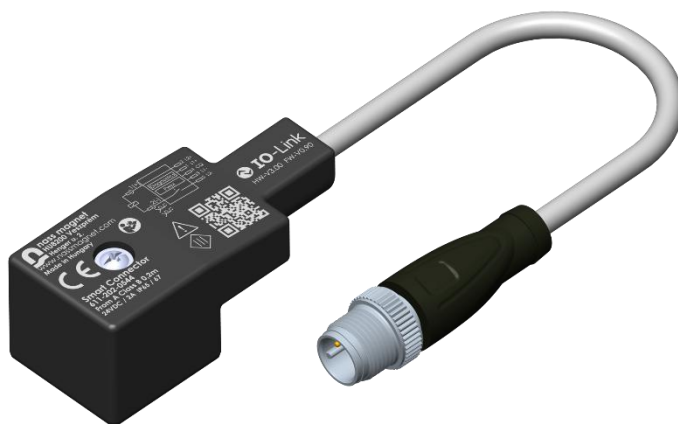


Operating instructions

Smart Connector Form A Class B

611-202-0544



Applies to:

HW-V4.00 | FW-V1.00

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1. Notes to the user

1.1 Structure of the guide

This manual is arranged so that the chapters build upon each other.

Chapter 2: Safety Instructions

Chapter 3: Intended use

...

1.2 Abbreviations

PWM	Pulse width modulation

1.3 Deviating views

Product views and illustrations in this manual may differ from the actual product. They are intended only as illustrative material.

1.4 Purpose

This document is only for device Smart Connector Form A Class B 611-202-0544. It contains information about the correct handling of the product. Read this manual before using the device.

1.5 Legal and copyright information

© All rights reserved by nass magnet Hungária Kft.. No part of this manual may be reproduced and used without the consent of nass magnet Hungária Kft..

All product names, pictures, companies or other brands used on our pages are the property of the respective rights owners:

- IO-Link® is the property of the PROFIBUS Nutzerorganisation e.V., Germany (www.io-link.com)

2. Safety instructions

2.1 General instructions

- Read this document before using the product.
- Installation, electrical connection, and configuration must be carried out by qualified person only.
- Replace damaged units, otherwise the technical data and safety will be impaired
- The manufacturer assumes no liability or warranty for any consequences caused by modifying the product or incorrect use.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.

3. Intended use

The product shall only be used for the following purposes:

- for solenoid valve systems
 - in real time applications
 - for IIoT applications to achieve predictive maintenance
- for hydraulic valve systems, and loads with higher consumption up to 2A

4. Functional overview

Dynamic PWM control

- Duty cycle
- Pull in time

RGB LED (7 possible colors)

- Custom color for on state
- Custom color for off state
- Custom color for alert state
- Locator function
- Communication LED mode

Technology

- Multiple switching counters
- Operating modes (see pin layout)
 - IO-Link mode
 - Always On mode
 - On-Off timer
 - Off-On timer
 - On delay timer
 - Off delay timer
- Failsafe mode
 - Communication lost
 - Sensor supply lost

Measurements

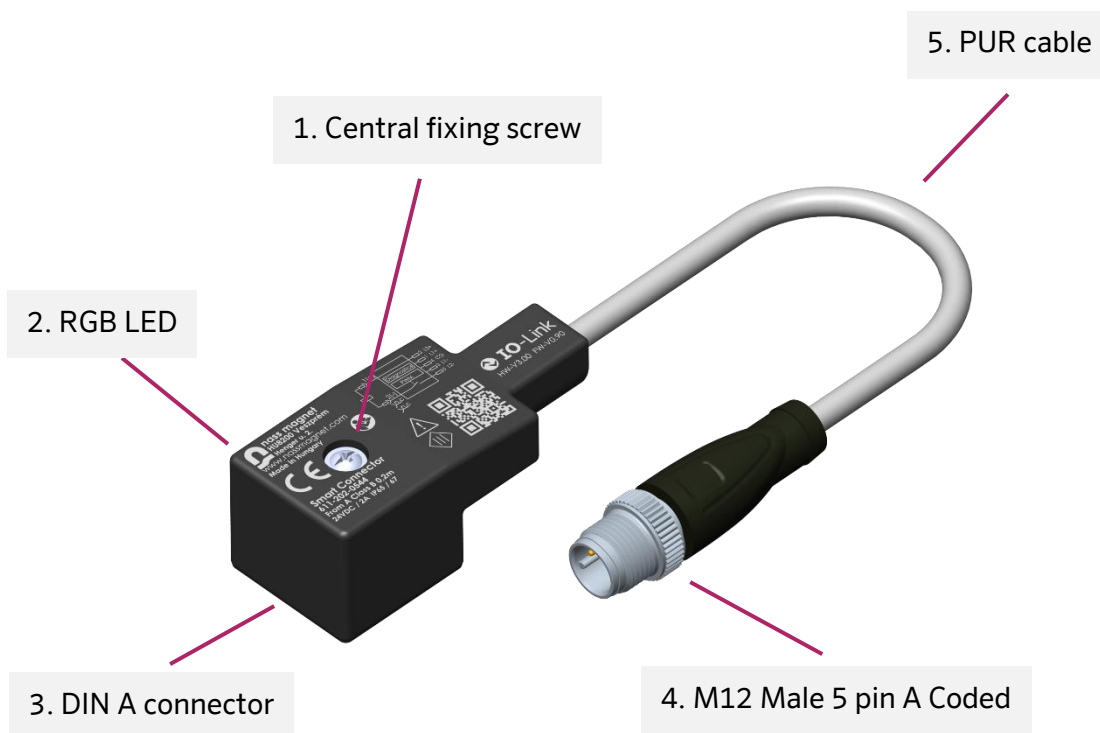
- Supply voltage (primary - sensor)
- Supply voltage (secondary - actor)
- Output current
- Output power
- Coil resistance
- Switching time
- Connector temperature

Diagnosis (IO-Link events)

- Valve switching detection
- Short-circuit detection
- Open-circuit detection
- Under voltage (primary - sensor)
- Over voltage (primary - sensor)
- Under voltage (secondary - actor)
- Over voltage (secondary - actor)
- Temperature underrun
- Custom current limit
- Custom temperature limit
- Custom switching counter limit

5. Product introduction

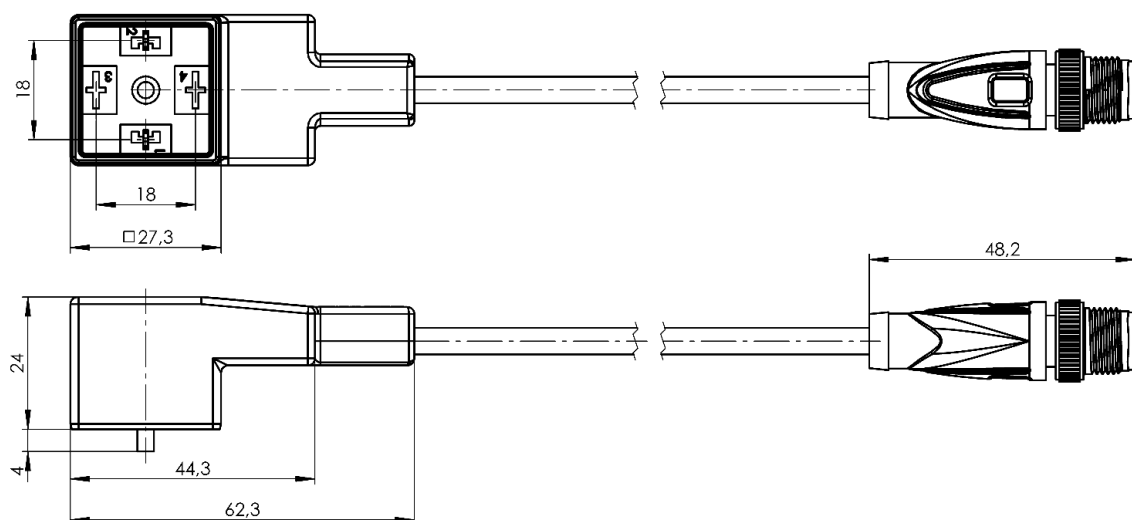
5.1 Overview



1. Figure -Overview

5.2 Dimensions

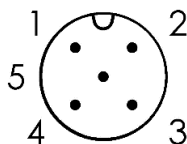
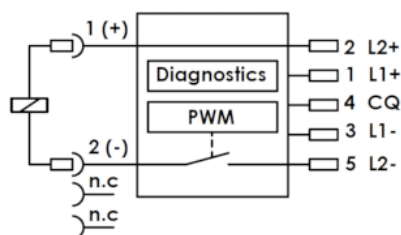
Please note that the values are in millimetres!



2. Figure Dimensions

5.3 Electrical connections

IO-Link mode (default) (IEC 60974-5-2)



Pin 1 L1+ (24V)

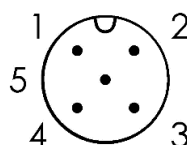
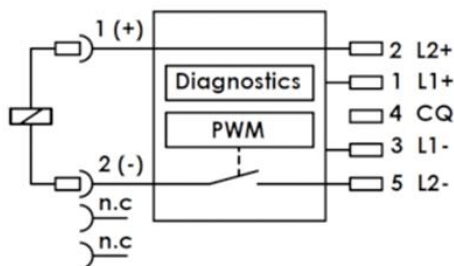
Pin 2 L2+ (24V)

Pin 3 L1- (0V)

Pin 4 C/Q

Pin 5 L2- (0V)

Standard mode



Pin 1 L1+ (24V)

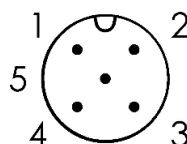
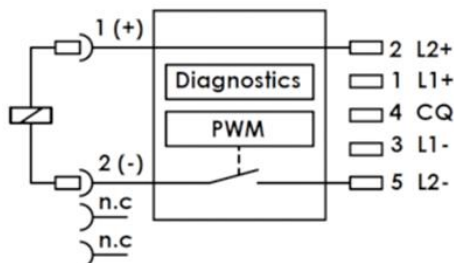
Pin 2 L2+ (24V)

Pin 3 L1- (0V)

Pin 4 -

Pin 5 L2- (0V)

No sensor mode



Pin 1 -

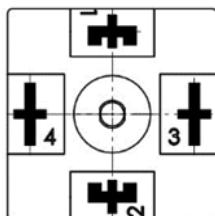
Pin 2 L2+ (24V)

Pin 3 -

Pin 4 -

Pin 5 L2- (0V)

Form A Connector



Pin 1 24V

Pin 2 0 V

Pin 3-4 Not connected

6. Technical data

Electrical specifications

Operating voltage	18...30 VDC
Rated operating voltage	24 VDC
Max. output current	2000 mA (according to IO-Link Class B)
Own consumption	17 mA
Electrical connection	1 x M12 male 5-pin A-coded

Cable connector

Ground position	6/12h
Poles	2-2(E)
Moulded jacket color	Anthracite grey
Moulded jacket material	TPU
Contact material	CuZn, Cu/Sn-plated
Gasket	Integrated
Imprint	White

Cabel

Type	PUR
Cable cores	5 (brown, black, blue, white, grey)
Conductor cross-section	0.34mm ²
Length	0.2 ± 0.02m

Central fixing screw

Type	M3 x 26mm
Material	A2-50 stainless steel
Head	Cross recess
Tightening torque	0.4 ± 0.1Nm

Environmental conditions

Ambient temperature	-20...70 °C
Storage temperature	-20...70 °C
IP rating	IP65/67

Interface

IO-Link revision	V 1.1.3
Data transfer rate	38.4 kBit/s (COM2)
Cycle time	2.8 ms
Vendor ID	0x054A (1354)
Device ID	0x000003 (3)
Process data IN	1 byte
Process data OUT	1 byte
SIO mode supported	No
Data storage supported	Yes

7. IO-Link interface description

7.1 System commands

7.1.1 Application reset

Resets the following technology parameters to their default values.

Index	Parameter	Default value
77	Mode	0
78	On time	1
79	Off time	9
81	Counter 1 limit	10000000
82	Counter 2	0
83	Counter 2 limit	2000000
102	Default PWM	50
103	PWM Pull time	150
106	Output current limit	2000
109	Temperature limit	85
111	Temperature peak	-100
113	Display mode	0
114	LED switched off	5
115	LED switched on	2
116	LED Alert	4
117	LED Alert Blink	True
119	Events enable	False
121/1	Fail safe behavior no comm	0
121/2	Fail safe behavior no sensor	0

7.1.2 Restore factory settings

Perform an application reset, and reset IO-Link parameters (app. specific tag, location tag, function tag).

7.2 Parameter overview

7.2.1 Identification

Index	Subindex	Parameter	Default value	Access
16	0	Vendor name	nass magnet Hungaria Kft.	R
17	0	Vendor text	www.nassmagnet.com	R
28	0	Product name	Smart Connector Class B	R
20	0	Product text	nass magnet smart valve driver connector	R
21	0	Serial number	S.N.xxxxxxx	R
22	0	Hardware version	HW-Vx.xx	R
23	0	Firmware version	FW-Vx.xx	R
24	0	Application specific tag	***	R/W
25	0	Function tag	***	R/W
26	0	Location tag	***	R/W

7.2.2 Technology parameters

Index	Bit	Parameter	Default value	Unit	Access	Page
77	8	Mode	0	-	R/W	9
78	16	On Time	1	sec	R/W	9
79	16	Off Time	9	sec	R/W	10
80	32	Counter 1	0	-	R	10
81	32	Counter 1 Limit	10 000 000	-	R/W	10
82	32	Counter 2	0	-	R/W	11
83	32	Counter 2 Limit	2 000 000	-	R/W	11
100/1	8	Supply Voltage Actor	-	V	R	11
100/2	8	Supply Voltage Sensor	-	V	R	11
101	16	Switch ON Resistance	-	Ω	R	12
102	8	PWM DC	50	%	R/W	12

Index	Bit	Parameter	Default value	Unit	Access	Page
103	16	PWM Pull Time	150	ms	R/W	13
104	16	Valve Switching Time	-	ms	R	13
105	16	Output Current	-	mA	R	13
106	16	Output Current Limit	2 000	mA	R/W	14
107	32	Output Power	-	mW	R	14
108	16	Temperature	-	°C	R	14
109	16	Temperature Limit Max.	85	°C	R/W	15
110	16	Overheated	-	-	R	15
111	16	Temperature Peak	-	°C	R	15
112	8	Temperature Peak Reset	-	-	W	16
113	8	Display Mode	0	-	R/W	16
114	8	LED Switched Off	Magenta	-	R/W	17
115	8	LED Switched On	Green	-	R/W	17
116	8	LED Alert	Red	-	R/W	18
117	8	LED Alert Blink	True	-	R/W	18
119	8	Events Enable	False	-	R/W	19
120	16	Diagnostic Bits	-	-	R	20
121/1	8	Fail safe behavior no comm	0	-	R/W	21
121/2	8	Fail safe behavior no sensor	0	-	R/W	21

7.3 Process data

7.3.1 Process data output

Subindex	Bit Offset	Name	Data type	Allowed Values
1	0	Valve set value	Boolean	false = Set off true = Set on
2	1	PWM set value (%)	7-bit UInteger	0 ... 100

Subindex	2							1
Bit offset	7	6	5	4	3	2	1	0

7.3.2 Process data input

Subindex	Bit Offset	Name	Data type	Allowed Values
1	0	Valve get value	Boolean	false = Set off true = Set on
2	1	PWM get value (%)	7-bit UInteger	10 ... 100

Subindex	2							1
Bit offset	7	6	5	4	3	2	1	0

7.4 Parameters in detail

Mode	Index 77 (0x4D)	Subindex 0	R/W
Type	UIntegerT		
Size	8 bit		
Unit	-		
Value Range	0 – IO-Link mode 1 – Always on mode 2 – On-Off timer 3 – Off-On timer 4 – On delay timer 5 – Off delay timer		
Default value	0		
Description	In Smart Connector mode (0) switching is performed by process data via IO-Link communication, for other modes (1...5) switching is performed by predefined functionalities, hence in that case it is enough to apply supply voltage without IO-Link. In all modes PWM is used.		

On time	Index 78 (0x4E)	Subindex 0	R/W
Type	UIntegerT		
Size	16 bit		
Unit	second		
Value Range	1 ... 65 535 (0xFFFF)		
Default value	1		
Description	In Timer mode, this parameter determines the switch-on time in seconds.		

Off time		Index 79 (0x4F)	Subindex 0	R/W
Type	UIntegerT			
Size	16 bit			
Unit	second			
Value Range	1 ... 65 535 (0xFFFF)			
Default value	9			
Description	In Timer mode, this parameter determines the switch-off time in seconds.			

Counter 1		Index 80 (0x50)	Subindex 0	R
Type	UIntegerT			
Size	32 bit			
Unit	-			
Value Range	0 ... 4 294 967 295 (0xFFFF FFFF)			
Default value	0			
Description	Each time the output is switched on, this counter counts. This variable cannot be reset or adjusted.			

Counter 1 Limit		Index 81 (0x51)	Subindex 0	R/W
Type	UIntegerT			
Size	32 bit			
Unit	-			
Value Range	0 ... 4 294 967 295 (0xFFFF FFFF)			
Default value	10 000 000			
Description	A limit value for the counter 1 can be defined. The aim of this parameter is to send a warning if the limit value is exceeded by the counter 1.			

Counter 2		Index 82 (0x52)	Subindex 0	R/W
Type	UIntegerT			
Size	32 bit			
Unit	-			
Value Range	0 ... 4 294 967 295 (0xFFFF FFFF)			
Default value	0			
Description	Each time the output is switched on, this counter counts. This variable can be reset or adjusted in case of changing the load.			

Counter 2 Limit		Index 83 (0x53)	Subindex 0	R/W
Type	UIntegerT			
Size	32 bit			
Unit	-			
Value Range	0 ... 4 294 967 295 (0xFFFF FFFF)			
Default value	2 000 000			
Description	A limit value for the counter 2 can be defined. The aim of this parameter is to send a warning if the limit value is exceeded by the counter 2.			

Supply Voltage Actor		Index 100 (0x64)	Subindex 1	R
Type	UIntegerT			
Size	8 bit			
Unit	V			
Value Range	0 ... 33			
Default value	-			
Description	This variable contains the supply voltage of the secondary power supply. Used for diagnostic purposes. Variable can only be read. Accuracy $\pm 5\%$			

Supply Voltage Sensor		Index 100 (0x64)	Subindex 2	R
Type	UIntegerT			
Size	8 bit			
Unit	V			
Value Range	0 ... 33			
Default value	-			
Description	This variable contains the supply voltage of the primary power supply. Used for diagnostic purposes. Variable can only be read. Accuracy $\pm 5\%$			

Switch On Resistance		Index 101 (0x65)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	Ohm			
Value Range	0 ... 65 535 (0xFFFF)			
Default value	-			
Description	The variable refers to the resistance of the load at the output. The value is updated each time the device detects a valve switch. The value is calculated from the current supply voltage and the drop-on current (after the pull-in transient). Value is used for diagnostic purposes. Variable can only be read.			

PWM Default Duty Cycle		Index 102 (0x66)	Subindex 0	R/W
Type	UIntegerT			
Size	8 bit			
Unit	%			
Value Range	10 ... 100			
Default value	50			
Description	Default value for PWM duty cycle in percentage, for multiple purposes: - Set the duty cycle at the output, when connector is in IO-Link mode, and the PDO duty cycle is < 11%. - Set the duty cycle at the output, when connector is in other modes. For different modes see Idx 77.			

PWM Pull In Time		Index 103 (0x67)	Subindex 0	R/W
Type	UIntegerT			
Size	16 bit			
Unit	millisecond			
Value Range	5 ... 2000			
Default value	150			
Description	This variable determines the pull-in time while the connector energizes the load with full power, so the PWM duty cycle is 100%. After the pull in time has elapsed the connector switches into energy saving (PWM) mode.			

Valve Switching Time		Index 104 (0x68)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	millisecond			
Value Range	0 ... 65 535 (0xFFFF)			
Default value	-			
Description	This variable contains the measured drop-on time of the armature. Used for diagnostic purposes. Variable can only be read.			

Output Current		Index 105 (0x69)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	mA			
Value Range	0 ... 2000			
Default value	-			
Description	This variable contains the measured output current of the connector. Used for diagnostic purposes. The variable can only be read. Accuracy $\pm 5\%$			

Output Current Limit		Index 106 (0x6A)	Subindex 0	R/W
Type	UIntegerT			
Size	16 bit			
Unit	mA			
Value Range	0 ... 2000			
Default value	2000			
Description	An upper limit for the measured output current. It sends a warning upon exceeded by the actual output current.			

Output Power		Index 107 (0x6B)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	mW			
Value Range	0 ... 65 535 (0xFFFF)			
Default value	-			
Description	This variable contains the measured output power in milliwatts. The value is calculated from the output current and supply voltage.			

Temperature of the connector		Index 108 (0x6C)	Subindex 0	R
Type	IntegerT			
Size	16 bit			
Unit	°C			
Value Range	-100 ... 200			
Default value	-			
Description	This variable indicates the temperature of the connector. The variable can only be read. Reference value only.			

Temperature limit		Index 109 (0x6D)	Subindex 0	R/W
Type	IntegerT			
Size	16 bit			
Unit	°C			
Value Range	-100 ... 200			
Default value	85			
Description	An upper limit for the measured temperature. It sends a warning upon exceeded by the actual temperature.			

Temperature limit counter		Index 110 (0x6E)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	-			
Value Range	0 ... 65 535 (0xFFFF)			
Default value	0			
Description	This variable indicates the number of overheatings, how many times the connector has exceeded the temperature limit (idx109).			

Temperature peak		Index 111 (0x6F)	Subindex 0	R
Type	IntegerT			
Size	16 bit			
Unit	°C			
Value Range	-100 ... 200			
Default value	0			
Description	This variable contains the peak temperature since the last reset (idx112).			

Temperature peak reset		Index 112 (0x70)	Subindex 0	W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	1			
Default value	-			
Description	Written in 1 resets temperature peak value.			

Display mode		Index 113 (0x71)	Subindex 0	R/W
Type	BooleanT			
Size	8 bit			
Unit	-			
Value Range	0 – Valve status display 1 – Communication state display			
Default value	0 – Valve status display			
Description	This variable defines the behavior of the LED built in the connector. - 0 - the LED lights according to ldx 114/115/116/117 - 1 - the LED blinks green in case of IO-Link communication is alive			

LED Switched Off		Index 114 (0x72)	Subindex 0	R/W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	0 – Off 1 – Blue 2 – Green 3 – Cyan 4 – Red 5 – Magenta 6 – Yellow 7 – White			
Default value	5 – Magenta			
Description	The color of the LED for switched off mode.			

LED Switched On		Index 115 (0x73)	Subindex 0	R/W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	0 - Off 1 - Blue 2 - Green 3 - Cyan 4 - Red 5 - Magenta 6 - Yellow 7 - White			
Default value	2 - Green			
Description	The color of the LED for switched on mode.			

LED Alert		Index 116 (0x73)	Subindex 0	R/W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	0 - Off 1 - Blue 2 - Green 3 - Cyan 4 - Red 5 - Magenta 6 - Yellow 7 - White			
Default value	4 - Red			
Description	The color of the LED for alert mode.			

LED Alert blink		Index 117 (0x74)	Subindex 0	R/W
Type	BooleanT			
Size	8 bit			
Unit	-			
Value Range	0 – Blinking off 1 – Blinking on			
Default value	1 – Blinking on			
Description	LED blinking enable or disable for alert mode.			

Events enable		Index 119 (0x77)	Subindex 0	R/W
Type	BooleanT			
Size	8 bit			
Unit	-			
Value Range	0 – Events disable 1 – Events enable			
Default value	0 – Events disable			
Description	Upon setting this variable, the device will start generating IO-Link events based on the diagnostic bits (idx120).			

Diagnostic bits		Index 120 (0x78)	Subindex 0	R
Type	UIntegerT			
Size	16 bit			
Unit	-			
Value Range	-			
Default value	-			
Description	Lower half for warning, higher half for error states. Can be read manually, or initiate event if events are enabled (idx119).			

Bit	Diagnostic bits	Appear On
0	Counter_1 overflow	Counter 1 > Counter 1 Limit
1	Counter_2 overflow	Counter 2 > Counter 2 Limit
2	Temperature underrun	Temperature < -25 °C
3	Overheat	Temperature > Temp. Limit Max
4	Valve switching detection	Could not detect valve switching during Pull In Time
5	Undervoltage sensor	Supply Voltage < 18
6	Overvoltage sensor	Supply Voltage > 30
7	Power supply fault sensor	Supply Voltage > 32
8	Undervoltage actor	Supply Voltage < 18
9	Overvoltage actor	Supply Voltage > 30
10	Power supply fault actor	Supply Voltage > 32
11	Overheat fault	Temperature > 90 °C
12	Open-circuit on output	During switched on state, Measured Current < 1.5 mA
13	Current overload on output	Measured Current > Max. Output Current Limit
14	Short-circuit on output	Measured Current > 1200 mA
15	No actor supply	No L2 supply detected

Fail safe behavior no comm		Index 121 (0x79)	Subindex 1	R/W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	0 - Reset			
	1- Set			
	2 - Hold last valid state			
Default value	0 - Reset			
Description	This variable defines the action to be taken in case of lost IO-Link communication in IO-Link mode (idx77).			

Fail safe behavior no sensor		Index 121 (0x79)	Subindex 2	R/W
Type	UIntegerT			
Size	8 bit			
Unit	-			
Value Range	0 - Reset			
	1 - Set			
	2 - Hold last valid state			
	3 - Force reset			
	4 - Force set			
Default value	0 - Reset			
Description	Defines the behaviour of sensor supply disconnection / startup without sensor supply. Force modes blocks any other driving features (idx77). In other modes it should be taken into consideration that reapplying sensor supply causes a reset at the output.			

7.5 Events

Code	Device status	Class	Description
0x4210	Out of specification	Warning	Device temperature overrun
0x4000	Failure	Error	Temperature fault – overload
0x5100	Failure	Error	General power supply fault
0x7710	Failure	Error	Output short-circuit
0x4220	Out of specification	Warning	Device temperautre underrun
0x5110	Out of specification	Warning	Supply voltage overrun
0x5111	Out of specification	Warning	Supply Voltage underrun
0x8CA0	Out of specification	Warning	Current overload
0x8CA1	Maintenance	Warning	Counter 1 overrun
0x8CA2	Maintenance	Warning	Counter 2 overrun
0x8CA3	Maintenance	Warning	Output open-circuit

7.6 Error types

Code	Name	Description
0x8011	Index not available	Read or write access attempt to a non-existing index
0x8012	Subindex not available	Read or write access attempt to a non-existing subindex
0x8020	Service temporary not available	Parameter not accessible due to the current state of the application
0x8023	Index not accessible	Write access to a read-only parameter or read access to a write-only parameter
0x8030	Parameter value out of range	Written parameter value is outside of the permitted value range
0x8031	Parameter value above limit	Written parameter value is greater than the upper limit.
0x8032	Parameter value under limit	Written parameter value is less than the lower limit.
0x8033	Parameter length overrun	Written parameter is longer than specified
0x8034	Parameter length underrun	Written parameter is shorter than specified
0x8035	Function not available	Written command is not supported by the technology-specific application.
0x8036	Function temporarily not available	Written command is unavailable due to the current state of the application.
0x8040	Invalid parameter set	Written single parameter value collides with other existing parameter settings.
0x8041	Inconsistent parameter set	Parameter set inconsistencies at the end of block parameter transfer.
0x8082	Application not ready	Read or write access denies. The application is temporarily not available.

8. Maintenance

8.1 Cleaning

- Clean the surface of the unit when necessary.
- Use a damp cloth for cleaning.

8.2 Maintenance

- In case of material damage the functioning of the product is not guaranteed.
- In the event of maintenance work, you can replace the module with the same type.

8.3 Disposal

- Dispose of the unit in an environmentally friendly way according to the applicable national regulations when it is no longer used.