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schaeper AUTOMATION GMBH

ES-SVGL2

Digital Synchronization monitor

Description

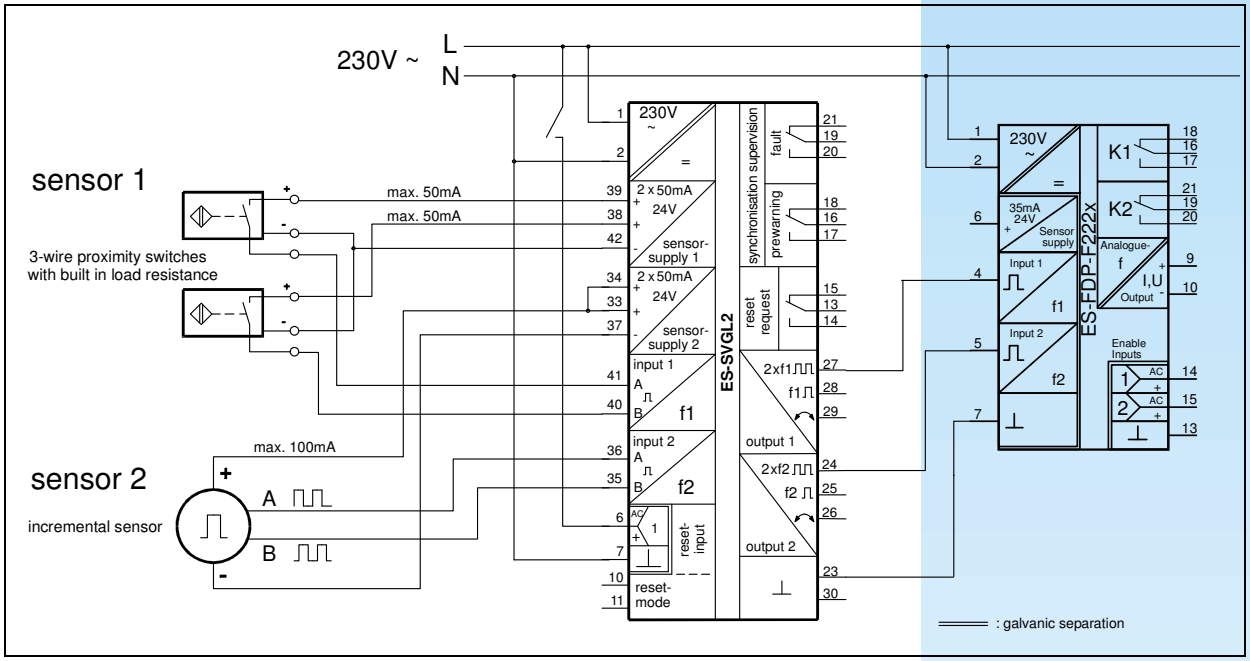

Fig. 1: Connection example for the ES-SVGL2

1 Connection example

In the following connection example, a system is supervised for synchronization with the ES-SVGL2 and simultaneously for overspeed with the frequency monitor ES-FDP-F222x. The example shows the connection of various sensor types as well as the connection to the frequency monitor.

The system is designed such that same number of pulses are sent from the rotary sensor and the proximity switches. With a deviation of more than the programmed pulses, the synchronization fault relay ("Gleichlauf-Fehler") in the ES-SVGL2 is activated.

Monitoring of the overspeed is carried out in the ES-FDP-F222x. The switching thresholds are freely programmable and the activation delays can also be programmed. The speed can be optionally output via an analogue output.

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Figures and Tables

Important information:

The unit has a watchdog to ensure high operating safety, so that the processor system is able to initialize itself again following extremely strong external interferences, which lead to a malfunction. One hundred percent security, however, can not be achieved with a single processor system. **With safety-relevant use, the system must therefore have a redundent system.**

Note: This document has been translated wiht the greatest of care and expertise. We would like to categorically point out, however, that only the information contained in the German version is binding! This version has been enclosed or can be requested.

This discription corresponds to the technical status of the unit in December 2018. The current software version is V3.1. **Subject to change.**

2 Function

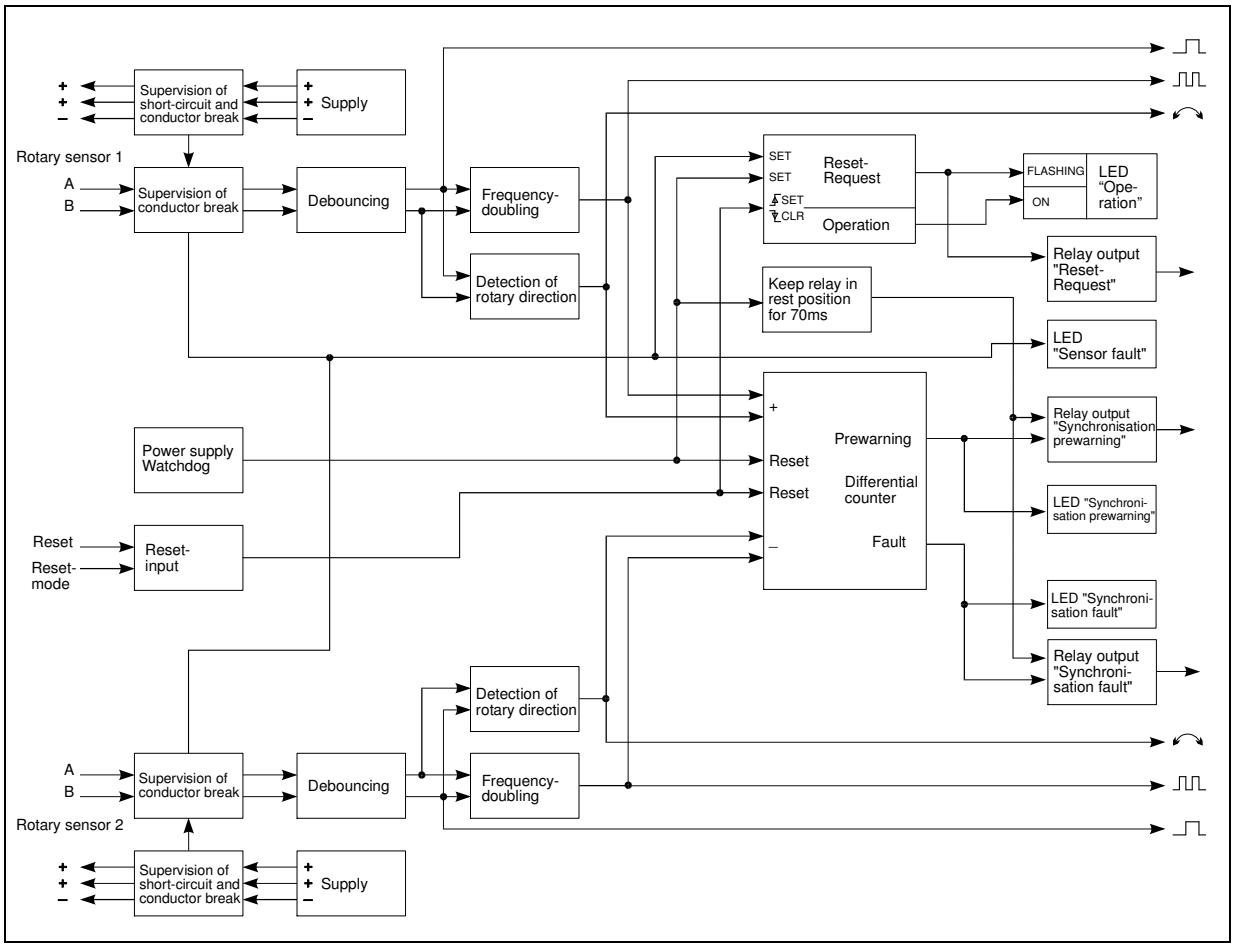


Fig. 2: Block diagram of the ES-SVGL2

2.1 General

The digital synchronization monitor ES-SVGL monitors the output signals from two incremental sensors (or proximity switches) for synchronization. It also provides the supply of the rotary sensor and a debouncing of the sensor pulses for the monitoring of overspeed with the frequency monitors of the unit series **ES-FDP-F...**. In addition, each sensor is tested for a possible short-circuit and interruption of the connection lines. The block diagram **(fig. 2)** shows the function.

Via 3 relays and 4 LED's the operation modes are signalized. In the case of correct operation of the system in all relays the NO contacts are switched to the closed state.

2.2 Switching on the power supply

When switching on power supply of the ES-SVGL2 there will be an initialising phase first. During this time the pulse differential counter is reset to 0. It has to be cared for a correct alignment of the drives during the initialising phase to ensure proper operation afterwards.

To ensure this the relay "reset-request" (Reset-Aufforderung) remains in off-state. The operator has to check the correctly aligned (synchronised) drives and to confirm this state by switching on the reset-signal of the ES-SVGL2. At the end of the reset pulse the relay "reset-request" switches on and remains in this state if no fault is detected.

The relays "synchronising-prewarning" (Gleichlaufvorwarnung) and "synchronising fault" (Gleichlauf-Fehler) switch on independently of the reset signal approx. 100ms after switching on power supply.

Because any interruption of power supply requires a system reset, we recommend to use a UPS for supplying the ES-SVGL2.

2.3 Synchronization supervision

The synchronization supervision between the inputs 1 and 2 is carried out via a differential counter. The sensor signals are respectively debounced and are frequency-doubled by evaluation of the phases A and B. The direction of rotation is also determined. This information is sent to the differential counter.

Due to the frequency doubling and the phase evaluation, the counter internally counts with the 4-fold frequency of the sensor, so the resolution is 0.25 increments. The difference of the number of pulses between the inputs 1 and 2 are counted. If the sum of the counter is greater than half the limit, then the synchronization prewarning relay ("Gleichlauf-Vorwarnung") is activated, and if the sum is greater than the limit, then switch-off is carried out by the synchronization fault relay ("Gleichlauf-Fehler"). The synchronization prewarning and fault are also indicated via LED's on the front panel of the unit.

Option fault memory: In the standard device any measured synchronisation fault is not stored. If the pulse difference gets lower than the limit again, the relay switches back to the on-state. In the optional device with fault storage any measured synchronisation fault is stored and a system reset is required. The relays are switching back to the on-state (after any system fault is cleared) not before a device reset is done.

Limits for the synchronisation fault: These limiting values are programmed at the factory, standard values are listed in the table:

2	2,25	2,5	2,75	3	3,25	3,5	3,75
4	4,25	4,5	4,75	5	5,25	5,5	5,75
6	6,25	6,5	6,75	7	7,25	7,5	7,75
8	8,25	8,5	8,75	9	9,25	9,5	9,75
10	10,25	10,5	10,75	11	11,25	11,5	11,75
12	12,25	12,5	12,75	13	13,25	13,5	13,75
14	14,25	14,5	14,75	15	15,25	15,5	15,75
16	16,5	17	17,5	18	18,5	19	19,5
20	20,5	21	21,5	22	22,5	23	23,5
24	24,5	25	25,5	26	26,5	27	27,5
28	28,5	29	29,5	30	30,5	31	31,5
32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55
56	57	58	59	60	61	62	63
64	66	68	70	72	74	76	78
80	82	84	86	88	90	92	94
96	98	100	102	104	106	108	110
112	114	116	118	120	122	124	126
128	132	136	140	144	148	152	156
160	164	168	172	176	180	184	188
192	196	200	204	208	212	216	220
224	228	232	236	240	244	248	252
256	264	272	280	288	296	304	312
320	328	336	344	352	360	368	376
384	392	400	408	416	424	432	440
448	456	464	472	480	488	496	504
512	528	544	560	576	592	608	624
640	656	672	688	704	720	736	752
768	784	800	816	832	848	864	880
896	912	928	944	960	976	992	1008

Table 1: Standard limiting values for the allowed synchronisation deviation at the ES-SVGL2 (in increments of the rotary sensor)

2.4 Sensor supply

Each output for the sensor supply (24V DC) may be loaded with max. 50mA. For supply of the incremental sensors, two outputs are switched in parallel, so that 100mA is available. At higher

currents the internal current limiter works. In that case the sensors do not output correct signals, so computing of the signals is not possible. The device signals sensor fault.

The sensor supply is optionally also available for Namur proximity switches.

2.5 Sensor inputs

The inputs for the rotary sensors evaluate phase shifted pulse sequences, such as those created by incremental sensors or two proximity switches mounted in a shifted manner. On the one hand, the **direction of rotation** is determined from this and, on the other hand, **bouncing**[1] of the pulses is suppressed, e.g. due to torsional vibration or suspension of the drive line.

The sensor inputs are optionally also available for Namur proximity switches.

2.6 Sensor faults

Monitoring of short-circuits and interruptions in the connection lines to the sensors is carried out separately for each sensor with the assistance of the current consumption. For the proper functioning of this monitoring system, **incremental sensors with push-pull output or proximity switches with built-in load resistance** (max. 10kΩ) must be used! With this, the sensors are continuously monitored (also when the drive is standing still), to the extent that the proper mains power is supplied for the ES-SVGL2.

Sensor faults light up the LED sensor fault (“Geberfehler”) and lead to a drop out of the sensor fault relay ("Geberfehler"). After elimination of the sensor fault the permanent light LED sensor fault switches to slowly flashing. The relay remains dropped out until the correct alignment of the drives is confirmed via a device reset. This is because the synchronisation monitoring is impossible while a sensor defect existed.

2.7 Outputs

The **ES-SVGL2** has three transistor outputs for each of the two sensors. One output supplies pulses with the frequency of the input pulse (⎍), while the second output supplies pulses with the doubled frequency of the input pulse (⎍⎍) and the third output signals the direction of rotation (↶). The allocation of the direction of rotation and signal level of the output is shown in **fig. 4**.

Fig. 3 shows the electrical structure of the output stages. They are designed for the connection of frequency monitors of the series **ES-FDP**.

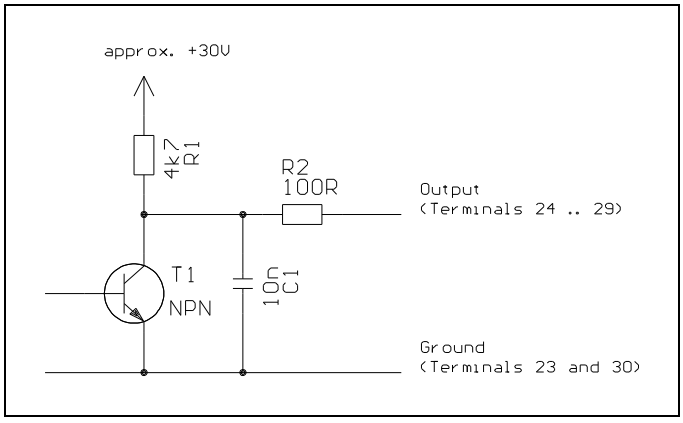


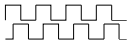
Fig. 3: Circuit diagram of the output stages

Attention:
The second output (⎍⎍) should only be used for further processing if the pulse has the sensing ratio 1:1 and approx. 90° phase shift at the inputs A and B.

2.8 Reset request

The relay “reset-request” switches to the off-state, if after a system fault or after power on a

[1] Bouncing exists when the pulses are not strictly alternating in the two phase-shifted pulse sequences.

Correctt:  Bouncing: 

synchronization reset is required. This has to be carried out and to be confirmed by applying the reset signal to the device.

As long as the reset signal is applied the relay remains in the off-state to indicate that the monitoring function is not active yet. After switching off the reset signal the relay switches to the on-state until the next fault occurs.

In this cases the relay switches off:

- Applying power supply
- Internal software errors
- Malfunction caused by low supply voltage
- Sensor faults
- Synchronization fault, if the device has the option fault storage
- During applied reset signal

If the relay “reset-request” is switched off, the LED “operation” is flashing.

2.9 Reset input and reset mode

The reset input is optionally available for activation with 230V AC/DC or 24V AC/DC. The reset input is galvanically isolated from all other inputs and outputs. A reset sets the differential counter for the synchronization supervision to 0. The duration of the reset pulse must be at least 80ms.

Changeover of the reset mode between operating current and rest current is carried out by means of a short wire bridge between the terminals 10 and 11 of the unit. **With the exception of the wire bridge, nothing else may be connected to these terminals.** The function of the reset changeover is shown in **table 2.**

Reset changeover	Status without signal at reset input	Status with signal at reset input
Not bridged	**Operation**	**Reset**
Bridged	**Reset**	**Operation**

Table 2: Meaning of the reset changeover

2.10 LED indicators

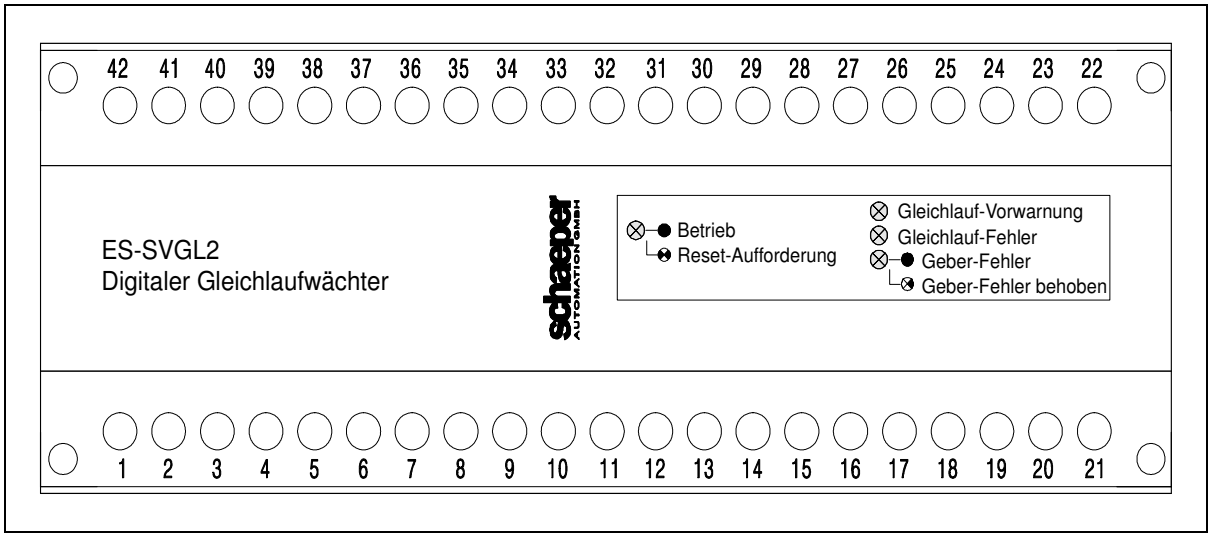


Fig. 4: Front panel view of ES-SVGL2

On the front panel of the unit, there are 4 LED's with the following functions:

Betrieb (*= operation),* green:	**Permanent light:** Operation ok, no faults or internal errors. **Flashing:** After a system fault, an internal error or power on a system reset is required. The relay "reset-request" is in the off-state. The LED is flashing while a reset signal is applied, too.
Gleichlauf-Vorwarnung (*= synchronization prewarning),* yellow:	The limiting value for the synchronization prewarning was exceeded and the corresponding relay is in the off-state.
Gleichlauf-Fehler (*= synchronization fault)*, red:	The limiting value for the synchronization supervision was exceeded and the corresponding relay is in the off-state.
Geberfehler (*= sensor fault),* red:	**Permanent light:** The sensor fault relay has been activated, since a short-circuit or a conductor break was determined with a sensor. All relays are in the off-state. **Flashing:** Caused by a sensor fault, which is already eliminated, the relay "reset-request" still is in the off-state. A system reset has to be carried out.

3 Order number

The device options are included in the article number:

ESG2- *a b / c d / nn V*

Break down of the article number of the ES-SVGL2	
ESG2-	Device typ ES-SVGL2
a	Implementation of the frequency inputs: *a* = **2** : 2-wire proximity sensor *a* = **3** : 3-wire proximity sensor or incremental rotary sensor
b	Fault storage: *b* = **F** : With fault storage *b* = **O** : Without fault storage
c	Voltage for reset input: *c* = **2** : 24V AC/DC *c* = **9** : 230V AC/DC
d	Power supply: *d* = **9** : 230V AC, 50-60Hz *d* = **7** : 115V AC, 50-60Hz
nn	Limiting value for the allowed synchronization deviation, Example: *nn* = **50**: synchronization fault at 50 increments, prewarning at 25 increments
V	without *V* : older device version with internal solder bridges for the limiting values *V* = **V** : Device with internal DIP-switches for the limiting values *V* = **T** : Device with internal DIP-switches for the limiting values and galvanically isolated sensor inputs

Example: **ESG2-3F/29/12V**: Device with fault storage for incremental (or 3-wire) sensor, limiting value 12 increments, reset 24V, power supply 230V.

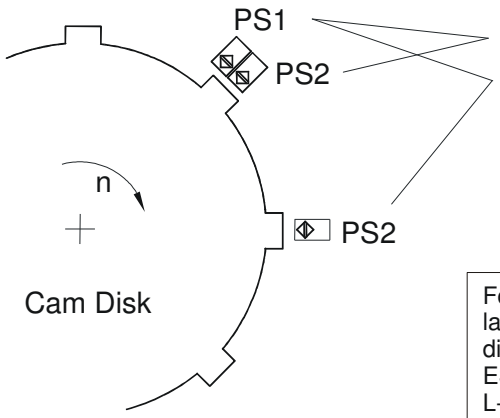
Table 3: Break down of the article number

4 Assembly of the rotary sensor

The rotary sensors must be mounted such that they are mechanically stable and low on vibration. Inaccuracies and play with the assembly of the rotary sensors could worsen the characteristics of the monitoring equipment.

Incremental sensors should be flange-connected to the shafts with a twistproof coupling, which can compensate for axial shift. Incremental sensors with hollow shafts are an alternative to this. In this case, the housing must be mounted so that it is twistproof.

If a cam disk is used as a rotary sensor in connection with proximity switches (PS), two proximity switches must be mounted such that their output pulse overlap, but do not come at the same time. This causes the phase shift necessary for detection of the direction of rotation. This phase shift consequently refers to the electrical behaviour. The mechanical layout and the right time ratio of the output signals is shown in **fig. 5**.



Possible mechanical layout of the two proximity switches of a rotary sensor. PS 1 is connected to channel A, PS 2 to channel B of the frequency inputs.

For the drawn-in direction of rotation and layout of the proximity switches, the direction of rotation output (↷) of the ES-SVGL2 gives the H-Level (approx. 24V). L-Level (0V) corresponds to the other direction of rotation.

Output pulses of the proximity switches

(Constant speed and direction of rotation ↷ of the cam disk as shown in the figure above)

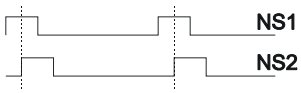
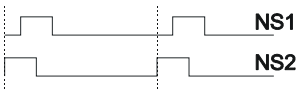
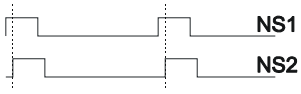
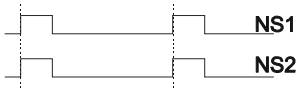
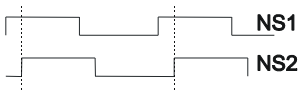
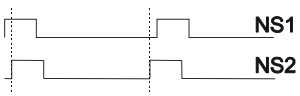
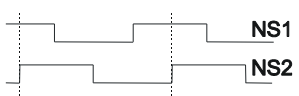
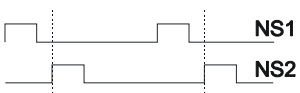
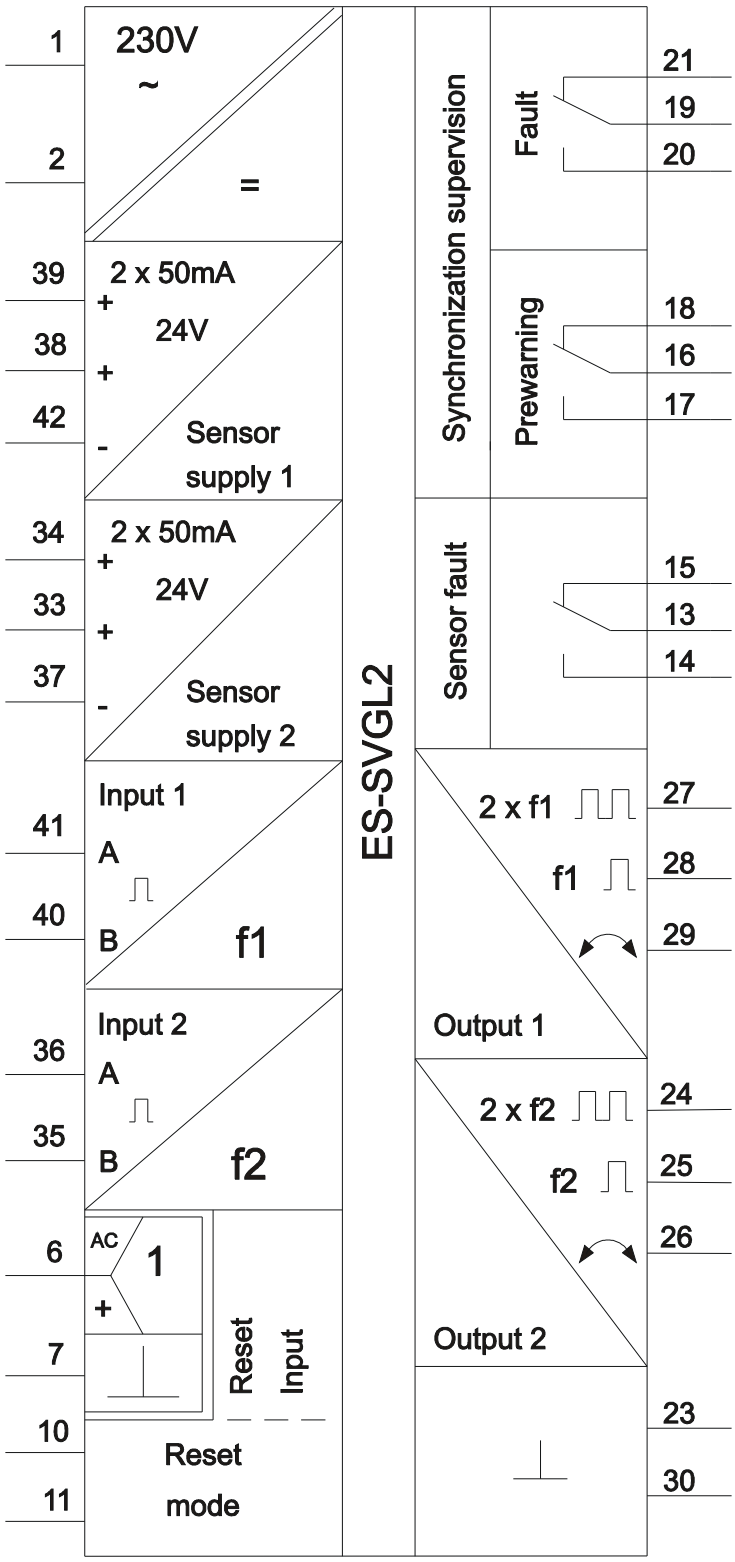
Examples of correct output signals	Examples of wrong output signals	Possible cause / Effect
		PS1 and PS2 are interchanged Direction of rotation will be wrongly detected
		Wrong distance between PS1 and PS2 Supervision unit does not function
		Irregular distances of the cam Supervision unit does not function
		Wrong distance between PS1 and PS2 Supervision unit does not function

Fig. 5: Mechanical layout of proximity switches to obtain phase-shifted pulse

5 Circuit diagram



6 Technical data

Measuring inputs: Terminals (40,41) and (35,36)	4 input stages for the connection of 2 increment sensors (with phases A and B) or 4 three-wire proximity switches, Pulse frequency max. 2 kHz (symmetrical input signals!), each input stage with integrated conductor break monitoring Option: Input stages for Namur proximity switches
Delay of synchronization monitoring:	max. 30ms
Sensor supply: Terminals (38,39,42) and (33,34,37)	4 outputs 24V DC / 50 mA with integrated short-circuit and conductor break monitoring For incremental sensors or proximity switches With the use of incremental sensors, two outputs each are switched in parallel (100 mA) Option: Sensor supply 24V with Ri=2,4kΩ for Namur proximity switches
Reset input: Terminals (6) and (7)	230 V AC/DC ± 15%, pulse duration at least 80ms Option: 24V (20 … 40V AC/DC)
Reset mode: Terminals (10) and (11)	Selection of the operation mode of the reset input (Attention: Keep potential-free, only wire-bridge is allowed)
Frequency outputs: Terminals (27,28,29)	Transistor, 24V/1mA, 30V unloaded, only for connecting of frequency monitors ES-FDP-…
Fault outputs: Terminals (13) to (21)	3 relays, 1 changeover contact, 250V AC, 5A 30V DC, 5A
Supply voltage: Terminals (1) and (2)	230V AC +10/–15%, 50 ... 60Hz (at total sensor supply of 100mA) 230V AC +/–10%, 50 ... 60Hz (at total sensor supply of 200mA)
Power consumption:	approx. 24VA
Fuse:	Type TR5 160mA / 250V, slow-acting (soldered)
Ambient temperature:	-10 ... + 50°C (operation) -20 ... + 70°C (storage)
Housing dimensions:	L = 200mm, W = 75mm, H = 126mm with screw and snap fastening (DIN 46277, 35mm profile rail)
Fire behaviour (housing):	According to UL: V-O and according to VDE 0304: stage 1 respectively
Connection termals:	**Detachable terminal strips**, with self-disengaging BI-slotted screws for 2x2.5 mm^2, including terminal covers with contact protection according to VBG 4 and VDE 0106, part 100
Creep resistance:	Insulation group C 250 VE/300 VG (creeping distance 4mm) according to DIN 57110 and VDE 0110
Degrees of protection of enclosures:	IP40
Weight:	approx. 1200 g

(Subject to change)