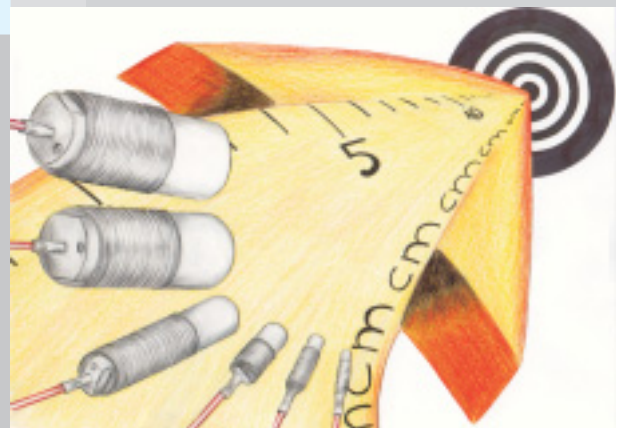


CATALOGUE

**CAPACITIVE
SENSORS
KXS**





Registration No.: 1327-01



Testing laboratory accredited according to
DIN EN 45001 Reg.-No. DAT-P-048/95-00

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Edition May 2004 With publication of this catalogue all former printed catalogues about RECHNER capacitive sensors KXS are invalid.

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TECHNOLOGY • MOUNTING • APPLICATION

The capacitive proximity sensors that make up the KAS-40..., KAS-70..., KAS-80..., KAS-90, KAS-1000 and KAS-2000 series ... are already established as powerful leaders in today's market. They are well accepted as sensors that are reliable, and there are a large number of versions to suit many applications in the processing industry and throughout mechanical engineering. Nowadays they are indispensable. Important parameters for the user are the achievable switching distance and the size of the sensor. Larger switching distances require larger sensors.

It is here, that the new KXS/KXA-Systems show their strength. Although one achieves essentially larger switching distances with these capacitive systems, their size is actually smaller.

The sensors of the KXS/KXA-Series are based on a different measuring principle, the three-electrode-principle.

Advantages:

- **Extreme large sensing distance, up to 10-times the norm**
- **miniature sensors from M5**
- **Measurement of smallest changes in capacity**
- **suitable for high-temperature areas up to +250°C (ceramics +800°C)**
- **up to three adjustable switching points in one sensor (Duplex and Triplex operation)**

With this Measuring principle, one electrode is removed to the outside. The protective conductor-potential PE – that means the machine and system potential – is now also used as a measurement electrode. The evaluation takes place with remote electronics. Due to the absolute measurement of the alteration in capacity, to a large extent, there is an independence of the static basic capacity. This means, the patented KXS/KXA-System detects an alteration of capacity of for example 0,1 pF regardless of whether the (static) basic capacity is 1 pF, 10 pF or 100 pF.

As a result very small switching-hystereses can be achieved.

Thanks to the remote evaluation electronics and the housing materials used, the standard types of capacitive sensors of the KXS-/KXA-Systems are suitable for use in high-temperature areas up to +250°C. For use at high temperatures, or in applications with large variations in temperature, the drift has to be determined by empirical tests. This is necessary, because for the mounting conditions, there is a dependency on the drift. For particular applications, sensors are available in stainless steel/ceramic housings that can be used up to 800°C.

With the three-electrode-principle the mounting variations flush or non-flush are irrelevant. The sensors can be installed in any position, including flush in metal. The function is guaranteed in each mounting position.

Our KXS-... sensors have a cylindrical design with threads from M5 to M32. The following types are available as evaluation units: KXA-5-1.. one sensor KXS -... with a limit switching point; the multi-channel evaluators KXA-5-M/S -... for several sensors as well as the evaluator KXA-5-1/3 -... for Duplex or Triplex applications.

Application example for Duplex operation:

No target at sensor	=	no output signal
empty glass-bottle present	=	output signal 1
full glass-bottle	=	output signal 1 and 2

It is easy to put the capacitive system in to operation:

Mechanical mounting of the sensor + electrical connection + adjustment = ready for operation.

Please note, if the sensor is not screwed in to metal, a galvanic connection must take place from the electronics to the protective conductor-potential.

The KXS/KXA series of capacitive sensors can be used for level monitoring of liquids, pastes or bulk material, including measurement through non-metal partitions. Furthermore as limit switches, contact-less position switches for monitoring and positioning, as pulse generator for counting tasks and for many other applications.

Wiring of the capacitive sensors should be routed separately or screened from large value conducting cables, as in extreme cases inductive peak voltages can destroy the sensors despite the integrated protective circuit. Screened cable or twisted lines are especially recommended long cable runs > 5 m. Direct control of electric light bulbs should be avoided, as during the switch-on moment the cold current is many times the rated current and can destroy the output stage of the sensor.

The data for the **nominal sensing distance** is based on the measuring method defined by DIN VDE 0660, Part 208. The respective nominal sensing distance is indicated with a tolerance of + 10 %. The **standard measurement plate** is square with a thickness of 1 mm and is made of carbon steel FE 360 (defined in ISO 630: 1980) with a smoothed surface and is earthed. The sides are equal to the diameter of the active area of the KAS or equal to 3 x Sn, depending on which value is greater. With a different material or a smaller surface of the actuating element, the sensing distance is smaller.

In order to prevent damage to the threaded sleeves when mounting, the material and version-dependent **maximum torque** should be taken into consideration. The values listed in the table are based on the use of the nuts supplied with the sensors.

Thread	Maximum torque
M 5 x 0.5	1.5 Nm
M 8 x 1	4.5 Nm
M 12 x 1	25 Nm
M 18 x 1	60 Nm
M 30 x 1.5	200Nm
M 32 x 1.5	230Nm

Due to the permitted thread tolerances specified in German standard DIN 13, the **maximum screw-in length** for threaded sensors should be taken into consideration. Based on this the length of the threaded block for screwing in proximity sensors should not exceed the following dimensions. Where a larger threaded block is used we recommend drilling a blind hole in order to adhere to the maximum screw-in length.

Thread	M 5 x 0.5	M 8 x 1	M 12 x 1	M 18 x 1	M 30 x 1.5	M 32 x 1.5
Max. screw-in length	3 mm	6 mm	8 mm	12 mm	12mm	12 mm

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APPLICATION EXAMPLES

Fig. 1: Duplex application

A possibility for Triplex-Function, with this example, could be the limit switching point S3 indicating "bottle filled with oil"

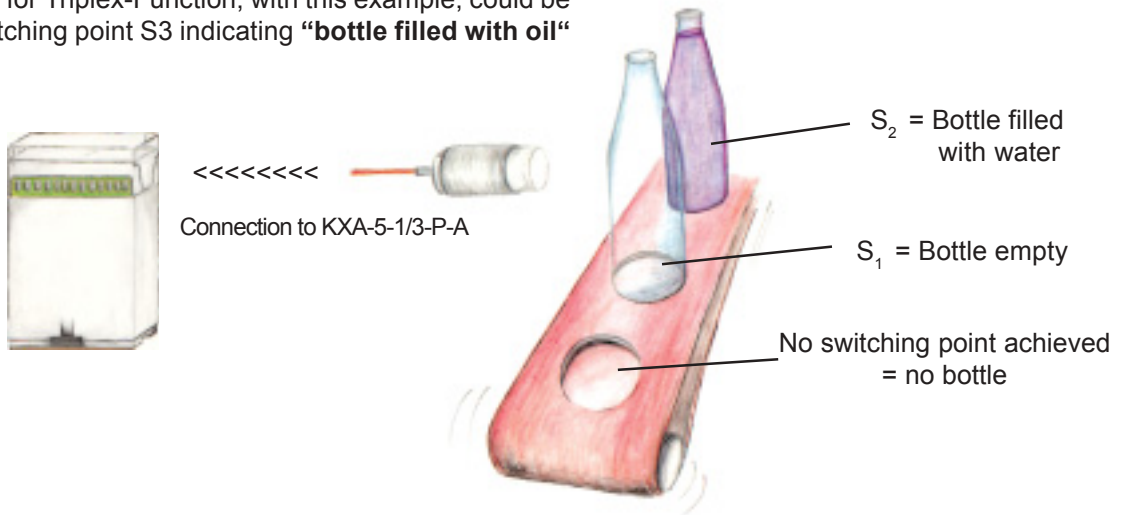


Fig. 2: Application in a container with glue granules

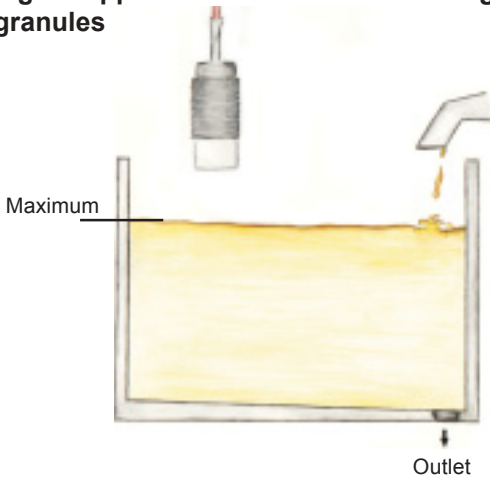


Fig. 4: Overflow protection of casts, for example for plastic lenses for glasses



Fig. 3: Application in a container with

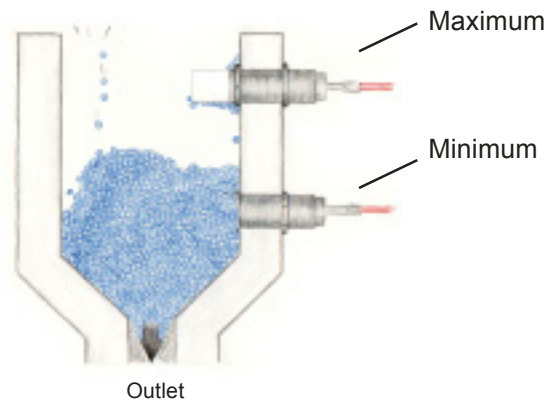
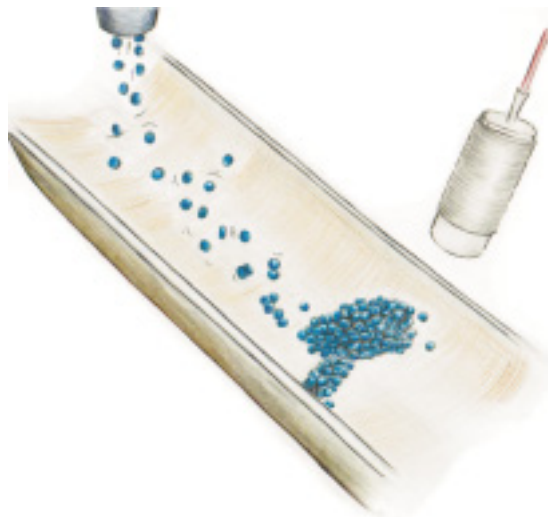


Fig. 5: For detection of accumulations during the production of small parts, like tablets



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TYPE CODE

Capacitive evaluation unit

KXA-5-1-...-A-...

Capacitive evaluation unit

Measurement of limit values

1 limit switching point

MINI = for sensor size $\varnothing = M5 - M12$

Antivalent output

P = transistor output PNP

N = transistor output NPN

KXA-5-...-...-A-...

Capacitive evaluation unit

Measurement of limit values

M = Master

S = Slave for extension

(not for Triplex evaluation units)

MINI = for sensor size $\varnothing = M5 - M12$

Antivalent output

P = transistor output PNP

N = transistor output NPN

3 = 3 sensors with one limit switching point

1/3 = 1 sensor with up to 3 adjustable
switching points

Capacitive sensor

KXS-.../...-...

Capacitive sensor

Diameter

Extended temperature range and special
versions if applicable

Sensor length in [mm]

Other process connection on request.

TECHNICAL TERMS

Housing materials

The application of the housing materials used is based on the technical specifications of the material and of the manufacturer. Even though RECHNER Sensors have far-reaching application experience concerning the use of different housing materials, the customer is responsible for checking in each case that the housing material is suitable for the application.

Cable

For the standard models COAX-, TRIAX-, PVC- or PUR-cable are used. One has to take into consideration that the cable should not be moved with ambient temperatures below -5°C . PVC is not suitable for use in applications with oil-based liquids or with UV-radiation. PUR is not suitable for continuous contact with water. For special application areas silicone or PTFE cables are available. COAX- and TRIAX-Cable are not destined for continuous movement/flexible use. When routing please consider the bending radius of minimum $10 \times \varnothing$.

Sensing distance S_n

Characteristic value of a proximity sensor, without consideration of production tolerances and variations due to temperature and voltages.

Enclosure rating

IP 65: Protection against contact with voltage-carrying parts, protection against ingress of dust and water jets.

IP 67: Protection against contact with voltage-carrying parts, protection against ingress of dust and protection against ingress of water when the equipment is immersed in water, up to 1 m depths for a period of 30 minutes.

Voltage drop U_d

Voltage drop is the voltage, which is at the active output of the sensor, in the on state.

Repeat accuracy

Measurement of the sensing distance in succession, which is made at constant ambient conditions.

Permitted residual ripple

The permitted residual ripple of the used power pack, used as power supply.

The products of Rechner Industrie-Elektronik GmbH are designed and checked in accordance with the latest standards and specifications, DIN - VDE - IEC, for electrical and electronic instruments. For new and revised products the newest standards are always used.



**Capacitive sensors
Series - KXS**

Housing M5 x 0.5

- For connection to capacitive evaluation units KXA-...-MINI
- Extreme large sensing distance
- Up to 250°C ambient temperature

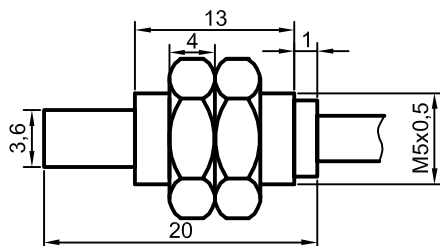
Certificate:



Technical data

Operating distance Sn [mm]	3
Operating distance [mm] adjustable	0...5
Mounting: flush/ non-flush	variable
Type	KXS-M5/20
Art.-No.	498 000
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-...-MINI with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE

All specifications are subject to change without notice. (05/2004)





Capacitive sensors Series - KXS

Housing M8 x 1

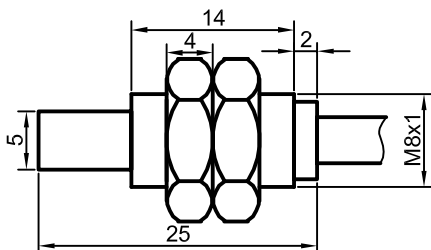
- For connection to capacitive evaluation units KXA-...-MINI
- Extreme large sensing distance
- Up to 250°C ambient temperature

Certificate:



Technical data

Operating distance S_n [mm]	7
Operating distance [mm] adjustable	0...10
Mounting: flush/ non-flush	variable
Type	KXS-M8/25
Art.-No.	498 001
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-...-MINI with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE





**Capacitive sensors
Series - KXS**

Housing M12 x 1

- For connection to capacitive evaluation units KXA-...-MINI
- Extreme large sensing distance
- Up to 250°C ambient temperature

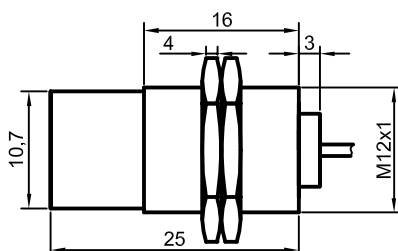
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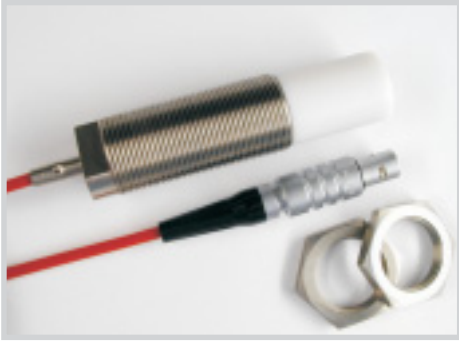


Technical data

Operating distance Sn [mm]	15
Operating distance [mm] adjustable	1...25
Mounting: flush/ non-flush	variable
Type	KXS-M12/25
Art.-No.	498 002
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-...-MINI with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE

All specifications are subject to change without notice. (05/2004)





**Capacitive sensors
Series - KXS**

Housing M18 x 1

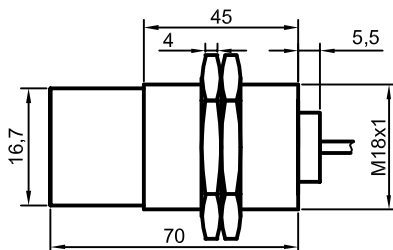
- For connection to capacitive evaluation units KXA-...
- Extreme large sensing distance
- Up to 250°C ambient temperature

Certificate:



Technical data

Operating distance S_n [mm]	30
Operating distance [mm] adjustable	2...50
Mounting: flush/ non-flush	variable
Type	KXS-M18/70
Art.-No.	498 003
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-... with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE



All specifications are subject to change without notice. (05/2004)



**Capacitive sensors
Series - KXS**

Housing M30 x 1.5

- For connection to capacitive evaluation units KXA-...
- Extreme large sensing distance
- Up to 250°C ambient temperature

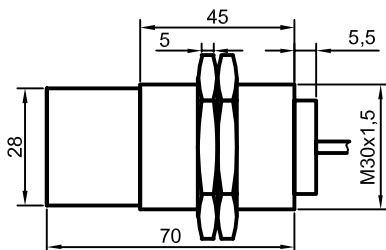
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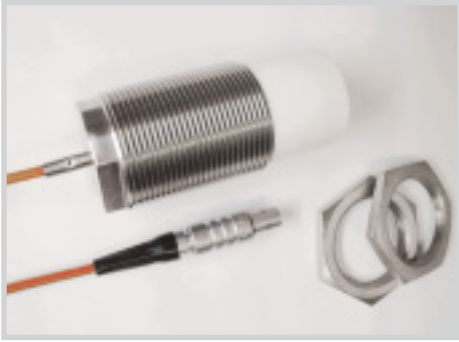


Technical data

Operating distance Sn [mm]	60
Operating distance [mm] adjustable	5...100
Mounting: flush/ non-flush	variable
Type	KXS-M30/70
Art.-No.	498 004
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-... with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE

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**Capacitive sensors
Series - KXS**

Housing M32 x 1.5

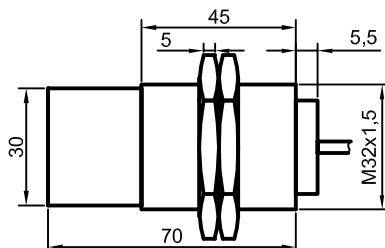
- For connection to capacitive evaluation units KXA-...
- Extreme large sensing distance
- Up to 250°C ambient temperature

Certificate:



Technical data

Operating distance Sn [mm]	80
Operating distance [mm] adjustable	5...120
Mounting: flush/ non-flush	variable
Type	KXS-M32/70
Art.-No.	498 005
Permitted ambient temperature	-70...+250°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-... with plug-in connector	2m FEP, Triax
Housing material	VA No. 1.4305
Active surface	PTFE



All specifications are subject to change without notice. (05/2004)



**Capacitive sensors
Series - KXS**

Housing Ø 28mm

- For connection to capacitive evaluation units KXA-...
- Extreme large sensing distance
- Up to 800°C ambient temperature
- Mounting non-flush

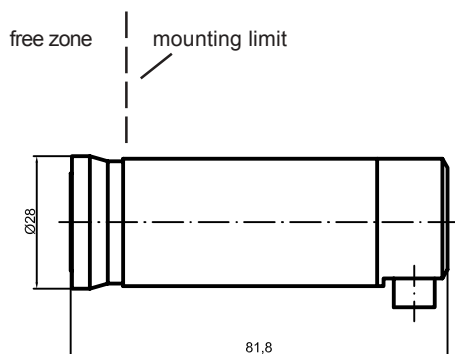
Certificate:



Technical data

Operating distance Sn [mm]	60
Operating distance [mm] adjustable	10...100
Mounting: flush/ non-flush	non-flush
Type	KXS-28/82-800°C
Art.-No.	498 007
Permitted ambient temperature	-70...+800°C
Enclosure rating IEC 529	IP 67
Connection cable for connection to capacitive evaluation units KXA-... with plug-in connector	1.5m Triax with metallic protective tube
Housing material	VA No. 1.4305/ceramic
Active surface	VA No. 1.4305/ceramic

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Capacitive evaluation units - KXA Series - NPN Series - PNP

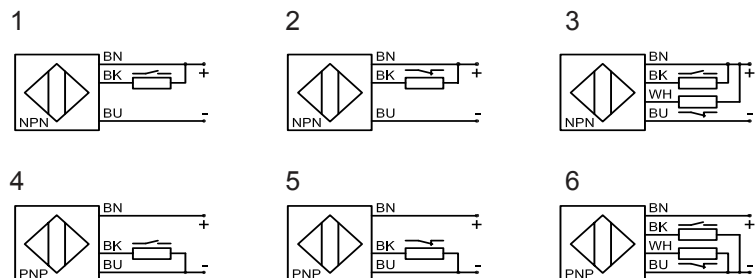
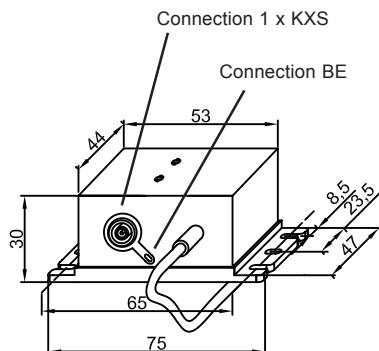
- KXA-... for connection to capacitive sensors KXS-M18/...-M32/...
- KXA-...-MINI for connection to capacitive sensors KXS-M5/...-M12/...

Certificate:



Technical data

Electrical version	4-wire DC	4-wire DC
Output	antivalent	antivalent
Type NPN	KXA-5-1-N-A-MINI	KXA-5-1-N-A
Art.-No.	498 505	498 501
Connection diagram No.	3	3
Type PNP	KXA-5-1-P-A-MINI	KXA-5-1-P-A
Art.-No.	498 503	498 500
Connection diagram No.	6	6
Operating voltage (U_B)	18...36 V DC	18...36 V DC
Output current max. (I_o)	2 x 250 mA	2 x 250 mA
Voltage drop max. (U_o)	≤ 2.5 V	≤ 2.5 V
Permitted residual ripple max.	40 %	40 %
No-load current (I_o)	typ. 50 mA	typ. 50 mA
Frequency of operating cycles max.	50 Hz	50 Hz
Switching hysteresis	$\leq 20\%$	$\leq 20\%$
Repeat accuracy	$\leq 1\%$	$\leq 1\%$
Permitted ambient temperature	-25...+55°C	-25...+55°C
LED-display	green/yellow	green/yellow
Protective circuit	built-in	built-in
Enclosure rating IEC 529	IP 65	IP 65
Connection cable	PUR 2 m, 4 x 0.14 mm ²	PUR 2 m, 4 x 0.14 mm ²
Housing material	PA	PA



All specifications are subject to change without notice. (05/2004)



Capacitive evaluation units - KXA (Triplex)
Series - NPN
Series - PNP

- Triplex - evaluation unit (3 adjustable switching points) for connection to capacitive sensors KXS-M18/...-M32/...
KXA-...-MINI for KXS-M5/...-M12/...
- Output function changeable (for safety circuits)

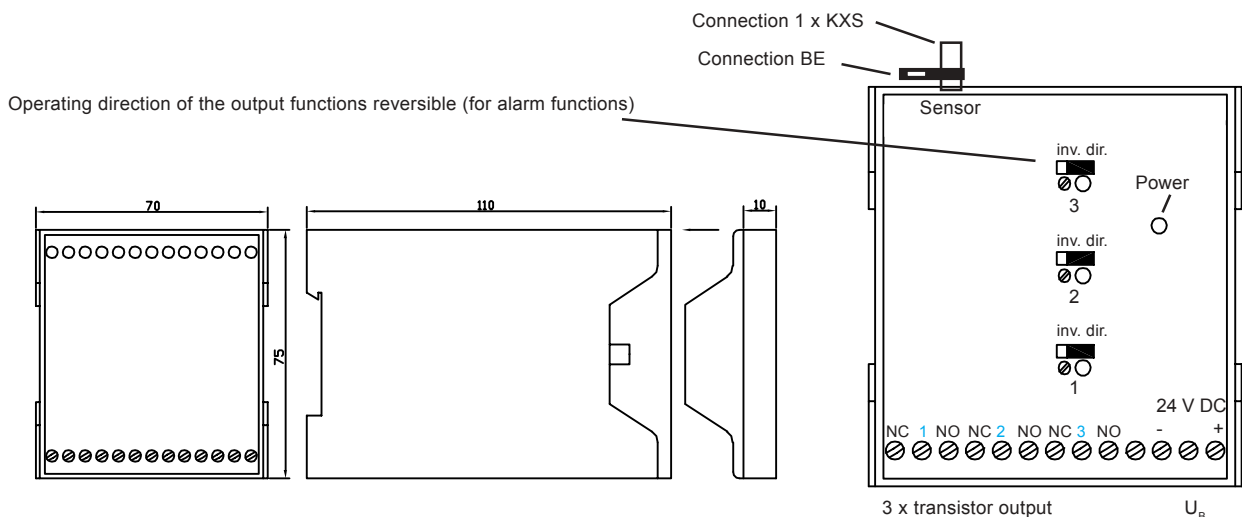
Certificate:



Technical data

Output	3 x antivalent	3 x antivalent
Type NPN	KXA-5-1/3-N-A-MINI	KXA-5-1/3-N-A
Art.-No.	498 509	498 508
Connection diagram No.	see below	see below
Type PNP	KXA-5-1/3-P-A-MINI	KXA-5-1/3-P-A
Art.-No.	498 511	498 510
Connection diagram No.	see below	see below
Operating voltage (U_B)	18...36 V DC	18...36 V DC
Output current max. (I_o)	400 mA each output	400 mA each output
Permitted residual ripple max.	40 %	40 %
Power consumption (outputs without load)	typ. 3.5 W	typ. 3.5 W
Permitted ambient temperature	-25...+55°C	-25...+55°C
LED - display	green/yellow	green/yellow
Protective circuit	built-in	built-in
Degree of protection IEC 529	IP 20	IP 20
Connection	Screw terminals and triax socket	Screw terminals and triax socket
Housing material	ABS	ABS

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Capacitive evaluation units - KXA (Master) Series - NPN Series - PNP

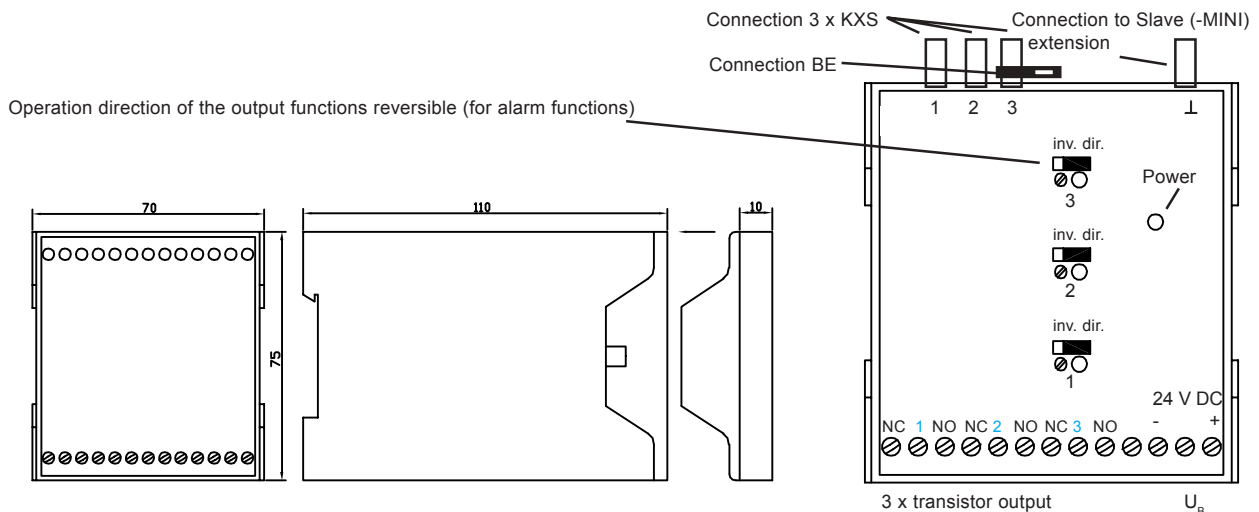
- KXA-... for connection of 3 capacitive sensors KXS-M18/... - M32/...
- KXA-...-MINI for connection of 3 capacitive sensors KXS-M5/... - M12/...
- Output function changeable (for safety circuits)
- Extension possible with Slave and Slave-MINI

Certificate:



Technical data

Output	3 x antivalent	3 x antivalent
Type NPN	KXA-5-M-3-N-A-MINI	KXA-5-M-3-N-A
Art.-No.	498 513	498 512
Connection diagram No.	see below	see below
Type PNP	KXA-5-M-3-P-A-MINI	KXA-5-M-3-P-A
Art.-No.	498 514	498 506
Connection diagram No.	see below	see below
Operating voltage (U_B)	18...36 V DC	18...36 V DC
Output current max. (I_B)	400 mA each output	400 mA each output
Permitted residual ripple max.	40 %	40 %
Power consumption (outputs without load)	typ. 3.5 W	typ. 3.5 W
Permitted ambient temperature	-25...+55°C	-25...+55°C
LED - display	green/yellow	green/yellow
Protective circuit	built-in	built-in
Degree of protection IEC 529	IP 20	IP 20
Connection	Screw terminals and triax socket	Screw terminals and triax socket
Housing material	ABS	ABS



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Capacitive evaluation units - KXA (Slave)

Extension of the KXA-connections is possible with use of a capacitive evaluation unit KXA (Master) with a capacitive evaluation unit (Slave).

Each evaluation unit KXA (Slave) provide further 3 KXS-connections and one extension socket.

For the connection to the evaluation unit KXA (Master) the following evaluation units KXA (Slave) are available:

KXA-5-S-3-N-A-MINI	Art.-Nr. 498516
KXA-5-S-3-N-A	Art.-Nr. 498515
KXA-5-S-3-P-A-MINI	Art.-Nr. 498518
KXA-5-S-3-P-A	Art.-Nr. 498517

Please note: The use of the capacitive evaluation units KXA (Slave) is only possible in connection with a capacitive evaluation unit KXA (Master).

ACCESSORIES



For extra charge the sensors are available with metallic protection tube at the connection cable.

Type selection in article number order

Type selection in description order

Art.-No.	Type Description	Page	Type Description	Art.-No.	Page
498000	KXS-M5/20	9	KXA-5-1-N-A	498501	16
498001	KXS-M8/25	10	KXA-5-1-N-A-MINI	498505	16
498002	KXS-M12/25	11	KXA-5-1-P-A	498500	16
498003	KXS-M18/70	12	KXA-5-1-P-A-MINI	498503	16
498004	KXS-M30/70	13	KXA-5-1/3-N-A	498508	17
498005	KXS-M32/70	14	KXA-5-1/3-N-A-MINI	498509	17
498007	KXS-28/82-800°C	15	KXA-5-1/3-P-A	498510	17
498500	KXA-5-1-P-A	16	KXA-5-1/3-P-A-MINI	498511	17
498501	KXA-5-1-N-A	16	KXA-5-M-3-N-A	498512	18
498503	KXA-5-1-P-A-MINI	16	KXA-5-M-3-N-A-MINI	498513	18
498505	KXA-5-1-N-A-MINI	16	KXA-5-M-3-P-A	498506	18
498506	KXA-5-M-3-P-A	18	KXA-5-M-3-P-A-MINI	498514	18
498508	KXA-5-1/3-N-A	17	KXS-28/82-800°C	498007	15
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498510	KXA-5-1/3-P-A	17	KXS-M18/70	498003	12
498511	KXA-5-1/3-P-A-MINI	17	KXS-M30/70	498004	13
498512	KXA-5-M-3-N-A	18	KXS-M32/70	498005	14
498513	KXA-5-M-3-N-A-MINI	18	KXS-M5/20	498000	9
498514	KXA-5-M-3-P-A-MINI	18	KXS-M8/25	498001	10

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