User's manual

Pressurized enclosure system

F870S

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Content

The symbols WARNING, CAUTION, NOTE

 **Warning**	This symbol warns of a serious hazard. Failure to observe this warning may result in death or the destruction of property.
 **Caution**	This symbol warns of a possible failure. Failure to observe this caution may result in the total failure of the device or the system or plant to which it is connected.
 **Note**	This symbol highlights important information.

Safety Measures: to read and to comply

 **Warning**	Warning! Extreme caution is advised when handling this device. High electrical discharge is possible and can be fatal. Work on electrical installations and apparatus in operation is generally forbidden in hazardous locations, with the exception of intrinsically safe circuits. In special cases work can be done on non-intrinsically safe circuits, on the condition that during the duration of such work no explosive atmosphere exists. Only explosion protected certified measuring instruments may be used to ensure that the apparatus is voltage-free. Grounding and short-circuiting may only be carried out, if there is no explosion hazard at the grounding or short circuit connection.
 **Warning**	Danger of static charge! Clean only with humid cloth! Do not open when an explosive dust atmosphere is present!

1 Operation instruction for Explosion protected device

Application and Standards

This instruction manual applies to explosion-protected devices of types below. This apparatus is only to be used as defined and meets requirements of EN 60 079 particularly EN60 079-14 "electrical apparatus for potentiality explosive atmospheres".

Use this manual in hazardous locations, which are hazardous due to gases and vapors according to the explosion group and temperature class as stipulated on the type label. When installing and operating the explosion protected distribution and control panels you should observe the respective nationally valid regulations and requirements.

General Instructions

Work on electrical installations and apparatus in operation is generally forbidden in hazardous locations, with the exception of intrinsically safe circuits. In special cases work can be done on non-intrinsically safe circuits, on the condition that during the duration of such work no explosive atmosphere exists.

Only explosion protected certified measuring instruments may be used to ensure that the apparatus is voltage-free. Grounding and short-circuiting may only be carried out, if there is no explosion hazard at the grounding or short circuit connection.

To achieve an impeccable and safety device operation, please take care for adept transportation, storage and mounting, as well as accurate service and maintenance. Operation of this device should only be implemented by authorized persons and in strict accordance with local safety standards.

The electrical data on the type label and if applicable, the "special conditions" of the test certificate BVS 10 ATEX E 112are to be observed.

For outdoor installation it is recommended to protect the explosion protected distribution and control panel against direct climatic influence, e.g. with a protective roof. The maximum ambient temperature is 40°C, if not stipulated otherwise.

Terminal compartment in Increased Safety

When closing, it is to be ensured that the gaskets of the terminal compartment remain effective, thus maintaining degree of protection IP 54 according to EN 60529. Close unused entries by impact-proof stopping plugs, which are secured against self-loosening and turning.

Do not open the device in Ex area, as long the device is energized.

Inside area with explosive dust do clean the inner of the housing of the dust before closing the housing.

Maintenance Work

The gaskets of Ex e enclosures are to be checked for damages and replaced, if required. Terminals, especially in the Ex e chamber are to be tightened. Possible changes in color point to increased temperature. Cable glands, stopping plugs and flanges are to be tested for tightness and secure fitting.

Intrinsically Safe Circuits

Erection instructions in the testing certificates of intrinsically safe apparatus are to be observed. The electrical safety values stipulated on the type label must not be exceeded in the intrinsically safe circuit. When interconnecting intrinsically safe circuits it is to be tested, whether a voltage and/or current addition occurs. The intrinsic safety of interconnected circuits is to be ensured. (EN 60079-14, section 12)

2 Introduction: Pressurized enclosure system F870S

2.1 Explosion protection: pressurized enclosure

The use of pressurized enclosures allows the operation of 'non explosion protected' devices in hazardous areas inside zone 1 and zone 2. The protection type 'pressurization' is based on the principle of maintaining a constant pressure using air or a protective gas to prevent an explosive mixture forming near the device inside the pressurized enclosure.

Before start-up, the pressurized enclosure must be purged with air or protective gas to remove any explosive mixture that may be inside the enclosure.

2.2 Pressurized enclosure according to EN 60079

Since the second issue of the standard EN 50016 (May, 1996) control devices for the protection type "pressurized enclosure" are classified as security related devices.

At that time, the notified bodies, (PTB, EXAM, TUEV NORD, etc.) declared that an ex p-control device must fulfill the category 3 of EN 954-1. This concept was taken over also in the standards EN 60079 ff.

After the replacement of EN 954-1 by the standards IEC / EN 61508-1 and -2, respectively EN ISO DIN 13849-1 and -2 and DIN EN 50495 a security level of at least SIL 2 is required for a pressurized enclosure control unit according to EN 60079-2. This is a valid arrangement between the German notified bodies.

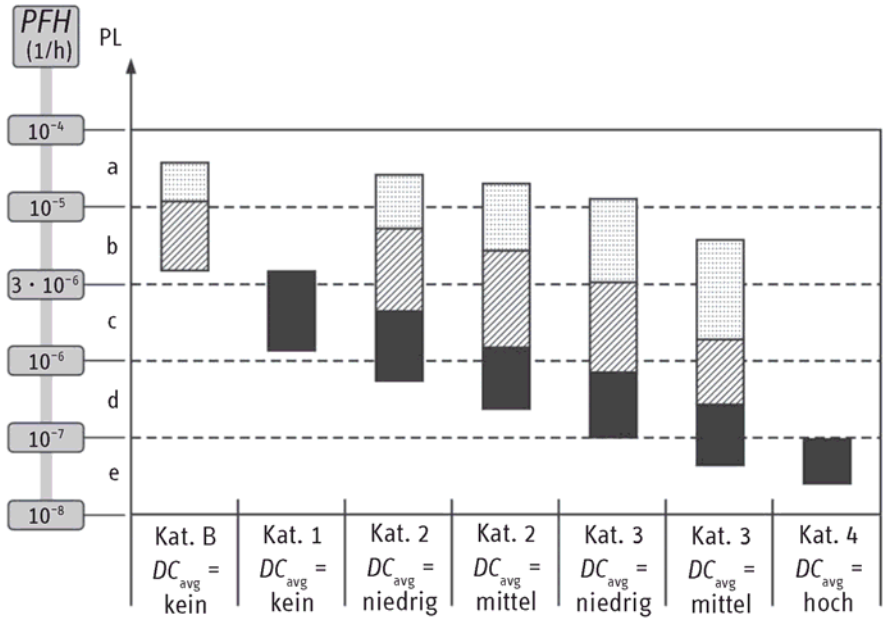


Figure 1: Performance levels

The pressurized enclosure system F870S reaches **performance level „d" according to EN 13849 and therefore** it reaches **SIL Level 2** according to IEC / EN 61508.

2.3 Pressurized enclosure system F870S

2.3.1 Simultaneous PID- control of cabinet pressure and flow rate

Based on the first introduction of proportional valve technology within pressurized enclosure systems (patented system Gönnheimer F850) an additional **active proportional valve** was integrated to the F870S **in the outlet**.

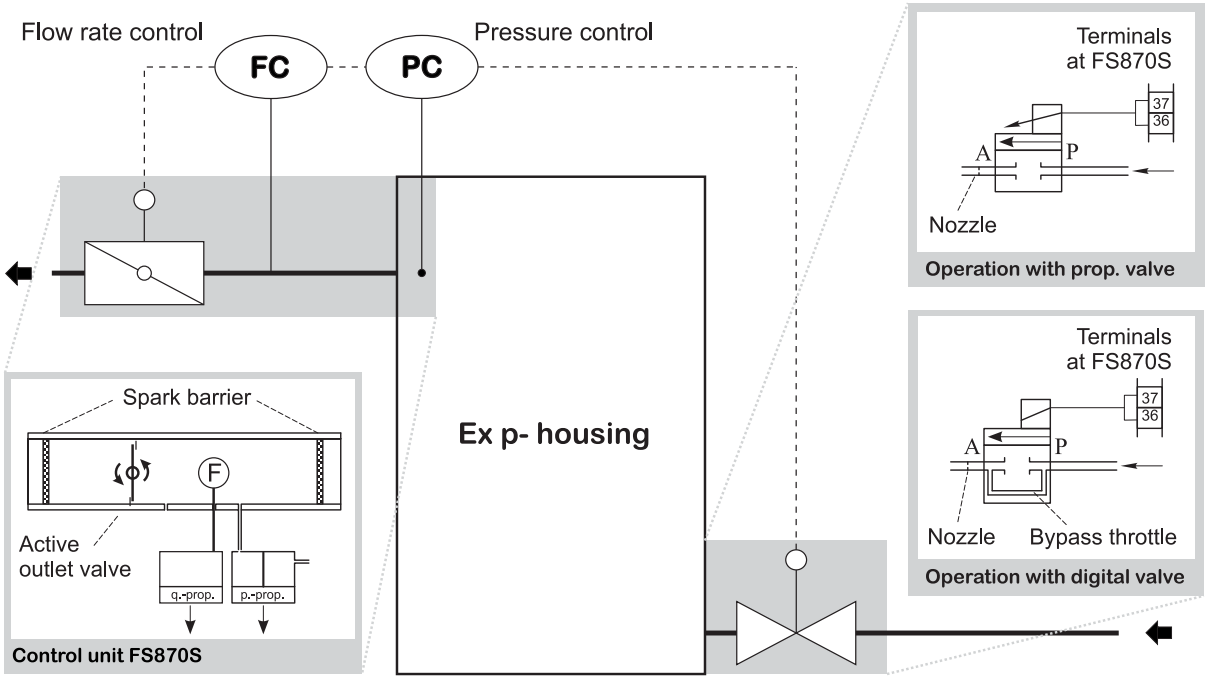


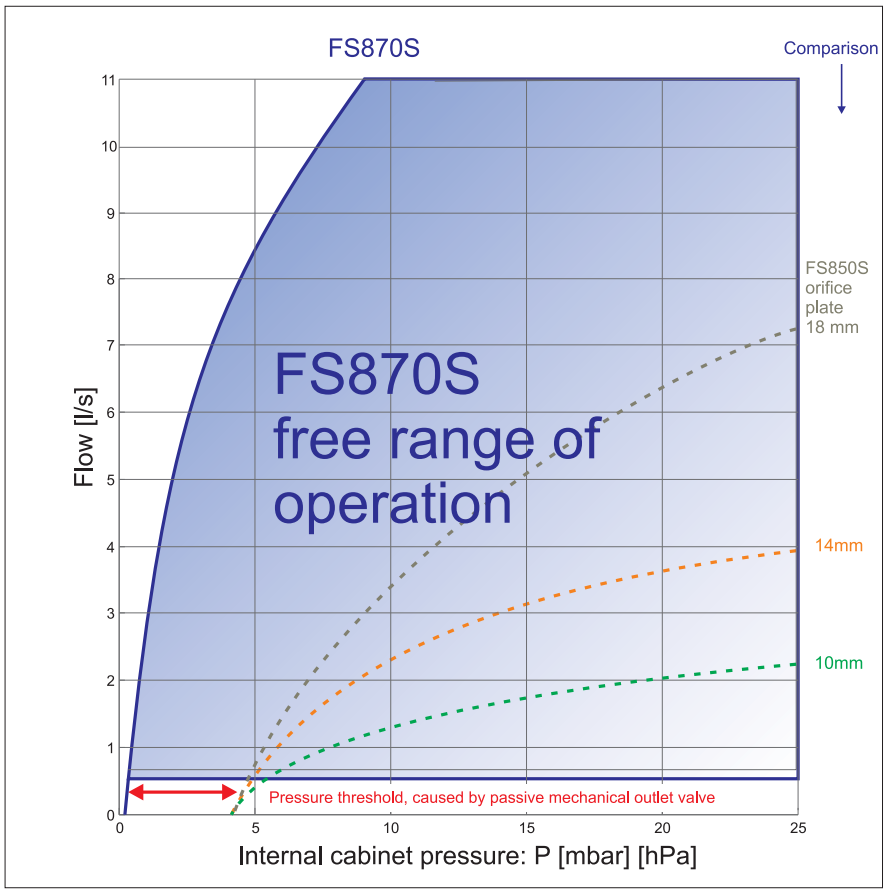
Figure 2: block diagram simultaneous pressure and flow control

This concept permits simultaneous **PID-regulation of cabinet pressure and flow rate** and generates new solutions and possibilities for pressurized enclosure systems and attachments.

2.3.2 Enlarged, free programmable range of operation

In comparison to common Ex p control systems, the FS870S offers an increased and free programmable range of operation (characteristic pressure / flow curve).

The conventional systems are characterized by a fixed pressure / flow curve (see e.g. FS850S) with an offset, caused by the opening pressure of the passive mechanical outlet valve. This typical opening pressure (2... 4 mbar at standard systems) is required to minimize the system leakage rate during normal operation.



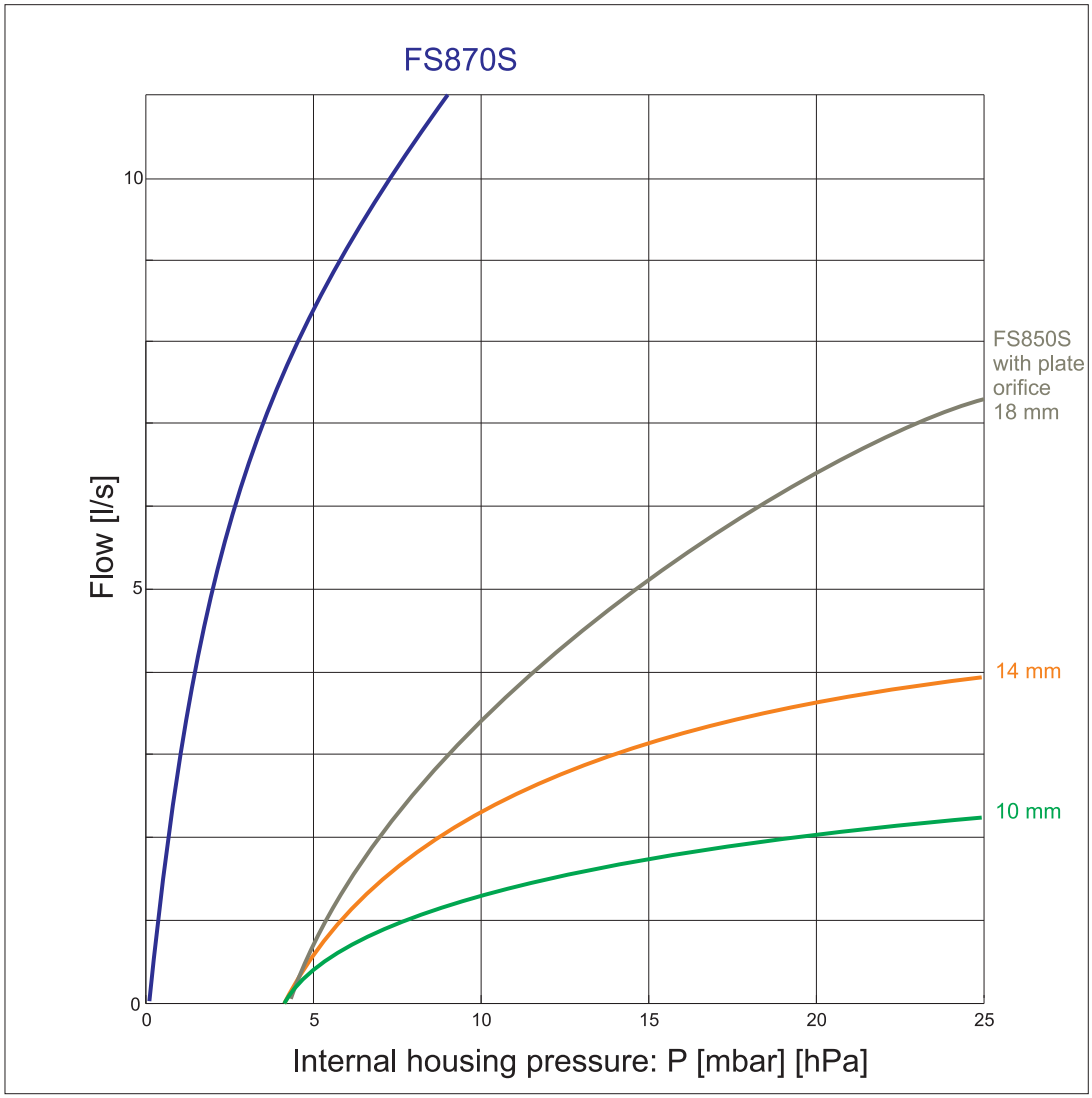
Fixed curves by control devices with flow measurement with plate orifice

Figure 3: Range of operation

The input and output sided PID-control loops allow the FS870S to perform in the whole range of operation (see figure 2).

2.3.3 Lowered cabinet stressing due to smaller pressure and pressure gradients

During the purging phase a high flow rate should be achieved to shorten the purge time. Based on their construction, conventional Ex p- systems show only a smooth rising of the flow rate while increasing the cabinet pressure.



In this aspect, the FS870S with its reduced flow restriction and back pressure is superior to any conventional Ex p system.

Within midrange flow rates, the load to the Ex p- cabinet walls is up to four times lower in comparison to conventional systems!

2.4 Components of pressurized enclosure system F870S

The pressurized enclosure system F870S contains at least the control unit FS870S and a solenoid valve. Each can be mounted in- or outside the enclosure. Furthermore several remote controls (operation panels) are available to improve ease of operation. It is also possible to connect intrinsically safe sensors to the control unit FS870S.

The pressurized enclosure system F870S has **two basic operation modes**:

- Pressurization using **leakage compensation**
- Pressurization using **continuous flow** of protective gas.

2.4.4 Leakage compensation

Within this operation mode the unit generate and hold a pressure level of at lest 0.8 mbar (80 Pa) inside the Ex p- cabinet.

The use of a proportional solenoid valve prevents wasting of the purge medium while the pre purging procedure as well later in basic operation mode.

In tradition to the control unit GÖNNHEIMER FS850S, the first Ex p- control unit using proportionally working pressure and flow control, the FS870S works as well as an **input-sided pressure regulator**:

The proportional solenoid valve is the actuator of a PID- control and regulates the incoming purge medium accordingly to the leakage of the cabinet. The benefits of pressure feedback control are:

1. Considerable less consumption of protective gas - additional costs for proportional valve will be amortized soon
2. Increased service reliability achieved by constant pressure inside enclosure - increasing leakage caused by e.g. ageing of the enclosure will be balanced and sudden failure is pre vented
3. Almost no flow noise and only a small protective gas consumption using a solid enclosure

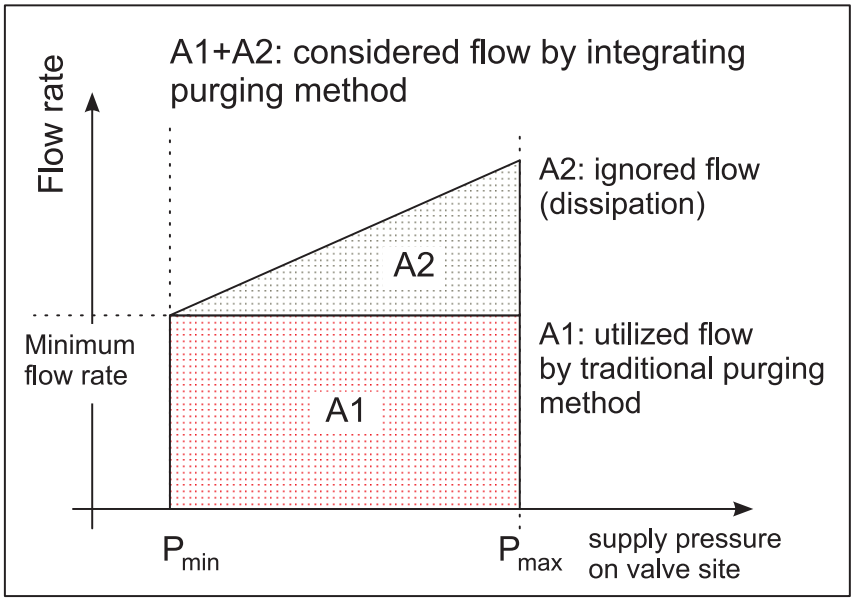


Figure 4: Consumption of protective gas

Another advantage using a proportional solenoid valve is; that pressure control is also used during purging. A set-point pressure will be achieved in the enclosure, while the flow volume, that leaves the enclosure, will be recorded and integrated over time, until the required purge volume is achieved. The advantages are:

1. A defined pressure while purging - pressure sensitive parts of the enclosure, like membrane switch panels or windows, will not be overloaded.

2. Purge volume accuracy is achieved by integration of the purge medium flow volume at the outlet. Wasting purge medium is no more a topic of today.

The use of the F870S system leads to a considerable stress relief of the Ex p cabinet and sensitive parts like foil keyboards, windows etc.. In comparison to conventional Ex p- systems, the FS870S requires a much lower cabinet pressure to achieve a comparable flow rate. (Example: A reduction of the cabinet pressure by 5 mbar leads to 50 kg / m² decreased load at the cabinet walls).

2.4.5 Continuous flow

The control unit FS 850S incorporates the operation mode „continuous flow“. This operation mode is necessary, for example if an analyzer produces an explosive atmosphere inside the enclosure (containment system). The operation mode continuous flow flushes the enclosure permanently. After the (pre-) purging procedure (purging process) a set-point flow rate is adjusted during normal operation. A flow rate minimum will be monitored also.

This system design allows a **simultaneous PID- control** of cabinet pressure and flow rate and opens new possibilities within the construction of pressurized enclosure systems and applications.

In operation mode "continuous flow" the FS870S is capable to lower the flow rate from a high value during purging to a low value during normal operation at a constant, low cabinet pressure level. (Example: 3 liters/sec. to 0.3 liters/sec. decrease without pressure variation)

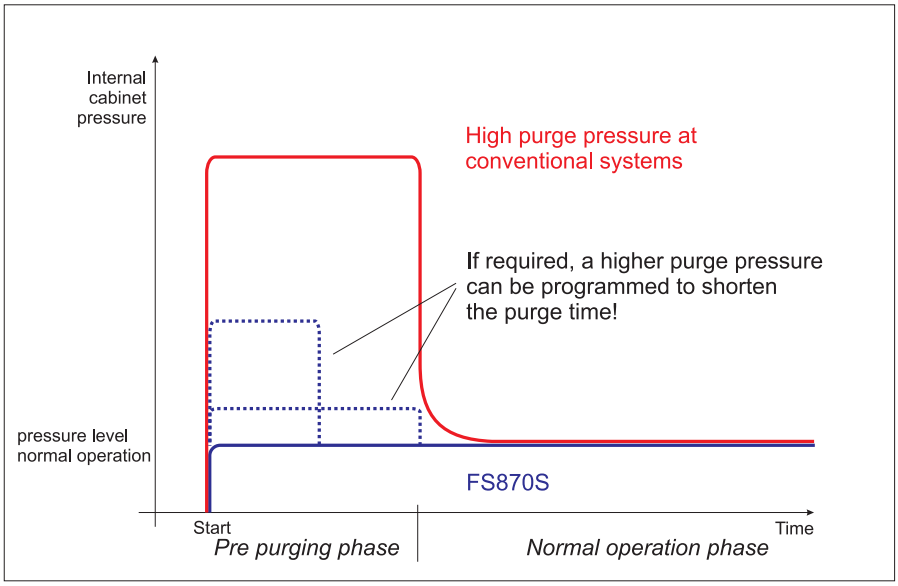


Figure 5: time diagram

2.4.6 F870S - Application using „Containment Systems “

„Containment Systems“ are defined as parts of a device within a pressurized enclosure, which could emit combustible gas (or occasionally an explosive environment: zone 1, explosive mixture) from within the enclosure.

In order to receive an Ex p-System including a „Containment System“, which is failsafe according EN 60079-2, with the attribute 'no emission', the following conditions must be met:

1. The flammable substance inside the containment system is in the gas or vapor phase when operating between the specified temperature limits
2. The minimum pressure specified for pressurized enclosure is at least 50 Pa higher than the maximum pressure specified for the containment system
3. An automatic safety device initiates, if the pressure difference falls below 50 Pa.

This automatic safety device can be activated by a difference pressure switch, looped into the external alarm loop (terminal 5/6 on FS870S). If an alarm occurs on this loop, the control device FS870S will turn off the ignition-capable device immediately. After alarm canceling the control device FS870S starts operation automatically with the purging procedure.

The external alarm loop is made by a normaly closed connection method.

2.5 Peripherals

2.5.1 Ex i- external sensory: ES872

The intrinsically safe bus interface is used to transmit measurement values from the external proportional sensor module ES872 to the control unit. This allows the integration of additional safety control features into the purge control system.

This interface is also suitable for e.g. temperature or other sensors.

2.5.2 Configuration module: CM873

Using the same Ex i- bus, the customer can connect the optional configuration module CM873 to load application specific configuration data and parameters into the control unit without further manual programming.

The handling is quite simple: plug this CM873 into the intended port and restart the control device.

2.5.3 Operating panels

For the control unit FS870S several operating and visualizing panels are available. These panels consist of the explosion protection class 'intrinsically safe' and are considerably advantageous, particularly when the control unit is mounted inside the enclosure.

2.5.4 Common operating panels: BT 854.1 and BT 855.1

- On/Off-Switch
- Key-operated switch for bypass
- LED-indicator for READY and ON

The connection to the control unit consists of 6 wires.

2.5.5 Intelligent operating panel type BT871

This operation panel indicates operation and malfunction reports as plain text. The 5 membrane switches offer total command of the control unit. Status, actual pressure, flow rate as well as remaining purge time are always available.

The connection to the control unit consists of only 4 wires.

Signal lamps on BT871

The BT871 has three colored signal lights (LED). These report system states and warnings.

2.5.6 Disconnector unit SR852 and power relay SR853

According to EN 60079-2 all non- intrinsically safe connections of the ignition capable apparatus must be disconnect, if the protection gas pressure falls below the safety limit. In many applications more than the two connector terminals on the control unit FS870S are needed. In these cases the disconnector unit SR852, with 8 respectively 16 galvanically separated connectors, is considerable helpful.

The power relay S853 provides 4 lines with switching power of 250V, 16 A.

2.6 Features in operation zone 21 (Dust)

2.6.1 Purging period -> cleaning period: cleaning the housing inside

In zone 21 the housing must not be purged in comparison to the operation in gas zone 1. The operator has to insert the purging volume zero “0 [l]” into the parameter menu.

Purging in the presence of combustible dust would generate a dangerous explosive atmosphere inside the cabinet.

In the zone 21 the purging period is replaced by a cleaning period, viz. the operator has to remove thoroughly the combustible dust inside before he is energizing the electrical parts inside the cabinet.

After cleaning the pressure inside of the cabinet prevent an infiltration of dust.

2.6.2 Additional marking

The cabinet must contain a well viewable sign with the following content:

„WARNING: REMOVE ALL DUST FROM THE INSIDE OF THE ENCLOSURE BEFORE CONNECTING OR RESTORING THE ELECTRICAL SUPPLY“

On Ex p cabinets suitable for zone 21, which can be opened without tools, has to be placed the following mark:

„WARNING: DO NOT OPEN WHILE ENERGIZED UNLESS IT IS OBVIOUS THAT NO COMBUSTIBLE DUST IS PRESENT“

2.7 Additional information: EC- type certificate F850-SYST

Gönnheimer features as manufacturer of Ex p- Systems a comprehensive ATEX Ex p-SYSTEM Certification of a notified body.

Provides a economical solution for small quantities

- certified for Ex- Zone 1
- enhanced for Dust- Ex, Zone 21 (category 2D)
- the first ATEX certification of this type in Europe
- matches > 80% of all individual customer systems
- enhanced pressure ranges: 27mbar, 350mbar and 1 bar.

Costumer advantages:

+ usual delivery time, + usual quality,+ usual costs,+ no additional efforts

2.8 Conformity with standards

The explosion proof control unit FS870S meets requirements of listed standards in the attachment (Declaration of conformity). They were developed, manufactured and tested in accordance with state-of-the-art engineering practice and ISO9001:2008.

3 Installation and Connection

3.1 Mounting

3.1.3 Control unit FS870S

The control unit can be placed inside a hazardous area. The location (inside or outside the enclosure) as well as the position is almost arbitrary.

The control unit has 4 holes on the rear plate for mounting, although fixing only with the screw connection of intake or outlet is sufficient.

Caution

While mounting observe local safety guidelines and the regulative DIN EN 60079-14.

Caution

The reference input of the device (M5 thread on the left side) should be in the ex area.

If the device is mounted inside the Ex p- housing, the reference input must be connect to the ambient by a pipe connection.

Note

The solenoid valve(s) and the control unit (respectively pressure monitor) should be mounted on the enclosure as far away from each other as possible (E.g. space diagonal arrangement), to achieve a total purging.

3.1.4 Particle barrier

The control device contains a particle barrier according to EN 60079-2. Therefore it is allowed to exhaust the purge medium direct onto the ex area.

3.1.5 Proportional solenoid valve

The proportional working solenoid valve (SVP…) should be mounted outside of the Ex p cabinet. The mounting direction is arbitrary.

3.1.6 Operator panels BT8xx.x

- Operator panel BT871.0

  The operating tableau BT871.0 (without rear) becomes directly mounted outside on the Ex p- cabinet. Therefore 5 drillings must be made into the cabinet. Please refer the drilling scheme in the appendix.

- Operator panel BT871.5

  The operator panel BT871.5 contents a complete housing in protection class IP65. It could be mounted arbitrary in hazardous area Zone 1. Please refer the dimension scheme in the appendix for the position and diameter of drillings.

- Operator panel BT854.x

  The BT854.0 consists of 2 signal lamps and an On/Off switch which are directly attached to the Ex p- cabinet. For the BT 854.1 a key switch to active bypass mode is added. Please refer the dimension scheme in the appendix for the position and diameter of drillings.

- Operator panel BT855.x

The operating tableau BT855.x has got a complete housing (protection class IP65). It can be mounted in the ex-area of Zone 1 at any place. Please refer the dimension scheme in the appendix for the position and diameter of drillings.

3.1.7 Disconnector unit SR852 and power relay SR853

The disconnector unit SR852 and power relay SR853 could be placed in hazardous area Zone 1. These are certified on its own in protection type Ex e.

3.2 Connecting and Commissioning

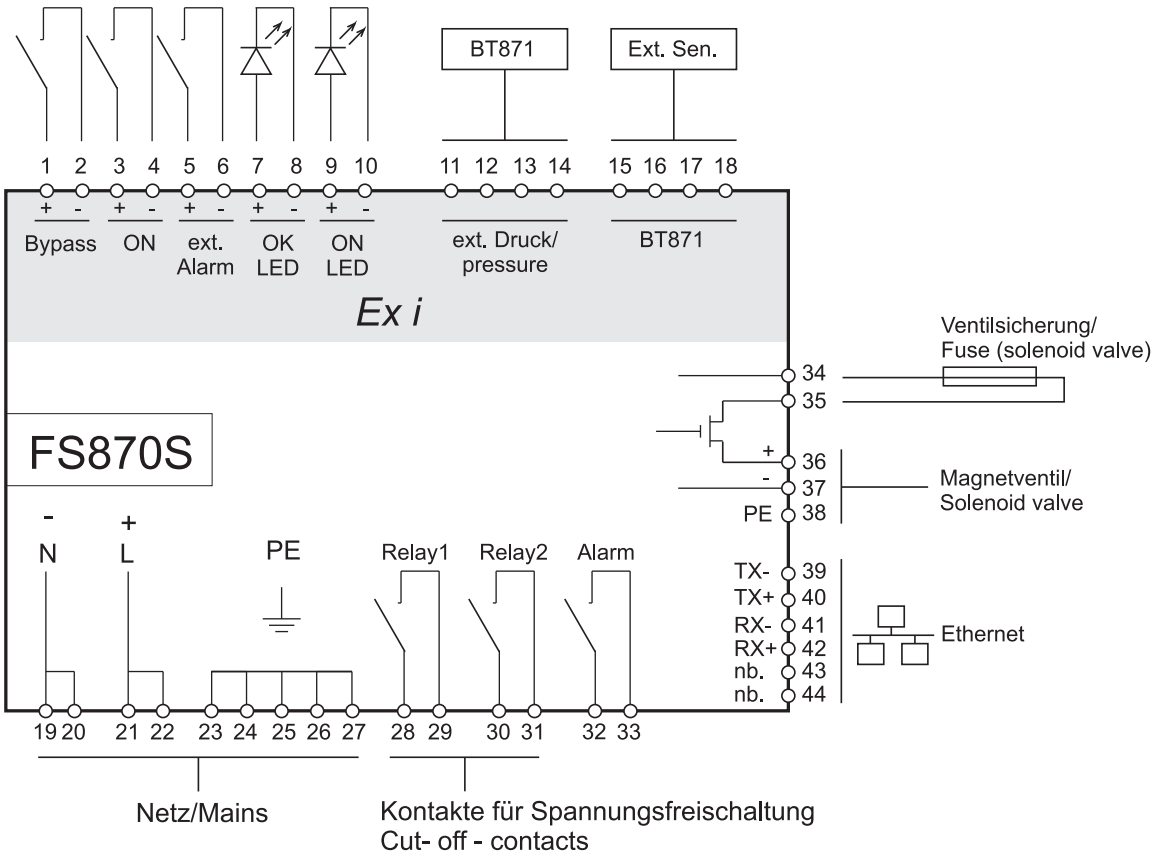


Figure 6: electrical block diagram

3.2.1 Connection hints

Conditions for the Ex e clamps

Min. and max. clamping torque	min. 0,3 Nm max. 0,4 Nm
Min. und Max. wire cross- section	steep: 0,2 – 2,5 mm² flexible: 0,2 – 2,5 mm²

Consider the following items while connecting und starting

Warning

LINE VOLTAGE!
Extreme caution is advised when handling this device. High electrical discharge is possible and can be fatal.
Please note the following Standard of Compliance: BVS 10 ATEX E 112 and the regulative DIN EN 60079-14.
Do not exceed terminal safety limits of each terminal.
See limits in technical details or declarations of conformity.
The breaking current of the built-in valve fuse must correspond to the used solenoid valve

3.2.2 Switching power off ability

Warning

The maximum current limits (5 A) on the clamps 28, 29 and 30, 31 should not be exceeded at <u>any time</u>!

E.G. By an application of switched power supply a multiple higher current as the nominal max. current may occur. In this case a switching on current limitation (e.g., NTC) must be added to avoid the off-limits high current.

If this is missed the risk of welded relay contacts and within the loss of the explosion protection exists!!

3.2.3 Intrinsically safe (Ex i-) connection of FS870S

Clamps	*Description*	*Limits*				
1,2	Digital input: *Bypass*	U0 5,4V	I0 6,2mA	P0 8,3mW	C0 100nF	L0 0,5mH
3,4	Digital input: *On / Off*	U0 5,4V	I0 6,2mA	P0 8,3mW	C0 100nF	L0 0,5mH
5,6	Digital input:: *External alarm*	U0 5,4V	I0 6,2mA	P0 8,3mW	C0 100nF	L0 0,5mH
7 (+) 8 (-)	LED- output: "*System On"*	U0 5,4V	I0 9,7mA	P0 13mW	C0 100nF	L0 0,5mH
9 (+) 10 (-)	LED- output: "*System Ready"*	U0 5,4V	I0 9,7mA	P0 13mW	C0 100nF	L0 0,5mH
Clamps	*Description*	*correspondences*				
11-14	Port BT871	11 (FS870S) – 1 (BT871) 12 - 2 13 - 3 14 - 4				
15-18	External Pressure/temperature sensor: ES872 Ext. configuration module: CM873	15 (FS870S) – 1 (ext. device) 16 - 2 17 - 3 18 - 4				

3.2.4 Connections FS870S of protection class (Ex e)

Clamps	*Description*
19, 20 (N -)	Line voltage, either **neutral** conductor at AC or **minus pole** at DC
21, 22 (L +)	Line voltage, either **outer** conductor at AC or **plus pole** at DC
23 up to 27	Potential earth, **PE**
28, 29	Working current circuit 1 (**Relays 1**), Um = 253V, Im = 5A, cos (φ) = 0,7
30, 31	Working current circuit 2 (**Relays 2**), Um = 253V, Im = 5A, cos (φ) = 0,7
32, 33	signal pressure alarm (**Alarm**), Um = 253V, Im = 5A
34, 35	Terminals for solenoid valve fuse inside device
36 (-), 37 (+) 38 (PE)	**Output solenoid valve:** 24V DC, connect the valve here
39 (TX-) 40 (TX+) 41 (RX-) 42 (RX+) 43 (nb.) 44 (nb.)	**ETHERNET** 10/100Mbit Um = 63V AC/DC *The claps 43-44 serve for the connection the not used ETHERNET wires*

3.2.5 Default parameter

Parameter defaults ex works.

	Description	Display	Settings	Unit
Structure	Language setting of FS870S	Language	English	
	Do you use a proportional (SVP..) or digital (SVD…) working valve	Valve	SVP3	
	Operation mode: - Leakage compensation - Continuous flow	Operation mode	Leakage compen-sation	
	Function of the free programmable alarm contact	Output function	Bypass is active	
	Contact order Normally closed (NC) Normally open (NO)	NC/NO	NO	
	The external alarm loop is programmable to work in special situation only	Ext-Alert mode	Inactive	
	External sensor ES872 is connected to the system or not	ES872 connected	No	
Parameter	Purge volume	Purge volume	500	Ltr.
	Set point of pressure controller while pre purging phase	Setpoint Pres.Purge	2.0	mbar
	Monitored minimum flow while pre purging phase	Min.Flow Purge	0,5	Ltr./s
	Set point of flow controller while pre purging phase	Setpoint-Flow Purge	2,0	Ltr./s
	Set point of pressure controller while normal operation (after pre purging phase)	Setpoint - Pres.Oper	2,0	mbar
	Monitored minimum pressure inside Ex p housing - at all times	Min. Pressure	0,8	mbar
	Monitored maximum pressure inside Ex p housing - at all times	Max. Pressure	15,0	mbar
	Pressure limit of alarm pressure	Alarm Pressure		
Codes	Code word main menu	Menu code	0001	
	Code word to activate bypass function	Bypass code	0002	
	Code word to switch on or off the ignition capable apparatus inside the Ex p cabinet	On/Off code	0001	
Network	IP- Address	IP-Address	192.168.0.48	
	Subnet mask	Subnet Mask	255.255.255.0	
	Gateway	Gateway	192.168.0.1	

3.2.6 Ex works parameter – Reset

Do RESET :
1. Press the joystick* while powering up the device until "RESET appears on the display.
2. Enter RESET-Code: "1111"
3. Press the joystick
The ex works parameter are now active.

*: only on the control unit, not on the BT871

3.3 Maintenance

Depending upon purity of the assigned purging air the inlet and outlet opening of the FS870S must regularly be examined on impurities (e.g. oil, dust, etc) or corrosion. In case of serious impurities the operator should weigh the possibility of a punctual appropriate cleaning by Gönnheimer Elektronic GmbH in relation to a spontaneous loss of the controller.

3.4 Repairs

Repairs of the controller as well as the accessories may be made only by the Gönnheimer Elektronic GmbH.

4 Operation

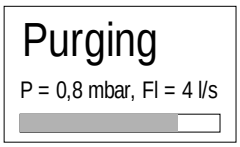
The user has total control of the purging system F870S by the use the joystick on the control unit FS870S respectively by using the external operating panel BT871. Operation on control unit FS870S panel BT871 is equal. Using the other operating panels only a restricted operation is possible.

4.1 Human interface

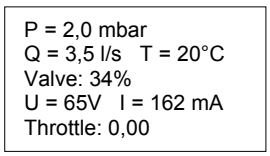
4.1.1 Display

The built-in graphical display indicates operation modes, actual data of pressure or flow rate, as well as malfunctions.
Beside the status side the user can switch to the info side using the joysticks right move.

Status side



Info side



Description to Info- side:

Row	Description
P = 2,0 mbar	Actual pressure inside Ex p cabinet
Q = 3,5 l/s T = 20°C	Flow rate through FS870S, air temperature
Valve: 34%	aperture rate of the input valve
U = 65V I = 162 mA	Voltage and current at input valve (SVP)
Throttle: 0,00	Opening rate of the output valve Positive values : Throttle opens Negative values: Throttle gets tighter

4.1.2 Joystick

See process information to your Ex p system using the joystick inside of the FS870S. Confirm settings by pressing this joystick.

4.1.3 Log file (show Log)

The FS870S logs every important information of the Ex p system into an internal log file. The logs get a time stamp. With this information the user gets useful information if something works unexpected.

The log file is located in the operation menu.

4.1.4 How to enter and leave the bypass mode

Caution

Utilize bypass only, if it is sure that no explosive atmosphere is inside the cabinet!

Fire certificate required!

Caution

The bypass mode is denied, if it is possible that an explosive atmosphere can arise inside the Ex p- housing!

The bypass can be activated with the joystick and the menu in the display as follows:

1. Press joystick 2 x times
2. Move joystick down one time: Select “Bypass”
3. Enter bypass code with the joystick “0002”
4. Change Bypass mode to active “Bypass ON”
5. Confirm the setting by pressing by pressing the joystick

The bypass is active immediately

Note

Leave the bypass mode in the same way as enter.

4.2 Parameter input and parameter query

The control unit has two types of menus

- operation menu
- Parameter input menu

4.2.1 Operation menu

Within the operation menu the user gets more information of the Ex p- system.

The menu is active by pressing the joystick. The structure of the menu is:

a. Actions

- *Contacts*, with this function the relays contacts could be shut off
- *Bypass*, with this function the bypass mode could be activated or deactivated
- *Menu* (Parameter input menu), Start of the parameter input menu see below

b. Infos

- *Show log* (see log file)
- *Clear log* (erase log file)
- *Serial number* (see the serial number of the device)
- *Inputs* (see actual status of the Ex i- inputs)

c. Exit menu

4.2.2 Parameter input menu

Program the operation modes introduced above (paragraph 2) within the setup menu of the FS870S. Read in this paragraph how to navigate and find the structure data and parameters.

Master code (M-Code) ex work is: 0001

Menu	The menu is structured in 4 divisions • Structure • Parameter • Codes • Network
Structure	The structure of the Ex p- system consists of *Language*: menu language of the FS870S *Valve type*: use of proportional valve or digital valve *Operation*: operation mode „Leakage compensation“ or „continuous flow“ *Output function*: function of the free programmable relay output *NC / NO*: Contact order: Normally closed (NC) or Normally open (NO) *Ext-Alert mode*: The external alarm loop is working in special situations only *ES872*: connection of an external sensor to the FS870S
Parameter	Parameter list: • *Purge volume* • *Set point pressure Purge*

- *Min.FlowPurge:*
- *Set point Flow Purge*
- *Set point pressure operation*
- *Min.Flow operation*
- *Set point Flow operation*
- *Min. Pressure*
- *Max. Pressure*
- *Alarm Pressure*

Codes

This sub menu contains the 3 code words

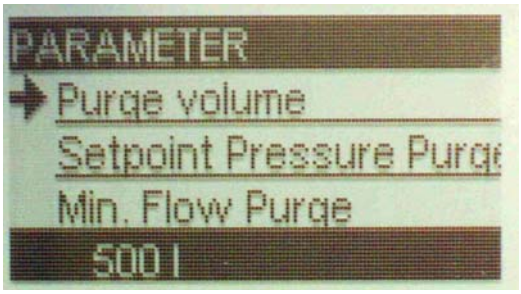
- *Menu Code*: to enter he parameter input menu
- *Bypass Code:* to protect the bypass function
- *E/A-Code*: to switch the relay contacts off / on

Note

The FS850S does not working while the menu is active. - That means the solenoid valves and the ignition capable device inside the cabinet are switched off.

Find more details of the input parameter in “List of parameters” in the end of this manual.

4.2.3 Menu exposition



→ superior menu item

→ selected parameter (parameter name)

→ (next Parameter)

→ parameter content (value and unit)

Parameter query

If the operator wants only to take a look on the parameters, don’t want to change them, he should choose the parameter query instead of entering the parameter input menu.

To do this enter the parameter input menu using the **code word “1000”**

The user steps through the menu as usual – the parameter can not be changed for sure.

Master code word for parameter query: “1000”

4.3 Alarm and malfunction indications

4.3.4 Alert

Alert	*Reason*	*Procedure*
Ext. Alert	The external alarm occurred.	If the ext. alert loop is not needed, switch off the monitoring of the external loop in the parameter input menu

4.3.5 Error messages

The error messages are shown on the display of the control unit and they are listed in the internal log file with time stamp.

Error	*Cause*	*Remedy*
BT871 not connected	The BT871 was not recognized	Check the wires, this is no direct error – the FS870S works without BT871 or refit a BT871
Valve missing	There is no solenoid valve connected to the control unit	Connect a solenoid valve to the appropriate claps
Configuration error	A READ error with the internal EEPROM or the CM872 has occurred – the system data is corrupted	Switch the unit off and on if the error remains send the unit back for maintenance
Stepper motor failure	Internal error on the output valve	Send the unit back for maintenance
Stepper motor wire break	Internal error on the output valve	Send the unit back for maintenance
Stepper motor over current	Internal error on the output valve	Send the unit back for maintenance
Stepper motor over temperature	Internal error on the output valve	Send the unit back for maintenance
Stepper motor under voltage	Internal error on the output valve	Send the unit back for maintenance
Sensor error	The pressure und flow sensors work not correct and send corrupted data	Send the unit back for maintenance
Memory error	RAM / ROM error occurred	Switch the unit off and on if the error remains send the unit back for maintenance
Task error	Program task error	Switch the unit off and on if the error remains send the unit back for maintenance
Valve Fuse blown	The valve fuse is blown or a wire is broken	Replace the fuse, check the wires
Valve over current	a) the connected valve do not match to the programmed valve in the parameter input menu b) The solenoid valve is defect	a) Change the solenoid valve or the settings in the parameter input menu b) Replace the solenoid valve

5 Annex

5.1 Technical Details

		Control unit FS870S
General	Mounting	Inside Hazardous Area (Zone 1/21)
	Group	2 II G/D
	Ex- protection	II 2 G, Ex e d mb ib [px] IIC T4 II 2 D, Ex tD [ibD] [pD] A21 IP65 T 100°C
	Certificates	ATEX: BVS 10 ATEX E 112 IECEx: IECEx BVS 10.0095
	Safety standards	SIL 2 acc. to IEC 61508 Performance level “d” acc. to DIN EN ISO 13849
Housing	Dimensions	H x W x D: 220 mm x 120 mm x 90 mm
	Purging gas in- and outlets	G1“ - inside thread
	Protection class	IP65 (except purging gas in- and outlet)
	Material	Aluminum, coated / RAL 7035
Electrical Specifications	Power supply	24 V DC; 110.. 230 V AC
	Potential free relay contacts	250 VAC / 5A cos (φ) = 0,7 U ≤ 30 VDC, I ≤ 5 A, P ≤ 150 W
Pneumatics	Pressure range	0 ... 18 mbar Optional: 0 … 350 mbar
	Flow range	0 .. 10 ltr./sec. (0 .. 36 m³/h), at cabinet pressure < 10 mbar (hPa) Extended measurement ranges on demand
	Ambient temperature	-10°C ...+60°C (T4)
	Humidity	5-95%, non-condensing
Configuration	Parameter input	Guided menus at graphic LC display Selectable language Single button programming and operation
	Visualization	Simultaneous clear text indication of multiple system information and measurement values
	Shut off delay	Programmable 0..10 sec. (default 2 sec.)
	System diagnosis	Integrated log file memory
	Ethernet Option	Ethernet interface and web server for remote system monitoring

See EC type certificate for more information

5.1.6 Pneumatic data

Tolerance	+/- 5% of value
Maximum pressure (P max.)	adjustable: 0,0 mbar ... 20 mbar
Minimum pressure (P min. (operation)	adjustable: 0,8 mbar ... 20 mbar
Alert pressure (P alert)	adjustable: 0,0 mbar ... 20 mbar
Minimum flow	adjustable: 0,1 l/s ... 10 l/s

5.2 Type codes

Control unit						
FS870S	.	.	.	.	.	.
Mains voltage:						
110 - 230 V AC	.0					
24 V DC	.6					
Nominal width:						
Standard		.0				
Custom		.x				
Pressure range:						
Standard			.0			
extended			.x			
Ethernet- Interface:						
Not installed				.0		
Ethernet- interface				.1		
External sensor connector						
Not installed					.0	
External sensor connector					.1	
Hardware / Software- version						
Standard						.0
Custom						.x

Solenoid valve	SV	.	-			
Operation method:						
digital	D					
proportional	P					
Effective diameter:						
2 mm		.2				
3 (if SVP: up to 300 ltr. Ex p cabinet)		.3				
5 (if SVP: more than 300 ltr. Ex p cabinet)		.5				
n mm(if SVD; size of installed nozzle)		.n				
Coverage						
Europe (ATEX)			-A			
USA (NEC 500)			-U			
Main voltage						
24 V				6		
Design						
Standard, wired 1,5 m, brass valve body					.0	
Additional Ex e terminal box, brass valve body					.K	

External Pressure sensor	**ES872**
External Pressure sensor	ES872

Configuration module	**CM873**
Configuration module	CM873

Operator panel	**BT871**
Intelligent Operator panel	
Panel mounting type	BT871.0
Type with separate IP65 housing.....	BT871.5

Operator panel	**BT85x**
Operator panel for panel mounting	
Without key-operated switch.....	BT854.0
With key-operated switch „Bypass“.....	BT854.1
Operator panel in separate IP65 housing	
Without key-operated switch.....	BT855.0
With key-operated switch „Bypass“.....	BT855.1

Ex- solenoid valve fuse		
	Nominal	**Order.Nr.**
SVD.x.x	630 mA	SI870.5
SVP.x	1600 mA	SI870.7

5.3 Marking

Marking of FS870S

	II 2 G Ex e d mb ib [px] IIC T4 II 2 D Ex tD [ibD] [pD] A21 IP 65 T100°C

Marking of BT871:

	II 2 G Ex ib IIC T4 II 2 D Ex ibD T135°C

Marking of ES872:

	II 2 G Ex ib IIC T4 II 2 D Ex ibD T135°C

Marking of CM873:

	II 2 G Ex ib IIC T4 II 2 D Ex ibD T135°C

5.4 Dimensions

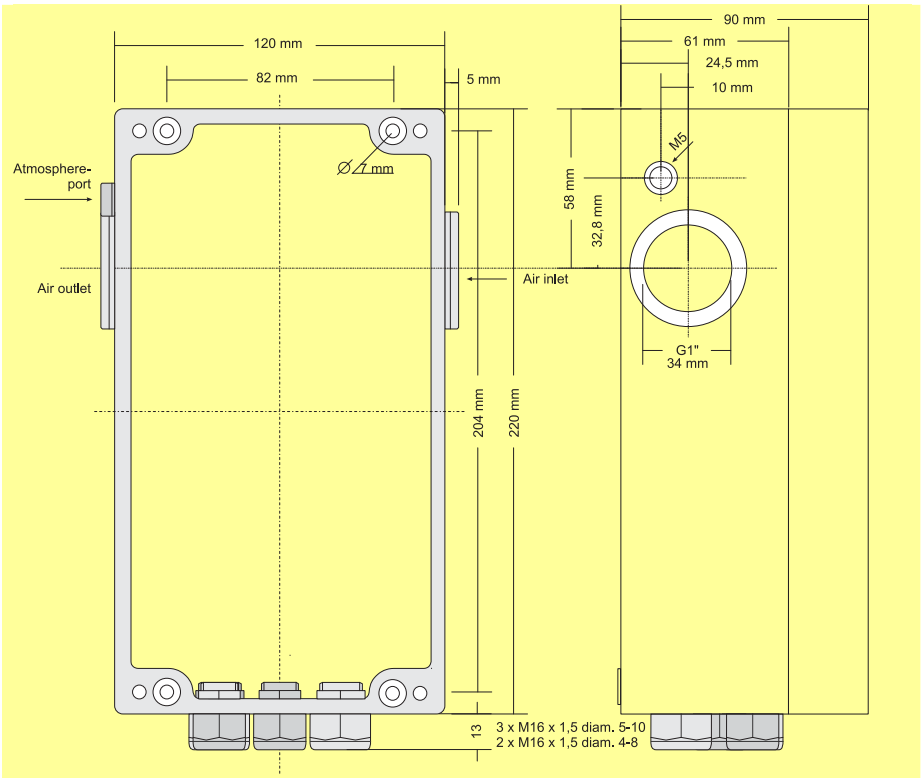


Figure 7:
Dimensions FS870S

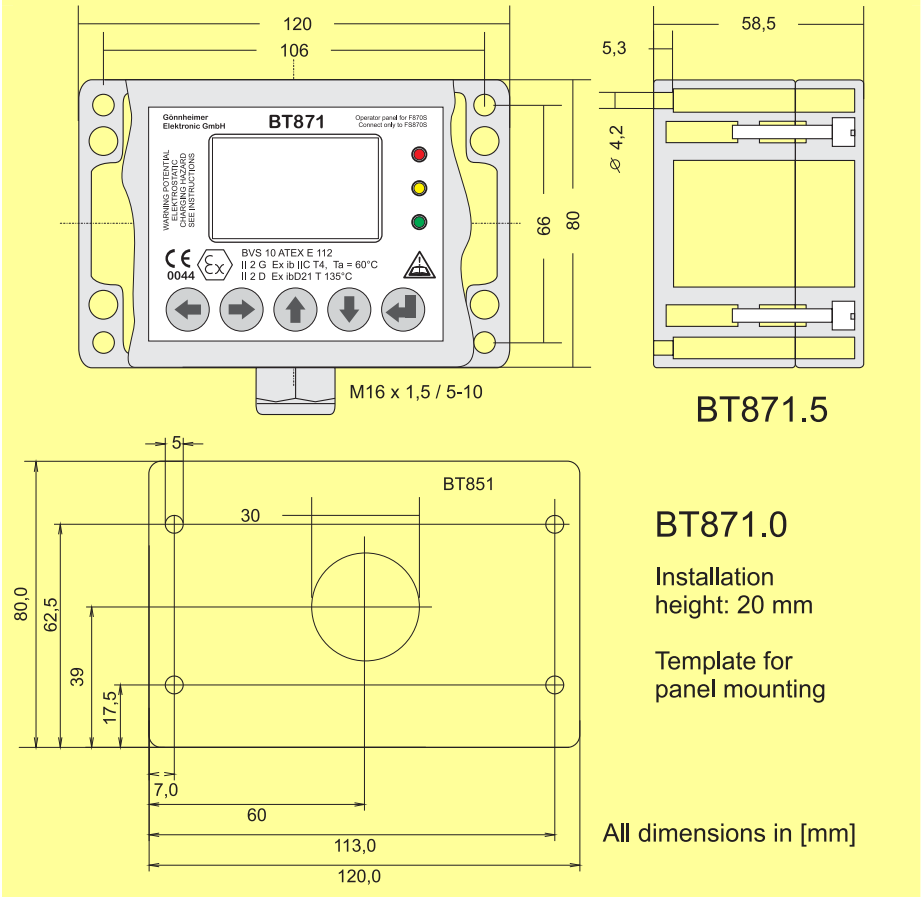


Figure 8:
Dimensions BT871

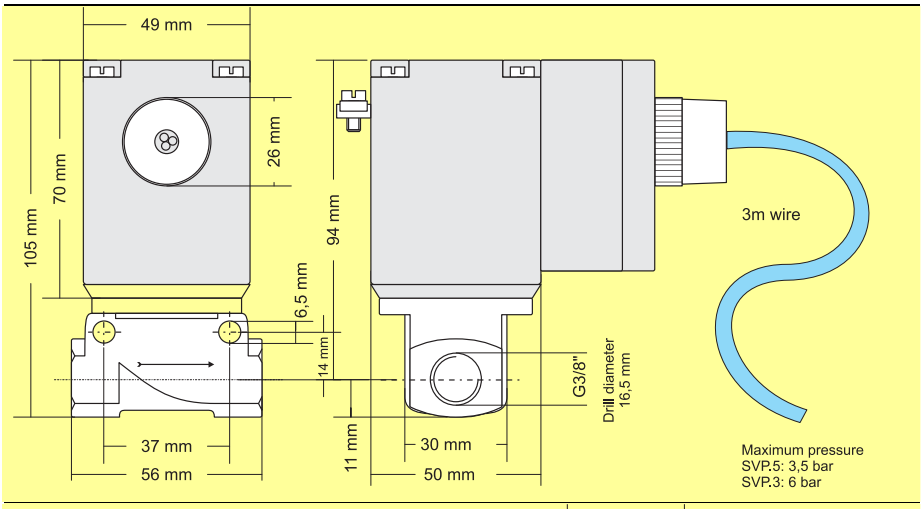


Figure 9:
Dimensions SVP.3/5

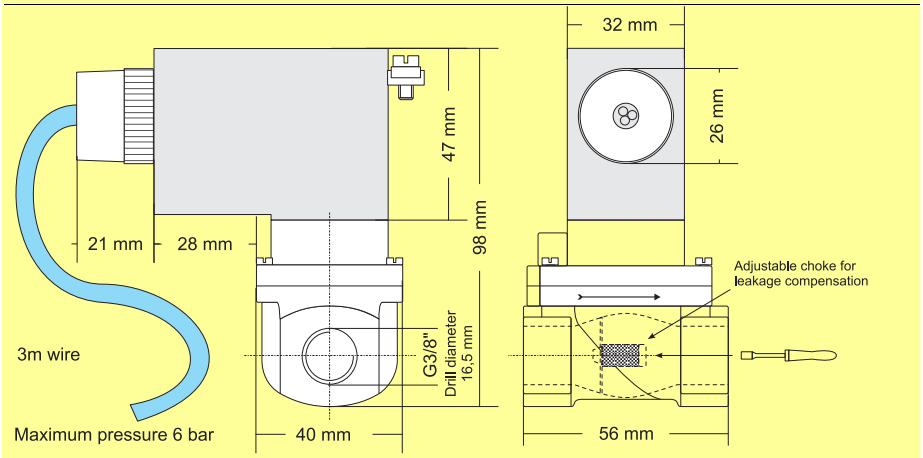


Figure 10:
Dimensions SVD.L.x

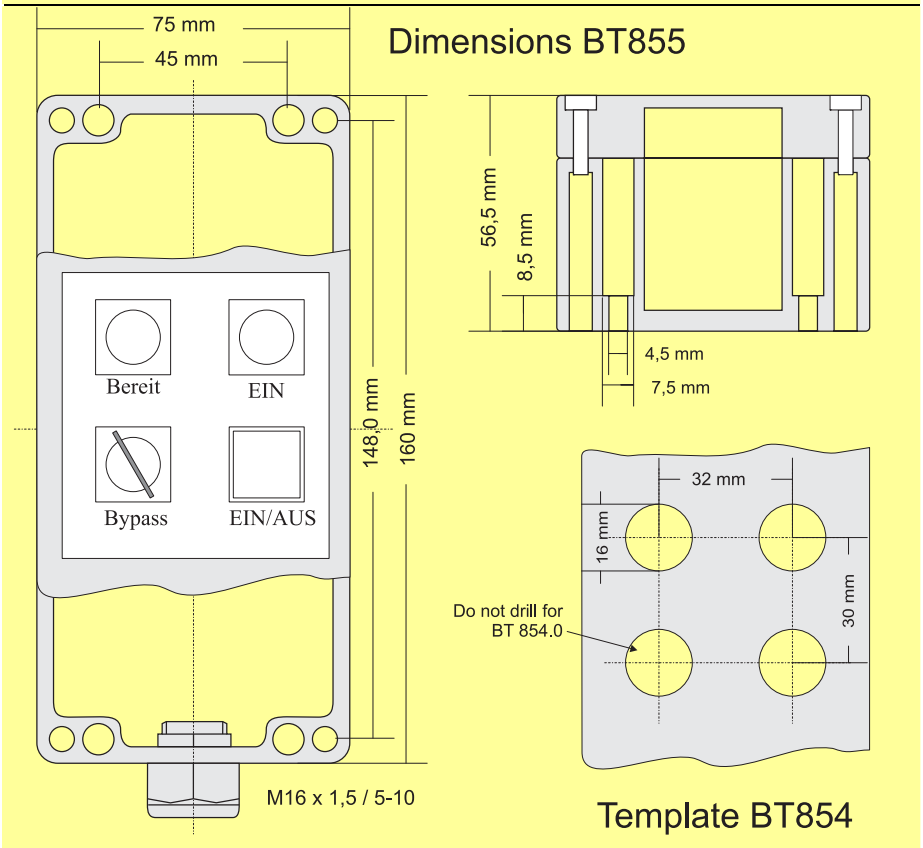


Figure 11:
Dimensions BT85x.x

5.5 Mounting examples

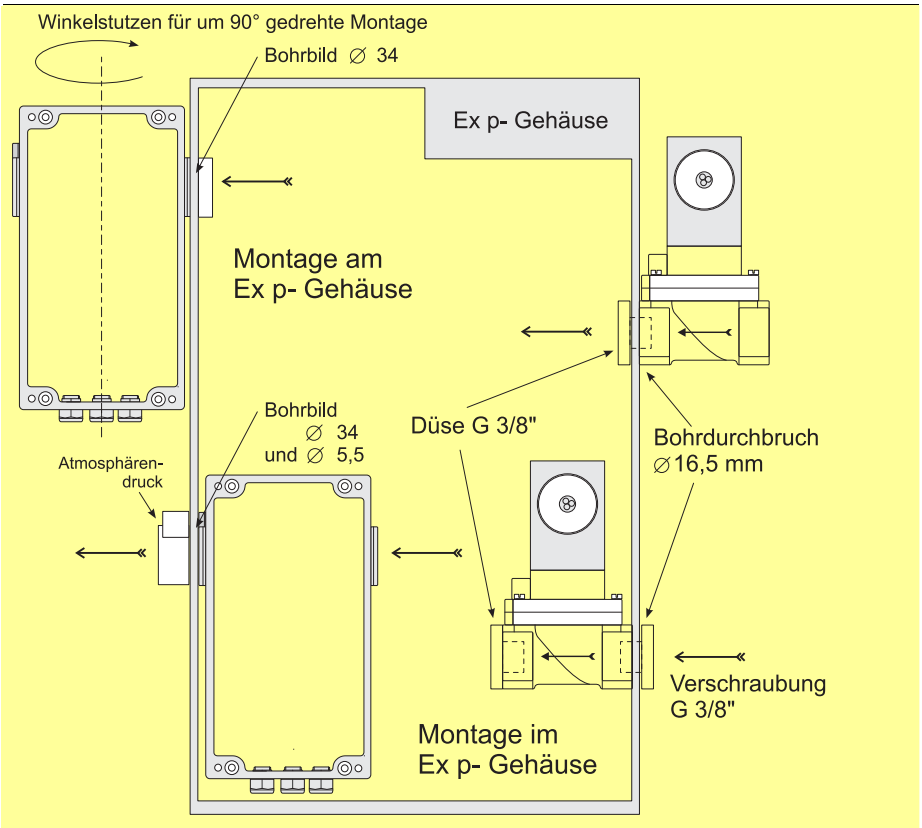
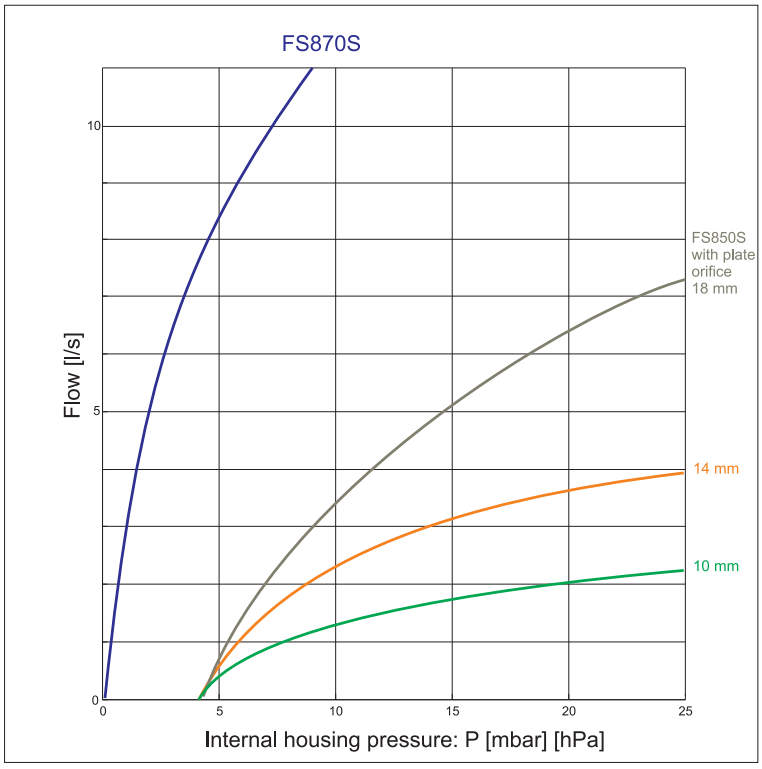


Figure 12:
Mounting examples

5.6 Flow diagram



The diagram shows the relationship between pressure inside of enclosure and the output flow. The diagram is only valid, without reducing input or output diameters as well as flow reducing pipes.

5.7 Block diagram

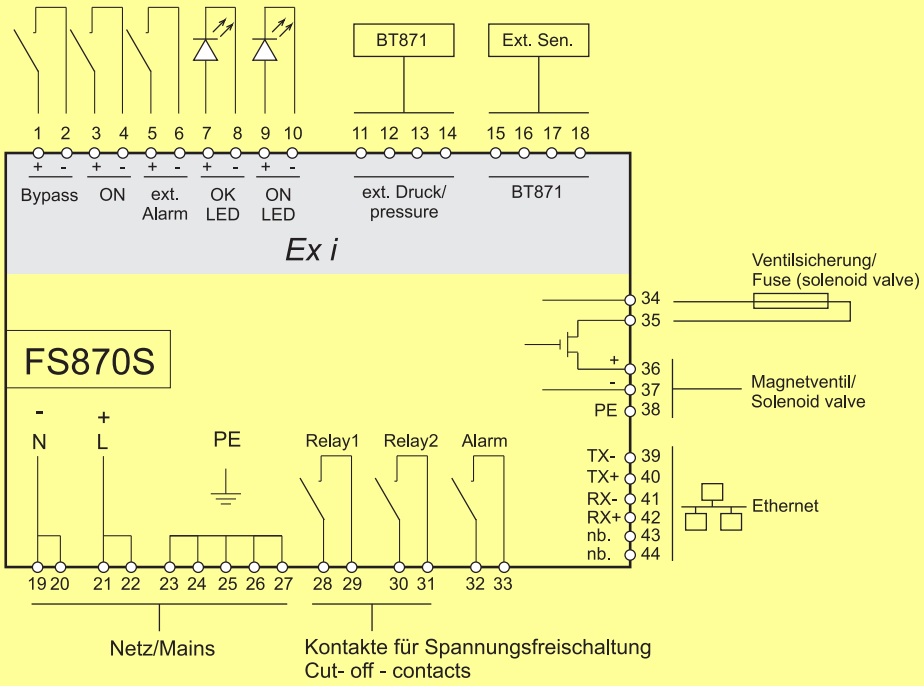


Figure 13:
Electrical block diagram

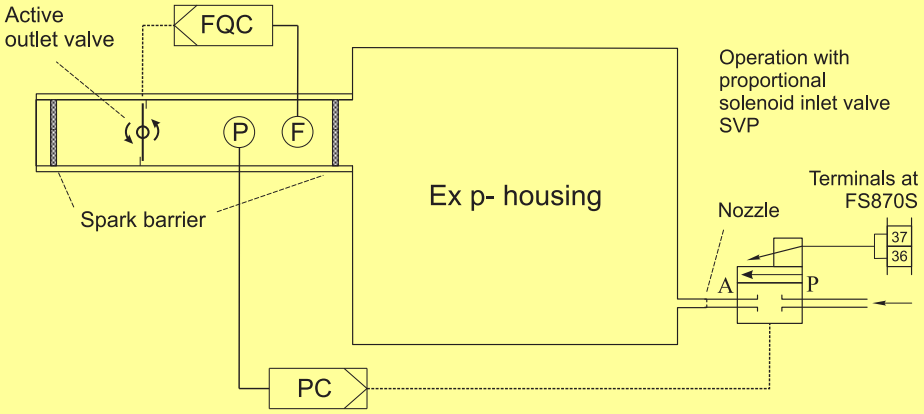


Figure 14:
Pneumatical block diagram

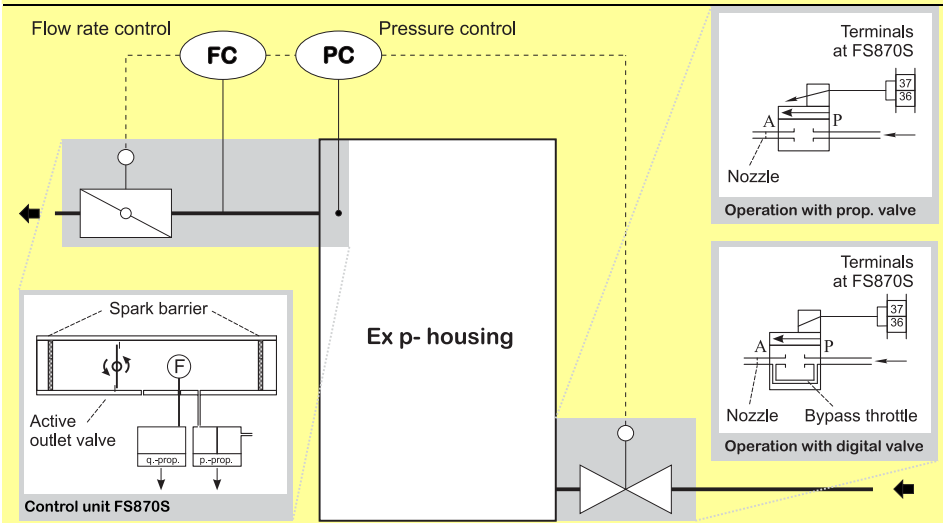
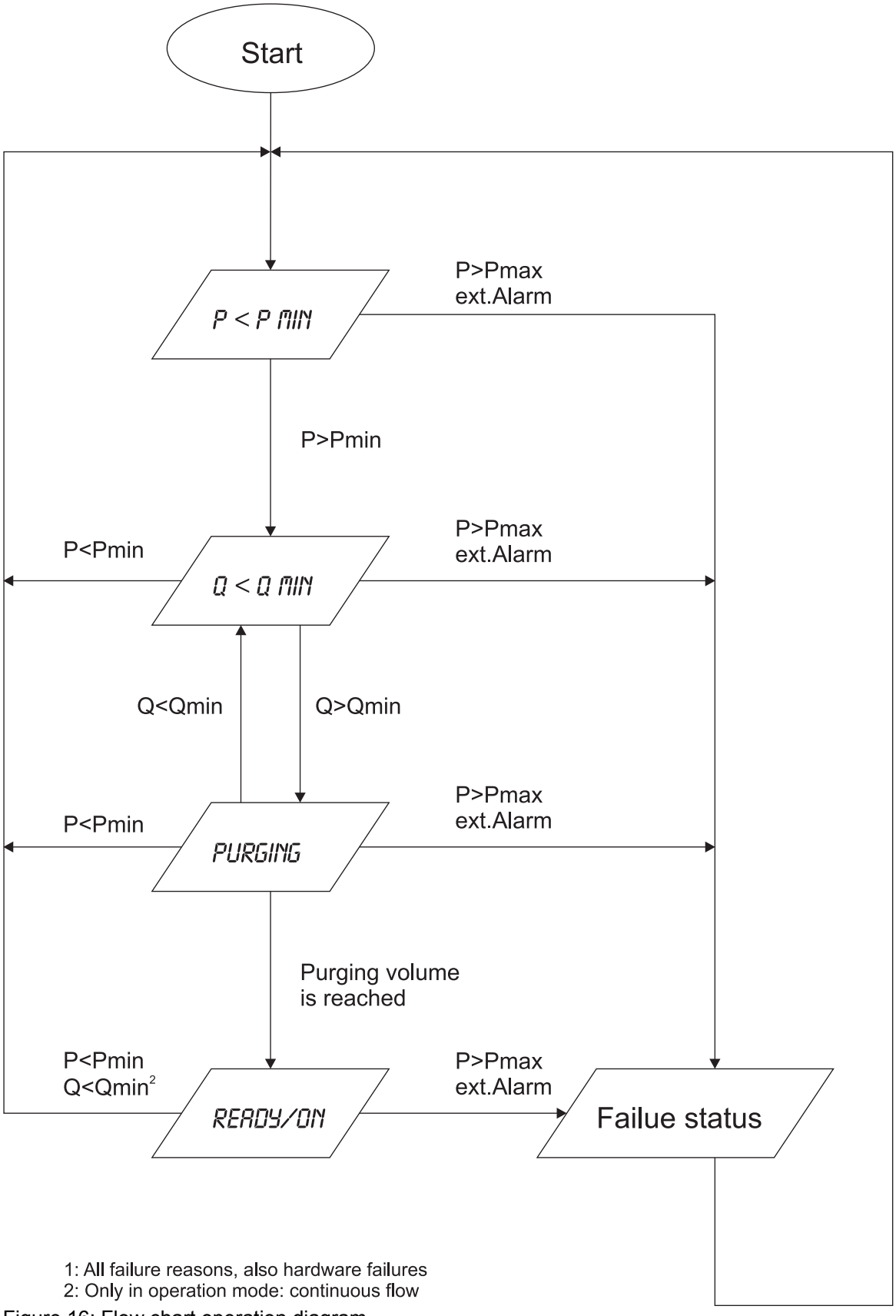


Figure 15:
Pressure and flow PID- loop back controls in FS870S

5.8 Transport, Storing, Disposal and Repairs

Transport	Vibration-free in origin package, do not drop, handle carefully
Storing	Store the device dry, inside of the origin package
Disposal	When the explosion proof multipurpose distribution, switching and control units are eventually disposed of, the national regulations governing the disposal of waste materials in the country concerned must be rigorously observed.
Repairs	Defective parts may only be replaced by the Manufacturer or by personnel specially trained and supervised by the Manufacturer. Only genuine spare parts from the Manufacturer may be fitted.

5.9 Sequence of operation diagram



1: All failure reasons, also hardware failures
2: Only in operation mode: continuous flow

Figure 16: Flow chart operation diagram

5.10 List of Parameters

System identification	Installation no.:	Date:	
FS870S. .	Production no.:	Solenoid valve	BT 8

	Description	Display	Settings	options
Structure	Language setting of FS870S	Language		(German, English, French ..)
	Do you use a proportional (SVP..) or digital (SVD…) working valve	Valve		(SVP, SVD)
	Operation mode: - Leakage compensation - Continuous flow	Operation mode		- Leakage compensation - Continuous flow
	Function of the free programmable alarm contact	Output function		(No function, P lower P-Alarm, Bypass is active, Contacts are active, Cabinet Purged, Fault)
	Contact order Normally closed (NC) Normally open (NO)	NC/NO		Normally closed (NC) Normally open (NO)
	The external alarm loop is programmable to work in special situation only	Ext-Alert mode		(Inactive, Pre purge, During purge, pre + during purge, After purge, Pre + after purge, During + after purge, Always)
	External sensor ES872 is connected to the system or not	ES872 connected		(Yes, No)
Parameter	Purge volume	Purge volume		Ltr.
	Set point of pressure controller while pre purging phase	Setpoint Pres.Purge		mbar
	Monitored minimum flow while pre purging phase	Min.Flow Purge		Ltr./s
	Set point of flow controller while pre purging phase	Setpoint-Flow Purge		Ltr./s
	Set point of pressure controller while normal operation (after pre purging phase)	Setpoint - Pres.Oper		mbar
	Monitored minimum pressure inside Ex p housing - at all times	Min. Pressure		mbar
	Monitored maximum pressure inside Ex p housing - at all times	Max. Pressure		mbar
	Pressure limit of alarm pressure	Alarm Pressure		
Codes	Code word main menu	Menu code		
	Code word to activate bypass function	Bypass code		
	Code word to switch on or off the ignition capable apparatus inside the Ex p cabinet	On/Off code		
Network	IP- Address	IP-Address		
	Subnet mask	Subnet Mask		
	Gateway	Gateway		