

EDS

Pressure switch



KLAY INSTRUMENTS B.V.
PROCESS INSTRUMENTATION
Nijverheidsweg 5, 7991 CZ Dwingeloo
P.O. Box 13, 7990 AA Dwingeloo
The Netherlands

Tel +31 (0) 521 591 550

Fax +31 (0) 521 592 046

Email : info@klay.nl

Site : www.klay.nl

1. Important details for your information
2. A quick overview for you
3. Signs, symbols and abbreviations
4. Function
5. For your safety
6. Packaging
7. Starting, operation
8. Maintenance, accessories
9. Trouble shooting
10. Storage, disposal



Read these operating instructions without fail before installing and starting the pressure transmitter.

1. Important details for your information

Keep the operating instructions in a place that is accessible to all users at any time. The following installation and operating instructions have been compiled by us with great care but it is not feasible to take all possible applications into consideration. These installation and operation instructions should meet the needs of most pressure measurement applications. If questions remain regarding a specific application, you can obtain further information:

The product data sheet

Via our Internet address

Contact KLAY for additional technical support Tel. +31(0)521-591550

Install and start the pressure switch only if you are familiar with the relevant regulations and directives of your country and if you have the qualification required. You have to be acquainted with the rules and regulations on measurement and control technology and electric circuits, since this pressure switch is „electrical equipment“ as defined by EN 50178. Depending on the operating conditions of your application you have to have the corresponding knowledge, e.g. of aggressive media.

2. A quick overview for you

If you want to get a quick overview, read Chapters 3, 5, 7 and 10. There you will get some short safety instructions and important information on your product and its starting. Read these chapters in any case.

3. Signs, symbols and abbreviations



Warning

Potential danger of life or of severe injuries.



Warning

Potential danger of life or of severe injuries due to catapulting parts.



Caution

Potential danger of burns due to hot surfaces.



The product has an IO-Link communication interface, if this logo is on the product label.



Notice, important information, malfunction.



DC V Direct voltage



The product complies with the applicable European directives.



UL
Underwriters Laboratories Inc.[®]
The product was tested according to the applicable US-American and Canadian standards and certified by UL.

- U+ Positive supply connection
- U- Negative supply connection
- SP1 Switching point 1
- SP2 Switching point 2
- S+ Analogue output
- C Communication with IO-Link
- 3-wire Two connection lines are intended for the voltage supply.
One connection line is intended for the measurement signal.

4. Function

The pressure prevailing within the application is transformed into a switching output or standardised electrical signal through the deflection of the diaphragm, which acts on the sensor element with the power supply fed to the transmitter. This electric signal changes in proportion to the pressure and can be evaluated correspondingly.

5. For your safety



Warning

Select the appropriate pressure switch with regard to scale range, performance and specific measurement conditions prior to installing and starting the instrument.

Observe the relevant national regulations (e.g.: EN 50178) and observe the applicable standards and directives for special applications (e.g. with dangerous media such as acetylene, flammable gases or liquids and toxic gases or liquids and with refrigeration plants or compressors). If you do not observe the appropriate regulations, serious injuries and/or damage can occur!

Open pressure connections only after the system is without pressure!
Please make sure that the pressure switch is only used within the overload threshold limit all the time!

Observe the ambient and working conditions outlined in section 7 „Technical data”.
Observe the technical data for the use of the pressure switch in connection with aggressive / corrosive media and for the avoidance of mechanical hazards.
Ensure that the pressure switch is only operated in accordance with the provisions i.e. as described in the following instructions.

Do not interfere with or change the pressure transmitter in any other way than described in these operating instructions.

Remove the pressure switch from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation

Take precautions with regard to remaining media in removed pressure transmitter.

Remaining media in the pressure port may be hazardous or toxic!

Have repairs performed by the manufacturer only.

Open circuit before removing connector.

6. Packaging

Has everything been supplied?



Check the scope of supply:

- Completely assembled pressure switches
- Ordered accessories

Inspect the pressure switch for possible damage during transportation. Should there be any obvious damage, inform the transport company and KLAY without delay. Keep the packaging, as it offers optimal protection during transportation (e.g. changing installation location, shipment for repair). Ensure that the pressure connection thread and the connection contacts will not be damaged.

7. Starting, operation



Required tools: wrench (flats 27), screw driver

Diaphragm test for your safety

It is necessary that before starting the pressure switch you test the instrument visual, as the diaphragm is a safety-relevant component.



Warning

Pay attention to any liquid leaking out, for this points to a diaphragm damage.

Use the pressure switch only if the diaphragm is undamaged.

Use the pressure switch only if it is in a faultless condition as far as the safety-relevant features are concerned.

Mechanical connection



When mounting the instrument, ensure that the sealing faces of the instrument and the measuring point are clean and undamaged.

Screw in or unscrew the instrument only via the flats using a suitable tool and the prescribed torque. The appropriate torque depends on the dimension of the pressure connection and on the sealing element used (form/material). Do not use the case as working surface for screwing in or unscrewing the instrument.

When screwing the transmitter in, ensure that the threads are not jammed.

Electrical connection

i Connect the instrument to earth via the pressure connection.

For power supply, use a circuit with energy limitation (EN/UL/IEC 61010-1, section 9.3) with the following maximum values for the current: with $U_+ = 35\text{ V (DC)}$: 4 A.

Provide a separate switch for the external power supply.

Alternative for North America: The connection may also be made to „Class 2 Circuits“ or „Class 2 Power Units“ according to CEC (Canadian Electrical Code) or NEC (National Electrical Code).

Wiring details

	Circular connector M12x1, 4-pin	Circular connector M12x1, 5-pin
		
	2 switching outputs or 1 switching output + 1 analogue output	2 switching outputs + 1 analogue output
	U+ = 1 U- = 3 SP 1 = 4 / C = 4 SP2 = 2 / S+ = 2	U+ = 1 U- = 3 SP1 = 4 / C = 4 SP2 = 2 S+ = 5
Ingress Protection per IEC 60 529	IP 65 and IP 67	IP 65 and IP 67
	The ingress protection classes specified only apply while the pressure transmitter is connected with female connectors that provide the corresponding ingress protection.	

Specifications EDS

Pressure ranges	bar	1	1.6	2.5	4	6	10	16	25
Over pressure safety	bar	2	3.2	5	8	12	20	32	50
Burst pressure	bar	5	10	10	17	34	34	100	100
Pressure ranges	bar	40	60	100	160	250	400	600	
Over pressure safety	bar	80	120	200	320	500	800	1200	
Burst pressure	bar	400	550	800	1000	1200	1700	2400	
MPa and kg/cm ² are available									
{Absolute pressure: 0 ... 1 bar bis 0 ... 25 bar}									
{Vakuumdruck: -1 ... 0 bar bis -1 ... 24 bar}									
Pressure ranges	psi	15	25	30	50	100	160	200	300
Over pressure safety	psi	30	60	60	100	200	290	400	600
Burst pressure	psi	75	150	150	250	500	500	1500	1500
Pressure ranges	psi	500	1000	1500	2000	3000	5000	8000	
Over pressure safety	psi	1000	1740	2900	4000	6000	10000	17400	
Burst pressure	psi	2500	7975	11600	14500	17400	24650	34800	
{Absolute pressure: 0 ... 15 psi bis 0 ... 300 psi}									
Fatigue life		10 Mio. max. load cycles							
Materials									
Wetted parts									
» Pressure connection		316 L							
» Pressure sensor		316 L (up to 0 ... 10 bar rel 13-8 PH)							
Case									
» Lower body		316 L							
» Plastic head		Highly resistive, fibreglass-enforced plastic (PBT)							
» Keyboard		TPE-E							
» Display window		PC							
Internal transmission fluid		Synthetic Oil (only for pressure ranges < 0 ... 10 bar and ≤ 0 ... 25 bar abs)							

Specifications	EDS	
Power supply U+		DC 15 ... 35 V
Signal output and maximum ohmic load RA	RA in Ohm	4 ... 20 mA, 3-wire RA ≤ 0,5 k 0 ... 10 V, 3-wire RA > 10 k
Setting time (Analogue signal)	ms	Adjustment zero point offset, max. 3 % of span 3
Current consumption	mA	max. 100
Total current supply	mA	max. 600 (max. 500 with IO-Link) incl. switching current
Switch points		Individually adjustable via external control keys
Type		Transistor switching output PNP or NPN (SP1 = PNP with IO-Link)
Number		1 or 2
Function		normally open / normally closed; windows- and hysteresis function freely adjustable
Contact rating	DC V	Supply voltage U+ - 1 V
Switching current	mA	SP1: 250 (100 mA with IO-Link) SP2: 250
Response time	ms	≤ 10
Accuracy	% of span	≤ 0.5 (setting accuracy)
Insulation voltage		DC 500 V
Display		
Design		14-Segment-LED, red 4-digits, height 9 mm electronic 180° rotatable
Accuracy	% of span	≤ 1.0 ± 1 Digit
Update	ms	100, 200, 500, 1000 (adjustable)
Accuracy	% of span	≤ 1.0 *)
		*) Including non-linearity, hysteresis, zero point and full scale error (corresponds to error of measurement per IEC 61298-2)
Non-linearity	% of span	≤ ± 0.5 (BFSL) according to IEC 61298-2
Long-term drift	% of span	≤ 0.2 according to IEC 61298-2

Specifications	EDS	
Permissible temperature of		
Medium		-20 ... +85 °C -4 ... +185 °F
Ambience		-20 ... +80 °C -4 ... +176 °F
Storage		-20 ... +80 °C -4 ... +176 °F
Rated temperature range		0 ... +80 °C +32 ... +176 °F
Temperature error within rated temperature range	% of span	≤ 1.0 typ., ≤ 2.5 max.
Temperature coefficients within rated temperature range		
Mean TC of zero	% of span	≤ 0.2 / 10 K
Mean TC of span	% of span	≤ 0.2 / 10 K
Reference conditions		Relative humidity: 45 ... 75 % according to IEC 61298-1
Approval		cULus
RoHS-conformity		Yes
CE-conformity		
Pressure equipment directive		This instrument is a pressure accessory as defined by the directive 97/23/EC
EMC directive		2004/108/EC, EN 61 326 Emission (Group 1, Class B) and Immunity (industrial locations)
Shock resistance	g	50 according to IEC 60068-2-27 (mechanical shock)
Vibration resistance	g	10 according to IEC 60068-2-6 (vibration under resonance)
Wiring protection		
Overvoltage protection		DC 40 V
Short-circuit proofness		S+/SP1/SP2 towards U-
Reverse polarity protection		U+ towards U-
Weight	kg	Approx. 0.2

{ } Items in curved brackets are optional extras for additional price.



When designing your plant, take into account that the stated values (e.g. burst pressure, over pressure safety) apply depending on the material, thread and sealing element used.

Keys and functions

	Display-Mode	Programming-Mode
	<p>short press: Display units</p> <p>long press: Run-through Parameter Info 1. UNIT + unit 2. SP1 / FH1 + value 3. RP1 / FL1 + value 4. SP2 / FH2 + value (optional) 5. RP2 / FL2 + value (optional) 6. LOW + value 7. HIGH + value 8. TAG + value (Only display when value set)</p>	<p>short press: - Menu up - Increase parameter value</p> <p>long press: - Menu up - Increase parameter value</p>
	<p>short press: display units</p> <p>long press: Switch to Programming Mode If the password is set to <> 0000, a password will be requested. If authentication is successful, then it enters the Programme Mode, otherwise it reverts to Display Mode.</p>	<p>short press: - Menu down - Decrease parameter value</p> <p>long press: - Menu down - Decrease parameter value (Increment rate is time dependent) long press (during Restart, keep pressed)</p>
	<p>short press: display units</p>	<p>short press: - Select Menu Item - Confirmation of the entry (Parameter value)</p>
 +	-	short press (both keys at the same time): Return to Display Mode
		

4-digit LED display

- Display system pressure
- Display Menu Item
- Display Parameter
- Status Switch Output 1
- Status Switch Output 2 (Optional)

1. LED (red)

2. LED (red)

Operating Modes

System start

- Display is fully activated for 2s
- When the pressure switch is powered up within the range of the hysteresis, the output switch is set to „not active“ by default

Display Mode

Programming Mode

Parameter

Parameter	Description
SP1 / SP2	Hysteresis function: Switch point Switch output (1 or 2)
FH1 / FH2	Window function: Window high switch output (1 or 2)
RP1 / RP2	Hysteresis function: Reset point switch output (1 or 2)
FL1 / FL2	Window function: Window Low switch output (1 or 2)
EF	Enhanced Programming Functions
RES	Return the set parameter to the Factory Settings
DS1	Switch Delay Time, which must occur without interruption before any electrical signal change occurs (SP1 or SP2)
DS2	
DR1	Switch Delay Time, which must occur without interruption before any electrical signal change occurs (RP1 or RP2)
DR2	
OU1	Switching Function Switching Output (1 or 2)
OU2	HNO = Hysteresis Function, normally open HNC = Hysteresis Function, normally closed FNO = Window Function, normally open FNC = Window Function, normally closed
UNIT	Changing Units (If the pressure range is higher than the display range, no change of the unit is possible and the parameter UNIT is not shown)

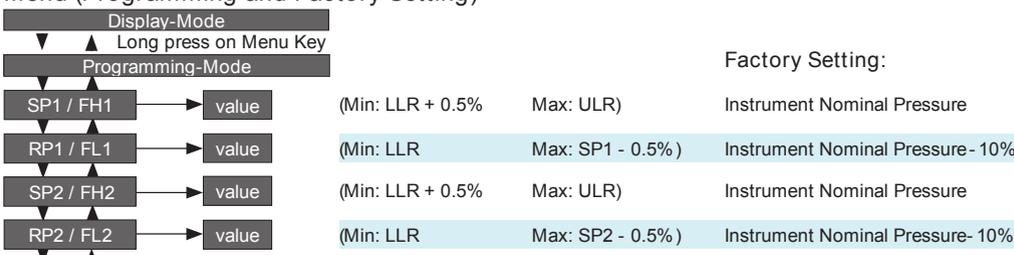
7. Starting, operation GB

Parameter	Description
OSET	Zero Point adjustment (+ 3% of Nominal Pressure)
DISM	Display value in Display Mode ACT = Current System Pressure, LOW, HIGH = Minimum, Maximum System Pressure, OFF = Display off; SP1/FH1 = Function switch point 1, RP1/FL1 = Function reset point 1, SP2/FH2 = Funktion switch point 2, RP2/FL2 = Function reset point 2
DISU	Display-Update 1, 2, 5, 10 Updates/Second
DISR	Display rotate 180°
RHL	Clear the Min- and Max-value memory
PAS	Password input, 0000 = no password Password input Digit by Digit
TAG	Input of a 16-digit alphanumeric Measuring Point number

Error display Acknowledgement of an Error Display by pressing the „Enter“ key.

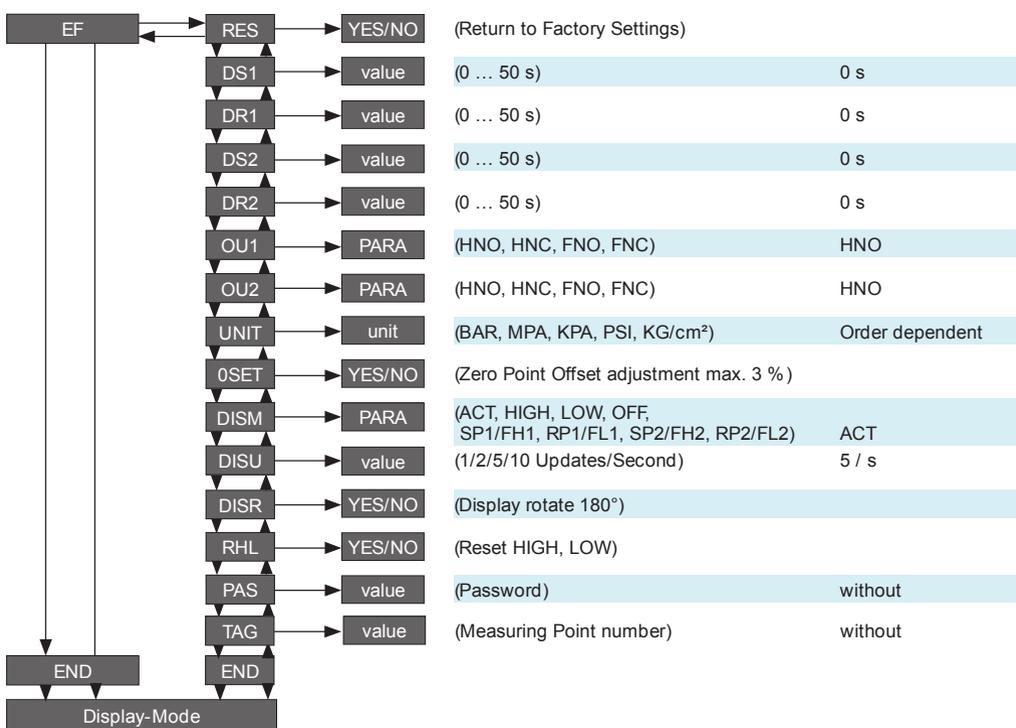
Error	Description
ATT1	On changing the Switch Point the system automatically reduces the Reset Point
ATT2	Zero Point adjustment error, current pressure is outside the limits
ATT3	Password entered for Menu access is incorrect
ERR	Internal error
OL	Overpressure, measuring range exceeded > approx. 5% (Display blinks)
UL	Underpressure, under measuring range < approx. 5% (Display blinks)

Menu (Programming and Factory Setting)



7. Starting, operation GB

Factory Setting:



Legend:
LLR = lower limit of range
ULR = upper limit of range

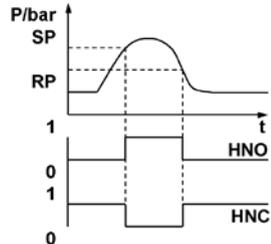
Switch function

Hysteresis function

If the system pressure fluctuates around the nominal value, the hysteresis keeps the switch status of the outputs stable. When the system pressure is rising, the output switches when it reaches the respective set point (SP); if the pressure falls again, the output switches back only if the reset point (RP) is reached.

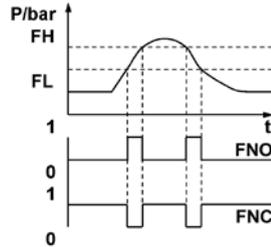
Application example: loading an accumulator.

The shut-off valve loads up to 80 bar and then shuts off. When 70 bar is reached again, it switches on once more.



Window function

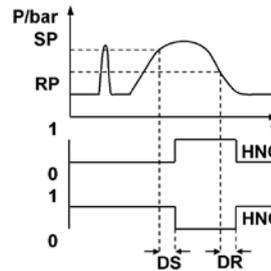
The window function allows the monitoring of a defined range. If the system pressure is between the window high (FH) and the window low (FL), the output is activated (NO) respective deactivated (NC).



Delay times (0.00 to 50 s):

By this means unwanted pressure peaks of short duration or high frequency can be filtered out.

The pressure must remain for at least this time to enable the switch to operate. The switching output does not immediately change its status when it reaches the switching event, but only after the delay time has elapsed. If the switching event no longer pertains when the delay time has elapsed, the switching output does not change.



Description of the IO-Link functionality (optional)

IO-Link is a point-to-point connection enabling communication between the EDS and an IO-Link master.

Physical layer

The ESD supports the following features

IO-Link specification	Version 1.0
SIO Modus	Yes
Min. cycle time	2.3 ms
Rate	COM2 (38.4 kBaud)
Process data bandwidth	16 bit (Frametype 2.2)

Process data

The ESD has 1 or 2 digital outputs. Both switching outputs are transmitting process data via IO-Link.

In the so-called SIO mode (default I/O mode), i.e. no IO-Link operation, the switching output 1 is switched at pin 4 of the M12 connector.

In the IO-Link communication mode this pin is reserved exclusively for the communication. The switching output 2 at pin2 of the M12 connector is always switched additionally.

For the frametype 2.2 the 16-bit process data of the pressure switch are transmitted cyclically. Bit 0 indicates the status of the switching output 1 and bit 1 the status of the switching output 2. 1 corresponds in this case to the logical state "closed" or + DC 24 V at the corresponding output.

The other 14 bits contain the analogue measured value of the pressure switch. The upper limit of the measuring range (MBA) matches the value 1000 d and the lower limit of the measuring range (MBE) has the value 9000 d.

Bit	Process value	Value range
0	OU1	0 = off, 1 = on
1	OU2	0 = off, 1 = on
2 ... 15	Measured value (Integer)	1000d = MBA 9000d = MBE

Service data (SPDU-Service Protocol Data Unit)

Service data are always acyclic and are replaced on request of the IO-Link master.

The Service data can be used to read out the following parameter values or instrument states:

IO-Link specific:

Index (decimal)	Object Name	Format	Access	Factory setting	Note
16	Vendor Name	Visible String	R	KLAY Instruments	
17	Vendor Text	Visible String	R	www.klay.nl	
19	Product ID	Visible String	R	e. g. 1013093	This SPDU establishes the connection to the associated IODD
21	Serial Number	Visible String	R	S#	Corresponds to the Serial-No. on the product label (S#)
24	TAG	max. 16 Byte Visible String	R/W	-	customer-specific measuring point number
33	Last Event	Visible String	R	-	
40	Process Data In	16 Bit unsigned	R	-	Mapping of the process data that are transmitted cyclically
243	Order No	Visible String	R	P#	Corresponds to the Product-No. on the product label (P#)

Manufacturer-specific:

Index (decimal)	Object Name	Format	Access	Value range	Factory setting	Note
65	SP1 bzw. FH1	16 Bit unsigned	R/W	1040 ... 9000	9000	Switch point/Window high switch output 1
66	RP1 bzw. FL1	16 Bit unsigned	R/W	1000 ... 8960	8200	Reset point/Window low switch output 1
67	OU1	8 Bit Enumeration	R/W	0 = HNO = Hysteresis Function, normally open 1 = HNC = Hysteresis Function, normally closed 2 = FNO = Window Function, normally open 3 = FNC = Window Function, normally closed	0	Switch point switch output 1
68	SP2 respectively FH2	16 Bit unsigned	R/W	1040 ... 9000	9000	Switch point/Window high switch output 2
69	RP2 respectively FL2	16 Bit unsigned	R/W	1000 ... 8960	8200	Reset point/Window low switch output 1
70	OU2	8 Bit Enumeration	R/W	0 = HNO = Hysteresis Function, normally open 1 = HNC = Hysteresis Function, normally closed 2 = FNO = Window Function, normally open 3 = FNC = Window Function, normally closed	0	Switching Function Switching Output 2
72	Unit	8 Bit Enumeration	R/W	0 = bar 1 = Mpa 2 = kPa 3 = PSI 4 = kg/cm ²	order-related	Switching over the measuring units. After writing access the MBA and MBE must be read in again.
73	HIGH	16 Bit unsigned	R	0 ... 10000	-	Maxvalue memory
74	LOW	16 Bit unsigned	R	0 ... 10000	-	Minvalue memory
75	DS1	16 Bit unsigned	R/W	0 ... 50,000 (0 ... 50 s)	0	Switch delay time Switch point 1

Index (decimal)	Object Name	Format	Access	Value range	Factory setting	Note
76	DR1	16 Bit unsigned	R/W	0 ... 50,000 (0 ... 50 s)	0	Switch delay time Reset point 1
77	DS2	16 Bit unsigned	R/W	0 ... 50,000 (0 ... 50 s)	0	Switch delay time Reset point 2
78	DR2	16 Bit unsigned	R/W	0 ... 50,000 (0 ... 50 s)	0	Switch delay time Reset point 2
240	MBA	32 Bit IEEE 754 Float	R	-	1000	The pressure value is always linearised in such a way that the MBA matches the value 1000 and the MBE matches 9000.
241	MBE	32 Bit IEEE 754 Float	R	-	9000	The pressure value is always linearised in such a way that the MBA matches the value 1000 and the MBE matches 9000.
250	DISR	8 Bit Enumeration	R/W	0 = standard 1 = 180° rotated	0	Display rotate 180°
251	DISM	8 Bit Enumeration	R/W	0 = Act 1 = HIGH 2 = LOW 3 = SP1/FH1 4 = RP1/FL1 5 = SP2/FH2 6 = RP2/FL2 7 = Off	0	Display value in Display-Mode
252	PAS	16 Bit unsigned	R/W	0 ... 9999	-	Password input for parameter adjustment at the instrument. Password 0 = no password
253	LOCK	8 Bit Enumeration	R/W	0 = Unlocked 1 = Locked	0	Global keylock

Manufacturer-specific system commands:

Index (decimal)	Objekt Name	Value	Note
2	RES	130	Return the set parameter to the Factory Settings
2	LOCK	163	Global keylock on
2	UNLOCK	164	Global keylock off
2	RHL	176	Clear the Min- and Max-value memory
2	0SET	177	Zero Point adjustment (+ 3% of Nominal Pressure)

Functional test

i The output signal must be proportional to the pressure. If not, this might point to a damage of the diaphragm. In that case refer to chapter 9 „Trouble shooting“.



Warning

Open pressure connections only after the system is without pressure!
Observe the ambient and working conditions outlined in section 7 „Technical data.“

Please make sure that the pressure switch is only used within the overload threshold limit at all times!



Caution

When touching the pressure switch, keep in mind that the surfaces of the instrument components might get hot during operation.

8. Maintenance, accessories

i EDS pressure switches require no maintenance.
Have repairs performed by the manufacturer only.

9. Trouble shooting



Warning

Open pressure connections only after the system is without pressure!



Warning

Take precautions with regard to remaining media in removed pressure switches. Remaining media in the pressure port may be hazardous or toxic!

Remove the pressure switch from service and mark it to prevent it from being used again accidentally, if it becomes damaged or unsafe for operation.

Have repairs performed by the manufacturer only.



Do not insert any pointed or hard objects into the pressure port for cleaning to prevent damage to the diaphragm of the pressure connection.

Please verify in advance if pressure is being applied (valves/ ball valve etc. open) and if the right voltage supply and the right type of wiring (3-wire) has been chosen?

Failure	Possible cause	Procedure
No output signal	Cable break	Check connections and cable
No output signal	No/incorrect voltage supply	Adjust the voltage supply to correspond with the Operating Instructions
No/False output signal	Incorrectly wired	Follow pin assignment (see Instrument Label / Operating Instructions)
Output signal unchanged after change in pressure	Mechanical overload through overpressure	Replace instrument; if failure reoccurs, consult the manufacturer
Abnormal zero point signal	Overload limits exceeded	Ensure permissible overload limits are observed (see Operating Instructions)
Signal span too small	Mechanical overload through overpressure	Replace instrument; if failure reoccurs, consult the manufacturer
Signal span too small	Power supply too high/too low	Correct the power supply in line with the Operating Instructions

Failure	Possible cause	Procedure
Signal span drops off	Moisture present (e.g. at the cable tail)	Install the cable correctly
Signal span dropping off/too small	Diaphragm is damaged, e.g. through impact, abrasive/aggressive media; corrosion of diaphragm/pressure connector; transmission fluid missing.	Contact the manufacturer and replace the instrument

In case of unjustified reclamation we charge the reclamation handling expenses.

If the problem persists, contact our sales department.

10. Storage, disposal



Warning

When storing or disposing of the pressure switch, take precautions with regard to remaining media in removed pressure transmitters. We recommend cleaning the transmitter properly and carefully. Remaining media in the pressure port may be hazardous or toxic!

Disposal



Dispose of instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the instrument is supplied.

KLAY reserves the right to alter these technical specifications.