 = The device shall use statically-assigned IP configuration values. 1 = The device shall obtain its interface configuration values via BOOTP. 2 = The device shall obtain its interface configuration values via DHCP. 3-15 = Reserved for future use.
4	DNS Enable	If 1 (TRUE), the device shall resolve host names by querying a DNS server.	
5-31	Reserved	Reserved for future use and shall be set to zero.	

Attribute 3 of TCP/IP Interface Object: Configuration Method

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Attribute 5 contains the configuration parameters required to operate as a TCP/IP node. At least network address and network mask needs to be configured.

Name	Meaning
IP address	The device's IP address.
Network mask	The device's network mask. The network mask is used when the IP network has been partitioned into subnets. The network mask is used to determine whether an IP address is located on another subnet.
Gateway address	The IP address of the device's default gateway. When a destination IP address is on a different subnet, packets are forwarded to the default gateway for routing to the destination subnet.
Name server	The IP address of the primary name server. The name server is used to resolve host names. For example, that might be contained in a CIP connection path.
Name server 2	The IP address of the secondary name server. The secondary name server is used when the primary name server is not available, or is unable to resolve a host name.
Domain name	The default domain name. The default domain name is used when resolving host names that are not fully qualified. For example, if the default domain name is "odva.org", and the device needs to resolve a host name of "plc", then the device will attempt to resolve the host name as "plc.odva.org".

Attribute 5 of TCP/IP Interface Object: Interface Configuration

Next table shows the structure of the interface configuration attribute

5	STRUCT of:	Interface Configuration
	UDINT	IP Address
	UDINT	Network Mask
	UDINT	Gateway Address
	UDINT	Name Server
	UDINT	Name Server 2
	STRING	Domain Name
	USINT	Pad [1]

Structure of Attribute 5: Interface Configuration

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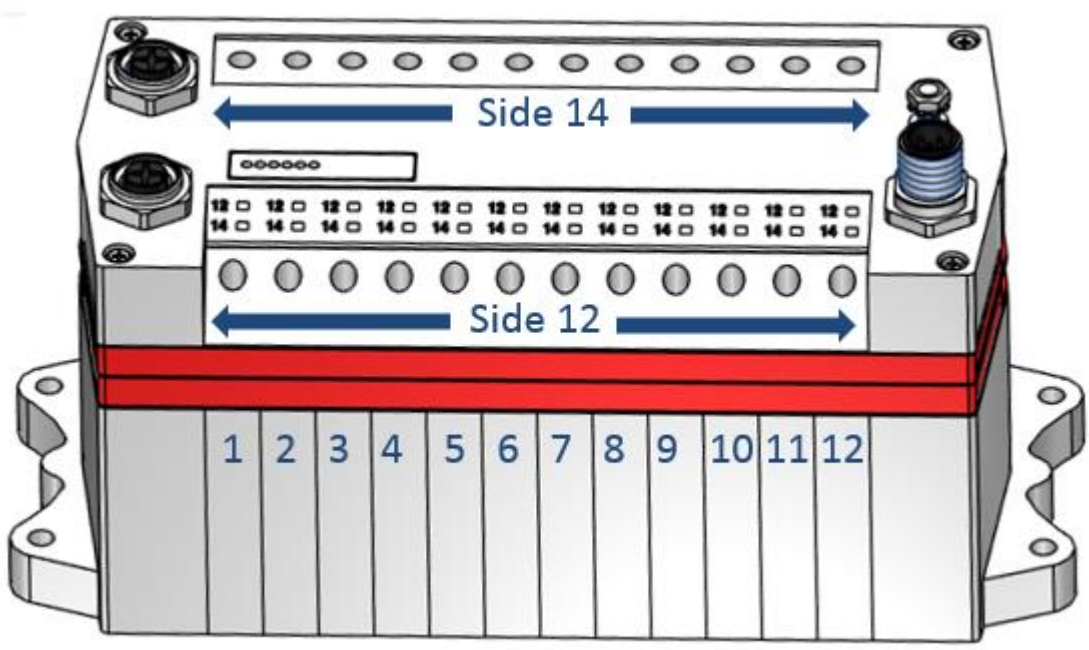
5. I/O connection via Assembly Object

The Assembly Object is used to bundle attributes of different objects, to use only one connection exchanging I/O data. One instance is used for input data and one for output data.

5.1 Bit allocation valve stations

The following picture shows exemplarily a VM10 with 12 valve stations.



Valves are numbered ascending from left to right.

The following acronym is used to identify the valves and their solenoids.

Vn-s

n: Valve number [1, 16]

s: Solenoid [12, 14]

Example: V3-12 is used to describe solenoid 12 of the third valve

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5.2 Input data (Assembly Object Instance: 101d)

The following table shows the bit allocation of the input data for VM10 with 8, 10, 12 and 16 valve stations.

Valve stations				Bit								Function
16	12	10	8	7	6	5	4	3	2	1	0	
Byte#	Byte#	Byte#	Byte#									
0	0	0	0	Res	Res	Res	Res	UV-VB	OV-VB	UV-VA	OV-VA	Module status
			1	V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Short Circuit/Overload
			2	V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Short Circuit/Overload
			3	V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Open Load
			4	V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Open Load
		1		V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Short Circuit/Overload
		2		V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Short Circuit/Overload
		3		N/A	N/A	N/A	N/A	V10-12	V10-14	V09-12	V09-14	Short Circuit/Overload
		4		V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Open Load
		5		V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Open Load
		6		N/A	N/A	N/A	N/A	V10-12	V10-14	V09-12	V09-14	Open Load
	1			V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Short Circuit/Overload
	2			V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Short Circuit/Overload
	3			V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14	Short Circuit/Overload
	4			V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Open Load
	5			V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Open Load
	6			V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14	Open Load
1				V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Short Circuit/Overload
2				V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Short Circuit/Overload
3				V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14	Short Circuit/Overload
4				V16-12	V16-14	V15-12	V15-14	V14-12	V14-14	V13-12	V13-14	Short Circuit/Overload
5				V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14	Open Load
6				V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14	Open Load
7				V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14	Open Load
8				V16-12	V16-14	V15-12	V15-14	V14-12	V14-14	V13-12	V13-14	Open Load

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5.3 Output data (Assembly Object Instance: 100d)

The following table shows the bit allocation of the output data for VM10 with 8, 10, 12 and 16 valve stations.

Valve stations				Bit							
16	12	10	8	7	6	5	4	3	2	1	0
Byte#	Byte#	Byte#	Byte#								
			0	V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14
			1	V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14
		0		V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14
		1		V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14
		2		N/A	N/A	N/A	N/A	V10-12	V10-14	V09-12	V09-14
	0			V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14
	1			V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14
	2			V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14
0				V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14
1				V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14
2				V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14
3				V16-12	V16-14	V15-12	V15-15	V14-12	V14-14	V13-12	V13-14

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6. Solenoid Object

Object Class:	100d	
Instances:	8 stations	1…16
	10 stations	1…20
	12 stations	1…24
	16 stations	1…32

Each solenoid is a separate instance of the Solenoid Object. The allocation between Instance ID and solenoid is shown in the following table:

Valve 1…4	V04-12	V04-14	V03-12	V03-14	V02-12	V02-14	V01-12	V01-14
Instance ID	8	7	6	5	4	3	2	1
Valve 5…8	V08-12	V08-14	V07-12	V07-14	V06-12	V06-14	V05-12	V05-14
Instance ID	16	15	14	13	12	11	10	9
Valve 12…9	V12-12	V12-14	V11-12	V11-14	V10-12	V10-14	V09-12	V09-14
Instance ID	24	23	22	21	20	19	18	17
Valve 13…16	V16-12	V16-14	V15-12	V15-14	V14-12	V14-14	V13-12	V13-14
Instance ID	32	31	30	29	28	27	26	25

Following table shows all Instance Attributes of the Solenoid Object:

Attr. ID	Acces Rule	Name	Data Type	Description	Schematic of Values
1	Get/Set	Solenoid Value	Bool	Output point value	0=Off 1=On
3	Get/Set	Enable Diagnostics	Bool	Enables/Disables Diagnostics (Channel diagnostics)	0=Disabled 1=Enabled
4	Get	Open load	Bool	Diagnostics Open Load	0=OK 1=Open Load
5	Get	Short Circuit / Overload	Bool	Diagnostics Short Circuit	0=OK 1=Short Circuit
6	Get/Set	Fault Action	Bool	Action taken on outputs value in recoverable fault state	0=Fault Value Attribute 1=hold last state
7	Get/Set	Fault Value	Bool	Value for use with Fault Action attribute	0=Off 1=On
8	Get/Set	Idle Action	Bool	Action taken on outputs value in idle state	0=Idle Value Attribute 1=hold last state
9	Get/Set	Idle Value	Bool	Value for use with Idle Action attribute	0=Off 1=On

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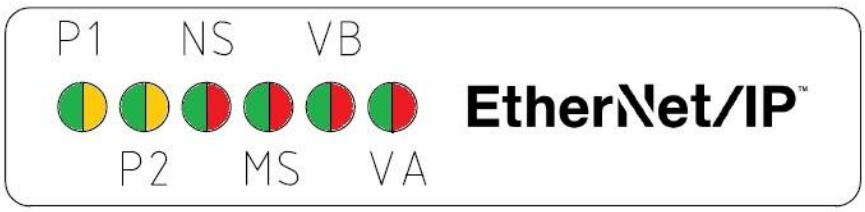
7. Diagnostics and LEDs

7.1 Status LEDs

7.1.1 Status LEDs description



LED type	Description
P1	Link Port 1 (TX/RX & Link)
P2	Link Port 2 (TX/RX & Link)
NS	Network Status
MS	Module Status
VA	Valves Power Supply Status
VB	Electronic Power Supply Status

7.1.2 Link states for Port P1 and Port P2

Link Status	LED State
Link Connection Established	yellow
Link Communication Active	flashing yellow / green
Link Connection Not Established	off

7.1.3 Network Status LED (NS)

Module Status	LED State
No Power	off
Connected	green
Not Connected	flashing green
Connection Timeout	flashing red
Duplicate IP n/a	red

7.1.4 Module Status LED (MS)

Network Status	LED State
No Power	off
Device Operational	green
Standby n/a	flashing green
Recoverable fault	flashing red
Non-recoverable fault	red

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7.1.5 Electronics Power Supply Status, LED (VB)

Electronics Power Supply States	LED State
Voltage O.K.	green
Undervoltage	flashing red
Overvoltage	red

7.1.6 Valve Power Supply Status, LED (VA)

Valve Power Supply States	LED State
Voltage O.K.	green
Undervoltage	flashing red
Overvoltage	red

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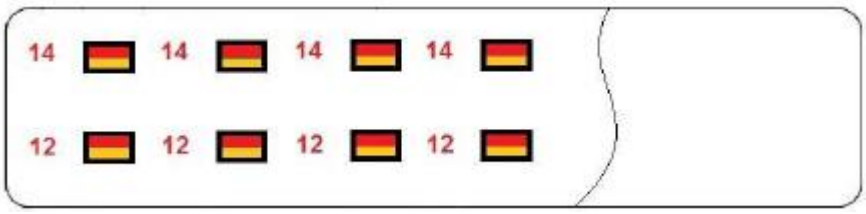
7.2 Valve slice Status LEDs



Each valve station has 2 separate status LEDs depending on its configuration, which indicate the control states “14” and “12” for the corresponding pilot valve solenoids.

Please note, that an error state will only be indicated if the valve island diagnostics for the corresponding valve has been activated in “Solenoid Object Attribute 3”.

Status	LED State
Valve not powered	off
Valve powered	yellow
Error	red

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8. Output behavior in fault condition (Idle mode/Fault mode)

The Fault Mode defines the behavior of the outputs while communication errors. The VM10 valve island executes the idle mode if requested by the controller.

The following states could be taken by the outputs in case of executing Idle Mode or Fault Mode:

- *Clear output*
- *Set output*
- *Freeze output*

This behavior could be set up for each single solenoid via the following attributes of their instance of the solenoid object:

Attr. ID	Acces Rule	Name	Data Type	Description	Schematic of Values
6	Get/Set	Fault Action	Bool	Action taken on outputs value in recoverable fault state	**0**=Fault Value Attribute 1=hold last state
7	Get/Set	Fault Value	Bool	Value for use with Fault Action attribute	**0**=Off 1=On
8	Get/Set	Idle Action	Bool	Action taken on outputs value in idle state	**0**=Idle Value Attribute 1=hold last state
9	Get/Set	Idle Value	Bool	Value for use with Idle Action attribute	**0**=Off 1=On
Bolded values are default values					

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9. Properties EtherNet/IP Interface

Specification		Comments
Number of ports	2	--
Link Speed	100Mbit/s	--
Duplex Mode	Full Duplex	--
QuickConnect	N/A	--
DLR Mode	N/A	Device Level Ring
EtherNet/IP (ODVA Certification)	Compliant to IEC61158	
IP Address modes	Static, BOOTP, DHCP	--
EDS languages	EN	--

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10. Electrical data

Requirement		Comment
Valve voltage range (VA)	24VDC +/-10%	PELV
Electronics voltage range (VB)	24VDC +/-25%	PELV
Maximal currents:	VA: 150mA + n x 30mA VB: 400mA	n = number of activated valves
Voltages are galvanic decoupled	Yes	--
Protection against polarity reversal	VA, VB	--
Overcurrent protection VB, VA	irreversible	Protection against overload and short-circuit currents, fused with 2A slow-acting fuse
PE/FE/Ground connection	Earth screw (M4)	--
Electrical power supply connection	M12 / 5-pin / A-coded / male connector	M12-1: L1 (VB+) M12-2: N2 (VA-) M12-3: N1 (VB-) M12-4: L2 (VA+) M12-5: FE
Bus connection	M12 / 4-pin / D-coded / female connector	M12-1: TD+ M12-2: RD+ M12-3: TD- M12-4: RD-

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11. Technical data

Medium:
Compressed air, filtered, lubricated and non-lubricated

Operational:
Spool valve indirectly actuated

Port sizes:
Ø 3 mm, 4 mm, 6 mm (1/8, 5/32, 1/4)

Operating pressure:
-0,9 ... 8 bar (116 psig)

Flow:

Series	Function	Cv [dm³ / s * bar]	'C'	'A'	Q_N [l/min]	k_v
VM10*5	5/2 port 1 to 2 & 4	0.44	1.77	7.1	430	0.36
VM10*5	5/2 ports 2 to 3 & 4 to 5	0.41	1.65	6.61	400	0.34
VM10*(A,B,C)	3/2 ports 1 to 2 & 1 to 4	0.36	1.44	5.78	350	0.29
VM10*(A,B,C)	3/2 ports 2 to 3 & 4 to 5	0.36	1.44	5.78	350	0.29
VM10*6	5/3 ports 1 to 2 & 4	0.36	1.44	5.78	350	0.29
VM10*6	5/3 ports 2 to 3 & 4 to 5	0.36	1.44	5.78	350	0.29

Ambient Media temperature:
-5°… +50°C (+23…+122 °F)

Air supply must be dry enough to avoid ice formation at temperature +2°C (+35°F)

Degree of protection:
NEMA 4 and IP65

Materials:

Body, end plates:	Engineered PPA co-polymer
Spool:	Aluminium
Seals:	NBR

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Customer support

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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.

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