

Limit Switches

Series NI700

Installation, Maintenance and
Operating Instructions

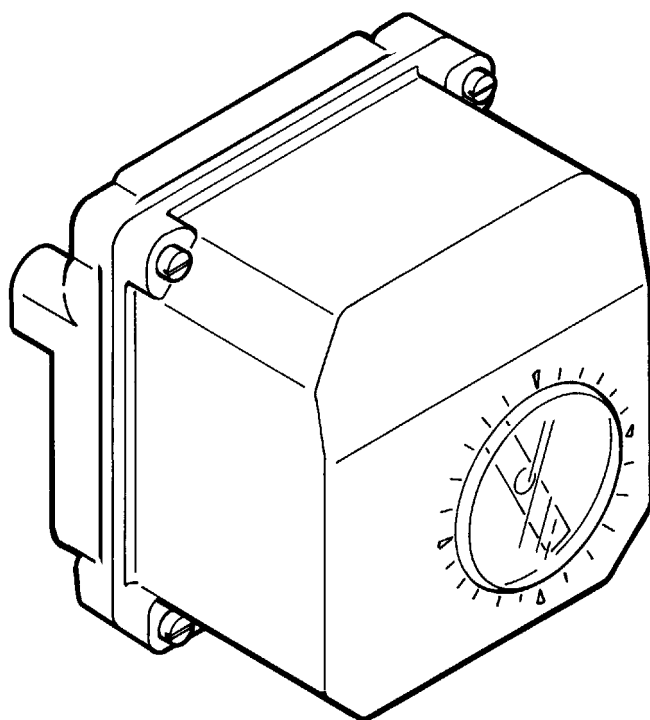


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READ THESE INSTRUCTIONS FIRST!

These instructions provide information about safe handling and operation of the limit switch.

If you require additional assistance, please contact the manufacturer or manufacture's representative.

Addresses and phone numbers are printed on the back cover.

SAVE THESE INSTRUCTIONS!

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Subject to change without notice.

1 INTRODUCTION

1.1 General description

The NI700 limit switch provided with inductive proximity switches is used for indication of the electrical position of valves and other devices.

The cam discs activating the proximity switches are mounted on the shaft.

The switching points of the proximity switches (1 or 2 pcs.) can be chosen freely.

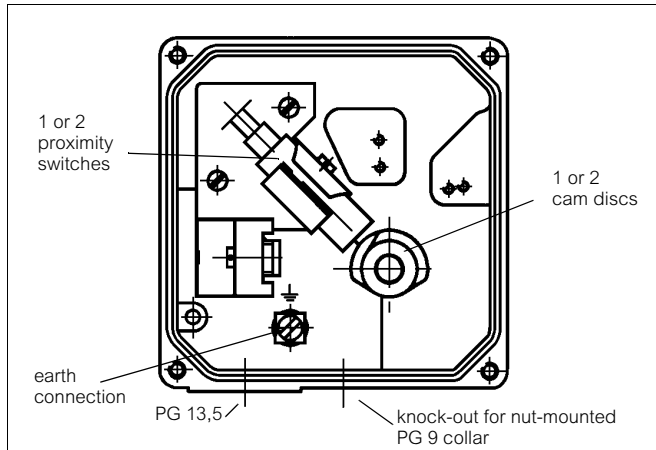


Fig. 1 Position transmitter layout

1.2 Markings

The limit switch is provided with an identification plate sticker, see Fig. 2. Identification plate markings from top to bottom are:

- Complete type designation
- Type of switch
- Electrical values
- Enclosure class
- Temperature range
- Conduit entry (-L, -I or -NJ)
- Serial number

A separate plate in older versions shows the conduit entry (-L, -I or -NJ).

The type designation is described in Section 11.

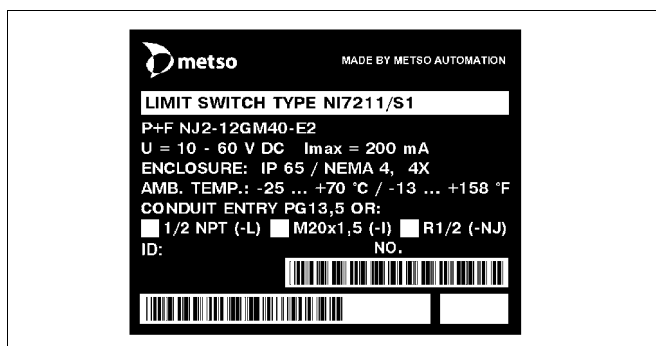


Fig. 2 Identification plate (NI7211)

1.3 Specifications

Proximity switch: Inductive, diameter 8-14 mm / 0.31-0.55 in
 Sensing range 2 mm / 0.08 in
 Protection class IP67
 P+F NJ2-12GK-N 01
 P+F NJ2-12GM40-E2 11
 P+F NJ2-12GM40-E 21
 OMRON E2E-X3D1-N 54
 ifm IFC2002-ARKG/UP 56
 Other switch types on special order

Electrical values: According to switch type

Switch accuracy: < 1°

Number of switches: 1 or 2

Approvals

NI72../X ATEX II 2 G EEx ia IIC T6

Protection class of housing:

IP65 (DIN 40050, IEC 529) /
 NEMA 4 and 4X

Conduit entry:

PG 13.5 and
 knockout for additional entry PG9
 NPT 1/2 = CE1 (L)
 ISO M20x1.5 = CE2 (I)
 R 1/2 = CE3 (NJ)

Ambient temperature: According to switch type or
 -25 - +51 °C / -13 - +123 °F
 for NI7201/X

Weight: Approx. 0.6 kg / 1.1 lbs

Materials:

Body: aluminium alloy, epoxy coated

Cover: polycarbonate

Internal parts: stainless steel and plastic

Sealing: nitrile and neopren rubber

1.4 Recycling and disposal

Most limit switch parts can be recycled if sorted according to material. Most parts have material marking. A material list is supplied with the limit switch. In addition, separate recycling and disposal instructions are available from the manufacturer. A limit switch can also be returned to the manufacturer for recycling and disposal against a fee.

1.5 Safety precautions

CAUTION:

Do not exceed the performance limitations!

Exceeding the limitations marked on the position transmitter may cause damage to the transmitter and associated devices. Damage or personal injury may result.

WARNING:

Observe caution with the live parts of the position transmitter!

The position transmitter and limit switches are fed with a voltage that, depending on the system, can be lethal. Do not touch any uncovered parts of the wires. Always detach the wires before dismantling the position transmitter.

Ex i WARNING:

Make sure that the complete installation and wiring is intrinsically safe before operating the device!

Ex i WARNING:

Electrostatic charge hazard!

The pointer window is non-conductive. Clean with damp cloth only.

Ex i WARNING:

Spark hazard!

Protect the aluminium housing from impacts.

Ex i NOTE:

The mounting must be in accordance with the installation guidelines IEC-EN 60079-10.

2 INSTALLATION ON A METSO ACTUATOR

When the limit switch is ordered together with the valve, installation and adjustment are performed at the factory according to circuit diagrams in Chapter 10 or the customer's specifications.

When the limit switch is ordered separately, the installation parts belonging to the particular entity must also be ordered.

Ordering example: (B1CU)-Z-NI7211/S1 or (B1J12)-Z-NI7211/S2 or (B1J12-NP724/S2)-Z-NI7211/S2

The limit switch is equipped with both VDI/VDE 3845 (S1) mounting face and Metso (S2) mounting face. Both mounting faces require different shafts. S1: H coupling; S2: C coupling.

The limit switch can be mounted on the actuator. If also the positioner is needed, use positioner/limit switch combination (e.g. NPI724/S1/7211).

If limit switch NI700/S1 is mounted on an existing actuator B_6-20 with bracket 4216200, make sure that the shaft and draught piece can rotate freely. Remove material from the bracket according to Fig. 3, if needed.

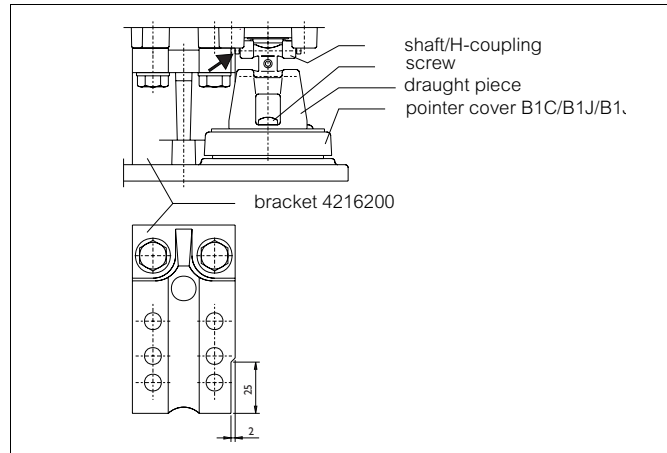


Fig. 3 Installing NI700/S1 position transmitter on B series actuator (older version).

2.1 Installing limit switch NI700/S1 on Metso actuators with VDI/VDE 3845 mounting face

2.1.1 Installation steps

1. The actuator piston must be in the up position (in spring-return actuators as determined by the spring).
2. Install the pointer (only B_U) parallel with the valve closure member and fasten the draught piece (2) with a screw (29) to the pointer cover (B_U) or to the coupling (QP), as shown in Fig. 4. Secure the draught piece fastening screw with thread-locking compound (e.g. Loctite) and tighten it properly.
3. Fasten the mounting bracket (1) to the position transmitter.
4. Fasten the mounting bracket (1) to the actuator. The mechanical coupling (223) of the position transmitter must be positioned in the draught piece (2) as shown in Fig. 4.

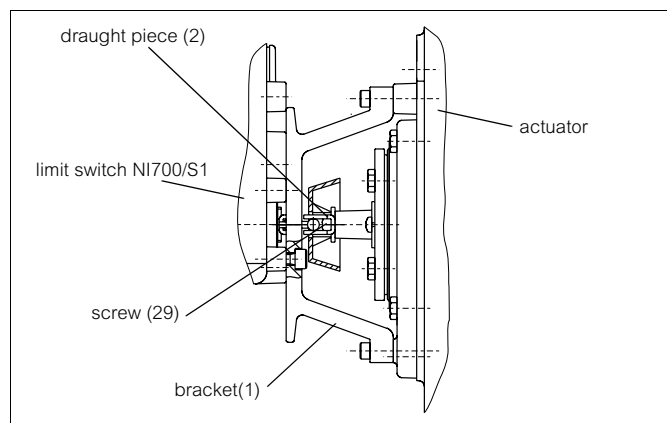


Fig. 4 Installing, S1

2.2 Installing the limit switch NI700/S2 on Metso series B actuator

2.2.1 Installation steps

1. Operate the actuator to place the piston in the up position (spring-return actuator as determined by the spring).
2. Install the pointer parallel with the valve closure member and fasten the draught piece (2) to the pointer cover with the coupling strap positioned as shown in Fig. 5. Secure the draught piece mounting screw with thread-locking compound (e.g. Loctite) and tighten it properly.
3. Fasten the mounting bracket (1) to the position transmitter. **Note the washers (3)!**
4. Fasten the mounting bracket (1) to the actuator. The mechanical coupling (223) of the position transmitter must be positioned in the draught piece (2) as shown in Fig. 5.

Observe the difference in installing the transmitter on the B1C and B1J actuators as compared with the case of the B1JA actuator.

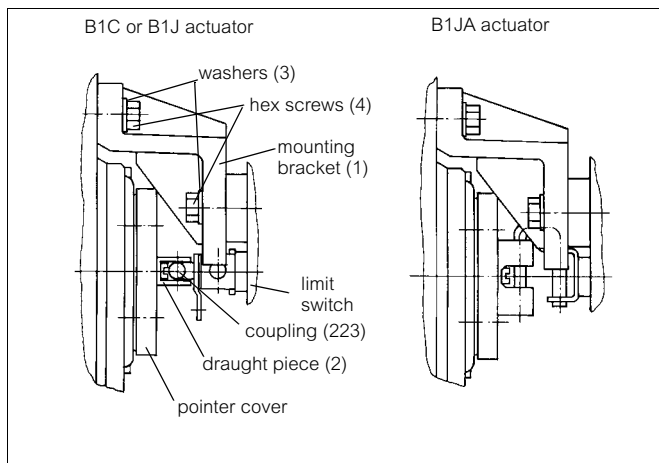


Fig. 5 Installing, S2

2.3 Installing the limit switch (S2) and positioner NP700/NE700/S2

Installation of a separate limit switch with a positioner is possible if both the limit switch and the positioner have S2 shaft.

E.g. NP724/S2-Z-NI7211/S2.

2.3.1 Actuators B1C/B1J/B1JA6-20

1. The actuator piston must be in the up position (in spring-return actuators as determined by the spring).
2. Install the pointer parallel with the valve closure member and fasten the spline driver (2) to the pointer cover with the coupling strap positioned as shown in Fig. 5. Secure the spline driver fastening screw with a sealant (e.g. Loctite) and tighten it properly.
3. Fasten the bracket (5) to positioner NP700/NE700 with screw (7) and washer (6), see Section 9.5.
4. Fasten limit switch NI700 to the bracket (5), see Section 9.2.

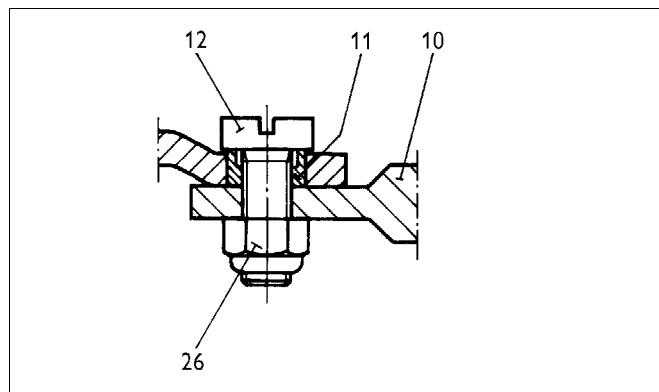


Fig. 6 Installing the rod (10)

5. Fasten the rod (10) with screws and bushings (12+11). Turn the bushing (11) onto the screw (12) so that the spacing inside the bushing is placed against the head of the screw, see Fig. 6. Apply the outer sphere of the bushing with Molykote BR2 vaseline (or the equivalent).
6. Tighten the lock nuts (26).
7. Fasten the assembly to the actuator. The mechanical coupling of the positioner must be placed into the spline driver (2) as shown in Fig. 5.
8. Complete the piping of the positioner according to its installation, operating and maintenance instructions.

For installation instructions of the positioner/limit switch combinations see positioners' manuals (7 NP 72 / 7 NE 72).

2.3.2 Actuators B1C/B1J/B1JA25-502

1. The actuator piston must be in the up position (in spring-return actuators as determined by the spring).
2. Install the pointer parallel with the valve closure member and fasten the spline driver (2) to the pointer cover with the coupling strap positioned as shown in Fig. 5. Secure the spline driver mounting screw with a sealant (e.g. Loctite) and tighten it properly.
3. Fasten positioner NP700/NE700 and limit switch NI700 to the mounting bracket (1), see Section 9.6.
4. Fasten the rod (10) with screws and bushings (12+11). Turn the bushing (11) onto the screw (12) so that the spacing inside the bushing is placed against the head of the screw, see Fig. 4. Apply the outer sphere of the bushing with Molykote BR2 vaseline (or the equivalent).
5. Tighten the lock nuts (26).
6. Fasten the assembly to the actuator. The mechanical coupling of the positioner must be placed into the spline driver (2) as shown in Fig. 3.
7. Complete the piping of the positioner according to its installation, operating and maintenance instructions.

2.4 Installation on other actuators

1. Operate the actuator so that the valve closes. Also turn the limit switch shaft to activate the closed limit proximity switch (the lower one).
2. Fasten the coupling (2) between the limit switch and the actuator to the actuator (or to limit switch shaft).
3. Fasten the mounting bracket (1) to the limit switch.
4. Fasten the mounting bracket (1) with the limit switch to the actuator so that the mechanical coupling (223) of the limit switch (or the shaft end) is inserted in the slot of the coupling (2). Observe what was said about the position of the limit switch shaft in step 1 above!

2.5 Installing the limit switch N_I700/700 on the positioner

The bottom of the limit switch acts also as the cover for the positioner. See drawings in chapter 9. It is possible to mount a limit switch on an existing positioner, however, the shaft and locking wheel of the positioner must be changed. It is recommended to order a pre-assembled combination.

The positioner should be adjusted before the mounting of the limit switch.

1. Operate the actuator until the valve is in the closed or open position.
2. Note the position of the actuator and valve when mounting the limit switch on the actuator. Make sure that the shaft (215) is in the right position: the lower switch is activated at the closed limit and the upper switch at the open limit.
3. Place the limit switch on the positioner so that the shafts are correctly engaged.
4. Fasten the screws (258).
5. Check the adjustment of the limit switch. See chapter 4 for details.

Remove the limit switch before the adjustment of the positioner. Loosen the screws (258). Note the position of the shaft relative to the positioner when removing the limit switch. Check the adjustment of the limit switch always after remounting.

3 ELECTRICAL CONNECTIONS

Before connecting the power, make sure that the electric specification and the wiring meet the installation conditions. Also observe the function of the proximity switch (make or break when the active face is covered). See also the information on the identification plate.

4 ADJUSTMENT

The pointer (210) need not be removed for adjustment.

When the limit switch is ordered together with the valve and the actuator, the proximity switches are adjusted at the factory.

The limits are adjusted by changing the position of the cam discs (221) on the shaft. Depending on the type, the proximity switch is activated when the active face is either covered or free.

With the actuator in the open or closed position, turn the

cam disc to adjust the point where the switch is activated 5°-6° before limit. Use the LED indicator or a separate measuring instrument as an aid.

After re-installation of the actuator, first adjust its mechanical limits according to the valve, then the possible positioner according to separate instructions, and finally the limit switch.

Adjustment completed, turn the pointer (210) to make the yellow line parallel with the valve closure member.

5 CIRCUITRY

The internal circuitry of the limit switch is shown in the circuit diagrams of Chapter 10.

The connection diagrams are also supplied with the limit switch

6 MAINTENANCE

Regular maintenance of the limit switch is not necessary.

7 ORDERING SPARE PARTS

NOTE:

Always use original spare parts to make sure that the position transmitter functions as intended.

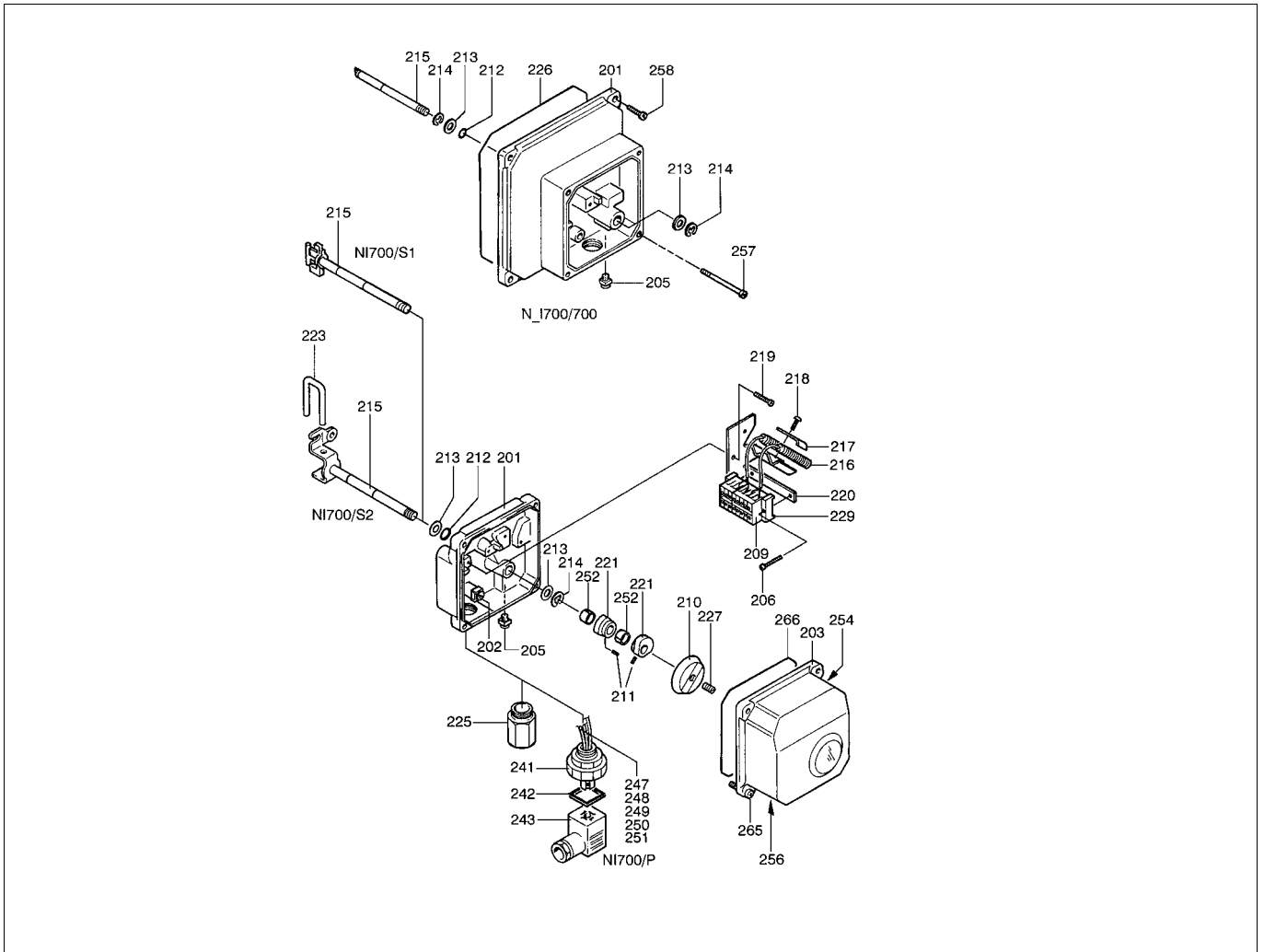
When ordering spare parts, always include the following information:

- type code, sales order number, serial number
- number of the parts list, part number, name of the part and quantity required

This information can be found from the identification plate or documents.

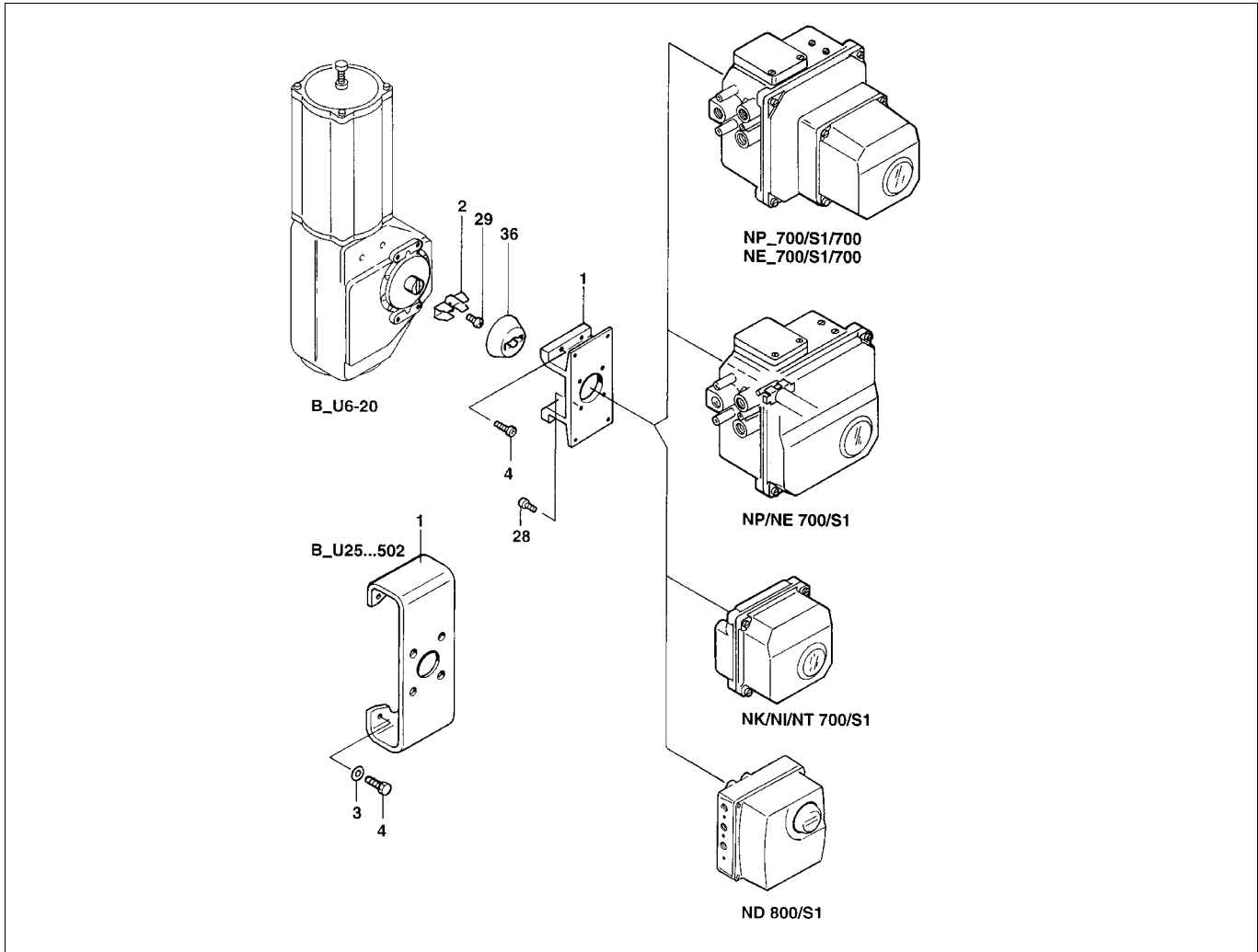
8 DRAWINGS AND PARTS LISTS

8.1 NI700, exploded view and parts list



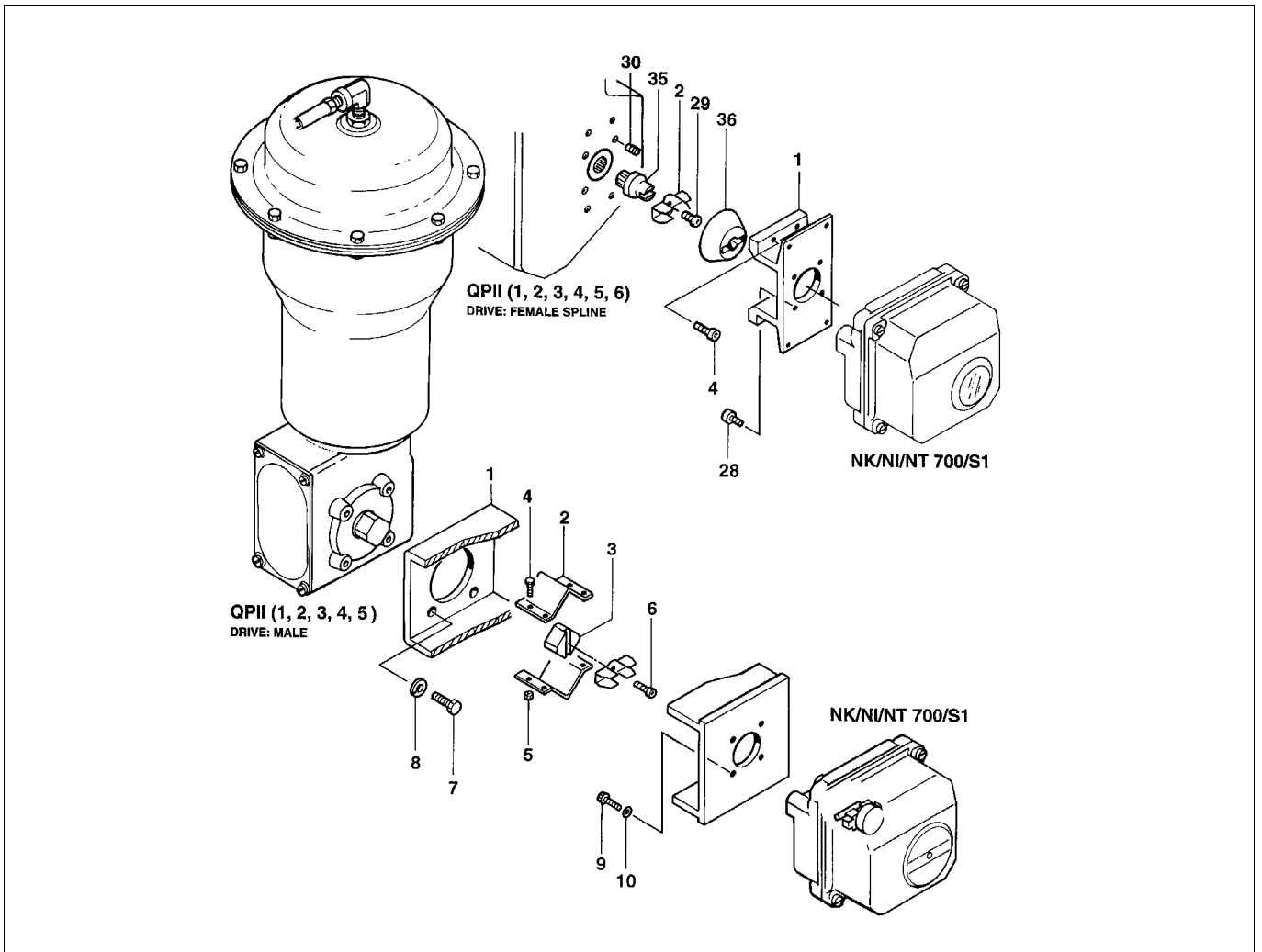
Item	Qty	Description	Recommended spare	Item	Qty	Description	Recommended spare
201	1	Housing		226	1	Seal	
202	1	Earth connection		227	1	Grub screw	
203	1	Cover, assy		229	2	End stop	
205	1	Equi potential bonding		241	1	Appliance connector	
206	2	Screw		242	1	Gasket	
209	8	Terminal		243	1	Appliance socket	
210	1	Pointer		247	1	Wire	
211	2 (1)	Screw		248	1	Wire	
212	1	O-ring	X	249	1	Wire	
213	2	Washer		250	1	Wire	
214	1 (2)	Lock ring	X	251	1	Wire	
215	1	Shaft, assy		252	2 (1)	Bushing	
216	2 (1)	Inductive proximity sensor		254	1	ID plate	
217	1	Washer		256	1	Additional plate	
218	1	Screw		257	1	Screw	
219	2	Screw		258	3	Screw	
220	1	Fastening plate		265	4 (3)	Screw	
221	2 (1)	Cam disc		266	1	Seal	X
223	1	Coupling		268	1	Support (with one switch only)	
225	1	Adapter		226	1	Seal	

8.2 Mounting parts for B1C6-502 and B1J8-322 actuators (S1)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	4	Washer
4	4	Screw
28	1	Screw
29	2	Screw
36	1	Coupling jacket

8.3 Mounting parts for Quadra-Powr actuators (S1)



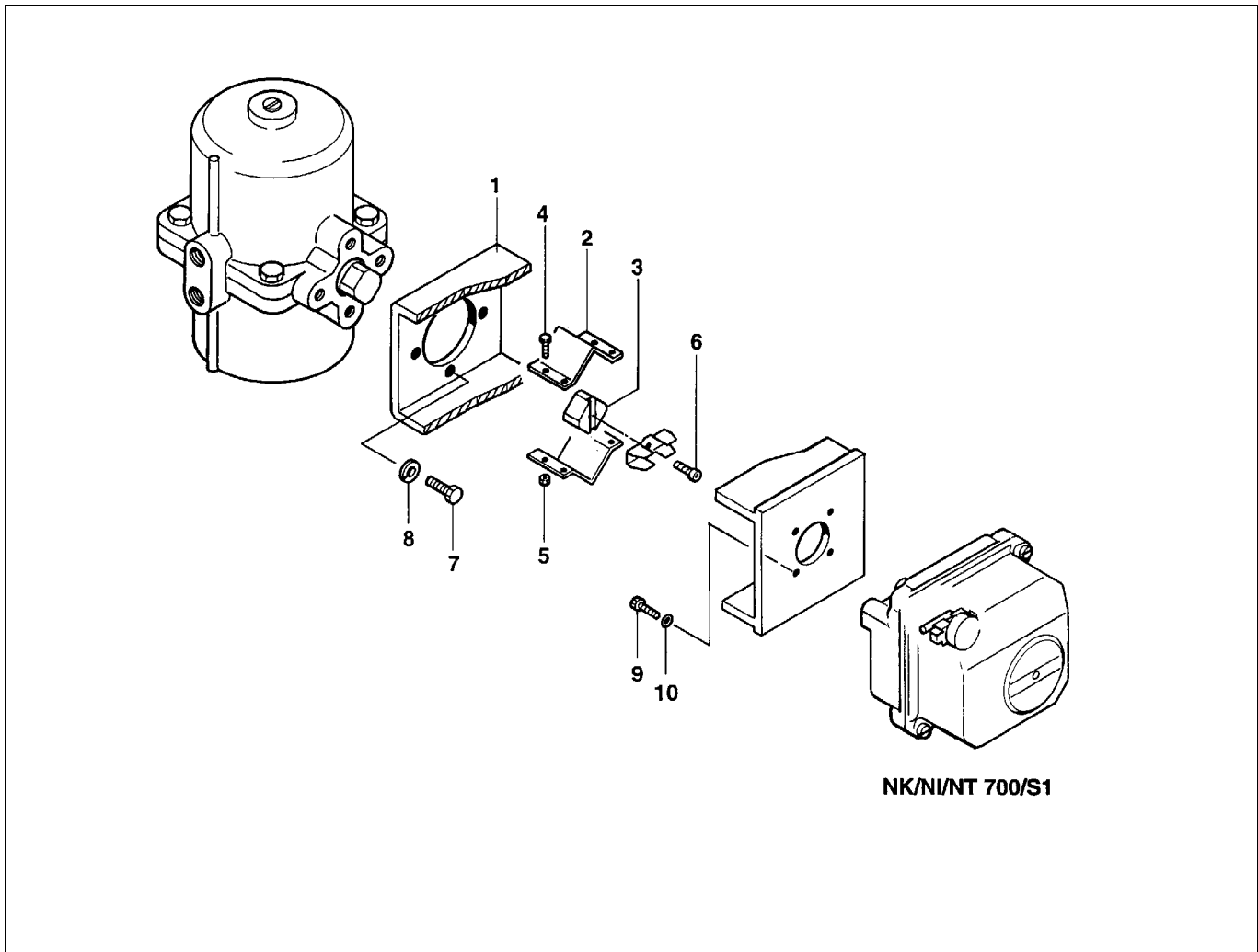
Drive: male

Item	Qty	Description
1	1	Mounting bracket
2	2	Coupling half
3	1	Adapter
4	4	Screw
5	4	Hex nut
6	1	Screw
7	4	Screw
8	4	Washer
9	4	Screw
10	4	Washer

Drive: female spline

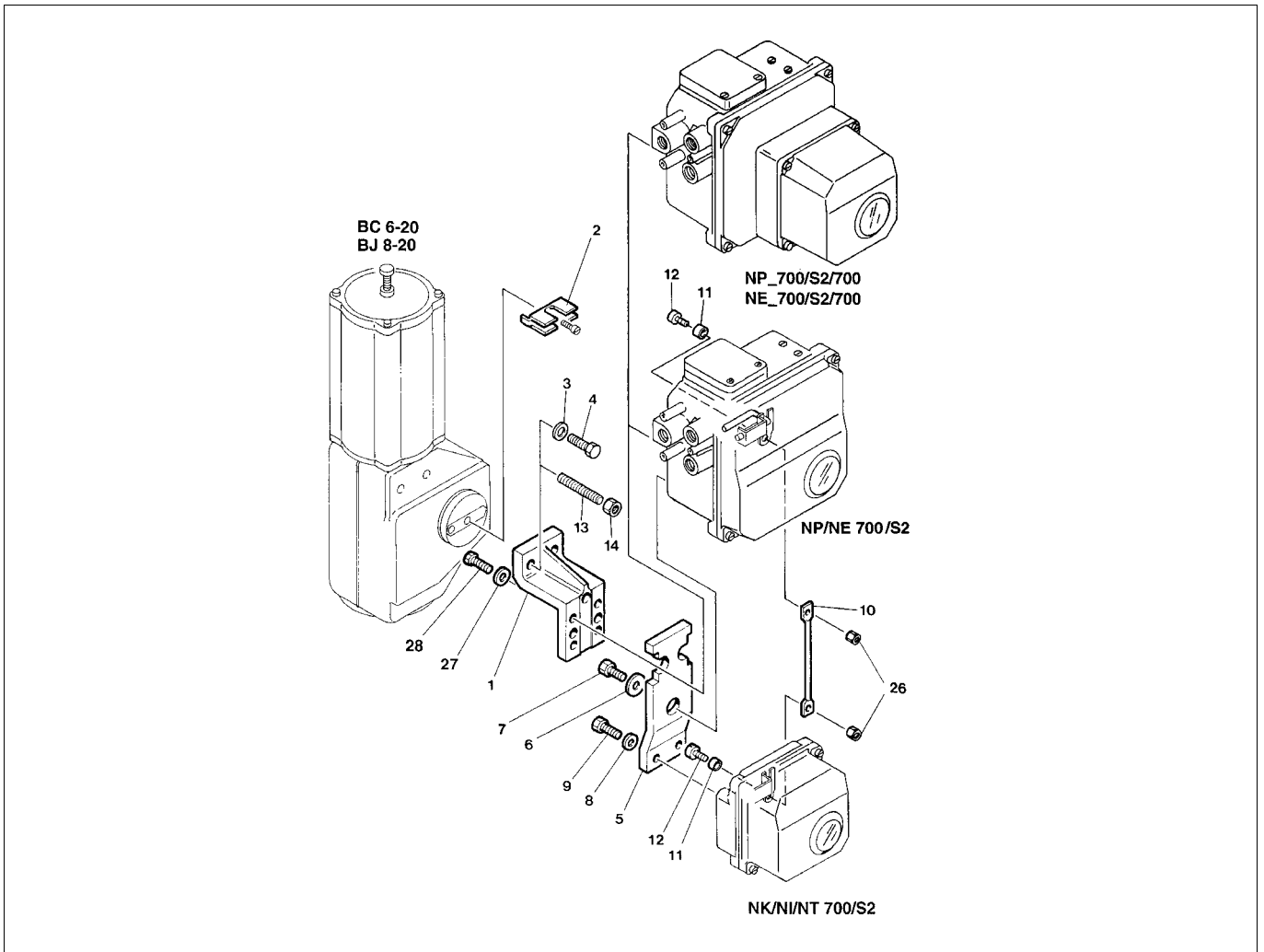
Item	Qty	Description
1	1	Mounting bracket
2	1	Ear
4	4	Screw
28	4	Screw
29	1	Screw
30	(4)	Screw
35	1	Coupling
36	1	Coupling jacket

8.4 Mounting parts for SP actuators (S1)



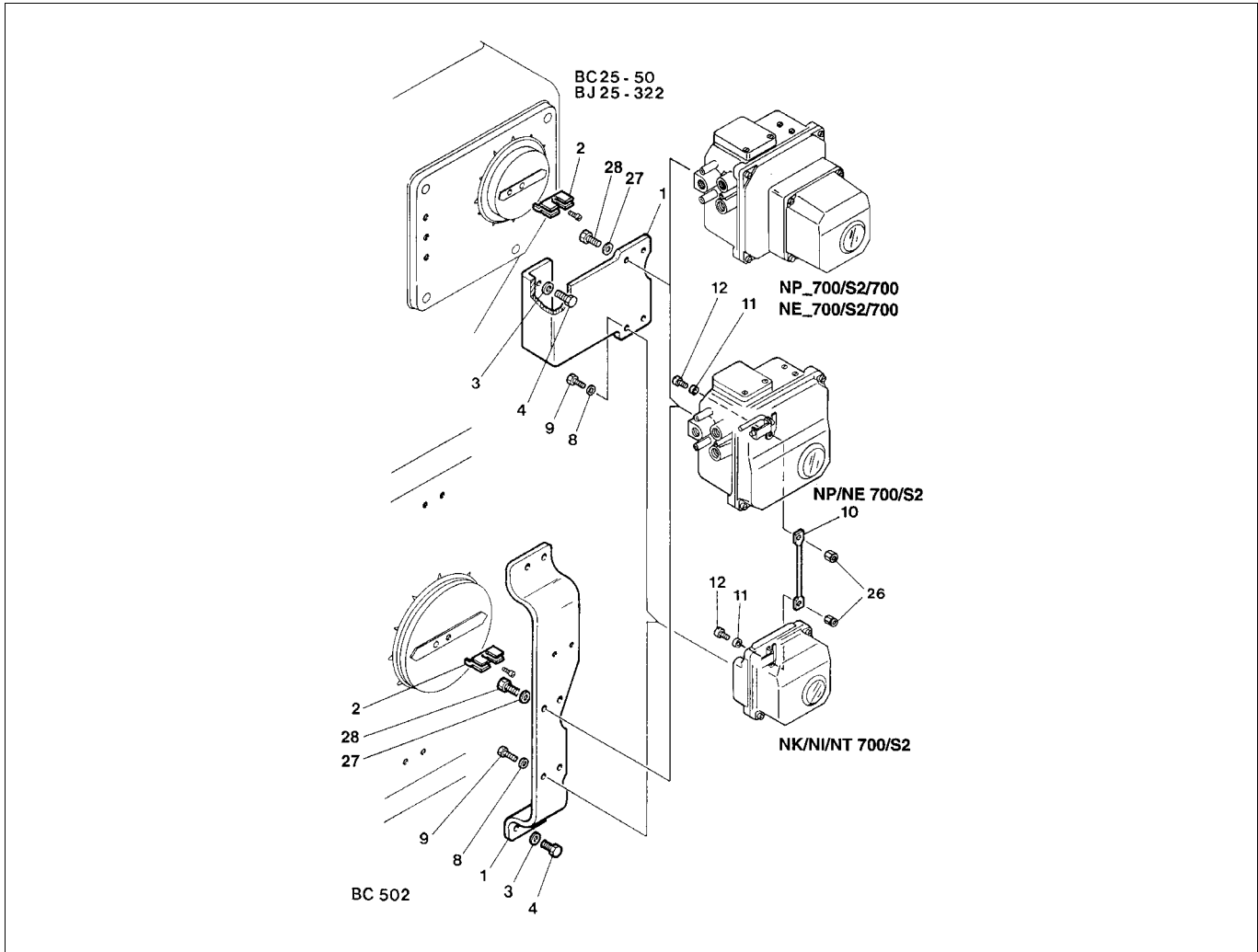
Item	Qty	Description
1	1	Mounting bracket
2	2	Coupling half
3	1	Adapter
4	4	Screw
5	4	Hex nut
6	1	Screw
7	4	Screw
8	4	Washer
9	4	Screw
10	4	Washer

8.5 Mounting parts for B1C6-20 and B1J8-20 actuators (S2)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	2	Washer
4	2	Screw
5	1	Bracket
6	1	Washer
7	1	Screw
8	2	Washer
10	1	Rod
11	2	Bushing
12	2	Screw
13	2	Stud (B1C6 only)
14	2	Hexagon nut (B1C6 only)
26	2	Locking nut
27	2	Washer
28	2	Screw

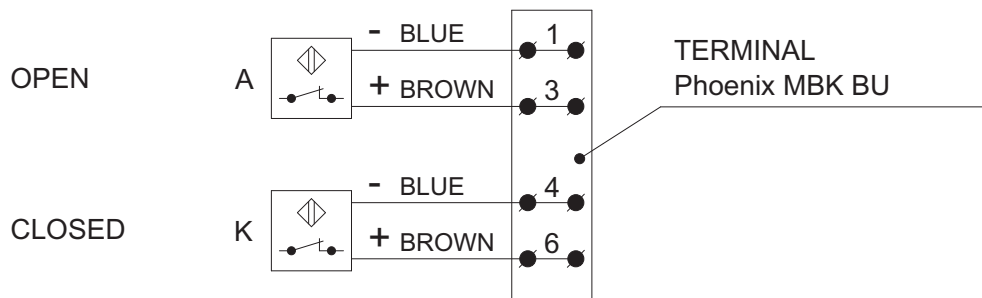
8.6 Mounting parts for B1C25-502 and B1J25-322 actuators (S2)



Item	Qty	Description
1	1	Mounting bracket
2	1	Draught piece
3	2 (4)	Washer
4	2 (4)	Screw
8	2	Washer
9	2	Screw
10	1	Rod
11	2	Bushing
12	2	Screw
26	2	Locking nut
27	2	Washer
28	2	Screw

9 CONNECTION DIAGRAMS

9.1 Limit switch NI700/X, NPI700/700/X



FACTORY ADJUSTMENT:

Active faces of proximity switches are covered when actuator is in intermediate position. Active face A (upper switch) becomes free at open limit of travel and face K (lower switch) at closed limit.

Function can be inverted on site by re-adjusting the cam discs.

Sensing distance 2...4 mm, depending on type of switch
 Supply voltage 8 V DC (Ri 1 k Ω)
 Current consumption
 active face free, > 3 mA
 active face covered, < 1 mA

PROXIMITY SWITCH

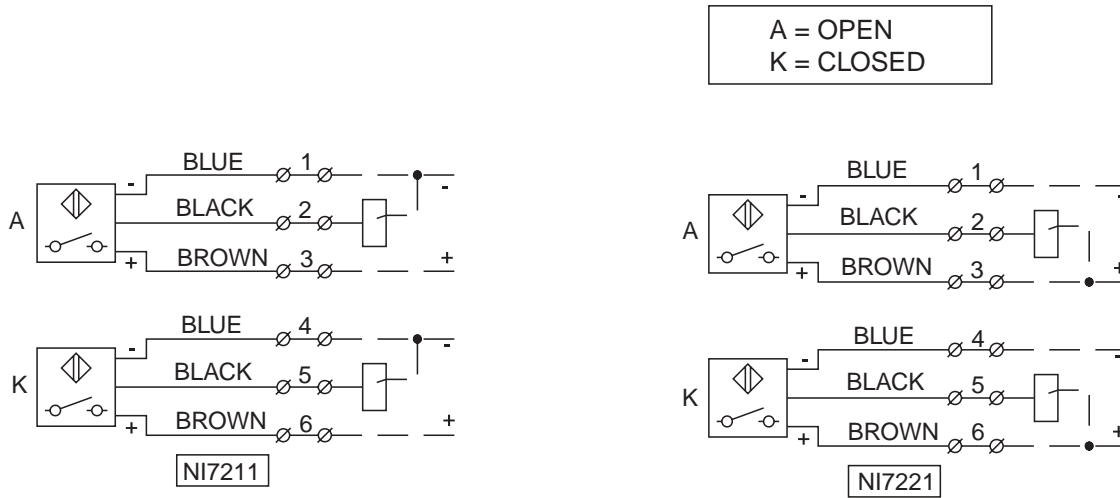
Intrinsically safe II 2 G EEx ia IIC T6.
 According to CENELEC EN50014 and EN50020.

Voltage (Ui), current (Ii), power (Pi), inductance (Li) and capacitance (Ci) according to certificate of switch, table 1.

Table 1.

	Type of proximity switch	Electrical values					Ambient temperature	Certificate of proximity switch
		Ui (V)	Ii (mA)	Pi (mW)	Li (μ H)	Ci (nF)		
01	P+F NJ2-12GK-N	16	52	169	50	45	-25 °C ... +51 °C	PTB 00 ATEX 2048 X
02	P+F NJ2-12GK-SN	16	52	169	150	50	-40 °C ... +51 °C	PTB 00 ATEX 2049 X
03	P+F NJ2-11-N-G	16	52	169	50	30	-25 °C ... +62 °C	PTB 00 ATEX 2048 X
04	P+F NJ2-11-SN-G	16	52	169	150	50	-40 °C ... +62 °C	PTB 00 ATEX 2049 X
07	P+F NJ2-12GM-N	16	52	169	50	30	-25 °C ... +62 °C	PTB 00 ATEX 2048 X
09	P+F NCB2-12GM35-N0	16	52	169	100	90	-25 °C ... +62 °C	PTB 00 ATEX 2048 X

9.2 Limit switches NI7211, N_I700/7211 and NI7221, N_I700/7221



FACTORY ADJUSTMENT:

Active faces of proximity switches are free when actuator is in intermediate position.
 Active face A (upper switch) becomes covered at open limit of travel and face K (lower switch) at closed limit.
 Function can be inverted on site by re-adjusting the cam discs.

PROXIMITY SWITCH

Pepperl+Fuchs NJ2-12GM40-E2, PNP (11)

Pepperl+Fuchs NJ2-12GM40-E, NPN (21)

Sensing range 2 mm / 0.08 in

Rated voltage $U = 10 - 60 \text{ V DC}$

Output current $\leq 200 \text{ mA}$

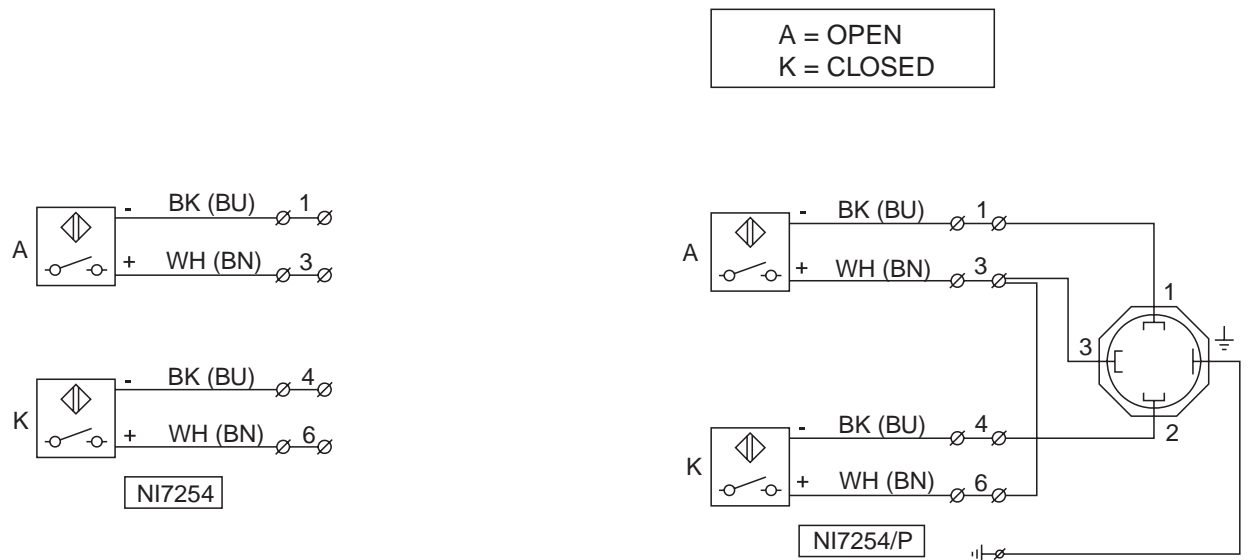
active face covered, LED on

Quiescent current $\leq 15 \text{ mA}$

active face free

Ambient temperature $-25 - +70 \text{ }^\circ\text{C} / -13 - +158 \text{ }^\circ\text{F}$

9.3 Limit switch NI7254, N_I700/7254



FACTORY ADJUSTMENT:

Active faces of proximity switches are free when actuator is in intermediate position.

Active face A (upper switch) becomes covered at open limit of travel and face K (lower switch) at closed limit.

Function can be inverted on site by re-adjusting the cam discs.

PROXIMITY SWITCH

OMRON E2E-X3D1-N (E2E-X3D1-G)

Sensing range 3 mm / 0.12 in

Rated voltage $U = 12 - 24 \text{ V DC}$

Output current 3 - 100 mA

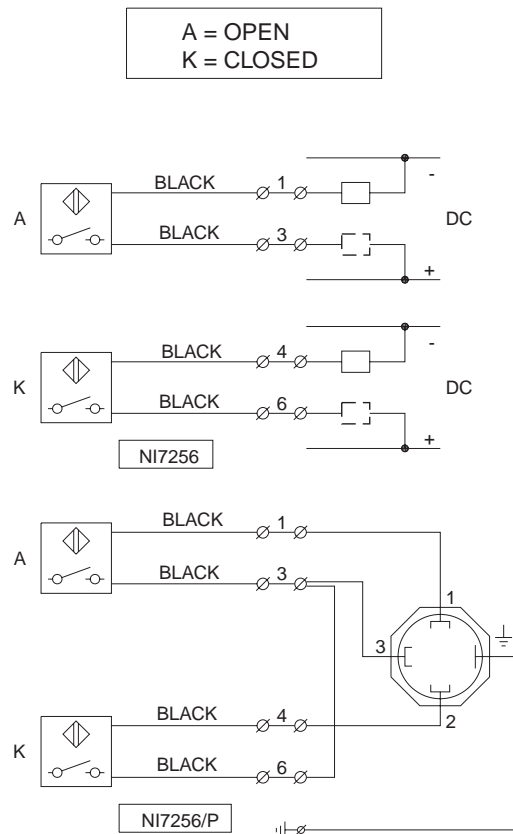
active face covered, LED on

Quiescent current $\leq 0.8 \text{ mA}$

active face free

Ambient temperature $-25 - +70 \text{ }^\circ\text{C} / -13 - +158 \text{ }^\circ\text{F}$

9.4 Limit switch NI7256, N_I700/7256



FACTORY ADJUSTMENT:

Active faces of proximity switches are free when actuator is in intermediate position.

Active face A (upper switch) becomes covered at open limit of travel and face K (lower switch) at closed limit.

Function can be inverted on site by re-adjusting the cam discs.

Connection: load can be connected to + or -.

PROXIMITY SWITCH

Ifm electronic IFC2002-ARKG/UP

Sensing range 2 mm / 0.08 in

Rated voltage $U = 10 - 36 \text{ V DC}$

Output current $\leq 150 \text{ mA}$

active face covered, LED on

Quiescent current $\leq 0.6 \text{ mA}$

active face free

Ambient temperature $-25 - +80 \text{ }^\circ\text{C} / -13 - +176 \text{ }^\circ\text{F}$

10 TYPE CODE

LIMIT SWITCH, Series NI700

1.	2.	3.	4.	5.	6.		
NI	7	1	11	A	/	S1	CE04

1.	PRODUCT GROUP
NI	Limit switch with inductive proximity switches

2.	SERIES CODE
-----------	--------------------

3.	QTY OF SWITCHES
1	1 pc.
2	2 pcs.

4.	SWITCH TYPE
01	P+F; NJ2-12GK-N DC; >3 mA; <1 mA; Intrinsically safe acc. to EEx ia IIC T6, 2-wire type. Temperature range -25 - +51 °C / -13 °F to +123 °F.
11	P+F; NJ2-12GM40-E2 DC; 200 mA; quiescent current <15 mA; PNP, 3-wire type. Temperature range -25 °C to +70 °C / -13 °F to +158 °F.
21	P+F; NJ2-12GM40-E DC; 200 mA; quiescent current <15 mA; NPN, 3-wire type. Temperature range -25 °C to +70 °C / -13 °F to +158 °F.
54	OMRON E2E-X3D1-N DC; 100 mA; quiescent current <0,8 mA, 2-wire type. Temperature range -25 °C to +70 °C / -13 °F to +158 °F.
56	IFM ELECTRONIC IFC2002-ARKG/UP DC; 150 mA; quiescent current <0.6 mA; 2-wire type. Temperature range -25 °C to +80 °C / -13 °F to +176 °F.

5.	ACTION (with 1 switch only)
A	Switch for open limit
K	Switch for closed limit

8.	OPTIONS
	Standard, IP 65 enclosure, PG 13.5 conduit entry, without sign. Temperature range according to switch type.
X	Intrinsically safe construction, VTT ATEX II 2 G EEx ia IIC T6 certification (EN 50014, EN 50020). Temperature range -25 °C to +51 °C / -13 °F to +123 °F.
S1	Limit switch with attachment face according to standard VDI/VDE 3845. Not applicable to globe valve actuators.
S2	Limit switch with attachment face according to Metso
P	Connection plug acc. to DIN 43650A and ISO 4400, with 2-wire types only.
Y	Special

— □	CONDUIT ENTRY NIPPLES
CE04	1/2 NPT conduit entry nipples PG13.5 / 1/2 NPT
CE05	M20x1.5 conduit entry nipples PG13.5 / M20x1.5
CE06	R1/2 (PF1/2) conduit entry nipples PG13.5 / R1/2

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