Application

Safety transmitters SAG in conjunction with the service unit ZAN are automatically activated signal transmitters manufactured according to fail-safe requirements. Conventional electro-mechanical limit switches as well as electronic proximity switches indicate only "transmitter actuated" or "transmitter not actuated" in the event of a false connection or a defect. Thus, if a malfunction should occur, conventional limit switches and electronic proximity switches do not determine whether the machine or installation should be inactivated, i. e. brought into undangerous position. Safety transmitters SAG and the service control unit ZAN are designed to establish a safe status and therefore to protect the operator and/or the machine against serious damage in the event of:

- component defects
- mechanical destruction
- interruption or short-circuit in connecting cables
- false connection

Some typical applications include:

- safety switches on protection grids, hoods, vehicle doors, elevator doors
- monitoring of valve and flap positions
- signal transmitters for escalators, cable cars, and cranes.

Reports by the Technical Supervision Commission (TÜV Bavaria, Germany) certify compliance with safety regulations and suitability for use in circuits with protective functions. Some transmitters have also been approved by the Swiss National Accident Insurance Fund (SUVA, Lucerne).

Principles of operation

Safety transmitters SAG are 3-pole inductive signal transmitters for DC operation.
Two models are available:

a) SAG ... a/ ... : activated by metals
b) SAG ... b/ ... : activated by actuating elements

Safety transmitters SAG are comprised of an oscillator and pulse shaper stage. A square-wave oscillation of constant frequency is obtained at the output only if the oscillator is operative and no disturbance occures. Oscillation starts if:

a) in model a), the sensing zone is free of metals
b) in model b), the actuating element SAG/B moves into the sensing zone.

In the service control unit ZAN 1 - 1.40, the dynamic output signal is amplified selectively and routed via a transmitter to a rectifier. The output relay pulls up only if the transmitter signal is present and no defect is detectable in the unit and the supply lines.

Further versions, ZAN 1-3.41 and ZAN 1-5.43, have two output relays fitted with positively-actuated contacts. The circuit is self-monitoring in that the disappearance of the dynamic input signal causes both relays to drop out. If only one relay drops out, it can no longer be activated if the input signal reappears. The output circuit is interrupted when only one relay drops out.
The actuating element required for SAG ... b ... consists of a particular ferrite material with specific dimensions. This results in additional safety features:

- the transmitters cannot be tripped by the operator using simple objects such as tools, for example.
- the system is switched to a safe status if the operating element is distorted or breaks off, or if the transmitter falls out of its mount.

Design

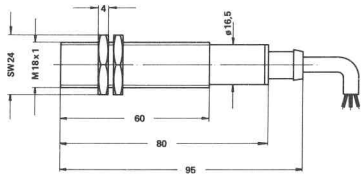
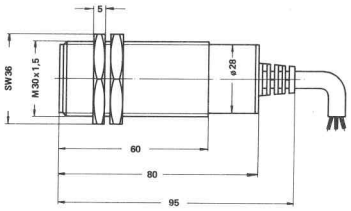
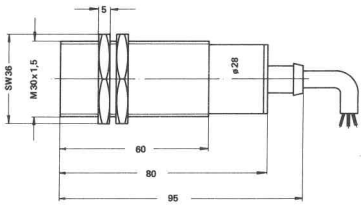
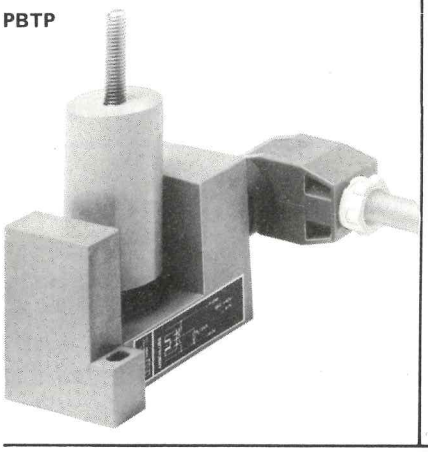
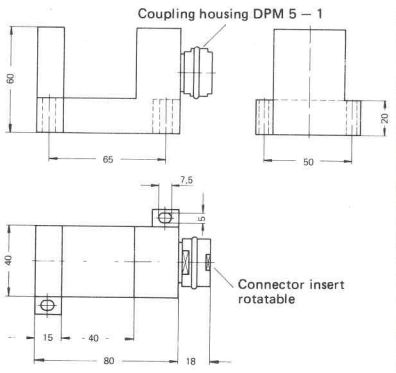
Safety transmitters SAG are incorporated in chemically resistant plastic housings or in mechanically rugged metal housings in the shape of cylinders or forks. All elements are embedded in casting resin. Connection is made via cable or a plug-in connector with high safety standards. The actuating elements consist of cylindrical plastic housings with a threaded stud. Special configurations are available on request.
The service control unit ZAN is incorporated in a contactor-like gray plastic housing with top-mounted terminals. It can be either screwed on or snapped on. The power supply for the safety transmitter is incorporated in the units. The output relay complies with safety standards according to VDE 0435. Relay contacts are protected by a fuse.

Installation

Configuration "a" safety transmitters can be installed in the same manner as regular proximity switches. They can be embedded flush and spaced $e \geqslant d$ from center to center.
Configuration "b" safety transmitters must be installed in such a manner that a zone all around it is equal to twice the housing width and diameter remains free of metal parts.

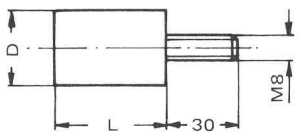
Mechanical Data

Order Code

Illustration Housing Material	Dimensional Diagram	Sensing distance in mm	Type	Item #	Mounting: Flush	Mounting: Not Flush	Actuating by: Metal	Actuating by: Actuating elements
Steel, PBTP 		3	**SAG – m18rg – a/1k** Valid test, No. 12D3/K1 – 01/75 TÜV Barvaria	13.14–01	x		x	
PBTP 		3	**SAG – p30rg – b/1k** Ambient temperature range – 10 ... + 50°C	13.14–02		x		x SAG/B – p30r
Steel, PBTP 		10	**SAG – m30rg – a/1k** hierfür gilt: Valid test, No. 12D3/K2 – 03/76 TÜV Barvaria	13.14–03	x		x	
PBTP 		–	**SAG – p40s – b/1s** Ambient temperature range – 10 ... + 60°C Valid test, No. 12D3/K2 – 04/77 TÜV Barvaria	13.14–04		x		x SAG/B – p34r

Tolerances for sensing distance ± 20 %

Service unit, Actuating elements, Accessories

	Actuating elements	SAG/B – p30r	13.14 – 05	D = 30, L = 40 Material: PVC, V4A
		SAG/B – p34r	13.14 – 06	D = 34, L = 60 Material: PVC, V4A
See accessories, page	Connector	SPF 5 – 1 SPF 5 – 2	78.02 – 13 78.02 – 15	Crimp connection

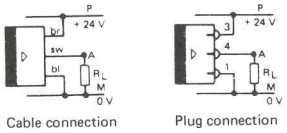
Technical Data

Safety transmitter SAG:

Supply voltage range	12 ... 30 VDC
Permissible ripple	⩽ 10 %
Power consumption without load at 24 VDC	⩽ 4 mA
Permissible load resistance	⩽ 4 kOhms
Output oscillation	dynamic, square-wave oscillation
Keying ratio	approx. 1 : 1
Frequency	13 kHz ± 30 %
Peak-to-peak voltage	0.8 x supply voltage
Sustained short circuit protection	built-in
Polarity reversal	built-in
Max. switching frequency	10 Hz
Switching hysteresis	⩽ 10 %
Ambient temperature range	– 25 ... + 75°C
Protection	IP 65
Max. permissible conductor length	300 m *)

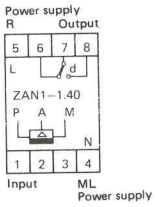
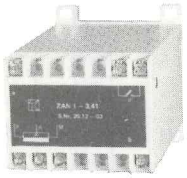
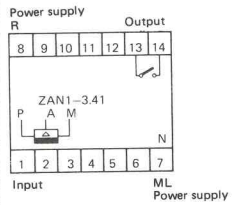
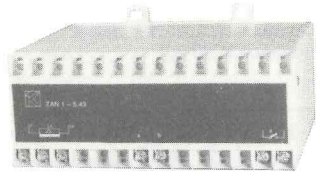
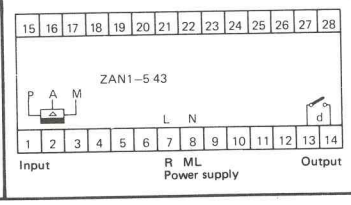
*) No shielding is required if the transmitter lines are kept separate from lines that radiate strong interference signals. However, shielded cables should be used when the interference conditions are unknown. Connect the shielding to the ground of the service unit only.

Connection diagram for safety transmitter SAG



Cable connection | Plug connection

Accessory units

Illustration	Type Item #	Connection diagrams	Special tech. data Output
	ZAN1–1.40 20.12–01		Aprox. 2 VA Relay. 1 changeover switch Card relay E Siemens or other
	ZAN1–3.41 20.12–03		Aprox. 3.6 VA Relays 2NO types in series Cradle relay H (Siemens) Positively actuated
	ZAN1–5.43 20.12–06		Aprox. 3.6 VA Relays 2NO types in series Cradle relay H (Haller) Positively actuated

Common Technical Data

Supply	220 VAC or 110 VAC 42 VAC or 24 VAC + 15 %, 45 ... 62 Hz
other supply voltages	upon request
Input frequency range	9 ... 18 kHz
Output	relay
Max. perm. switching voltage	250 V, 50 Hz
Max. perm. switching current	3.5 A
Protection of output contacts	4 A of quick-acting fuse
Mechanical service life	5 x 10^7 operations
Test voltage:	
Input against Output	2,500 V
Ambient temperature range	– 10 ... + 60°C
Operating mode	continuous
Mounting position	arbitraty
Vibration strength	max. 4 g
Terminal connections	for 2 conductors 2.5 mm^2

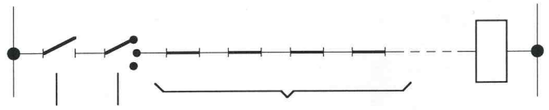
Safety Elements
General

GK 1.94, G1 / 1

Safety elements for machines and systems

Safety systems are used for protecting the operating staff and / or the machines and equipment. They form part of a safety circuit or interlocking conditions for operating sequences and functions.

Safety circuit of a machine:

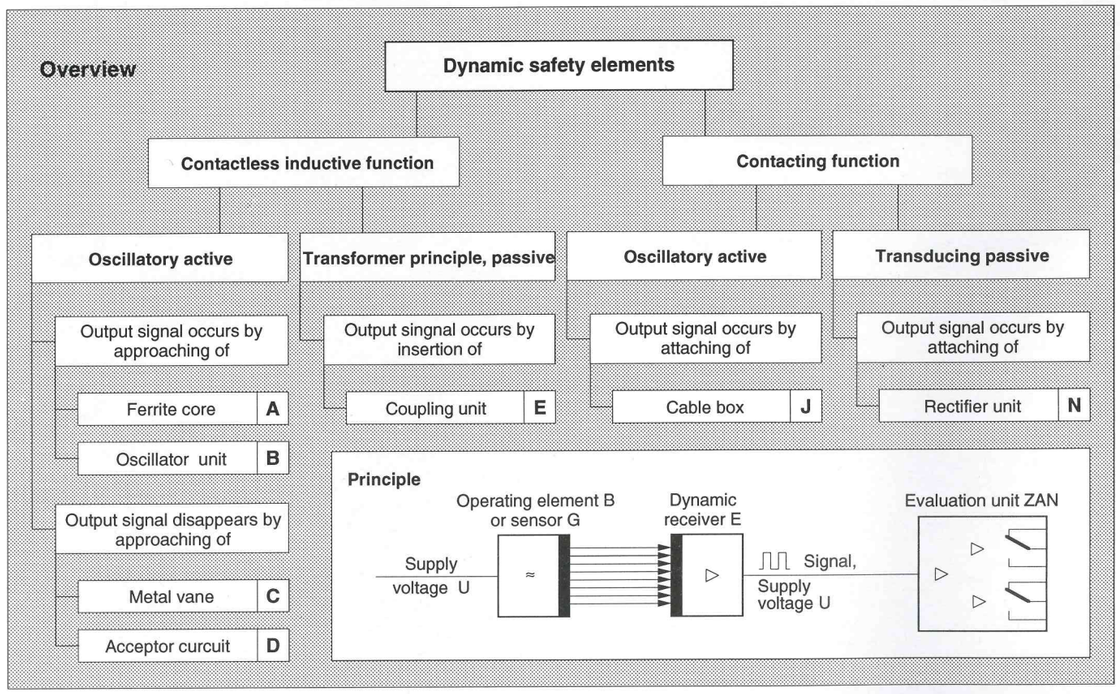


On Mode of operation Safety arrangements, e.g. Emergency stop switch, two-hand switch, protective fence, etc.

The safety elements in safety circuits are increasingly either contactless safety devices or two-part elements operated by plug connectors in conjunction with a signal evaluation device.

The overview illustrates various operating methods. In common, is the use of dynamic rather than static signals. Thus, in case of a fault (failure of a device, short circuit, or connection break), the dynamic signal disappears - the "fail safe" mode.

This same safety principle is applied to the evaluation device, where the dynamic signal is amplified. The amplified signal actuates two guided contact safety relays. The conversion of the dynamic to static occurs in two channels (redundant). The evaluation devices are equipped with an internal fault detection facility: if one relay should malfunction, switching on again is prevented.



The letters A ... O are also used as abbrevations in the rubric "Operating principle" in the technical data.

Operating pinciple	Operating element or sensor		Dynamic receiver		Evaluation unit	
	Type	Ref. No.	Type	Ref. No.	Type	Ref. No.
A (NO)	SAG/B - p30r	13.14-05	SAG - p30rg - b/1k	13.14-02	ZAN 1 - 1.40 or	20.12-01
	SAG/B - p34r	13.14-06	SAG - p40s - b/1s	13.14-04	ZAN 1 - 3.43	20.12-10
B (NO)	SAS/G - p40vk - 1k	13.14-11	SAS/E - p40vk - 1k	13.14-12	ZAN 1 - 1.40 or	20.12-01
	SAS/G - p40vk - 1s	13.14-25	SAS/E - p40vk - 1s	13.14-26	ZAN 1 - 3.43	20.12-10
C (NC)	- Steel vane -	-	SAG - m12rg - a/1p	13.14-27	ZAN 1 - 1.40 or	20.12-01
	- Steel vane -	-	SAG - m12rg - a/1s	13.14-28	ZAN 1 - 3.41 or	20.12-03
	- Steel vane -	-	SAG - m18rg - a/1p	13.14-01	ZAN 1 - 3.43	20.12-10
	- Steel vane -	-	SAG - m30rg - a/1k	13.14-03		
D (NC)	SAG/S - p80r		SAG - p80r - a/1s		- as C -	
E (NO)	SAG/G - p80r - 1s	13.14-16	SAG/E - p24r - 1k	13.14-14	ZAN 1 - 6.41	20.12-08
	SAG/G - p80r - 2s	13.14-19	SAG/E - p24r - 1k	13.14-14	ZAN 1 - 6.41	20.12-08
	SAG/G - p80r - 3s	13.14-21	SAG/E - p24r - 1k	13.14-14	ZAN 1 - 6.41	20.12-08
J (NO)	SMF 6 - 1	13.99-02	SZE/SD - 1.3	13.14-22	- as A -	
N (NO)	SMF 6 - 1	13.99-02	SZP/SS - 2.3	32.02-11	SZP 1 - 2.41	23.18-08
	SMF 6 - 2	13.99-03	SZP/SD - 2.3	32.02-12		

NO / NC means that the dynamic output signal occurs / disappears / the relay pull on / falls out when the operating element is detected.

Safety Elements

Safety Elements
Versions

GK 1.94, G2 / 1, Fold-out

Principles of Operation Mode (see page G1 / 1)
Operating Distance, Hysteresis
Mounting Instructions for Operating Element And Receiver
Dimension diagram
Connection diagram Accessories see chapter *M*

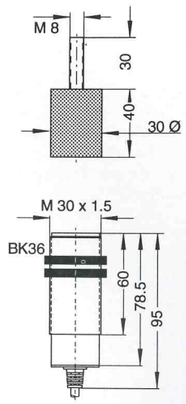
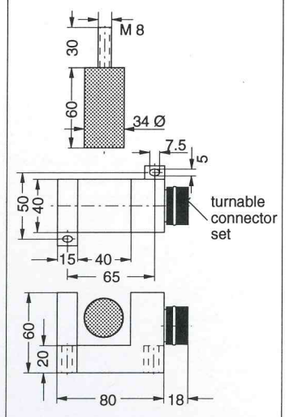
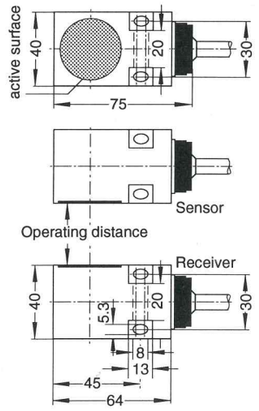
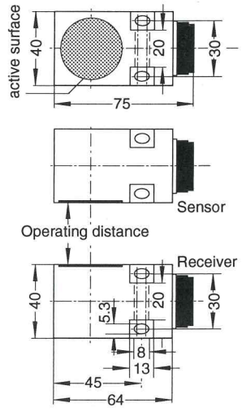
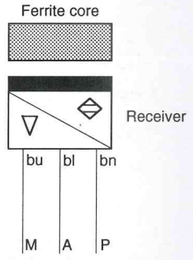
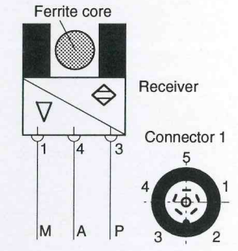
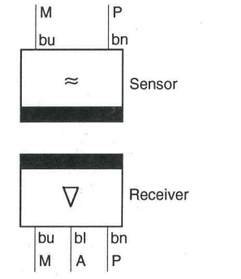
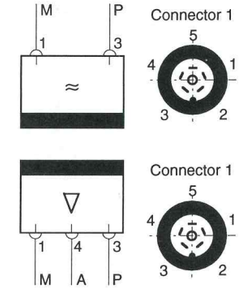
Operation element or sensor, type Ref. No. — Connection diagram AB
Type, dimension, housing material, operating voltage range ,
residual ripple of operating voltage, power consumption
Ambient temperature range. connection,
max. permissible cable length, reverse voltage protection (V),
short circuit protection (k), protection type, weight

Dynamic receiver, type Ref. No. — Connection diagram AB
Type, dimension, housing material
Operating voltage range, residual ripple of operating voltage,
Power consumption
Output voltage
Load current, Frequency
Pulse shape, duty cycle
Ambient temperature range
Connection
max. permissible cable length
Reverse voltage protection (V), short circuit protection (k),
Protection type, weight

Evaluation unit Ref. No. — Connection diagram AB
Type, dimension, housing material, Mode of operation,
Operating voltage range
Output,
Switching frequency,
Min. damping duration
Protection type housing/clamps, weight

Safety Elements
Versions

GK 1,94, G2 / 1

A	A	B	B
3 mm, ≤ 10 %	**--- (slit actuation)**	**30 mm**, ≤ 10 %	**30 mm**, ≤ 10 %
for surface mounting	for surface mounting	for surface mounting	for surface mounting
			
			

Type **SAG/B - p30r** Ref. No. 13.14-05	Type **SAG/B - p34r** Ref. No. 13.14-06	Type **SAS/G - p40vk - 1k** Ref. No. 13.14-11	Type **SAS/G - p40vk - 1s** Ref. No. 13.14-25
Cylinder Ø 30 mm, KS	Cylinder Ø 34 mm, KS	Rectangular 40 x 40 mm, KS	Rectangular 40 x 40 mm, KS
-	-	12 ... 30 VDC, ≤ 10 %, ≤ 4 mA	12 ... 30 VDC, ≤ 10 %, ≤ 4 mA
0 ... +50 °C	0 ... +50 °C	-25 ... +75 °C	-25 ... +75 °C
-	-	PVC - cable, 300 m	5-pole plug-connection, 300 m
IP 67, 100 g	IP 67, 100 g	IP 67, 350 g	IP 67, 220 g

Type **SAG - p30rg - b/1k** Ref. No. 13.14-02	Type **SAG - p40s - b/1s** Ref. No. 13.14-04	Type **SAS/E - p40vk - 1k** Ref. No. 13.14-12	Type **SAS/E - p40vk - 1s** Ref. No. 13.14-26
Cylinder M 30 x 1.5, KS	Fork 40 x 80 x 60, KS	Rectangular 40 x 40 mm, KS	Rectangular 40 x 40 mm, KS
12 ... 24 ... 30 VDC, ≤ 10 %	12 ... 24 ... 30 VDC, ≤ 10 %	12 ... 24 ... 30 VDC, ≤ 10 %	12 ... 24 ... 30 VDC, ≤ 10 %
≤ 4 mA	≤ 4 mA	≤ 10 mA	≤ 10 mA
Uss ≤ 0.8 Uv	Uss ≤ 0.8 Uv	Uss ≤ 0.8 Uv	Uss ≤ 0.8 Uv
≤ 10 mA	≤ 10 mA	≤ 10 mA	≤ 10 mA
approx. 12 kHz	approx. 12 kHz	approx. 12 kHz	approx. 12 kHz
Rectangular, 1 : 1	Rectangular, 1 : 1	Rectangular, 1 : 1	Rectangular, 1 : 1
0 ... +50 °C	0 ... +50 °C	-25 ... +75 °C	-25 ... +75 °C
PVC - cable	5 - pole pulg connection	PVC - cable	5 - pole plug-connection
300 m	300 m	300 m	300 m
V, k, IP 67, 180 g	V, k, IP 65, 200 g	V, k, IP 67, 350 g	V, k, IP 65, 220 g

Type **ZAN1-1.40 or ZAN1-3.43** Ref. No. 20.12-01 or 20.12-10	Type **ZAN1-1.40 or ZAN1-3.43** Ref. No. 20.12-01 or 20.12-10	Type **ZAN1-1.40 or ZAN1-3.43** Ref. No. 20.12-01 or 20.12-10	Type **ZAN1-1.40 or ZAN1-3.43** Ref. No. 20.12-01 or 20.12-10
Housing .40 or .43	Housing .40 bzw. .43	Housing.40 or .43	Housing .40 or .43
NO	NO	NO	NO
230, 115, 42, 24 VAC; 24 VDC	230, 115, 42, 24 VAC; 24 VDC	230, 115, 42, 24 VAC; 24 VDC	230, 115, 42, 24 VAC; 24 VDC
Relay output 2 x 2 S in series	Relay output 2 x 2 S in series	Relay output 2 x 2 S in series	Relay output 2 x 2 S in series
≤ 50 Hz, ≥ 20 ms	≤ 50 Hz, ≥ 20 ms	≤ 50 Hz, ≥ 20 ms	≤ 50 Hz, ≥ 20 ms
IP 40 / IP 10; 250 g or 600 g	IP 40 / IP 10; 250 g or 600 g	IP 40 / IP 10; 250 g or 600 g	IP 40 / IP 10; 250 g or 600 g