

Pressure monitoring equipment for oil-SF₆ bushings, type GOEK

Installation and maintenance guide



This document must not be copied without our written permission, and the contents thereof must not be imparted to a third party nor be used for any unauthorized purpose. Contravention will be prosecuted.

Safety information

Keep this instruction available to those responsible for the installation, maintenance, and operation of the bushing.

The installation, operation, and maintenance of a bushing present numerous potential unsafe conditions, including, but not limited to, the following:

- High pressures
- Lethal voltages
- Moving machinery
- Heavy components
- Slip, stumble or fall

Specialized procedures and instructions are required and must be adhered to when working on such apparatus. Failure to follow the instructions could result in severe personal injury, death, and/or product or property damage.

Additionally, all applicable safety procedures such as regional or local safety rules and regulations, safe working practices, and good judgement must be used by the personnel when installing, operating, maintaining and/or disposing such equipment.

Safety, as defined in this instruction, involves two conditions:

1. Personal injury or death.
2. Product or property damage (includes damage to the bushing or other property, and reduced bushing life).

Safety notations are intended to alert personnel of possible personal injury, death or property damage. They have been inserted in the instructional text prior to the step in which the condition is cited.

The safety conditions are headed by one of the three hazard intensity levels which are defined as follows:

DANGER

Immediate hazard which will result in severe personal injury, death, or property damage.

WARNING

Hazard or unsafe practice which could result in severe personal injury, death, or property damage.

***CAUTION:** Hazard or unsafe practice which could result in minor personal injury, or property damage.*

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1 Design

The oil pressure in bushings for SF₆ switchgear installation can be supervised by a pressure monitor according to Fig. 3 and a pressure sensor according to Fig. 4. The sensor is normally mounted in our factory on a valve on the bushing flange according to Fig. 5. A cable connects the sensor with the monitor, which is mounted at comfortable eye-level.

1.1 Pressure monitor

The pressure monitor is furnished with three pressure relays. The first relay shall give alarm at too low pressure and is pre-set at 85 kPa (abs). The second relay shall give alarm at too high pressure and is pre-set at 250 kPa (abs). The third relay is used for tripping the transformer breaker and is pre-set at 350 kPa (abs). The second and the third relay are pre-set well above the maximum service pressure in the bushings and below the minimum service pressure in the SF₆ system. The pressure relays must be set in the factory.

If the supply voltage disappears, no alarm will be released.

The pressure monitor is furnished with a display for pressure indication and three lamps indicating status of the pressure relays. The lamp is lit when the alarm level is reached.

Principal operation of the pressure monitor is shown in Fig. 2.

1.1.1 Fuse diagram

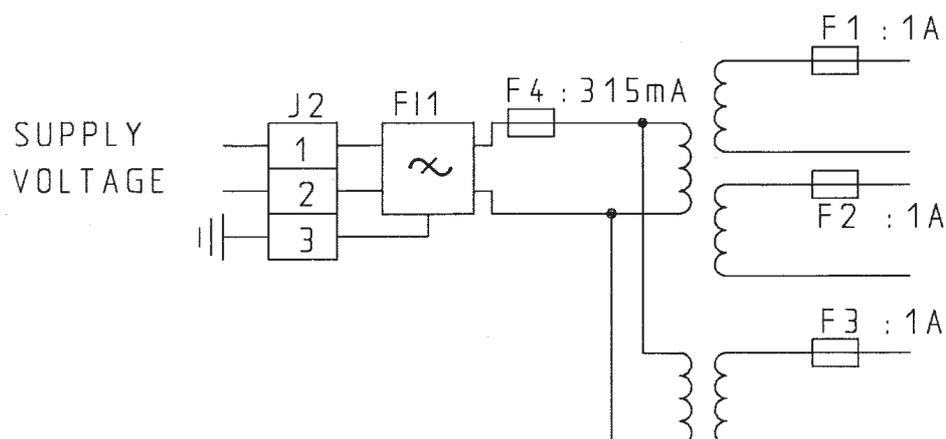


Fig. 1.

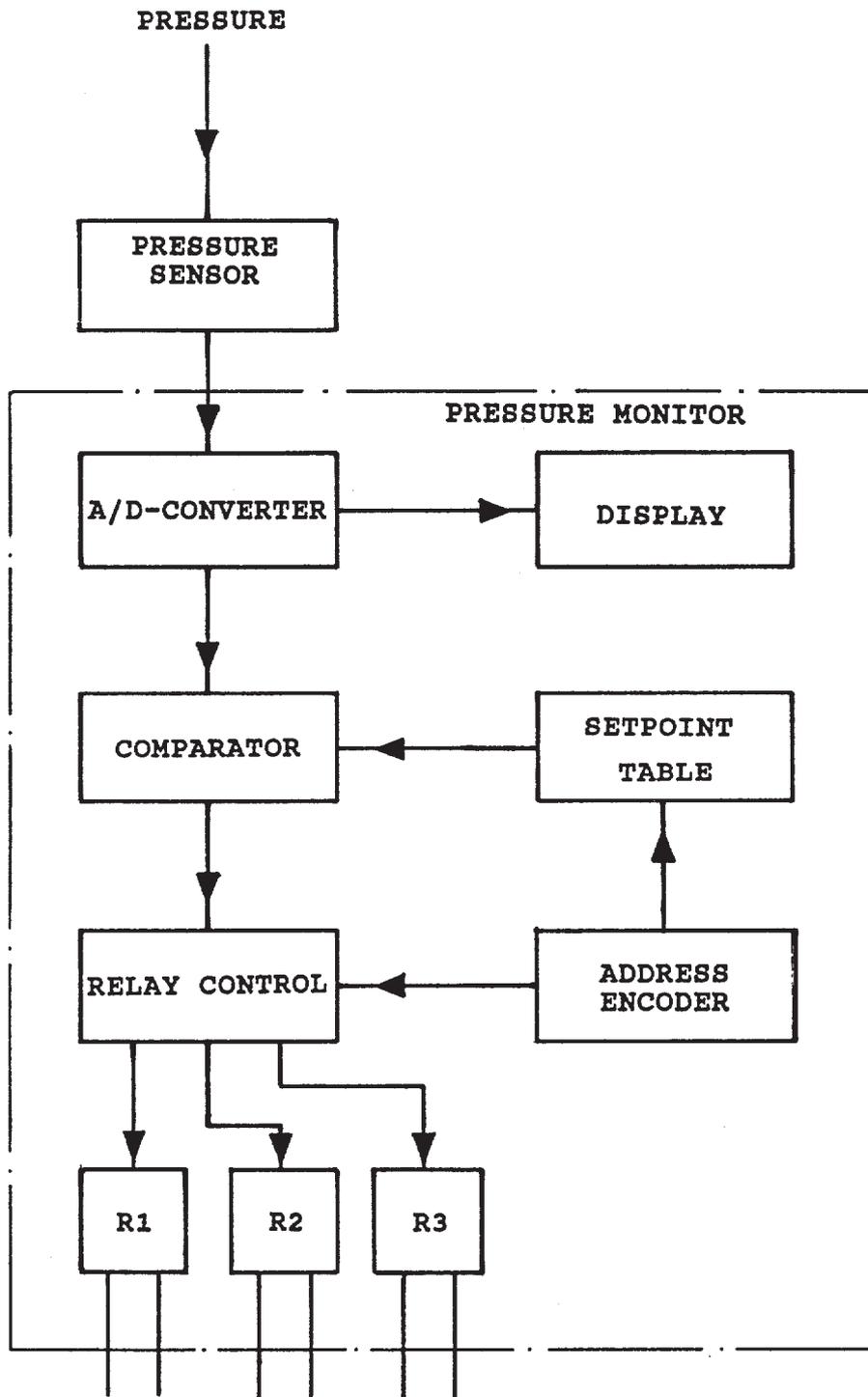


Fig. 2. Block diagram.

2 Technical data

2.1 Pressure monitor

Measuring range:	-100 kPa - +400 kPa
Indication accuracy:	1 %
Resolution:	1 kPa
Alarm level 1:	The relay is making at falling pressure
Alarm level 2:	The relay is making at rising pressure
Alarm level 3:	The relay is making at rising pressure
Switch differential:	20 kPa
Relay switching capacity:	5 A 250 V AC 0.4 A 110 V DC, L/R 40 ms
Operating range:	- 40 °C - +70 °C
Display type:	LED 14 mm high brightness 3½ digit
Supply voltage:	115 / 230 V AC 15 %, 50-60 Hz
Terminal instruction:	Circuit diagram acc. to Fig. 7
Input:	Pressure sensor with shielded cable

Immunity tested to conducted electromagnetic interference.

Impulse voltage tested and 1 MHz tested acc. to IEC 255-4.

Mains frequency tested.

Spark tested.

Vibration tested.

Casing: Die casted aluminium alloy with a two-pack urethane-based coating over a two-pack epoxy-urethane-based primer. Clear transparent window of tough polycarbonate plastic. Case is ventilated and weather proof acc. to DIN 40050 protective class IP 55.

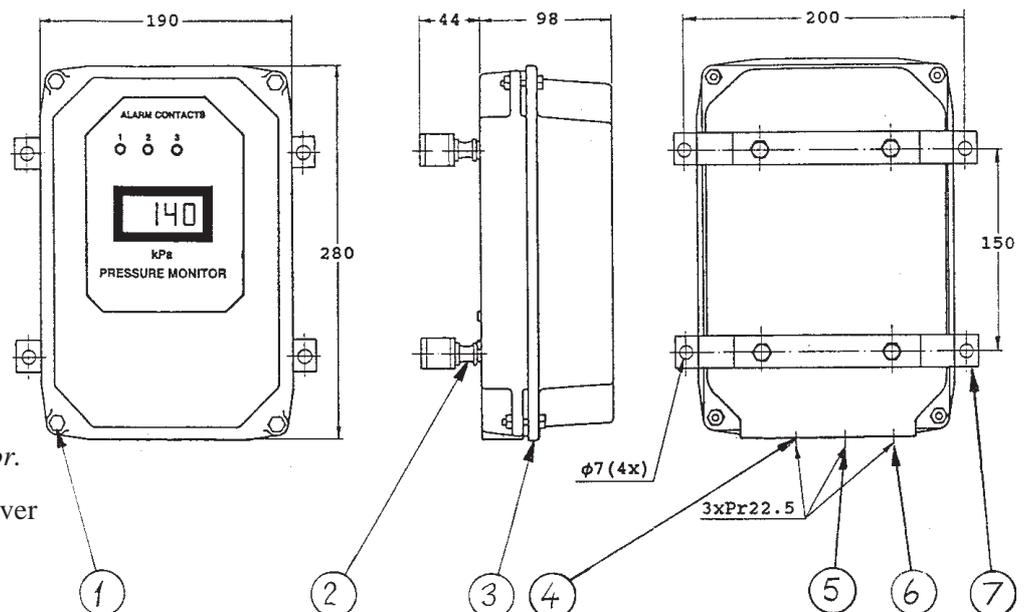


Fig. 3. Pressure monitor.

1. Four bolts for the cover
2. Vibration absorber
3. Cover
4. Cable entry for pressure sensor
5. Cable entry for pressure relays
6. Cable entry for supply voltage
7. Mounting clamp

2.2 Pressure sensor

Pressure range:	-100 kPa - + 400 kPa
Overpressure:	1 MPa
Output:	0-10 V
Accuracy:	2 %
Operating range:	- 40 °C - +70 °C
Withstand:	120 °C for 48 hours
Type:	Piezoresistive pressure sensor

Immunity tested to conducted electromagnetic interference.
 Impulse voltage tested and 1 MHz tested acc. to IEC 255-4.
 Mains frequency tested.
 Spark tested.
 Vibration tested.

Casing: Protective class IP 55 acc. to DIN or IEC.
 Weather proof for outdoor mounting.

Wetted parts: Stainless steel AISI 316.

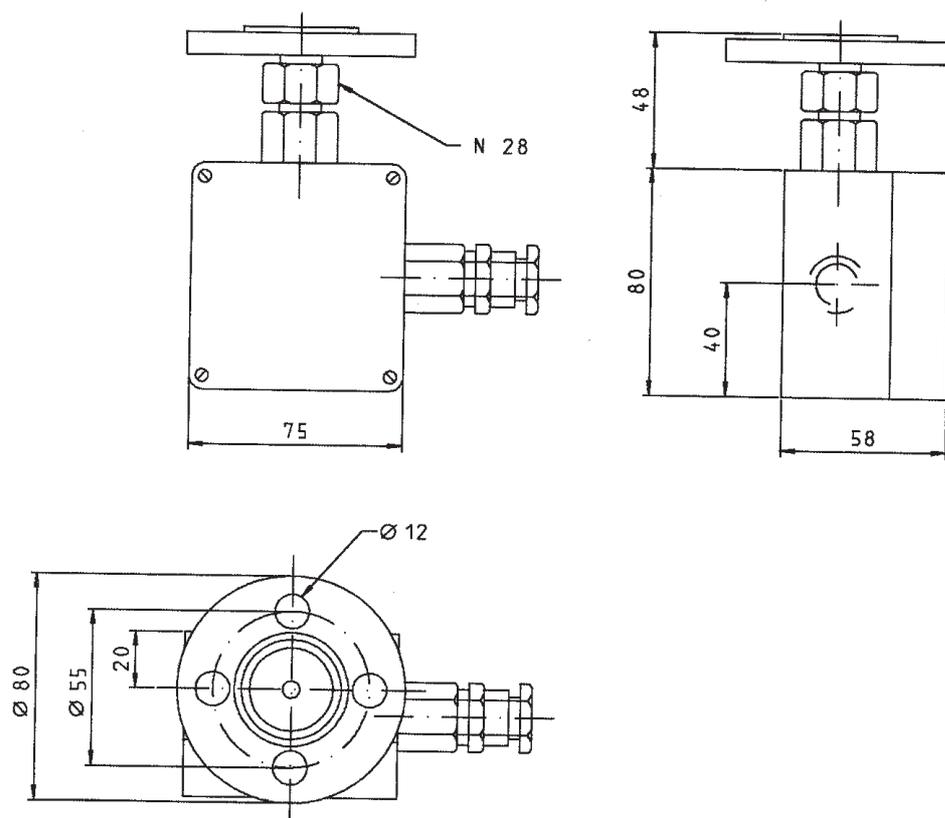


Fig. 4. Pressure sensor.

3 Mounting of pressure sensor

See Fig. 5.

WARNING

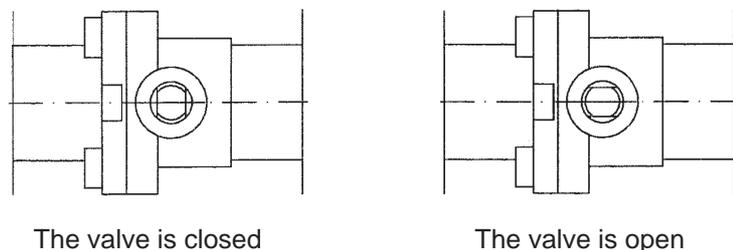
No work at all can be performed on the bushing while it is energized or not earthed.

Alternative 1: The pressure sensor is mounted in our factory.

- Check that the cable entry is directed downwards, when the bushing is mounted on the transformer. If not, close the valve.
- Unscrew the nut (2) as much as the pressure sensor can be turned.
- Turn the sensor in such a way that the cable entry is directed downwards.
- Screw the nut (2) tight.
- Open the valve.

Alternative 2: The pressure sensor is not mounted in our factory.

- Check that the valve is closed. If not, close the valve.
- Dismount the cover and the gasket (O-ring) from the valve.
(The gasket (O-ring) 29.2 x 3 is placed between the valve and the cover.)
- Mount the pressure sensor and the gasket (O-ring) on the valve. Unscrew the nut (2) as much as the pressure sensor can be turned.
- Turn the sensor in such a way that the cable entry is directed downwards, when the bushing is mounted on the transformer.
- Screw the nut (2) tight.
- Open the valve.



The valve is closed

The valve is open

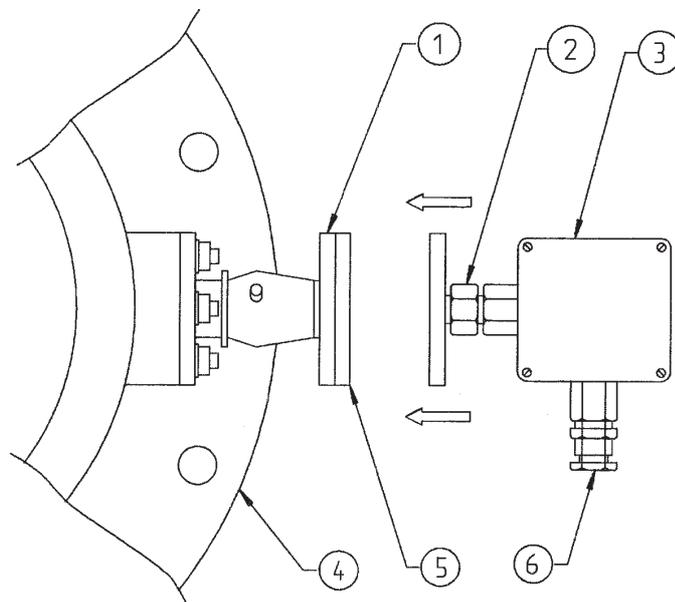


Fig. 5. Mounting of pressure sensor.

1. Valve
2. Nut
3. Pressure sensor
4. Bushing flange
5. Cover
6. Cable entry

4 Cable connections

WARNING

No work at all can be performed on the bushing while it is energized or not earthed.

4.1 Cable between pressure sensor and pressure monitor

The cable shall be connected on the connection terminal board in the junction box on the pressure sensor and on the connection terminal board in the pressure monitor. The cover of the pressure monitor is dismantled by unscrewing the four bolts according to Fig. 3.

The sheath of aluminium in the cable shall be connected to the enclosure of the pressure sensor and to the enclosure of the pressure monitor. The distance between the sheath of aluminium and the connection point on the enclosure shall be as short as possible. This connection shall normally be performed by squeezing the auxiliary bar conductor between the two tapered collars in the cable gland.

Circuit diagram according to Fig. 7.

Recommended type of cable: House wiring cable. ABB article no. 1684 0025-5.

Number of conductors and nominal cross-sectional area: 4G2.5 mm².

Outside diameter of cable: 11-13 mm.

General:

Operating temp: Max +70 °C
Flammability class: Acc. to IEC 332-1

Electrical ratings:

Rated voltage: 450/750 V
Test voltage: 2.5 kV, 50 Hz, 15 min

Material:

Conductor: Untinned copper acc. to IEC 228 class 2
Insulation: PVC acc. to IEC 227-1
Filling: PVC
Aux. bare conductor: Tinned copper acc. to IEC 228
Inner sheath: Aluminium
Sheath: PVC acc. to IEC 227-1

4.2 Cable from pressure relays and cable for supply voltage

The cables shall be connected on the connection terminal board in the pressure monitor.

Recommended type of cable: Control cable.

	Number of conductors and nominal cross-sectional area	Outside diameter	ABB article no.
Cable from pressure relays	7G2.5 mm ²	16.0-19.2 mm	1683 1927-4
Cable for supply voltage	4G2.5 mm ²	13.0-15.8 mm	1683 1927-2

General:

Operating temp: Max +105 °C
Flammability class: Acc. to IEC 332-1

Electrical ratings:

Rated voltage: 600/1000 V
Test voltage: 3 kV, 50 Hz, 5 min

Material:

Conductor: Stranded, tinned and annealed copper acc. to IEC 228 class 2
Insulation: Acc. to IEC 502, class PVC B
Inner sheath: Acc. to IEC 502, class PVC B
Armour: Galvanised steel wires in one layer
Sheath: Acc. to IEC 502 class ST2

4.3 Cable gland

Recommended cable glands:

Outside diameter of cable	Cable gland, ABB article no.
9-16 mm	2672 919-A
16-20 mm	2672 919-C

Material:

Basis metal: Wrought brass
Surface treatment: Nickel plating

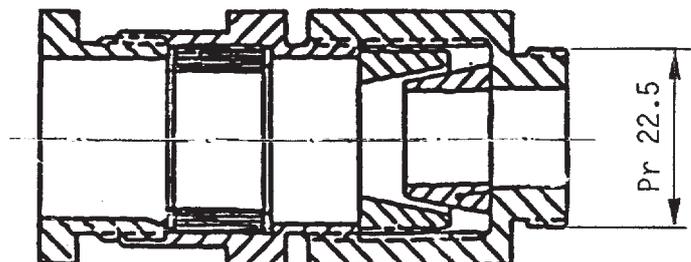


Fig. 6. Cable gland.

4.4 Circuit diagram

PRESSURE MONITOR

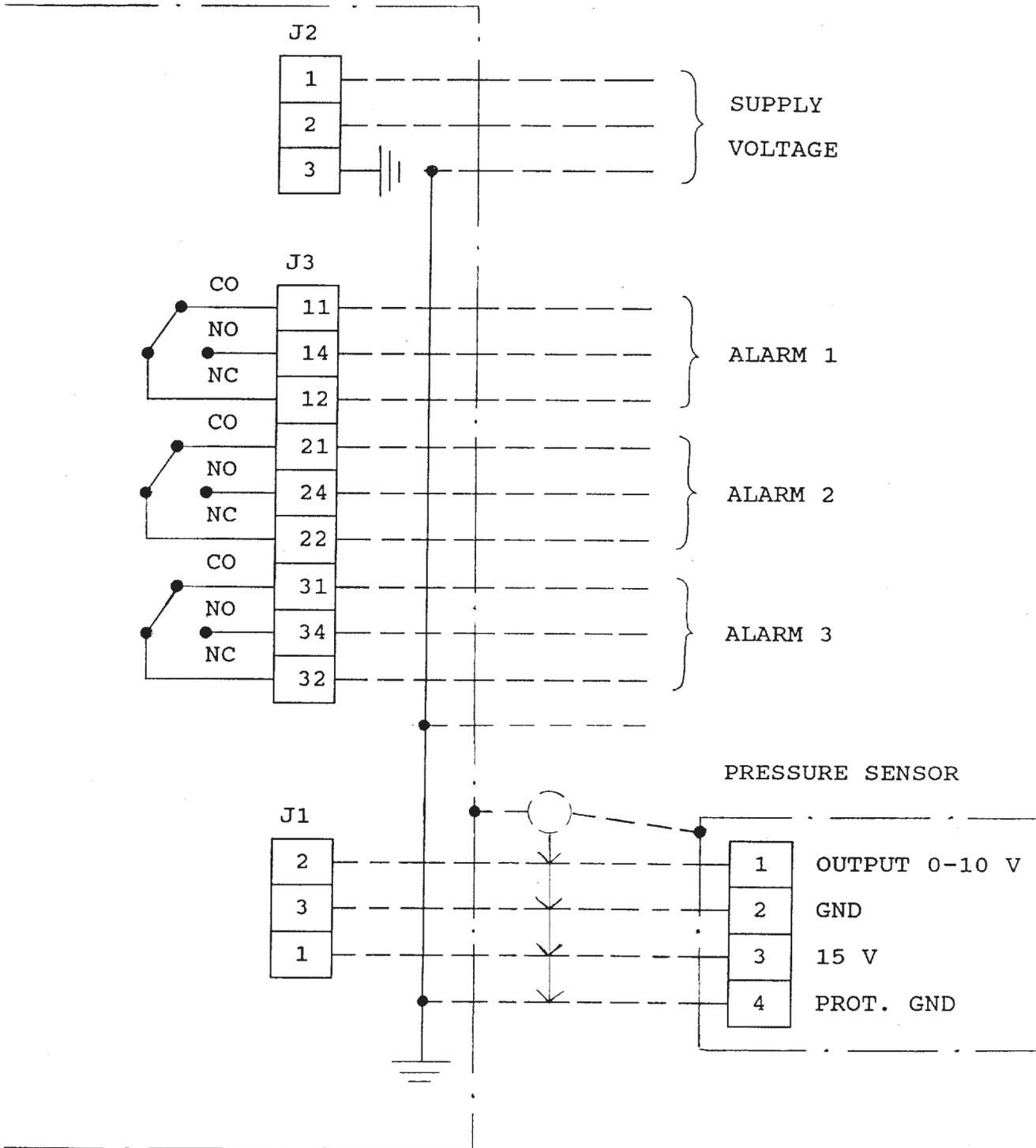


Fig. 7.

5 Ordering particulars

When ordering please state:

1. Catalogue no.
2. Alarm levels required if these deviate from recommended standard values.
3. Special requirements.

Supply voltage	Catalogue no.	Identity number marked on:	
		Pressure monitor	Pressure sensor
230 V AC	LF 410 024-K	AKM 47880-5	AKM 47881-1
115 V AC	LF 410 024-L	AKM 47880-6	AKM 47881-1

Cables and cable glands are not included in the catalogue numbers.



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