

Type 3738-20 Electronic Limit Switch

With optional solenoid valve

SAMSON

Application

Electronic limit switch for on/off applications to indicate the end position. Optionally with integrated solenoid valve.

CE Ex certified

Special features

- Automation of on/off valves
- Limit switch and optional integrated solenoid valve united in a compact housing or with commercially available external solenoid valves (Ex ia, Ex e)
- Proven operation concept already used in Series 373x Positioners: menu-driven, on-site operation using one rotary pushbutton, display easy to read in any mounting position
- Trouble-free integration into existing systems
 - NAMUR contacts (DIN EN 60947-5-6)
 - Solenoid valve 24 V DC
 - Intrinsically safe version
- Compact mounting and simple operation
- Contactless, wear-free travel sensor
 - Magneto-resistive sensor
 - No adjustment work necessary
 - Stable measured data and drift-free switching points
 - High level of accuracy
- Electronic limit switch powered over a two-wire system solely by the NAMUR signal
- Automatic initialization
- Easy-to-read LC display with selectable reading direction, LED for solenoid valve status
- Communication interface for convenient configuration and documentation
- Certified safety, use in safety-instrumented systems according to IEC 61508
- Diagnostic functions
 - Partial stroke test (PST)
 - Movement counter
 - Operating hours counter
 - Dead time and transit time measurement

Type 3738-50 Electronic Limit Switch with FOUNDATION™ fieldbus Communication, see Data Sheet ► T 8390-5



Fig. 1: Type 3738 Electronic Limit Switch with opened cover



Fig. 2: Type 3738 mounted on a piston actuator



Fig. 3: Type 3738 mounted on a linear actuator

Versions

– Type 3738-20-xxx14xxxxx2xx Electronic Limit Switch with integrated solenoid valve

The electronic limit switch with integrated solenoid valve form a compact unit together with a pneumatic actuator, which is easy to mount. The 3/2-way or 5/2-way function of the solenoid valve is selected by changing the position of a molded seal.

This version can be mounted directly onto a Pfeiffer Type 31b Rotary Actuator. The need for additional pneumatic connections is eliminated.

– Type 3738-20-xxx1000xxx200 Electronic Limit Switch for external solenoid valve

The electronic limit switch for an external solenoid valve allows switching capacities up to max. 18 W at 24 V DC, meaning all common solenoid valves, even the Ex e versions, can be combined with the electronic limit switch.

Principle of operation

The electronic limit switch is designed for attachment to pneumatic actuators. The angle of rotation is measured without

contact using a magnet (on a screw) positioned centrally on the actuator shaft. The screw with magnet does not need to be adjusted. The AMR (anisotropic magnetoresistive) sensor located in the device together with the measuring electronics (1) can detect the directional change of the applied magnetic field and, as a result, sense the rotation of the actuator.

The actuator is operated by an external or integrated solenoid valve (7) which converts the binary signal issued by electric control equipment (6) into a binary pressure signal.

The limit switch for fail-safe position (contact A, 13) and the limit switch for operating position (contact B, 14) issue a limit signal when the valve reaches the corresponding end position. Contact C (15) indicates when the PST target range of the partial stroke test has been reached. The switching response of the contacts can be adjusted within the travel range. The fault alarm contact St (16) indicates the generation of any status and error messages.

An electronic limit switch version for an external solenoid valve is available for higher air capacities required by large actuators.

Schematic diagrams

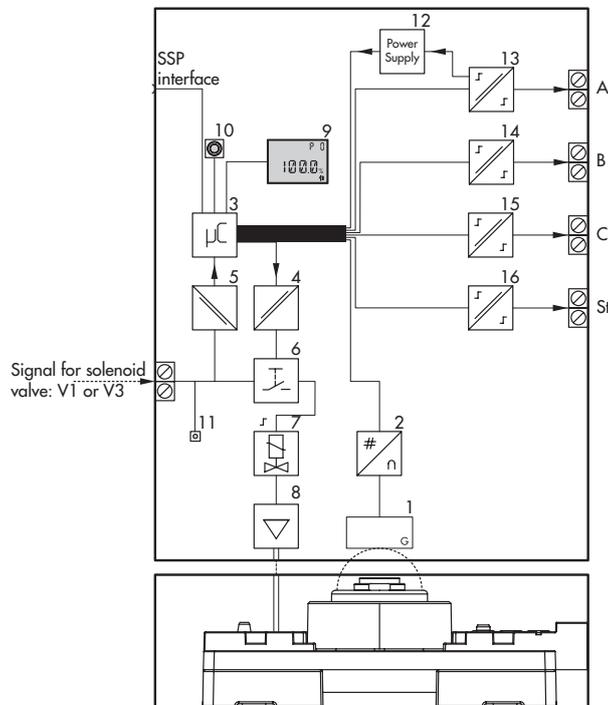


Fig. 4: Type 3738-20-xxx14xxxxx2xx
Version with integrated solenoid valve

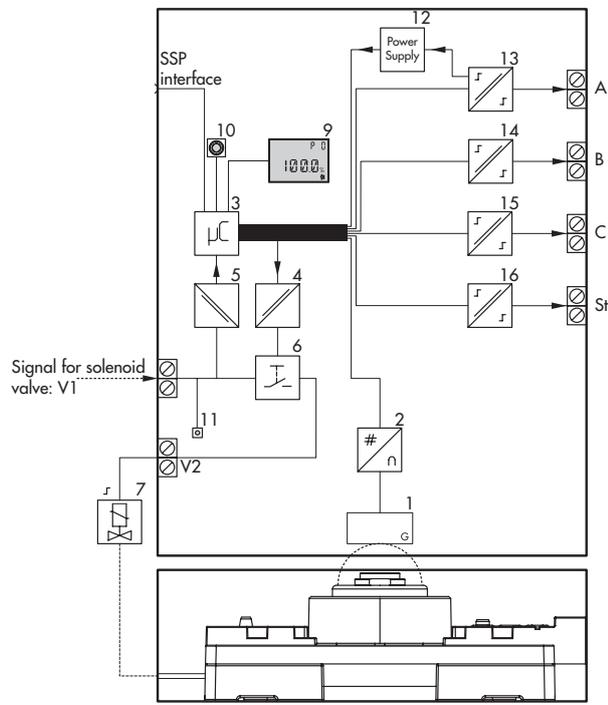


Fig. 5: Type 3738-20-xxx1000xxx200
Version with external solenoid valve

- | | | |
|-------------------------------|--|---|
| 1 AMR sensor with electronics | 7 Solenoid valve (integrated, external) | 12 Internal supply |
| 2 A/D converter | 8 Air capacity booster | 13 NAMUR contact A (limit switch for fail-safe position) |
| 3 Microcontroller | 9 Display | 14 NAMUR contact B (limit switch for operating position) |
| 4, 5 Electrical insulation | 10 Rotary pushbutton (on-site operation) | 15 NAMUR contact C (signal when PST target range reached) |
| 6 Actuation of solenoid valve | 11 LED for solenoid valve | 16 NAMUR contact St (fault alarm contact) |

Operation

A rotary pushbutton and LC display are used to operate the electronic limit switch on site. The functions for start-up, display readings and service functions are set over Codes (P0 to P28). When a fault occurs, a corresponding error code is displayed.

SAMSON's TROVIS-VIEW can be used to operate the electronic limit switch. An SSP interface on the electronic limit switch allows it to be connected to a computer using an adapter cable.

Attachment

- The electronic limit switch can be mounted on a linear actuator, e.g. Type 3271 Pneumatic Actuator (**NAMUR attachment**). Depending on the diaphragm area, various mounting parts are available (see Table 4).
- The electronic limit switch is mounted according to **VDI/VDE 3845**, fixing level 1 (2010) on rotary actuators using a mounting platform. Various mounting parts (accessories) are available depending on the follower shaft height of the rotary actuator (see Table 4).

Pneumatic connections

Run and attach the connecting lines and screw joints according to good professional practice. Check them for leaks and damage at regular intervals and repair them, if necessary. Before starting any repair work, depressurize any open connecting lines.

The air connection are designed as threaded holes with G ¼ or ¼ NPT thread depending on the device version. Protect the exhaust air connections or vent plugs by installing a filter or taking other appropriate precautions to prevent water or dirt from entering them.

Operation using a pressure reducing valve: The K_{VS} coefficient of an upstream pressure reducing valve must be at least 1.6 times larger than the K_{VS} coefficient of the device.

Air pipe: The minimum nominal size of the air pipe must be a pipe with an inside diameter of ≥ 4 mm. A larger nominal size is needed when the connection length exceeds 2 m.

Operation with external solenoid valve: The input pressure at the external solenoid valve must not exceed the maximum supply pressure (refer to the specifications given by the solenoid valve manufacturer).

Electrical connections

The electronic limit switch is powered over the connection of the contact A. An additional electrical power supply is not required.

Cable entry

The threaded connection for the terminal compartment is designed with an M20 x 1.5 thread.

The screw terminals are designed for wire cross-sections of 0.2 to 1.5 mm². Tighten by at least 0.5 Nm.

Use in safety-instrumented systems

- **Safety-related end position monitoring**
All switching contacts of the Type 3738-20 Electronic Limit Switch behave as stipulated in DIN EN 60947-5-6 and are suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) according to TÜV/IEC 61508. The contacts can be used either as NC or NO contacts. Their switching states are indicated according to DIN EN 60947-5-6. Contact A is assigned to the end position for the fail-safe position (limit switch for fail-safe position). The fail-safe position is the end position to which the single-acting actuator is moved by the spring-return mechanism when the solenoid valve is de-energized.
- **Emergency venting**
When the optional integrated solenoid valve is used, the electronic limit switch discharges its pneumatic output to the atmosphere when the solenoid valve is de-energized. This causes the mounted actuator to be vented.
The function is suitable for use in safety-instrumented systems up to SIL 2 (single channel) and SIL 3 (redundant configuration) according to IEC 61508.

Safety-related end position monitoring and emergency venting work independently from one another to meet the device design requirements to conform with SIL.

Table 1: Technical data of the electronic limit switch

Electronic Limit Switch Type		3738-20-xxx14xxxxx2xx	3738-20-xxx1000xxx200
Version		With integrated solenoid valve	For external solenoid valve
Range of rotation	Minimum	0 to 30°	
	Maximum	0 to 170°	
Communication	Local communication	SAMSON SSP interface with serial interface adapter	
	Software requirements	TROVIS-VIEW with database module 3738-20	
Supply air		2.4 to 8 bar	Same as specifications of the solenoid valve manufacturer
	Air quality	Acc. to ISO 8573-1, edition 2004 Max. particle size and density: Class 4 Oil content: Class 3 Moisture and water: Class 3 · Pressure dew point: at least 10 K below the lowest ambient temperature to be expected	
	Air consumption	In neutral position: <60 l/h In switching position: <30 l/h	
Electric power supply		Powered over contact A according to DIN EN 60947-5-6	
Permissible ambient temperature		-25 to 80 °C	-40 to 80 °C
The temperature limits for the explosion-protected devices may be restricted by the limits specified in the test certificates.		The permissible operating temperature for use in safety-instrumented systems is -25 to 70 °C Metal cable glands must be used for ambient temperatures below -20 °C. The limits specified in the examination certificate additionally apply.	
Influences	Temperature	±0.7 %/90° angle above the permissible temperature range	
	Effect of vibration	≤0.25 % up to 2500 Hz and 4 g according to IEC 770	
Electromagnetic compatibility		Complying with EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21	
Electrical connections		Four M20 x 1.5 cable glands for 6 to 12 mm clamping range, screw terminals for 0.2 to 2.5 mm ² wire cross-sections	
Explosion protection		See certificates in Table 3	
Degree of protection		IP 66	
Safety approval	Safety-related end position monitoring	The limit switches are suitable for use in safety-instrumented systems up to SIL 2 (single channel) and SIL 3 (redundant configuration) according to IEC 61508.	
	Emergency venting	The function is suitable for use in safety-instrumented systems up to SIL 2 (single channel) and SIL 3 (redundant configuration) according to IEC 61508. See section on Use in safety-instrumented systems.	Same as specifications of the solenoid valve manufacturer
Materials	Housing	Die-cast aluminum EN AC-ALSi12(Fe) (EN AC-44300) acc. to DIN EN 1706, powder paint coated	
	Housing cover	Computer	
	Cover gasket	PU	
	Indicator wheel	Computer	
	Magnet material	Hard ferrite	
Weight		Approx. 1.2 kg	Approx. 1.0 kg
Contacts · Only for connection according to DIN EN 60947-5-6, reverse polarity protection, galvanic isolation			
Switching contacts		NC contact	NO contact
	No response/no fault	≥2.2 mA	≤1.0 mA
	Response/fault alarm	≤1.0 mA	≥2.2 mA
Hysteresis		1 %	
Contacts	Contact A Limit switch for fail-safe position (solenoid valve de-energized)	PTO (power to open): responds when the valve moves through the switching contact towards the lower end position PTC (power to close): responds when the valve moves through the switching contact towards the upper end position	
	Contact B Limit switch for operating position (solenoid valve energized)	PTO (power to open): responds when the valve moves through the switching contact towards the upper end position PTC (power to close): responds when the valve moves through the switching contact towards the lower end position Signal for wire breakage according to DIN EN 60947-5-6	

Electronic Limit Switch Type		3738-20-xxx14xxxxx2xx	3738-20-xxx1000xxx200
Version		With integrated solenoid valve	For external solenoid valve
Contacts	Contact C Signal when target range reached during partial stroke test Limit contact for intermediate position	Responds when the valve reaches the PST target range (= PST step final value \pm 1/2 PST tolerance band) PTO (power to open): responds when the valve moves through the switching contact towards the operating position PTC (power to close): responds when the valve moves through the switching contact towards the fail-safe position	
	Contact St Fault alarm contact	Responds when a status message or error message is generated Switching function of NC contact cannot be changed	
Current specifications when contact A is not connected		Contact B: I = 50 μ A (wire breakage) Contact C: I = 1.2 mA Contact St: I = 1.2 mA	
Compliance			

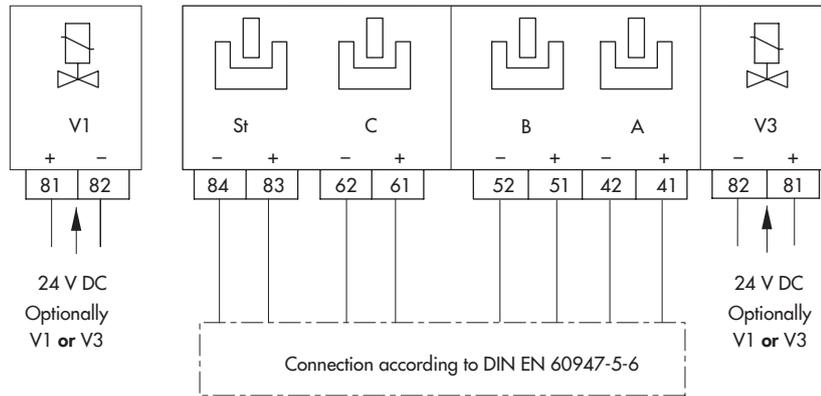
Table 2: Technical data of solenoid valve

Integrated solenoid valve (Type 3738-20-xxx14xxxxx2xx)		
Version		3/2-way or 5/2-way function Function determined by the position of the molded seal
K _{Vs} coefficient		0.32
Service life		1,000,000 switching cycles
Temperature range (operation)		-25 to +80 °C
Switching voltage	Nominal voltage	24 V DC, reverse polarity protection, galvanic isolation
	Current draw	I = 2.7 x U/(3650 Ω) - 3.325 mA · Corresponding to 14.4 mA at 24 V DC
	Signal 0	When the voltage falls below 15 V DC
	Signal 1	Min. 18 V DC
Switching capacity		24 V DC; 15.2 mA (0.36 W)
Duty cycle		100 %
Static destruction limit		32 V DC
External solenoid valve (for Type 3730-20-xxx1000xxx200)		
Read manufacturer's specifications!		
Nominal voltage		24 V DC, max. 18 W
Switching voltage	Signal 0	When the voltage falls below 15 V DC
	Signal 1	Min. 18 V DC
Static destruction limit		32 V DC

Table 3: Summary of explosion protection certificates for Type 3738-20 Electronic Limit Switch

Type	Certification			Type of protection/comments
3738-20	 EC type examination certificate	No.	PTB 08 ATEX 2039 X	II 2G Ex ia IIC T6; II 2D Ex ia IIIC T80°C IP66
		Date	2012-02-02	
		No.	RU C-DE.08.B.00114	I Ex ia IIC T6/T5/T4 Ga X; Ex tb IIIC T80°C Db X
		Date	2013-11-15	
		Valid until	2018-11-14	
	 EC type examination certificate	No.	PTB 08 ATEX 2039 X	II 2G Ex eb[ia] IIC T4; II 2D Ex tb IIIC T80°C IP66
Date		2012-02-02		
	No.	RU C-DE.08.B.00114	I Ex e [ia] IIC T4 Gb X; Ex tb IIIC T80°C Db X	
	Date	2013-11-15		
	Valid until	2018-11-14		
 EC type examination certificate	No.	PTB 08 ATEX 2039 X	II 3G Ex ic IIC T4; II 3G Ex nA II T4 Gc; II 3D Ex tc IIIC T80°C IP66	
	Date	2012-02-02		
	No.	GYJ12.1108X	Ex nL IIC T4~T6 Gc; Ex nA IIC T4~T6 Gc; DIP A22 Ta, T4~T6	
	Date	2012-04-27		
	Valid until	2017-04-26		

Electrical connections



NOTICE
Only connect one pair of 81/82 terminals.

Fig. 6: Version with integrated solenoid valve (Type 3738-20-xxx14xxxx2xx)

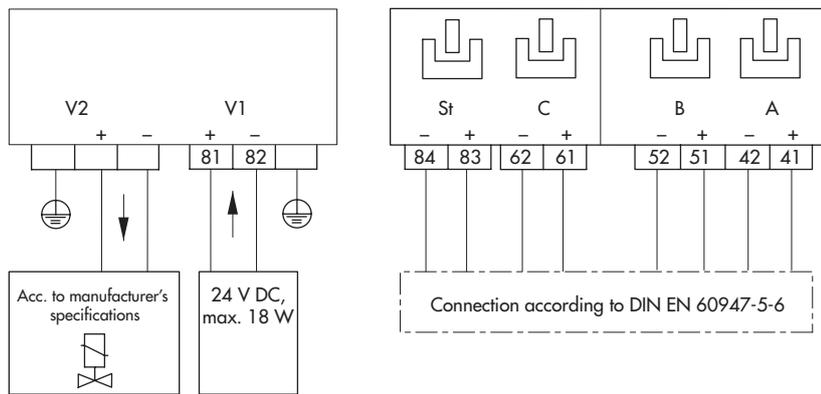


Fig. 7: Version with external solenoid valve (Type 3738-20-xxx1000xxx200)

Dimensions in mm

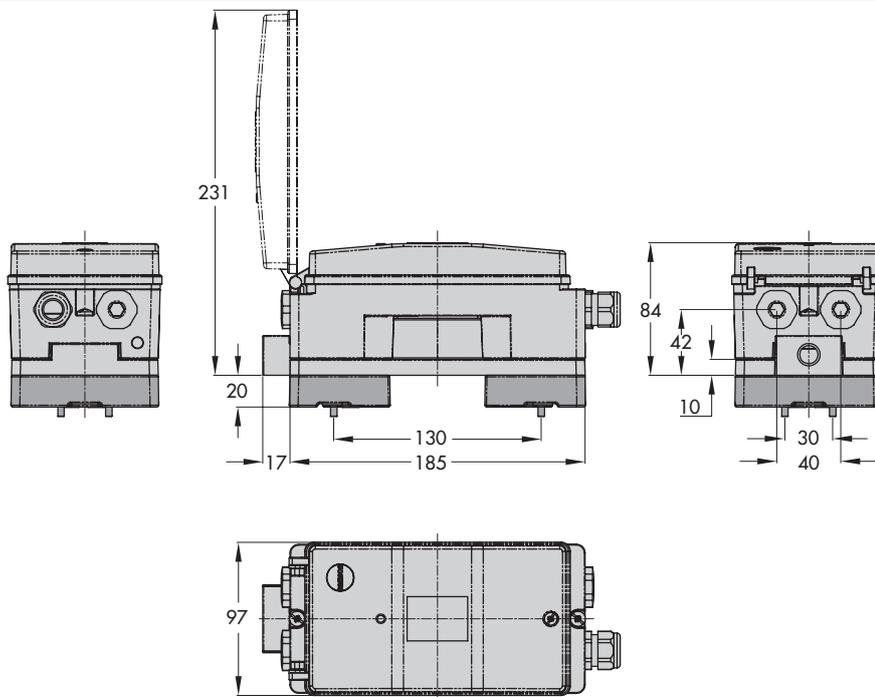


Fig. 8: Dimensional drawing for Type 3738 Electronic Limit Switch

Article code

Type 3738-20 Electronic Limit Switch	x	x	x	1	x	0	0	x	x	x	2	0	x
With LCD													
Explosion protection													
Without	0	0	0										
ATEX: II 2G Ex ia IIC T6; II 2D Ex ia IIIC T80°C IP66	1	1	0										
ATEX: II 2G Ex eb[ia] IIC T4; II 2D Ex tb IIIC T80°C IP66	3	1	0		0								
GOST: 1Ex ia IIC T6/T5/T4 Ga X; Ex tb IIIC T80°C Db X	1	1	3										
GOST: 1Ex e [ia] IIC T4 Gb X; Ex tb IIIC T80°C Db X	3	1	3										
Solenoid valve													
External					0								
Integrated					4								
Company version													
SAMSON								0					
AIR TORQUE								1					
Housing													
Standard aluminum, black structured, RAL 9005									1				
Cover													
Gray beige										0			
Black										1			
Silver gray										3			
Safety approval													
TÜV/IEC 61508											2		
Special applications													
Without													0

Table 4: Accessories

	Order no.
Attachment to linear actuators (NAMUR attachment)	
Version with integrated solenoid valve G ¼	1402-0540
Version with integrated solenoid valve ¼ NPT	1402-0541
Version for external solenoid valve G ¼	1402-0542
Version for external solenoid valve ¼ NPT	1402-0543
Plus mounting parts for Type 3271 Actuator	
Version up to 700 cm ²	–
1400-60 and 2800-120 versions	1402-0544
2800-30 and 2800-60 versions	1402-0545
Attachment to rotary actuators acc. to VDI/VDE 3845, fixing level 1 (2010)	
Attachment (20 mm shaft height)	1400-9859
Attachment (30 mm shaft height)	1400-9860
Attachment (50 mm shaft height)	1400-9861
Attachment (50 mm shaft height, 88 mm shaft diameter), e.g. Pfeiffer Type 31b, 2000 size	1402-0332
Mounting platform (black) G ¼	1380-1266
Mounting platform (black) ¼ NPT	1380-1268
Mounting platform (black) with piping as required G ¼	1380-1738
Mounting platform (black) with piping as required ¼ NPT	1380-1739
Cable glands (M20 x 1.5)	
Nickel-plated brass	1880-4875
Stainless steel 1.1305	8808-0160
Version for Ex i: black plastic	8808-0180
Version for Ex i: blue plastic	8808-0181
TROVIS-VIEW Configuration and Operator Interface software	
TROVIS-VIEW with device module 3738-50 (free download from www.samson.de)	
Serial interface adapter (SAMSON SSP interface to RS-232 port on a computer)	1400-7700
Isolated USB interface adapter (SAMSON SSP interface to USB port on a computer)	1400-9740

Ordering text

Electronic limit switch	Type 3738-20
Explosion protection	With/without
Solenoid valve	Integrated/external
Company version	SAMSON/AIR TORQUE
Housing cover version	See article code
Safety approval	With/without
Special applications	
Mounting accessories	
TROVIS-VIEW	

Specifications subject to change without notice



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