Safety Manual

automation technology

SIL3 PLe Safety Function

SIL2 PLd Safety Function

DS250 / DS260

Safety Motion Monitors for Incremental Encoders / Sensors

Product features:

- Monitoring of ramp, underspeed, overspeed, standstill and direction of rotation
- Wire monitoring of the sensor signals
- Up to SIL3/PLe with two independent non certified sensors (Version **DS250**)
- Up to SIL3/PLe with one equally certified sensor (Version **DS260**)
- Safety Functions equivalent to EN 61800-5-2 (SS1, SS2, SOS, SLS, SDI, SSM, SLI, SBC, STO, SMS)
- Inputs: 2 incremental inputs (HTL differential/ HTL single ended/ RS422) (Version **DS250**)
  1 incremental input (HTL differential/ RS422) (Version **DS260**)
  8 control inputs (HTL, PNP)
- Outputs (safe): 2 connected relay outputs, 2 closer (5 … 250 VAC/ VDC)
  1 analogue output (4 … 20 mA
  4 x 2 control outputs (HTL, Push-Pull)
- Signal splitter (safe):1 programmable splitter output (HTL/ RS422)
- Mounting to 35 mm top hat rail (according to EN 60715)
- USB interface for simple parametrization by the OS operator surface
- Optional available display unit BG200

Available Models:

- **DS250:** 2 inputs for non-certified incremental encoders
- **DS260:** 1 input for a SIL3/PLe incremental encoder

Die deutsche Beschreibung ist verfügbar unter:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Ds250_d.pdf

The English description is available at:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Ds250_e.pdf

La description en français est disponible sur:
https://www.motrona.com/fileadmin/files/bedienungsanleitungen/Ds250_f.pdf

The operator software OS (freeware) is available at:
https://www.motrona.com/en/support/software.html

Version:	Description:
Ds250_01a_oi/sn/01/18	First edition pre series
Ds250_01b_oi/sn/af/05/18	First edition series
Ds250_01c_oi/sn/af/06/18	Revised version
Ds250_01d_oi/af/cn/07/18	Next revised version
Ds250_01e_oi/mbo/05/19	Next revised version
Ds250_02a_oi/af/mbo/11/19	Next revised version
Ds250_02b_oi/af/mbo/05/21	Revised version
Ds250_02c_oi/mbo/12/21	Revision in chapter 11.2 --> PRG Error
Ds250_03a_oi/mbo/05/24	Revision in chapter 5.9 / DIL switch

Important note about this document:

In addition to this manual, you can find the parameter description in the separate description **Ds250_pd_e**. It contains a detailed description and a list of all parameters for setup and operation.

Further important manuals:

- OS Operating Manual
- OS User Installation Manual
- BG200 Operating Manual (optionally)

Table of Contents

1. Safety Instructions and Responsibility

1.1. General Safety Instructions

This operation manual is a significant component of the unit and includes important rules and hints about the installation, function and usage. Non-observance can result in damage and/or impairment of the functions to the unit or the machine or even in injury to persons using the equipment!

Please read the following instructions carefully before operating the device and observe all safety and warning instructions! Keep the manual for later use.

A pertinent qualification of the respective staff is a fundamental requirement in order to use these manual. The unit must be installed, configured, commissioned and serviced by a qualified electrician.

Liability exclusion: The manufacturer is not liable for personal injury and/or damage to property and for consequential damage, due to incorrect handling, installation, operation and maintaining. Further claims, due to errors in the operation manual as well as misinterpretations are excluded from liability.

In addition the manufacturer reserves the right to modify the hardware, software or operation manual at any time and without prior notice. Therefore, there might be minor differences between the unit and the descriptions in operation manual.

The raiser respectively positioner is exclusively responsible for the safety of the system and equipment where the unit will be integrated.

During installation, operation or maintenance all general and also all country- and application-specific safety rules and standards must be observed.

If the device is used in processes, where a failure or faulty operation could damage the system or injure persons, appropriate precautions to avoid such consequences must be taken.

1.2. Use according to the intended purpose

The unit is intended exclusively for use in industrial machines, constructions and systems. Non-conforming usage does not correspond to the provisions and lies within the sole responsibility of the user. The manufacturer is not liable for damages which are arisen through unsuitable and improper use. Please note that device may only be installed in proper form and used in a technically perfect condition in accordance to the technical Specifications. The device is not suitable for operation in explosion-proof areas or areas which are excluded by the EN 61010-1 standard.

1.3. Installation

The device is only allowed to be installed and operated within the permissible temperature range. Please ensure adequate ventilation and avoid all direct contact between the device and hot or aggressive gases and liquids.

Before installation or maintenance, the unit must be disconnected from all voltage-sources. Further it must be ensured that no danger can arise by touching the disconnected voltage-sources.

Devices which are supplied by AC-voltages, must be connected exclusively by switches, respectively circuit-breakers with the low voltage network. The switch or circuit-breaker must be placed as near as possible to the device and further indicated as separator.

Incoming as well as outgoing wires and wires for extra low voltages (ELV) must be separated from dangerous electrical cables (SELV circuits) by using double resp. increased isolation.

All selected wires and isolations must be conforming to the provided voltage- and temperature-ranges. Further all country- and application-specific standards, which are relevant for structure, form and quality of the wires, must be ensured. Indications about the permissible wire cross-sections for wiring are described in the technical specifications.

Before first Start-up it must be ensured that all connections and wires are firmly seated and secured in the screw terminals. All (inclusively unused) terminals must be fastened by turning the relevant screws clockwise up to the stop.

Overvoltage at the connections must be limited to values in accordance to the overvoltage category II.

1.4. EMC Guidelines

All motrona devices are designed to provide high protection against electromagnetic interference. Nevertheless you must minimize the influence of electromagnetic noise to the device and all connected cables.

Therefore the following measures are mandatory for a successful installation and operation:

- Use shielded cables for all signal and control input and output lines.
- Cables for digital controls (digital I/O, relay outputs) must not exceed a length of 30 m and are allowed for in building operation only
- Use shield connection clamps to connect the cable shields properly to earth
- The wiring of the common ground lines must be star-shaped and common ground must be connected to earth at only one single point
- The device should be mounted in a metal enclosure with sufficient distance to sources of electromagnetic noise.
- Run signal and control cables apart from power lines and other cables emitting electromagnetic noise.

Please also refer to motrona manual "General Rules for Cabling, Grounding, Cabinet Assembly". You can download that manual by the link
https://www.motrona.com/en/support/general-certificates.html

1.5. Cleaning, Maintenance and Service Notes

To clean the front of the unit please use only a slightly damp (not wet!), soft cloth. For the rear no cleaning is necessary. For an unscheduled, individual cleaning of the rear the maintenance staff or assembler is self-responsible.

During normal operation no maintenance is necessary. In case of unexpected problems, failures or malfunctions the device must be shipped for back to the manufacturer for checking, adjustment or reparation. Unauthorized opening and repairing can have negative effects or failures to the protection-measures of the unit.

The service interval of the DS device is 1 year, in case of continuous operation the DS unit must be switched on and off for at least 1 time a year.

2. Introduction

This series of speed monitors is suitable for safety-related monitoring tasks, e.g. over-speed, under-speed, standstill and direction of rotation. This SIL3/PLe certified generation of devices was developed to achieve functional safety by supporting a wide range of sensors and encoders in different combinations.

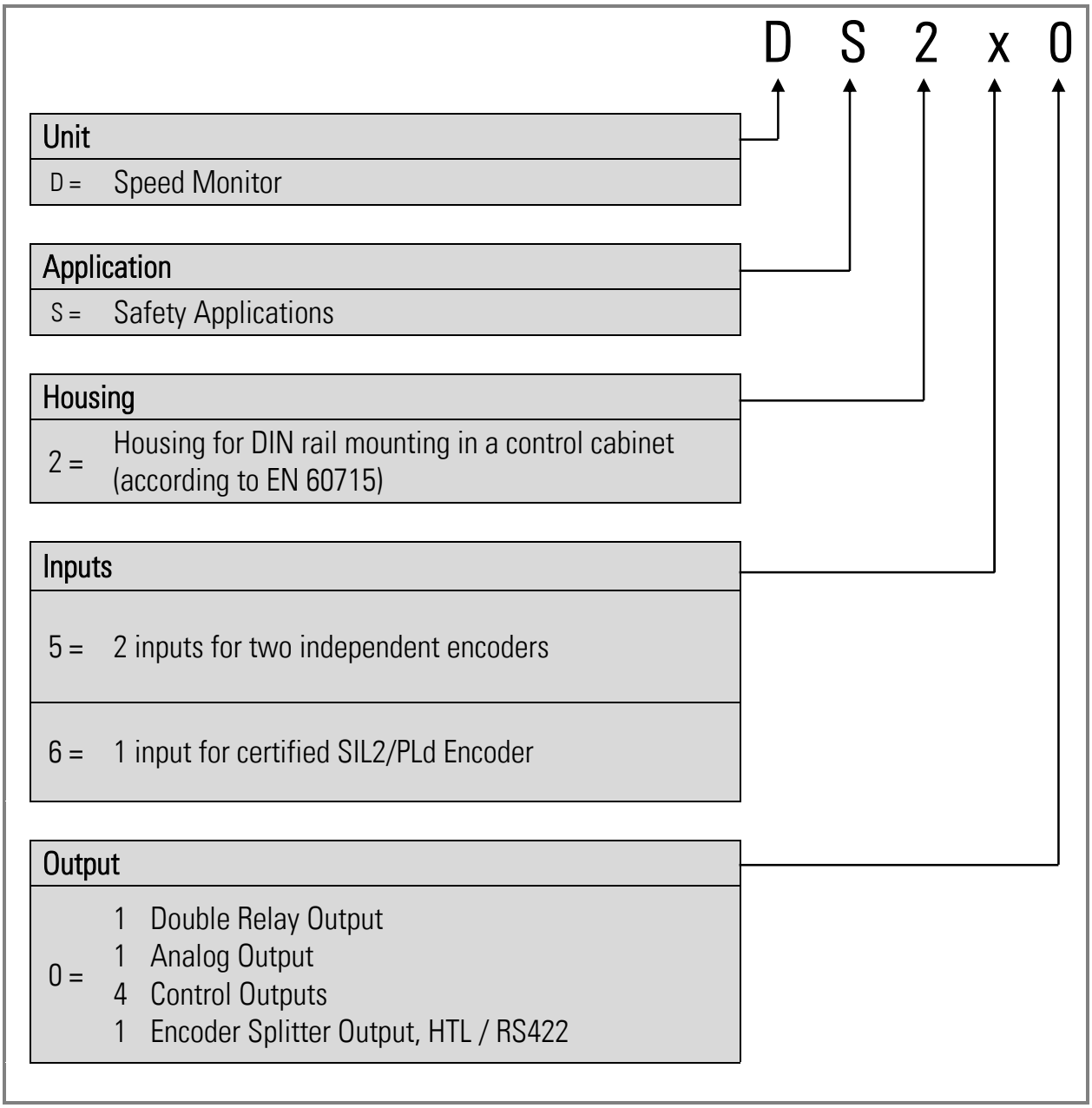
Due to parallel encoder inputs these devices are perfectly suitable for the retrofitting of existing plants and machines which are using "non-safe" sensors. This offers a great opportunity to save costs for expensive and certified sensors. Also the costs for new installations and adjustments can be reduced significantly by using the existing components and wiring.

Typical examples are centrifuges, cranes, wind power or hauling plants.

Special features:

- Additionally suitable for use with setup operations,
  e. g. for manual settings in plants with open protection doors and reduced speed
- All models are safety-related and dually certified according to
  EN 61508, EN 62061 / SIL3 and EN ISO 13849-1 Cat. 3 / PLe,
  even when using "non-safety-related" standard sensors or encoders
- Generally, the use of 2 sensors / encoders is required because only then SIL3 / PLe can be achieved. When using a single SIL2/PLd certified Incremental encoder, only a maximum of SIL2/PLd can be reached.
- Wide input frequency range and fast response time
- Very versatile range of possible monitoring functions
- It is recommended to setup the DS unit via the front USB port by using a PC and the OS operator software.
- The final "Safety Integrity Level (SIL)" or „Performace Level (PL)" results from the selected configuration and from external components connected to the unit.
- The additional display and operating unit BG200 (optional accessory, not included in the delivery) is used to display the encoder frequencies in converted operator units and further for visual monitoring of the DS unit.

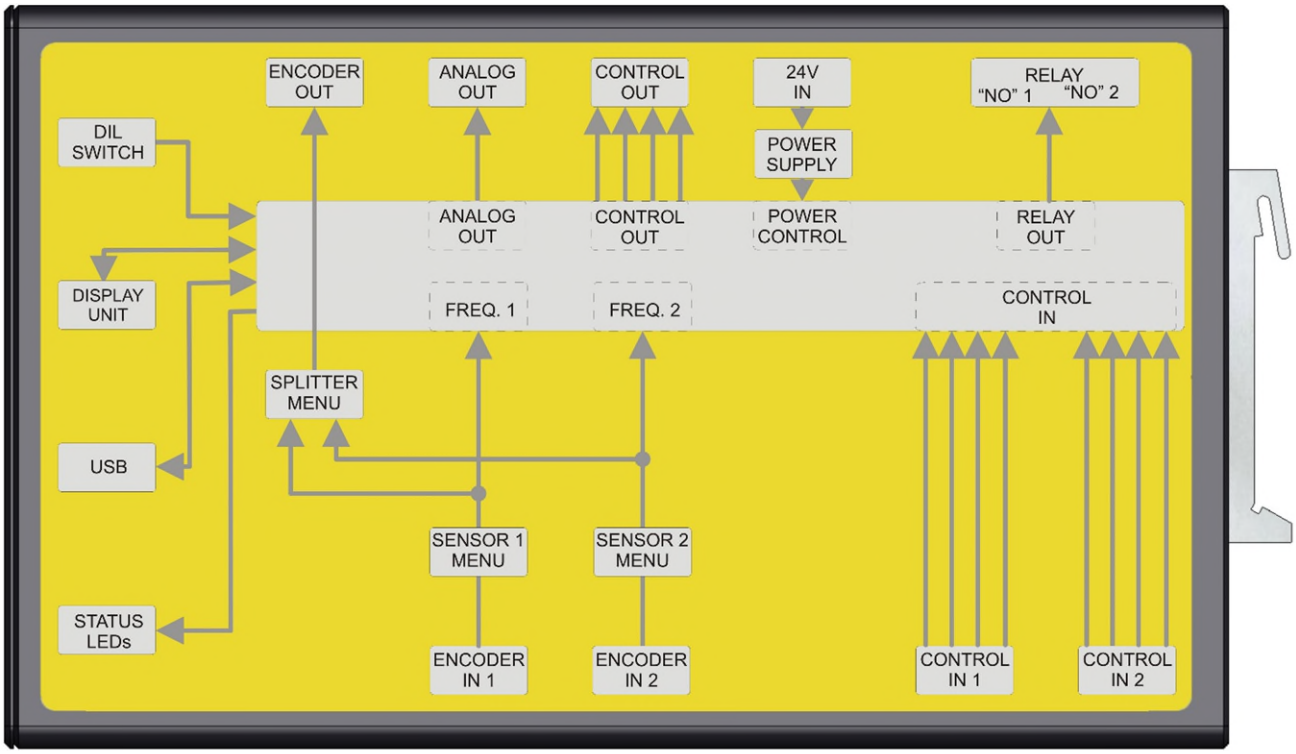
3. Available Models



DS250 is the execution for two independent encoder
DS260 is the execution for a certified SIL2 / PLd Encoder

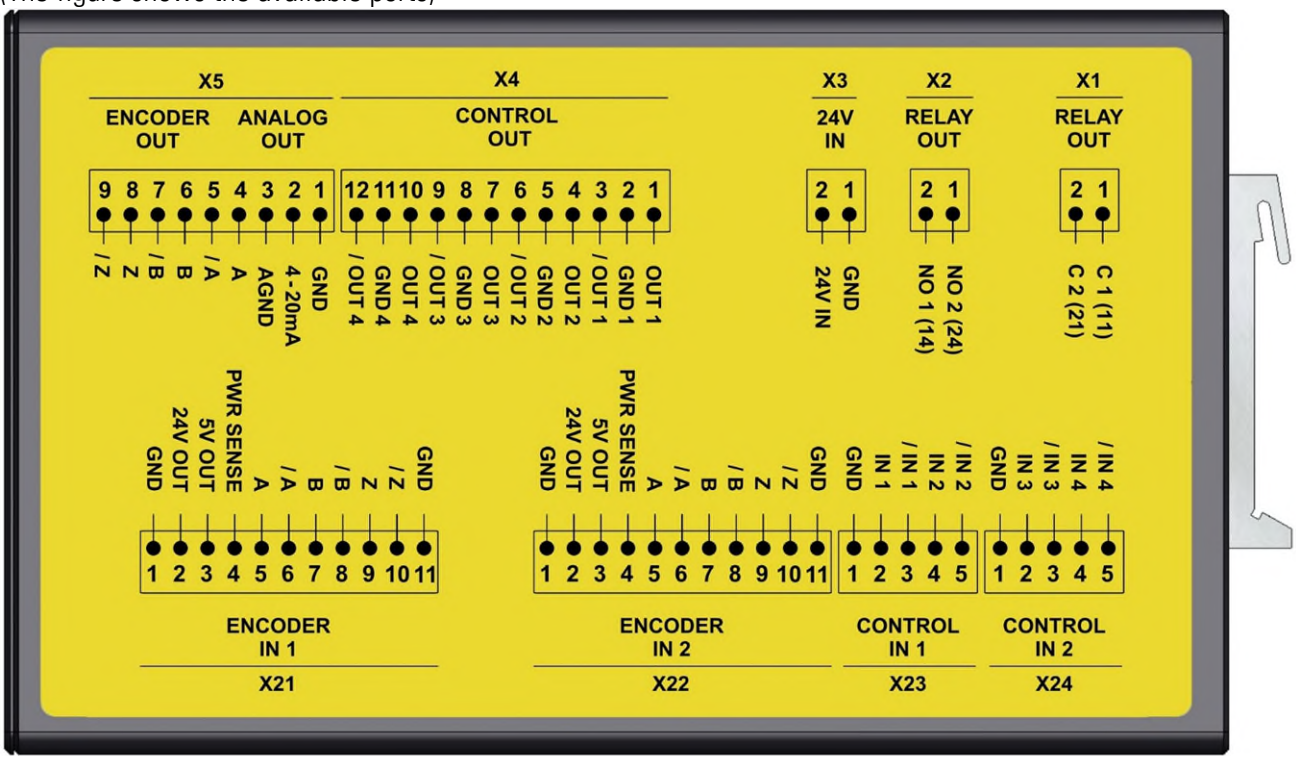
4. Block Diagrams and Connections

4.1. DS250 Block Diagram

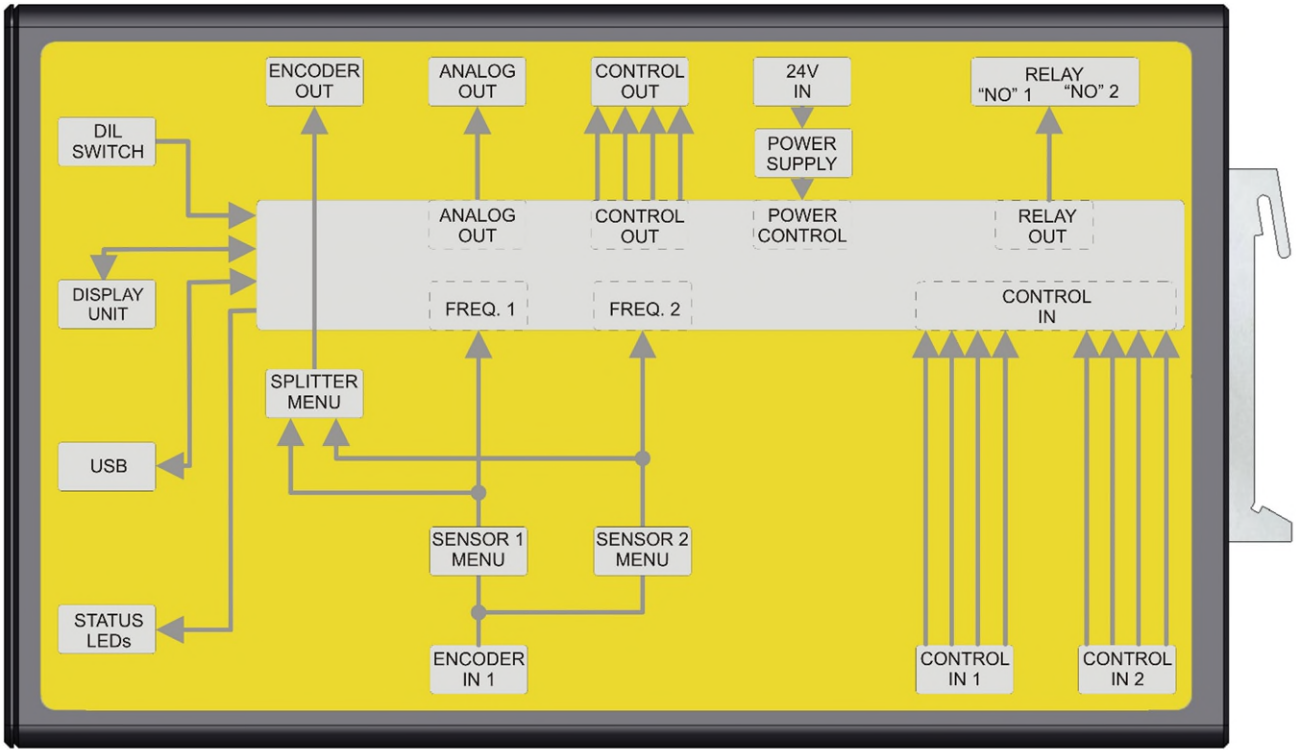


4.2. DS250 Connections

(The figure shows the available ports)

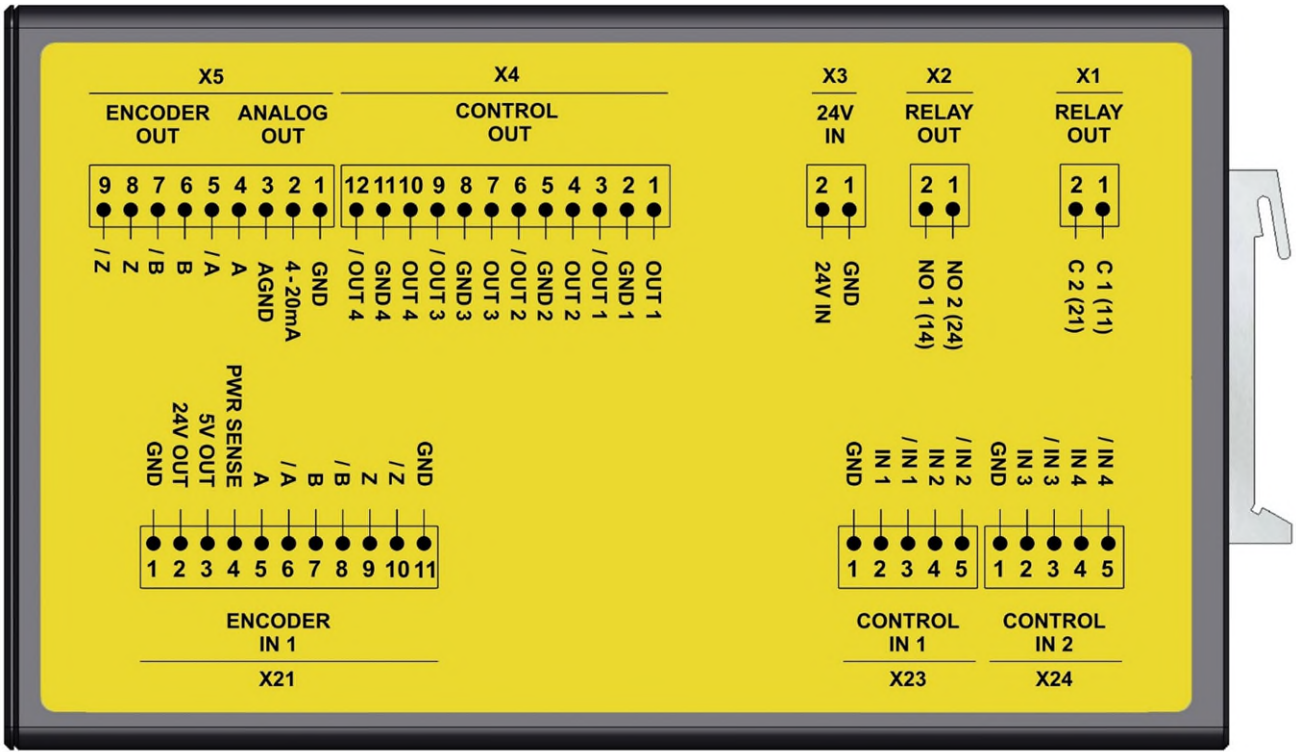


4.3. DS260 Block Diagram



4.4. DS260 Connections

(The figure shows the available ports)



5. Description of Connections

This chapter describes only the electrical connections and their general function.

Name	Description see chapter
X1 | RELAY OUT	0 Relais
X2 | RELAY OUT	0 Relais outputs
X3 | 24V IN	5.1 Power Supply
X4 | CONTROL OUT	5.7 Control output
X5 | ANALOG OUT	5.6 Analog output 4 to 20 mA
X5 | ENCODER OUT	5.5 Encoder output
X11	5.10 BG200 Operator Interface
X12	5.11 USB Interface for the OS Operator Surface
X21 | ENCODER IN 1	5.3 Encoder Inputs
X22 | ENCODER IN 2	5.3 Encoder Inputs
X23 | CONTROL IN 1	5.4 Control inputs
X24 | CONTROL IN 2	5.4 Control inputs
S1	5.9 DIL switch
ERROR – ON	5.12 LEDs / Status Indication

The connection to the outputs is only safe when the follower unit is able to detect the fault status of each output and when the outputs are configured accordingly.

In order to prevent simultaneous damages and disturbance of the cables by external influences, the encoder resp. sensor lines must be kept physically apart from each other.

5.1. Power Supply

If the unit is connected to a DC power supply network which also supplies further devices or systems, it must be ensured that no voltages ≥ 60 V can occur at the terminals [X3:1] und [X3:2].

If this cannot be ensured, the unit must be supplied by a separate DC power pack, which must not be connected to further devices or systems.

The requirements for both kinds of power supplies are:

- Nominal voltage range from 18 … 30 VDC
- Ripple < 10% @ 24 V and maximum load
- External fuse (3.15 A, medium time lag) required

A separate power pack must cover the following requirements:

- The consumption of the unit is approx. 45 W (at permissible load and without short-circuit)

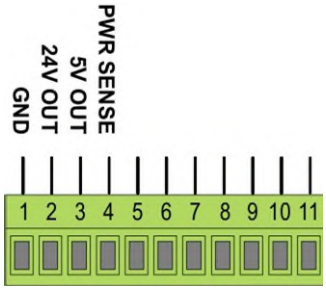
The 18 … 30 VDC power supply must be connected via the pluggable 2-position screw terminal strip [X3 | 24V IN]. The power supply input is protected by an internal reverse polarity protection.

Pluggable 2-position terminal [X3]

- The DC input must be protected by an external fuse (type and value see see above or technical specifications).
- The DS unit has no internal galvanic isolation, thus all GNDs are interconnected. Please avoid any GND loops to the power supply input [X3].
- Even with use of a SIL3 certified power supply (UFAIL < 60 V), an external fuse must be installed.

5.2. Encoder Supply

The unit offers an auxiliary voltage output for separate supply of the encoders or sensors in use. The encoder supply must be taken directly from the safety monitor, or via relay contact when using an indirect power supply.



Terminals for encoder supply (24V or 5V) with optional voltage monitoring

The maximum load of the encoder supply is 200 mA per channel (Sensor 1 and Sensor 2). An encoder supply is available for each sensor channel (24V out or 5V out). The voltage of the 24V Out encoder supply is approx. 2 V below the supply voltage of the device supplied to [X3] (18... 30 VDC). Via the connection PWR sense, the voltage of the encoder supply can be monitored (optional).

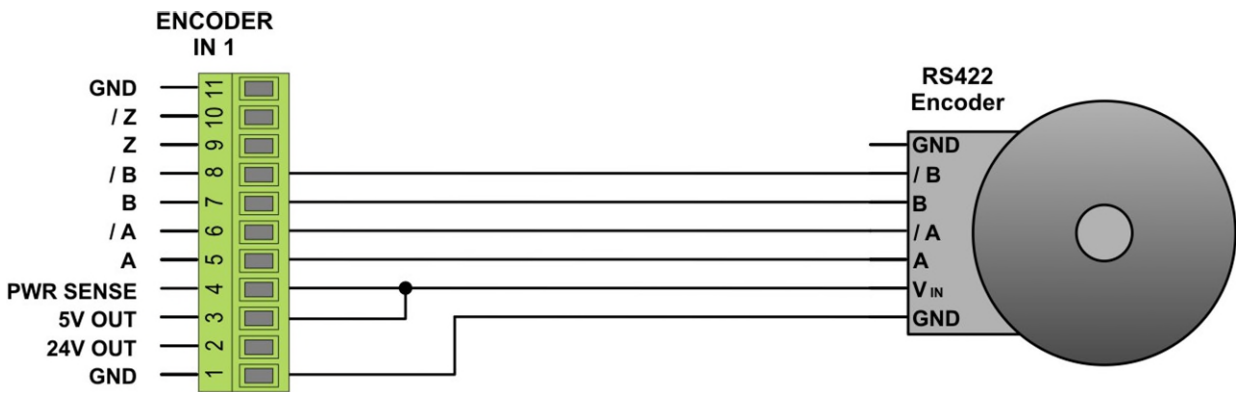
When powering up the encoder supply, the maximum input current of the safety unit could be exceeded, depending on the encoders in use. In this case, the encoder supply would not be enabled and an error appears.

In case of such problems, or if another voltage level is required, the encoder supply can be switched on from an external voltage source via remote relay. In this case, it is mandatory to energize the relay from the internal encoder supply of the DS unit.

- In case of a direct encoder supply it is mandatory to operate the encoders with the auxiliary voltage from the unit.
- Indirect encoder supply must in any case be carried out via relay, energized by the auxiliary voltage of the DS unit.

5.2.1. Direct Encoder Supply

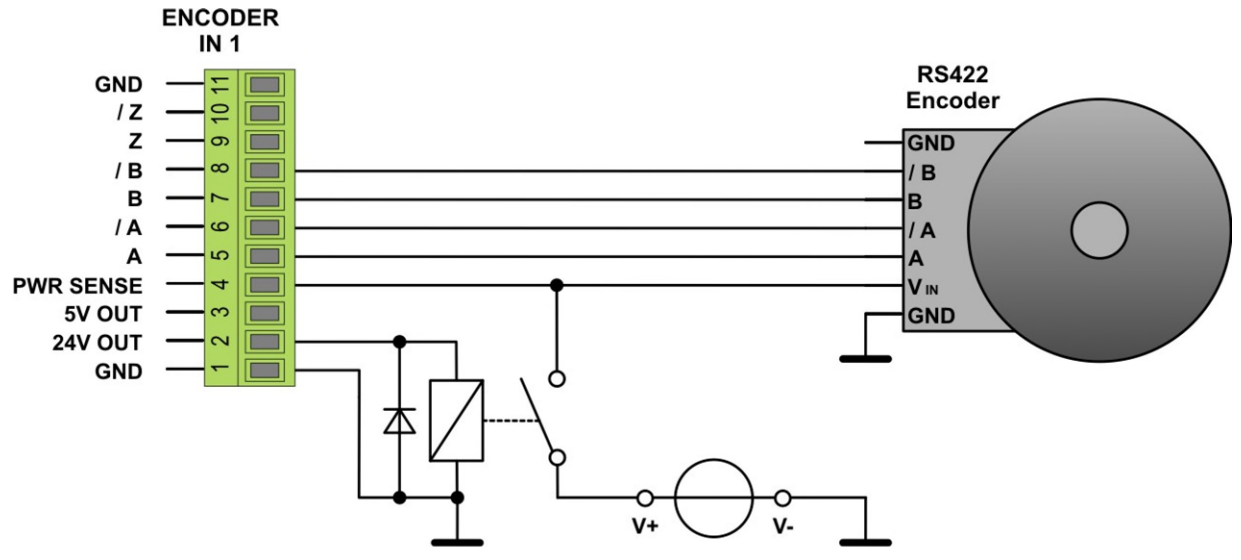
With direct encoder supply, the encoder must be connected as shown in the figure below:



Example: Direct encoder supply with monitoring (optional) of the encoder supply
for encoder with 5 VDC supply voltage

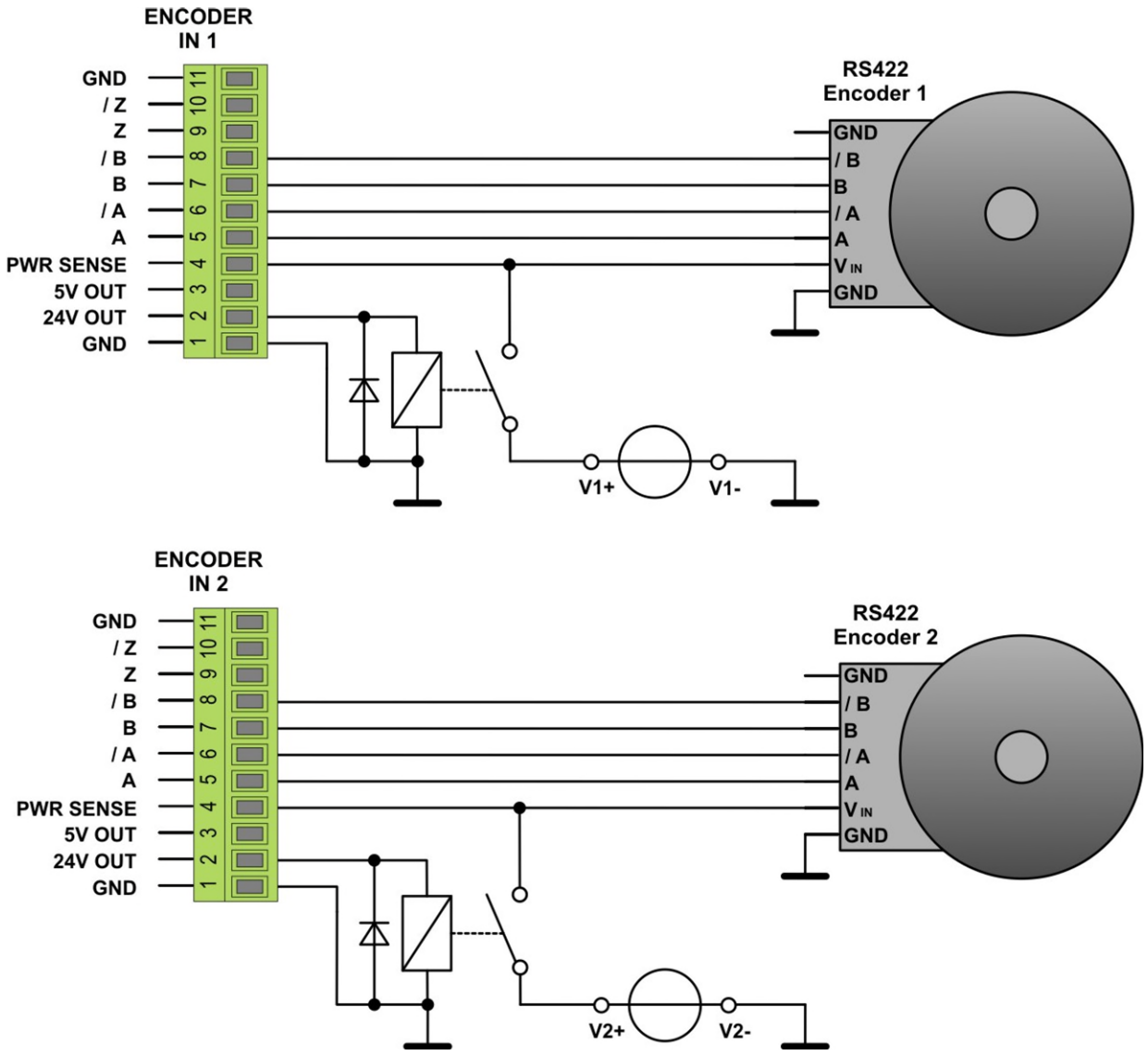
5.2.2. Indirect Encoder Supply

Indirect encoder supply must necessarily, and each separately, be switched on by use of a relay, energized with the auxiliary voltage of the unit. This is necessary, because no encoder signals must be applied to the safety monitor before the unit has successfully completed its initialization and self-test.



Example: Indirect encoder supply (1 encoder over 1 relay) with monitoring (optional) of the encoder supply

Continuation **"External Encoder Supply"**



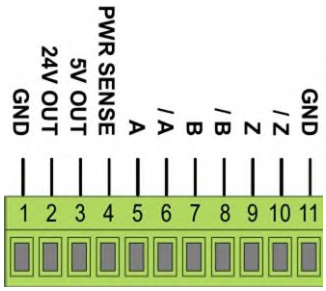
Example: Indirect encoder supply (2 encoders are switched via 2 relays) with monitoring (optional) of the encoder supply

- Indirect encoder supply must necessarily and each separately be switched on via relay, energized by the auxiliary voltage of the unit.
- In case of indirect supply of both encoders, two independent supply sources and two separate relays must be used.

5.3. Encoder Inputs

The incremental encoder is connected by one or both of the pluggable 11-position terminal [X21 | ENCODER IN 1] and [X22 | ENCODER IN 2]. The zero pulses (Z or/Z) do not have to be connected.

Encoder signals can be connected in the format RS-422, HTL differential (both with A, /A, B, /B and 90 ° phase offset) and HTL single ended (A, B 90 °) and only single lane HTL signals (A).



Pluggable 11-position terminal [X21], [X22]

The characteristics of the encoder inputs must be set in the Sensor menu.
No external networks may be connected to the encoder signals.
The encoder supply must be connected via the respective terminal.

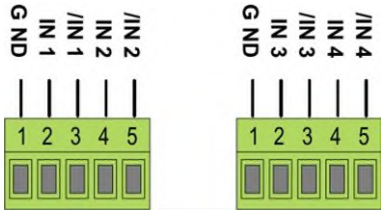
- For unbalanced single channel signals, the parameter “Edge 1” and “Edge 2” must be set to 1, so that a stable frequency can be detected.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

- The use of single track HTL signals (HTL single ended) can reduce the Safety Integrity Level (SIL) or the Performance Level (PL). At DS260, SIL2/PLd encoder in HTL single ended configuration is not allowed, as no sensor errors can be detected anymore.

- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

5.4. Control inputs

Up to 8 input channels for control signals with HTL level and PNP switching characteristics are available on the terminal strips [X23 | CONTROL IN 1] and [X24 | CONTROL IN 2].
The configuration of the inputs has an effect on the Safety Integrity Level (SIL) or the Performance Level (PL). Attention, not all inputs have the same configuration option.



Pluggable 5-postion terminal [X23 and X24]

5.4.1. Control outputs CONTROL IN 1

The following functions and configuration options are available on the terminal strip [X23 | CONTROL IN 1]:

- Two 2-pole inputs (IN1, /IN1 and IN2, /IN2)

Signalpair 1	[X23: 2] IN1	Control signal 1, fault detection
	[X23: 3] /IN1	Homogeneous or inverse control signal 1, fault detection
Signalpair 2	[X23: 4] IN2	Control signal 2, fault detection
	[X23: 5] /IN2	Homogeneous or inverse control signal 2, fault detection

- One 2-pole input (IN1, /IN1) and two 1-pole inputs (IN2 und /IN2)

Signalpair 1	[X23: 2] IN1	Control signal 1, fault detection
	[X23: 3] /IN1	Homogeneous or inverse control signal 1, fault detection
Signal 2	[X23: 4] IN2	Control signal 2
Signal 3	[X23: 5] /IN2	Control signal 3

- Four 1-pole inputs (IN1, /IN1, IN2 and /IN2)

Signal 1	[X23: 2] IN1	Control signal 1
Signal 2	[X23: 3] /IN1	Control signal 2
Signal 3	[X23: 4] IN2	Control signal 3
Signal 4	[X23: 5] /IN2	Control signal 4

- One 4-pole input (IN1, /IN1, IN2 and /IN2)

Signal 1 - 4	[X23: 2-5]	Signals in gray (4 states with error detection) or binary format (16 states without error detection) for switching the switching points

- The use of 1-pole inputs reduces the Safety Integrity Level (SIL) or the Performance Level (PL).
- The use of 16 switching points reduces the Safety Integrity Level (SIL) or the Performance Level (PL).

5.4.2. Control outputs CONTROL IN 2

The following functions and configuration options are available on the terminal strip [X24 | CONTROL IN 2]:

- Two 2-pole inputs (IN3, /IN3 und IN4, /IN4)

Signalpair 1	[X24: 2] IN3	Control signal 5, fault detection
	[X24: 3] /IN3	Homogeneous or inverse control signal 5, fault detection
Signalpair 2	[X24: 4] IN4	Control signal 6, fault detection
	[X24: 5] /IN4	Homogeneous or inverse control signal 6

- One 2-pole input (IN3, /IN3) and ztwo 1-pole inputs (IN4 and /IN4)

Signalpair 1	[X24: 2] IN3	Control signal 5, fault detection
	[X24: 3] /IN3	Homogeneous or inverse control signal 5
Signal 2	[X24: 4] IN4	Control signal 6
Signal 3	[X24: 5] /IN4	Control signal 7

- Four 1-pole inputs (IN3, /IN3, IN4 and /IN4)

Signal 1	[X24: 2] IN3	Control signal 5
Signal 2	[X24: 3] /IN3	Control signal 6
Signal 3	[X24: 4] IN4	Control signal 7
Signal 4	[X24: 5] /IN4	Control signal 8

- One 4-pole input(IN3, /IN3, IN4 and /IN4)

Signal 1 - 4	[X24: 2-5]	Signals in gray (4 states with error detection) or binary format (16 states without error detection) for switching the switching points

- The use of 1-pole inputs reduces the Safety Integrity Level (SIL) or the Performance Level (PL).
- The use of 16 switching points reduces the Safety Integrity Level (SIL) or the Performance Level (PL).

5.5. Encoder output

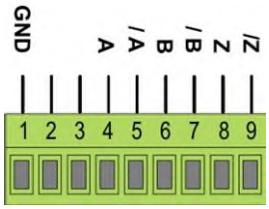
The unit provides a safety-related and programmable HTL / RS422-Splitter-Output.

The splitter output allows to return the input frequency of sensor 1 or sensor 2. The parameters in the Splitter menu allow the selection of the output level (5V = RS-422 or 18-30V = HTL) as well as the selection of the frequency source (sensor 1 or sensor 2).

The signal delay between encoder input and splitter output is approx. 500 ns.

In case of error, no encoder signals are available at the splitter output (Tri-State, internal with 10 kOhm pull-down resistors).

The connection of the splitter output is only safe if the following device can detect the fault condition of the safety device.



Pluggable 9-pole terminal [X5]

The terminal [X5] is 9-pole:

[X5 | ANALOG OUT]	Analog output	[X5:2-3]
[X5 | ENCODER OUT]	HTL / RS422-output	[X5:4-9]

- If the parameter "Split Level" is set incorrectly, the device connected to the encoder output can be damaged.

- In case of error, all traces of the splitter output are switched to "low".

- The Safety Integrity Level (SIL) or the Performance Level (PL) is reduced if only the splitter output is connected. A parallel connection of splitter and relay output or switching output is necessary to reach SIL3 / PLe.

5.6. Analog output 4 to 20 mA

A safety- related analogue output is available at terminal strip [x5 | ANALOGUE OUT]. The current output is freely scalable by setting parameters “Analog Start” and “Analog End”.
If the analogue output is not used, [X5:2] and [X5:3] must be bridged. An error is detected when the analogue output is open (e.g. wire breakage).

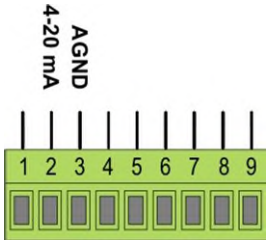
In the normal state, the output signal moves in the range between 4 and 20 mA.

In case of an error, the analogue output is controlled by 0 mA.

The connection of the analog output is only safe if the following device can detect the fault condition of the safety device.

The terminal [X5] provides 9 connections:

[X5 | ANALOG OUT]	Analog out	[X5:2-3]
[X5 | ENCODER OUT]	HTL / RS422-Output	[X5:4-9]



Pluggable 9-pole terminal [X5]

- If the analogue output is not used, [X5:2] and [X5:3] must be bridged.
- An error is detected when the analogue output is open (e.g. wire breakage).

- In case of an error, the analogue output is controlled by 0 mA.

- The Safety Integrity Level (SIL) or the Performance Level (PL) is reduced if only the analog output is connected. A parallel connection of splitter and relay output or switching output is necessary to reach SIL3/PLe.

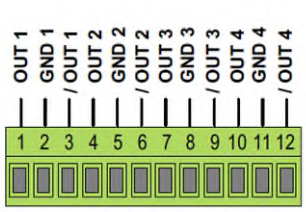
5.7. Control output

Four inverse/homogeneous HTL control outputs are available at the screw terminal [X4 | CONTROL OUT]. The switching points and switching conditions can be programmed by parameters.

In HIGH state, the output level is approximately 2 V lower than the supply voltage at terminal [X3 | 24V IN]. The outputs are short-circuit proof push-pull outputs. When switching inductive loads, additional external suppression measures are recommended.

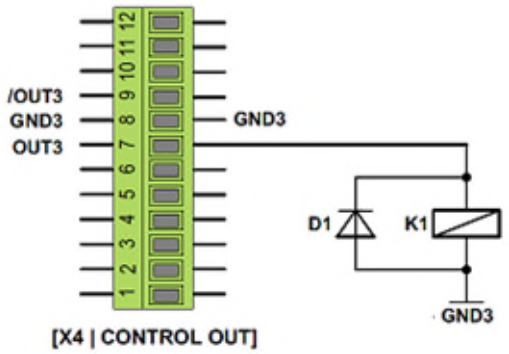
Connections to the control output are only safe if the target device is able to detect the error state of the safety monitor.

The configuration of the control outputs will affect the Safety Integrity Level (SIL/PL).

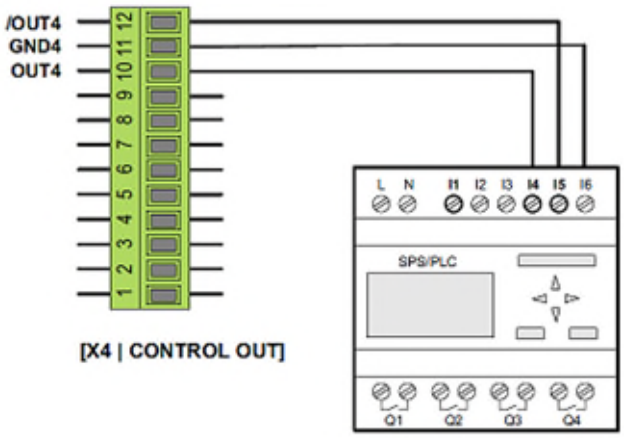


Pluggable 12-pole terminal [X4]

Example 1:



Example 2:

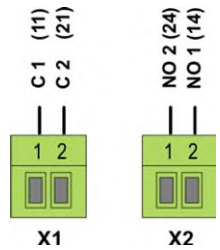


- In case of an error, all control outputs control a low level (no more inverted).

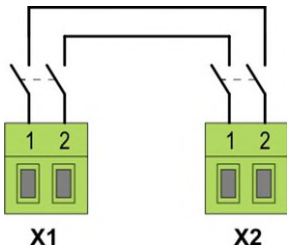
5.8. Relais outputs

The device has two connected-safety-oriented relay outputs. Each relay output consists of two consecutive contacts (NO). These series contacts are available at [X1 | RELAY OUT] and [X2 | RELAY OUT].

- The contacts are only closed during normal and disturbance-free operation. They will open to a safety state in case of errors or when the programmed switching condition occurs.
- In the de-energized state of the unit the contacts are also open.
- Switching points and switching conditions can be set by the corresponding parameters.
- An internal, forcibly guided opener of the relay is used to monitor the relay status by the unit itself.
- In case of an error the contact will change to the open and safe switching state.



Pluggable 2-pole terminal [X1] und [X2]



Internal connection [X1] and [X2]

- The operator is responsible to ensure a safe state of all relevant parts and components of the equipment, whenever the relay contact is open.
- The target unit must be able to evaluate edges, in order to determine dynamical conditions of the relay output, too.
- With frequencies close to the switching point, relay bouncing may occur in consequence of variation of the frequency measurement. To prevent this, a hysteresis should be set.
- If also short overshoots of the switching point should be detected, a lock function should be set to the output.

5.9. DIL switch

A 3-position DIL switch [S1] is located at the front of the unit
(only accessible when no display and programming unit BG200 is connected).

3-pos DIL switch [S1]

The DIL switch is used to set the operation state of the monitor:

DIL1	DIL2	DIL3	Status	Info
ON	ON	ON	Normal Operation	Device in normal operation. Yellow LED off (lights up permanently at error state). Ready for operation approx. 10 s after power up No self-test protocol is sent. An initialization test is not executed.
ON	OFF	ON	Normal Operation	Device in normal operation. Yellow LED off (lights up permanently at error state). Ready for operation approx. 10 s after power up. The self test protocol is sent. Initialization tests are executed.
ON	---	OFF	Programming / Test - Mode	Device in programming or test mode, e.g. Start-up. Yellow led blinks slowly (lights up permanently at error state)
---	OFF	---	Self Test Message	For internal testing After power-up the device sends a log of the self tests. Yellow led blinks slowly (lights up permanently at error state). Ready for operation approx. 15 s after power up
OFF	---	---	Factory Settings	After power-up the Unit is reset to factory Setting. All parameters are overwritten with default values. Yellow led blinks slowly (lights up permanently at error state.

- The Programming Mode (DIL switch) is used for Start-up and testing
- All DIL switch sliders must be set to “ON“ after Start-up and testing
- After Start-up the DIL switch sliders should be protected against manipulation (e. g. by covering with the adhesive tape)
- Normal operation is only permitted when the yellow LED is permanently off
- The safety function of the unit cannot be guaranteed before the commissioning has been completed.

- Min. 1x per year a complete test of the DS is required.
- To do this, the DS is disconnected from all connections except the power supply.
- A bridge must be provided at the current output.
- DIL switch 2 is set to OFF and the DS is restarted.
- The initialization process must run without errors.

5.10. BG200 Operator Interface

On the front site the unit provides a serial interface for communication with BG200 operator units (optional accessory), allowing display and parameter setting.

8-pin female connector [X11]

The BG200 unit and the safety monitor are connected by plugging the BG200 directly onto the female 8-pin connector [X11] at the front.

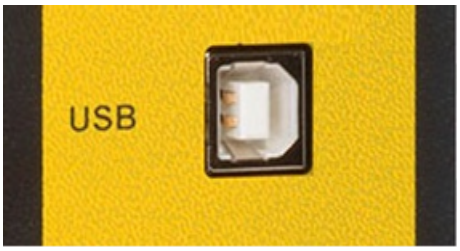
This operator unit is intended for display of the encoder signals (in user units) and for visual monitoring of the DS unit.

With the BG200 parameters can be changed or set in the DS250/DS260.
The user interface OS is required for Start-up and commissioning.

The female connector [X11] is reserved for exclusive use with a BG200 unit.

5.11. USB Interface for the OS Operator Surface

For communication between the unit and a PC or a superordinate controller, a virtual COM port is accessible at the USB connector. A standard USB-cable with a Type B connector is used for connection. This USB cable is available as an option. The USB port serves for PC setup of the DS monitors.



USB - Typ B

A separate manual is available describing the installation procedure of the USB driver
(see page 2).

5.12. LEDs / Status Indication

Two status LEDs are located on the front of the unit.
The green one is marked as [ON] and the yellow one as [ERROR].

Status LEDs

The green status LED uses the following conditions:

Green LED	Status
OFF	Power off (no power supply voltage)
ON	Power on (power supply voltage ok)

The yellow status LED uses the following conditions:

Yellow LED	Status
OFF	Normal operation, self-test successfully completed, no error messages
ON	During the self-test or with error state
Flashes slowly	Factory Settings or Programming / Test - Mode

6. Operational Modes D250

The following operating modes (combinations of encoders) are suitable for mapping a two-channel system. The table shows only a portion of the connection options, different duplicate applications are not shown.

Sensor 1			Sensor 2		
Format	Required signals	Optional signals	Format	Required signals	Optional signals
RS-422	A, /A, B, /B	Z, /Z	RS-422	A, /A, B, /B	Z, /Z
			HTL differential	A, /A, B, /B	Z, /Z
			HTL A, B, 90°	A, B	Z
			HTL A	A	
HTL differential	A, /A, B, /B	Z, /Z	HTL differential	A, /A, B, /B	Z, /Z
			HTL A, B, 90°	A, B	Z
			HTL A	A	
HTL A, B, 90°	A, B	Z	HTL A, B, 90°	A, B	Z
			HTL A	A	
HTL A *	A		HTL A	A	

The Z or/Z track is not evaluated by the device.
Only the line breakage monitoring of the Z tracks is active.

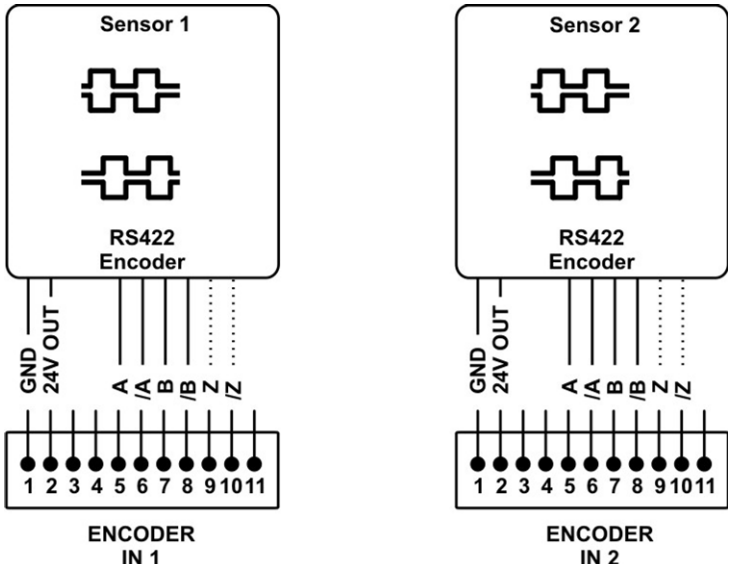
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

- For unbalanced single channel signals, the parameter A-Edge 2/1 must be set to 1, so that a stable frequency can be detected.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

6.1. Combination: RS-422 + RS-422

Device	DS250		
„Op-Mode 1“:	0		
Sensor 1:	[X21 | ENCODER IN 1]:	RS-422 Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	0		
Sensor 2:	[X22 | ENCODER IN 2]:	RS-422 Encoder	A, /A, B, /B, (Z,/Z)
Safety Level	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below)		

The encoder supply of the encoders can also be done over 5 V



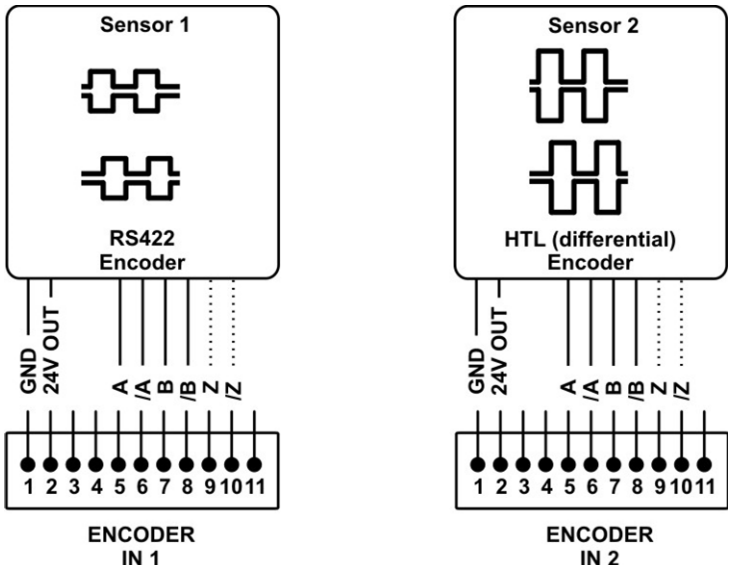
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.2. Combination: RS-422 + HTL (differential)

Device:	DS250		
„Op-Mode 1“:	0		
Sensor 1:	[X21 | ENCODER IN 1]:	RS-422 Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	1		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (differential) Encoder	A, /A, B, /B, (Z,/Z)
Safety Level:	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below))		

The combination HTL (differential) + RS-422 is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.

The encoder supply of the encoder 1 can also be done over 5 V



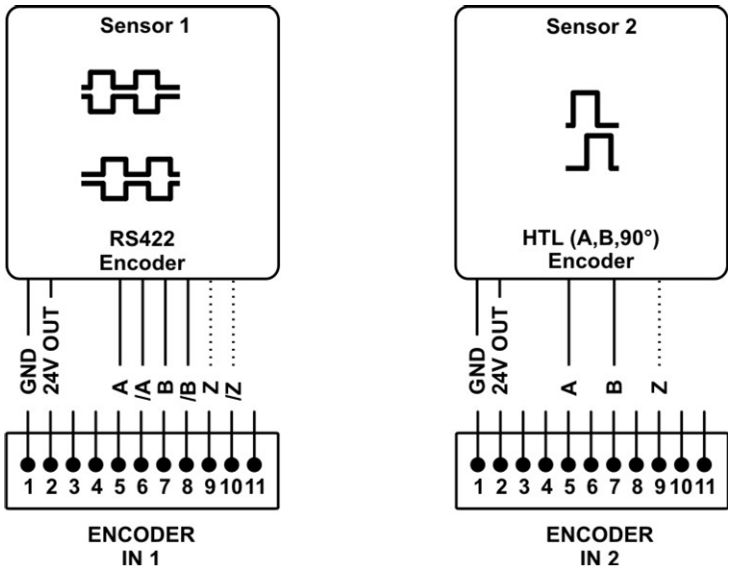
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.3. Combination: RS-422 + HTL (A, B, 90°)

Device:	DS250		
„Op-Mode 1“:	0		
Sensor 1:	[X21 | ENCODER IN 1]:	RS-422 Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	2		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (A,B,90°) Encoder	A, B, (Z)
Safety Level:	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below)		

The combination HTL (A; B; 90°) + RS-422 is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.

The encoder supply of the encoder 1 can also be done over 5 V



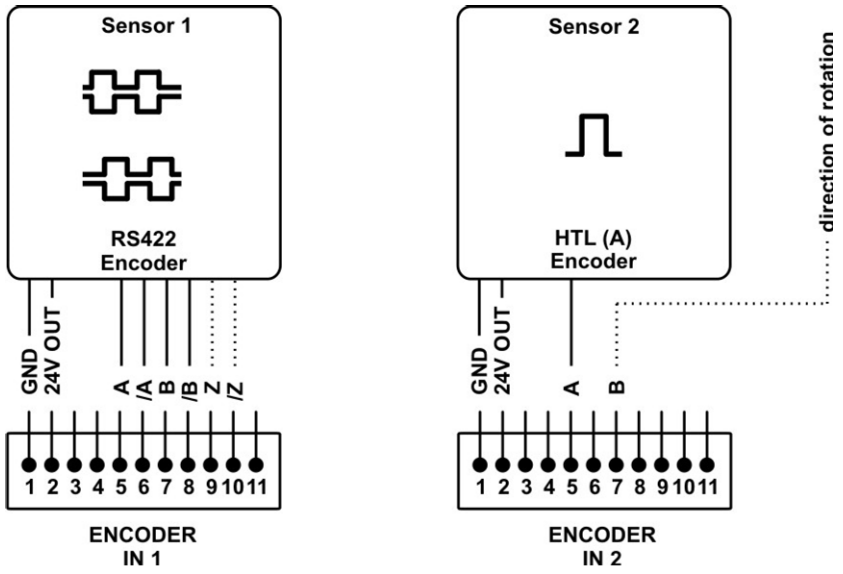
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.4. Combination: RS-422 + HTL (A)

Device:	DS250		
„Op-Mode 1“:	0		
Sensor 1:	[X21 | ENCODER IN 1]:	RS-422 Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	3		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (A) Encoder	A
Safety Level:	Speed → SIL3 / PLe achievable (see below) * Direction → SIL3 / PLe achievable (see below) * Standstill → SIL3 / PLe achievable (see below) *		

The combination HTL (A) + RS-422 is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.

The encoder supply of the encoder 1 can also be done over 5 V



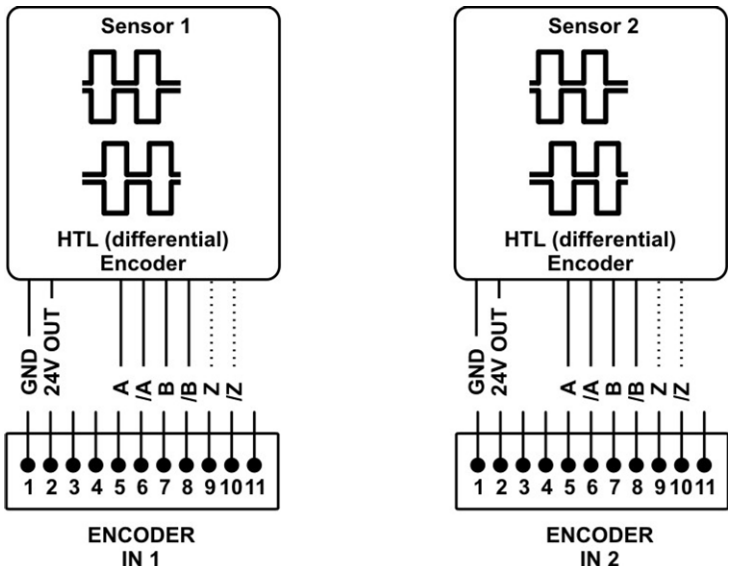
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

- For unbalanced single channel signals, the parameter “Edge 1” and “Edge 2” must be set to 1, so that a stable frequency can be detected.

*)
- To achieve a safety level with this configuration, the user must be sure that the equipment will physically be able to rotate or move in one direction only (no reversals!). This could e.g. be ensured by use of a self-locking gearbox.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

6.5. Combination: HTL (differential) + HTL (differential)

Device:	DS250		
„Op-Mode 1“:	1		
Sensor 1:	[X21 | ENCODER IN 1]:	HTL (differential) Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	1		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (differential) Encoder	A, /A, B, /B, (Z,/Z)
Safety Level:	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below)		

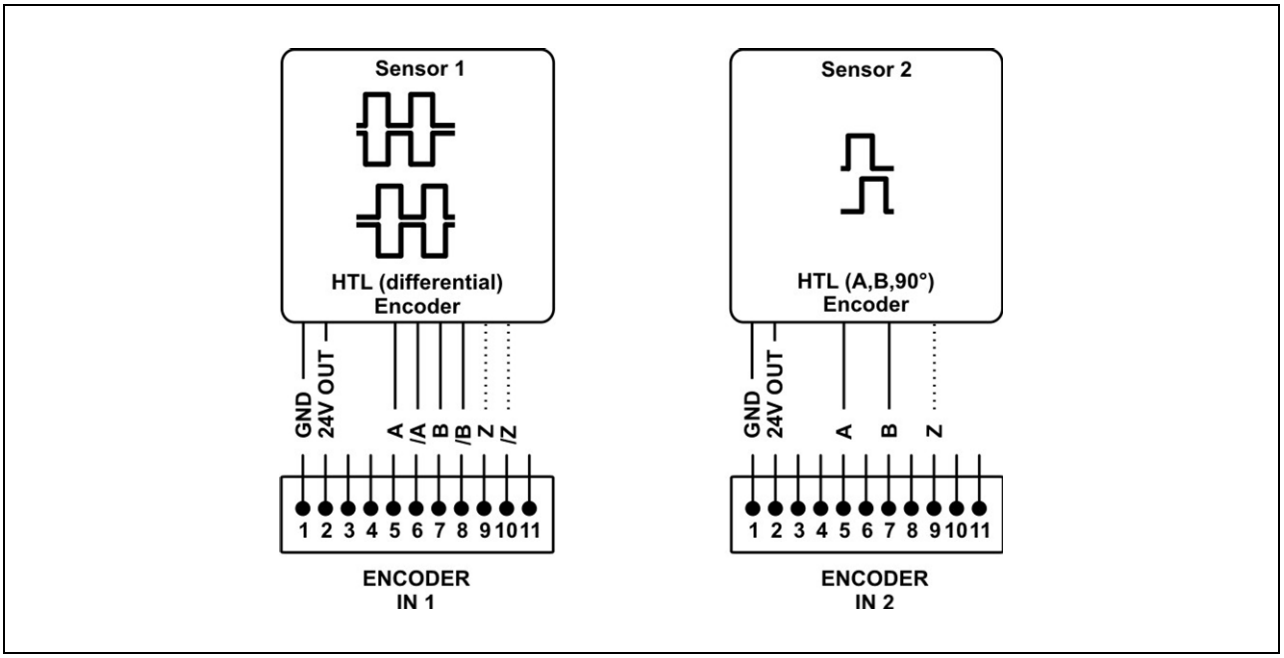


- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.6. Combination: HTL (differntial) + HTL (A, B, 90°)

Device:	DS250		
„Op-Mode 1“:	1		
Sensor 1:	[X21 | ENCODER IN 1]:	HTL (differential) Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	2		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (A,B,90°) Encoder	A, B, (Z)
Safety Level:	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below)		

The combination HTL (A, B, 90°) + HTL (differential) is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.

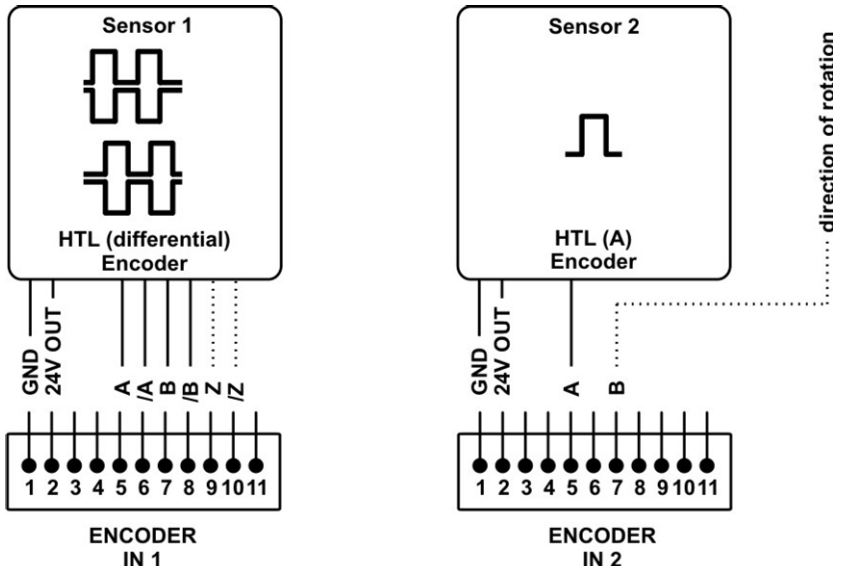


- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.7. Combination: HTL (differential) + HTL (A)

Device:	DS250		
„Op-Mode 1“:	1		
Sensor 1:	[X21 | ENCODER IN 1]:	HTL (differential) Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	3		
Sensor 2:	[X22 | ENCODER IN 2]:	HTL (A) Encoder	A
Safety Level:	Speed → SIL3 / PLe achievable (see below) * Direction → SIL3 / PLe achievable (see below) * Standstill → SIL3 / PLe achievable (see below) *		

The combination HTL (A) + HTL (differential) is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.



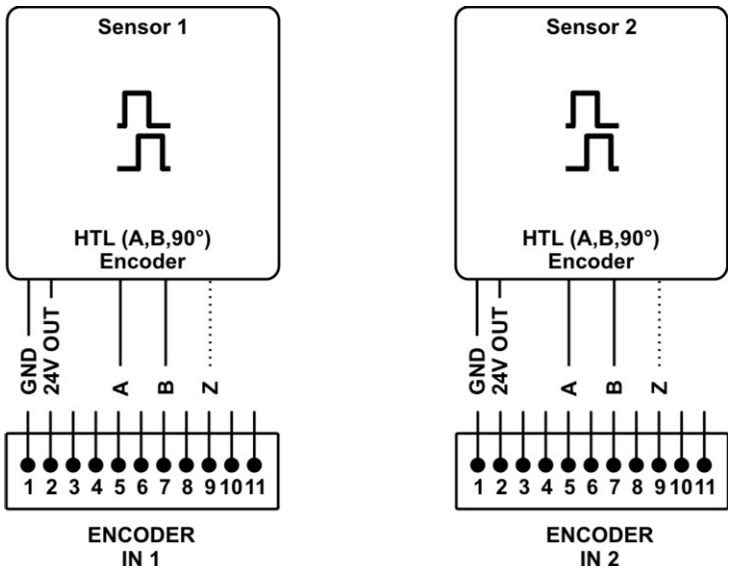
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

- For unbalanced single channel signals, the parameter “Edge 1” and “Edge 2” must be set to 1, so that a stable frequency can be detected.

*)
- To achieve a safety level with this configuration, the user must be sure that the equipment will physically be able to rotate or move in one direction only (no reversals!). This could e.g. be ensured by use of a self-locking gearbox.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

6.8. Combination: HTL (A, B, 90°) + HTL (A, B, 90°)

Device:	DS250
„Op-Mode 1“:	2
Sensor 1:	[X21 | ENCODER IN 1]: HTL (A,B,90°) Encoder A, B, (Z)
„Op-Mode 2“:	2
Sensor 2:	[X22 | ENCODER IN 2]: HTL (A,B,90°) Encoder A, B, (Z)
Safety Level:	Speed → SIL3 / PLe achievable (see below) Direction → SIL3 / PLe achievable (see below) Standstill → SIL3 / PLe achievable (see below)

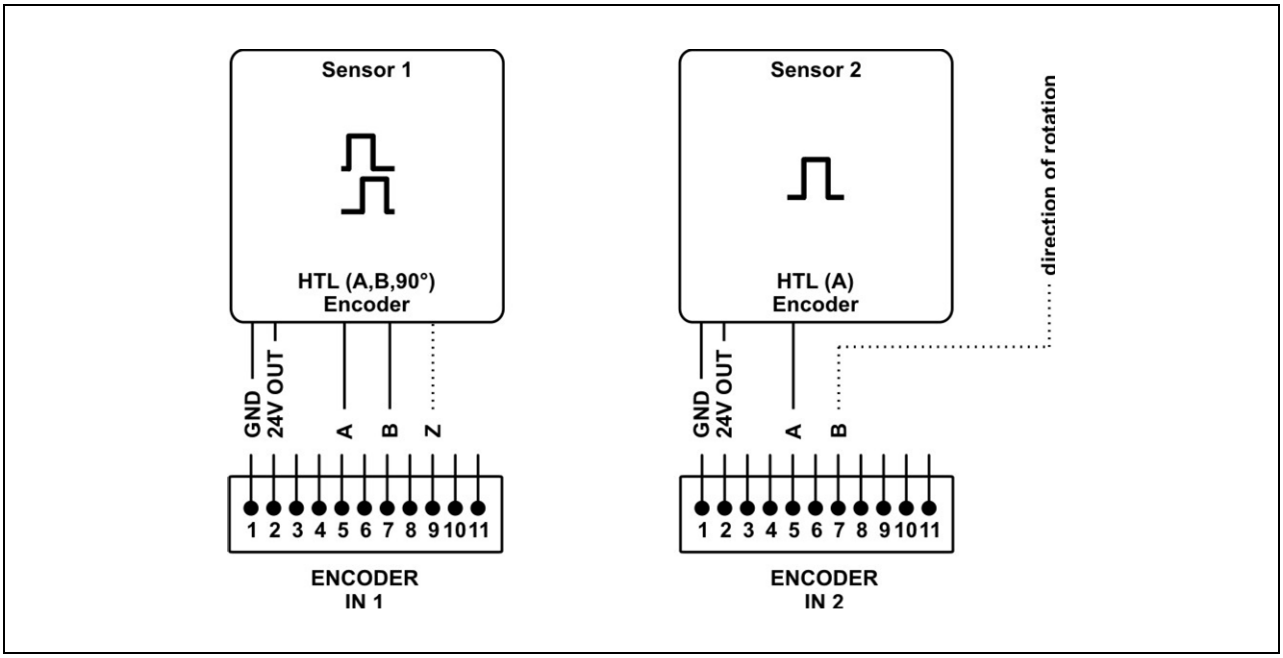


- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

6.9. Combination: HTL (A, B, 90°) + HTL (A)

Device:	DS250
„Op-Mode 1“:	2
Sensor 1:	[X21 | ENCODER IN 1]: HTL (A,B,90°) Encoder A, B, (Z)
„Op-Mode 2“:	3
Sensor 2:	[X22 | ENCODER IN 2]: HTL (A) Encoder A
Safety Level:	Speed → SIL3 / PLe achievable (see below) * Direction → SIL3 / PLe achievable (see below) * Standstill → SIL3 / PLe achievable (see below) *

The combination HTL (A) + HTL (A, B, 90°) is also possible, the sensors, the encoder supplies and the settings have to be adjusted accordingly.



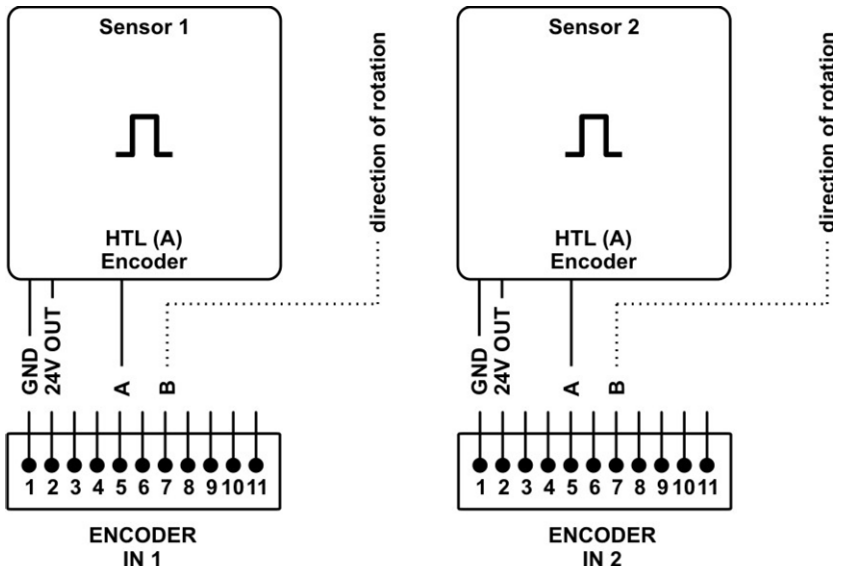
- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

- For unbalanced single channel signals, the parameter “Edge 1” and “Edge 2” must be set to 1, so that a stable frequency can be detected.

*)
- To achieve a safety level with this configuration, the user must be sure that the equipment will physically be able to rotate or move in one direction only (no reversals!). This could e.g. be ensured by use of a self-locking gearbox.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

6.10. Combination: HTL (A) + HTL (A)

Device:	DS250
„Op-Mode 1“:	3
Sensor 1:	[X21 | ENCODER IN 1]: HTL (A) Encoder A
„Op-Mode 2“:	3
Sensor 2:	[X22 | ENCODER IN 2]: HTL (A) Encoder A
Safety Level:	Speed → SIL3 / PLe achievable (see below) * Direction → SIL3 / PLe achievable (see below) * Standstill → SIL3 / PLe achievable (see below) *



- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.

- For unbalanced single channel signals, the parameter “Edge 1” and “Edge 2” must be set to 1, so that a stable frequency can be detected.

*)
- To achieve a safety level with this configuration, the user must be sure that the equipment will physically be able to rotate or move in one direction only (no reversals!). This could e.g. be ensured by use of a self-locking gearbox.
- With single channel encoders, jitter around an edge can be misinterpreted as a frequency.

7. Operation modes DS260

The following operating modes are suitable for mapping a system with a SIL2/PLd certified sensor.
The encoder tracks in the DS260 are internal bridged (two-channel structure).
The following operation modes are possible:

Sensor 1 – **SIL2 / PLd** z certified –			**Sensor 2** – internal bridged –		
Format	Required signals	Optional signals	Format	Required signals	Optional signals
RS-422	A, /A, B, /B	Z, /Z	RS-422	internal bridged	internal bridged
HTL differential	A, /A, B, /B	Z, /Z	HTL differential	internal bridged	internal bridged

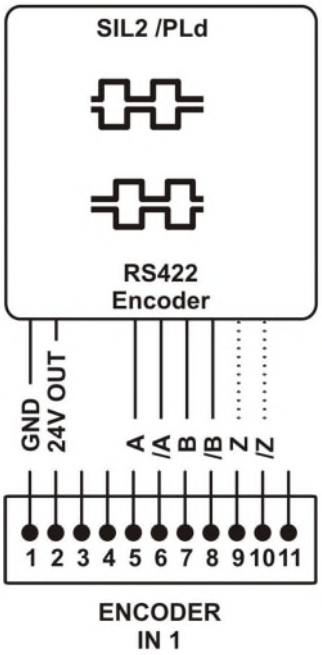
The Z or/Z track is not evaluated by the device.
Only the line breakage monitoring of the Z tracks is active.

- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.
- At the DS260, SIL2 / PLd can be reached.

7.1. Combination: RS-422 SIL2 / PLd Encoder

Device:	DS260		
„Op-Mode 1“:	0		
Sensor 1:	[X21 | ENCODER IN 1]:	SIL2 / PLd RS-422 Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	0		
Sensor 2:	[X22 | ENCODER IN 2]:	unbenutzt	(intern gebrückt)
Safety Level:	Speed → SIL2 / PLd achievable (see below) Direction → SIL2 / PLd achievable (see below) Standstill → SIL2 / PLd achievable (see below)		

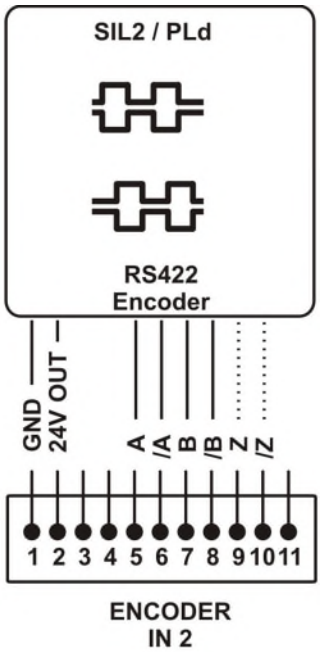
The encoder supply of the encoder can also be done over 5 V



- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.
- At the DS260, SIL2 / PLd can be reached.

7.2. Combination: HTL (differential) SIL2 / PLd Encoder

Device:	DS260		
„Op-Mode 1“:	1		
Sensor 1:	[X21 | ENCODER IN 1]:	SIL2 / PLd HTL Encoder	A, /A, B, /B, (Z,/Z)
„Op-Mode 2“:	1		
Sensor 2:	[X22 | ENCODER IN 2]:	unbenutzt	(intern gebrückt)
Safety Level:	Speed → SIL2 / PLd achievable (see below) Direction → SIL2 / PLd achievable (see below) Standstill → SIL2 / PLd achievable (see below)		



- The final Safety Integrity Level (SIL) and Performance Level (PL) depends on the selected configuration and on external components connected to the unit.
- At the DS260, SIL2 / PLd can be reached.

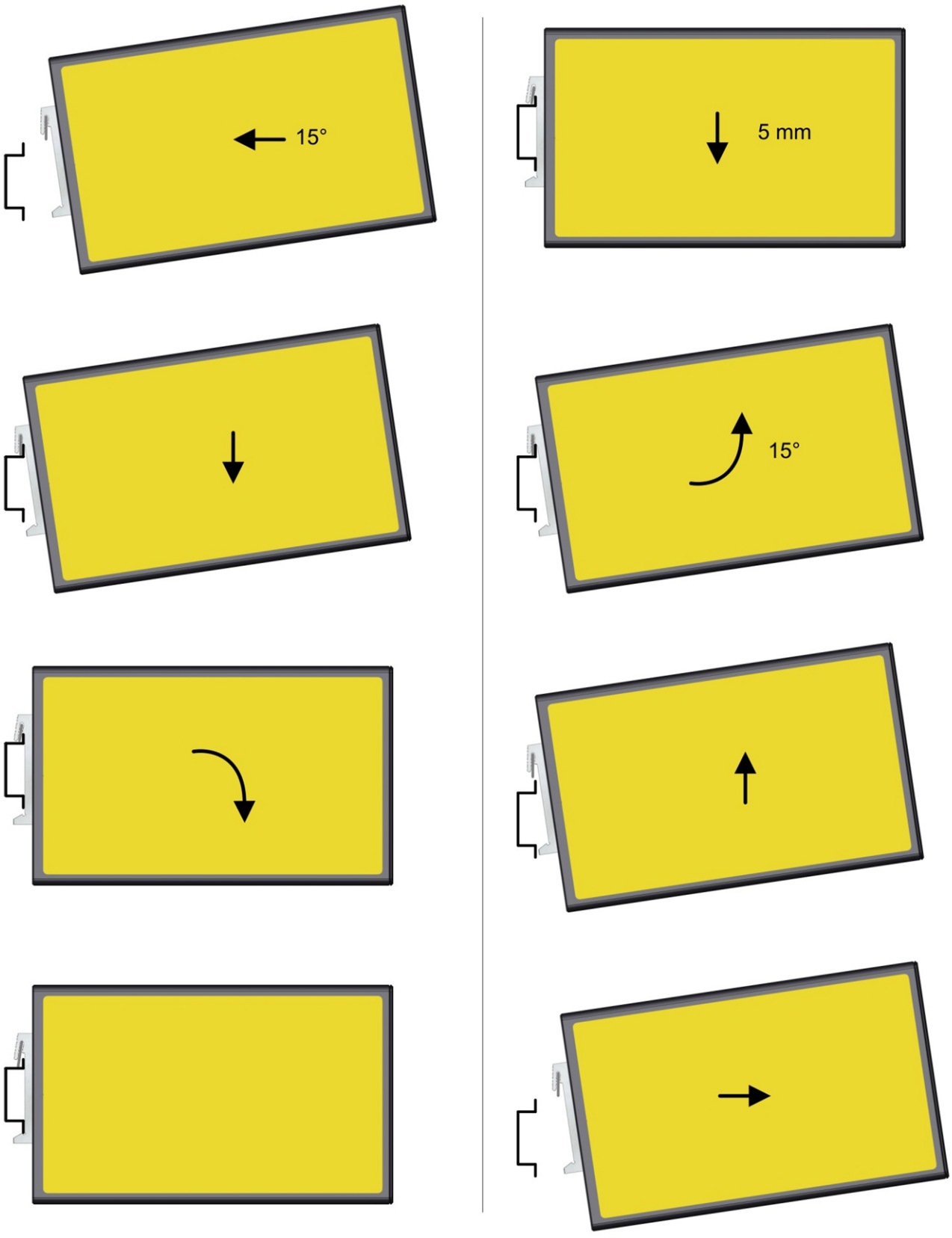
8. Commissioning

8.1. Cabinet installation

1. The unit must be in a mechanically and technically perfect condition.
2. The unit must be snapped onto a 35 mm DIN rail (according to EN 60715) by using the clip at the rear.
3. It must be ensured that the permissible environmental conditions of the specification are met accordingly.
4. All wirings must be executed in accordance with the general provisions for wiring (see www.motrona.com).
5. To choose and to connect the power supply unit, please refer to the chapter "Power Supply".
6. To choose and to connect the encoders, please refer to the chapter "Encoder Supply" and "Encoder Inputs".
7. When control inputs, digital inputs or external relays are used, please note that the configuration will take part in the final Safety Integrity Level (SIL).
8. Analog output, digital outputs as well as the splitter output are only safe, if the follower unit is capable to detect and evaluate the error states of the monitor.
9. The relay contacts at terminal [X1] and [X2] must be integrated into the safety circuit.

- In order to prevent simultaneous damages to the cables by external influences, the encoder lines or sensor lines must be kept physically separate from one another.
- Installation, commissioning and maintenance must only be performed by qualified personnel.
- In order to prevent manipulations, the machine as well as the equipment must be protected from unauthorized access.
- The machine must be securely mounted and be ready to operate.
- The safety function of the unit cannot be guaranteed before the commissioning resp. parametrization procedure has been fully completed.
- Before commissioning and parametrization, the risk situation of the system must be analyzed and all precautions must be taken accordingly. These are fundamental measures to protect persons and machinery.

8.2. Mounting / Dismounting



8.3. Preparations for Setup and Testing

In order to put the DS monitor into operation or to change settings and Parameters, the following measures must be taken:

- Connect the unit to a power supply source
- Set the DIL switch sliders 1, 2 ON and 3 to OFF (Programming and Testing Mode)
- Install the OS operating software properly on a PC and start the program
- Connect the unit to the OS operator surface via the USB port

The parameterization and testing can be performed with the help of the OS. Parameters can be changed on-the-fly and their behaviour can be verified immediately after changing. The Programming and Test-Mode contains the complete functionality of the Normal or Safety Mode, so that all tests in the Programming and Test-Mode are also valid in the Safety Mode.

The parameters “Set Frequency X“, “Action Output”, “Action Polarity” and the related commands “Set Frequency“and “Freeze Frequency” are an exeception, they are intended only for the Test Mode.
During the test the switching of the DIL-switch is not necessary to activate the parameter changes.

8.4. Parameter Setting by PC

For parameterization of the safety monitor by PC, the operator software OS is used. This software is included in delivery on CD and is also available for download from www.motrona.com. After successful installation of the operator software OS and the USB driver (see page 2) the PC can be connected to the safety monitor via USB cable.

Parameterisation with PC

All functions of the operator software OS are described in a separate manual (see page 2).

8.5. Visualization by the BG200 Operator Unit

Visualization as well as configuration of the safety device also can be done with use of the Display- and Programming Module Type BG200. This optional operator unit is primarily used for visualization and diagnosis without PC, it be used for parameter setting. The module can be simply plugging onto the front of the DS unit.

Visualization Module BG200

All functions of the BG200 display module are described in a separate manual.

9. Setup

In order to ensure proper functionality, the parameters must be set appropriate values. This section describes the most important parameters, which have to be set or checked in either case.

9.1. Operational Mode Settings

The Parameters "Op-Mode 1" and Op-Mode 2 "are determined by the used encoder. Notes on the encoder connection and the resulting "OP Modes" for Sensor 1 and sensor 2 can be read in the chapter Operating Modes DS250 or DS260.

No.	Parameter	Remark
017	„Op-Mode 1“	See chapter “Operating modes DS250” or “Operating modes DS260”.
029	„Op-Mode 2“	See chapter “Operating modes DS250” or “Operating modes DS260”. At DS260 "Op-Mode 2" must be set equal to "Op-Mode 1"!

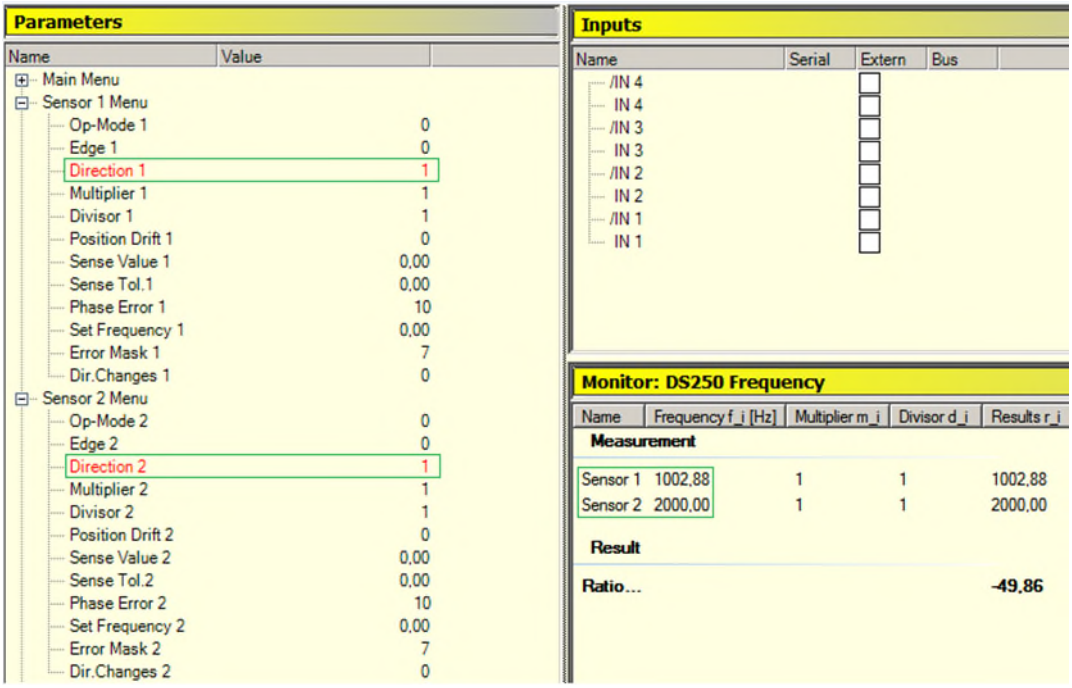
9.2. Direction Settings

In order to define the directions, the machine must move resp. turn in its working direction. As a first step, 

must be selected from the button bar of the operator screen.

The corresponding frequencies of Sensor 1 and Sensor 2 will then be indicated in the Monitor field. In case of negative frequency values, the direction must be changed by using the associated “Direction “ register in the parameter field of the corresponding sensor menu.

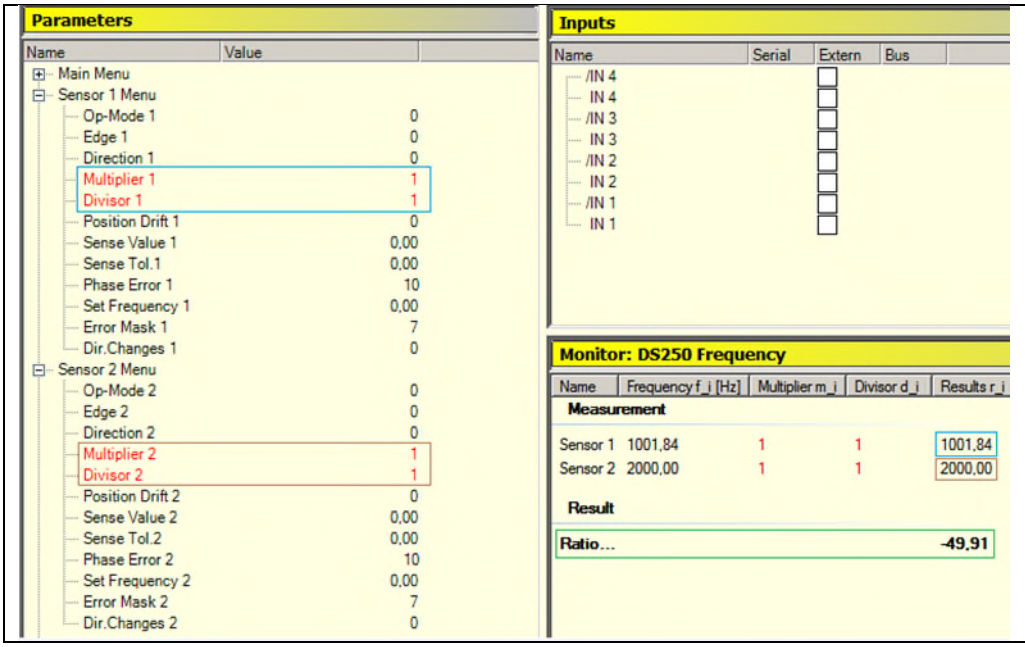
No.	Parameter	Remark
019	„Direction 1“	Select direction of rotation
031	„Direction 2“	Select direction of rotation At DS260 " Direction 2" must be set equal to " Direction 1"!



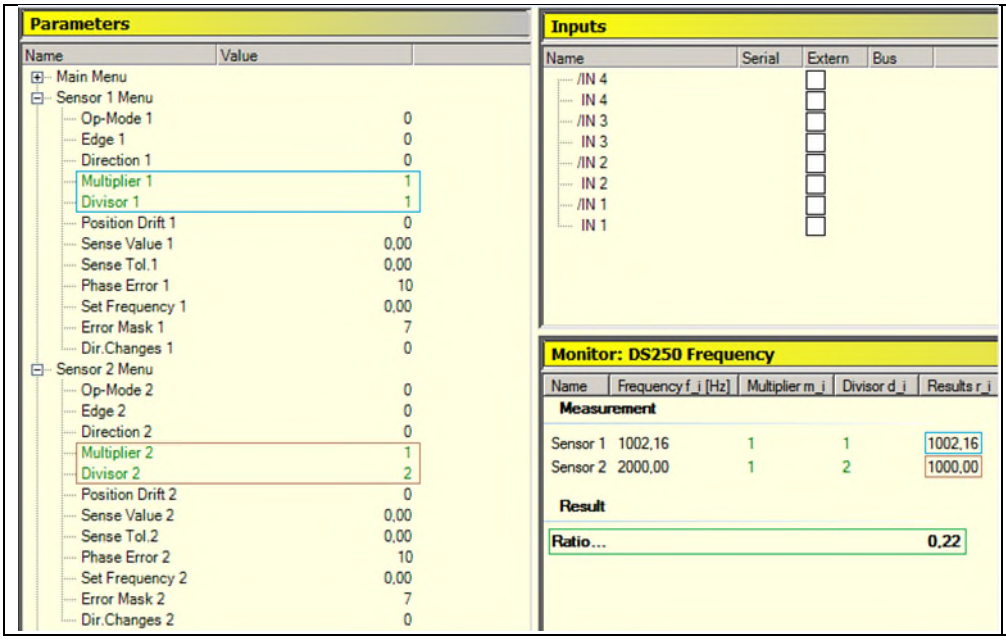
9.3. Frequency Ratio Settings

When using two sensors with different number of impulses, or in case of mechanical gear transmission ratio between both encoders, the higher one of the two frequencies must be adjusted to the lower one by corresponding setting of the scaling factors. Accurately calculated values are better than experimental results.

No.	Parameter	Remark
020	„Multiplier 1“	Proportional factor for sensor 1 For DS260, this parameter must be set to value 1!
021	„Divisor 1“	Reciprocal factor for Sensor 1 For DS260, this parameter must be set to value 1!
032	„Multiplier 2“	Proportional factor for sensor 2 For DS260, this parameter must be set to the value 1!
033	„Divisor 2“	Reciprocal factor for Sensor 2 For DS260, this parameter must be set to value 1!



In this example, the frequency 2 is greater than frequency 1 by a factor of 2.
For adjustment, parameter "Divisor 2" can be set to 2.



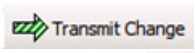
By this scaling procedure of frequency 2, internally both calculated frequencies are approximately equal and the calculated frequency ratio is close to 0.

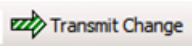
9.4. Clear Errors

After parameters „Op-Mode 1“ and „Op-Mode 1“ have been set correctly, the machine will move in working direction, with positive frequency indication of both, Sensor 1 and Sensor 2. Due to the frequency ratio setting, both frequencies are equal now, since the higher frequency has been scaled down to the lower frequency.

With the parameter “Error Simulation” the runtime test and initialization test can be set in the state field to green (green = no error, red = error). The following sequence must be followed.

At this time, the indication boxes “Runtime Test” and “Initialization Test” in the State field can be set to green (green = no error, red = error). For this purpose, the following sequence of operations must be observed:

- Set “Error Stimulation” to 2 and press 

- Set “Error Stimulation” back to 1 and press again 

Now, all State boxes, except the DIL switch States (S1.X) should light green.

If a runtime error is triggerd again, please press 

of the button bar to find out more details about this error.

More information about errors can be found in the chapters “Runtime Test” and “Initialization Test”.

Error	Remark
Digital Input Error	If a Digital Input Error appears again after deleting without changing the input signal, check the setting of parameter “Input-Mode” and the signal status (High/Low) at the input. If a Digital Input Error appears, when changing the input signal, check the setting of parameter „GPI Err Time“.
Sense Error	A Sense Error appears when the monitored voltage at the PWR sense input differs from the programmed values. If the fault persists, the actual current voltage should be measured directly at the input and the programmed tolerance range may be increased.
Encoder Line Error	An Encoder Line Error appears when an error is detected in differential HTL or RS-422 input signals, but the parameters Error Mask 1 and 2 must be set to match. If the error persists, the signals should be checked for switching, short-circuiting or demolition.
Frequency Error	If a Frequency Error appears at normal rotation speed, check the rotation direction and the ratio of the two encoders (see chapter “Direction Settings” and “Frequency Ratio Setting”). If the Frequency Error still appears, the rotations speeds are too different for a temporary or longer period of time. In case of temporary deviations, change the parameter settings of “Sampling Time” and “Filter” for smoothing the frequency or set the parameter “Div.Filter” to a higher value. In case of continual deviations, the permissible deviation can be increased by the parameter “Div %-Value”. In case of deviations in the low-frequency range, adjust the parameters „Div. f-Value“ and„Div. Switch“%-f“.
Position Error	If a Position error appears at normal rotation speed, check the rotation direction and the ratio of the encoders (see chapter Direction Settings and Frequency Ratio Setting). If the Position Error still appears, the encoder positions diverge. In this case, check the maximum permissible deviation of the encoder positons and adjust the parameter „Div. Inc-Value“. Do not use the Position comparison, when the encoders slip or no comparison is possible.

9.5. Sampling Time and Fliter

All **State** boxes (except DIL switch States S1.X) light green at this time. Now please select 

in the button bar. We must determine the operating range of the unit, comprising the frequency range from the lowest switching point to the highest switching point:

1. Find out, which of the sensor frequencies shows the highest instability and fluctuation.
2. Move through the frequency range and find out the point of maximum fluctuating. In general this will be around the lowest switching point (underspeed or frequency band).
3. The frequency can be smoothed by use of parameter "Sampling Time" and parameter "Filter". Higher settings result in smoother running, but increase the response time and the fault detection time.
4. A combination of Sampling Time and Filter achieve the best result for smoothing the complete frequency range of input frequencies. Frequencies out of the Sampling Time, regarding to lower frequency range, are smoothed by the parameter Filter.
5. Only exceptionally you should set the Sampling Time to smoothen frequencies below the lower switch point setting (under speed or frequency band).
6. The Sampling Time and the Filter setting may also affect the signal variation on the analog output.
7. The settings can be verified at the **"Monitor DS250 Frequency".**

No.	Parameter	Remark
000	"Sampling Time"	Control of frequency fluctuation
013	„Filter"	Control of frequency fluctuation

9.6. Wait Time

The Wait Time parameter defines the frequency below which all frequencies will be taken as zero. Setting of e.g. 1.0 second will result in zeroizing all frequencies lower than 1 Hz. In this context it must be clarified whether the application requires a standstill- or drift-monitoring or not.

1. Where the application does not require any standstill or direction or drift control, you are free to set Standstill Time with regard of the expected minimum frequency and the required response time only.
2. Where the application uses standstill control, please observe also possible jitter during standstill and adjust Wait Time correspondingly.
3. Where the application uses forward/reverse direction control, also possible jitter should be considered while the system holds in closed loop position control.

No.	Parameter	Remark
001	"Wait Time"	Adjust the zero balancing window

9.7. F1-F2 Selection

This parameter is used to determine the base frequency. When the original frequency of sensor 1 is higher than the original frequency of sensor 2, the parameter F1-F2-Selection is set to 0, otherwise to 1. The higher frequency is used to set the switching points, because it is more stable.

No.	Parameter	Remark
002	„F1-F2 Selection"	When Frequenz 1 > Frequenz 2, parameter is set = 0 (F1 selected). When Frequenz 2 < Frequenz 1, parameter is set = 1 (F2 selected).

9.8. Divergence Parameters

The parameter "Div.Mode" defines the type of comparison: Frequency Comparison or Position Comparison. The setting of this parameter affects only the error detection.
If the frequency ratio cannot be adjusted accurately, do not use the Position Comparison caused by cumulative position increments. If the encoders slip, Frequency Comparison has to be preferred.
At DS260 the position comparison can generally be used, since only one encoder is connected here.

No.	Parameter	Remarks
003	„Div. Mode"	Type of comparison of encoder inputs
004	„Div. Switch %-f"	Frequency threshold
005	„Div. %-Value"	Percentage of frequency deviation above the Div.Switch %.
006	„Div. f-Value"	Absolute frequency deviation (Hz) below the Div. Switch %-f threshold
007	„Div. Calculation"	0
008	„Div. Filter"	Filter (OFF = 0, MEDIUM = 5, HIGH = 10)
009	Div. Filter Time	Max. filter time for "Div. Filter"
010	„Div. Inc-Value"	Max. incremental deviation

Divergence parameters are relevant even for the DS260 devices, since also with only one SIL2 encoder frequency or position is splitted into two channels, where asynchronism during changes of the frequency may cause frequency divergence. Using DS260 position deviation has to be preffered.

9.8.1. Frequency comparison:

These parameters defines the maximum permissible frequency deviation between sensor 1 and sensor 2, based on percentaged values of Div Calculation. Parameter Div. Switch %-f defines the frequency threshold below which deviations are taken as absolute values, and above which deviations are taken as percentage. When the absolute difference of frequencies exceeds the setting of Div. f-Value below the threshold setting, a frequency error will be triggered. When the percentaged difference exceeds the setting of Div. %-Value above the threshold setting, also a frequency error will be triggered. Parameter Div. Filter provides an option for suppression of short-duration errors.

1. The facility of setting a frequency threshold provides suppression of possible frequency errors caused by jerking in the startup phase.
2. The threshold setting must be below the lower switchpoint setting (underspeed or frequency band).
3. It is an individual issue of the actual application to fix the deviation values under normal operating speed and under startup conditions that should trigger a frequency error signal.
4. Where no standstill nor drift nor direction control is needed, the frequency threshold can also serve as trigger threshold for error activation, by increasing the setting of Div. f-Value correspondingly (see 3.)
5. Where the application uses standstill control, possible jitter during closed-loop standstill should be observed to adjust Div. f-Value correspondingly.
6. Where forward/reverse direction control is used, please also observe possible jitter during standstill for best setting of Div. f-Value.

9.8.2. Sensor Position Comparison:

This parameter defines the maximum permissible position deviations between sensor 1 and sensor 2. Parameter DIV. Inc Value defines the position threshold. If deviation exceeds this threshold a frequency error will be triggered. This position threshold is implemented independent of the direction of rotation. If parameter DIV.Inc Value is set to zero, no error massage will be applied.

9.9. Power-up Delay

After initialization, Power-up Delay defines a retardation time before the unit takes the normal control state.

1. During this delay time, the unit will not take care of any errors
2. The delay is important to allow the encoder signals to stabilize after power up.
3. In case of indirect encoder connection, the retardation must also include the switching time of the relays.
4. In case of different power-up times of the parts and components, adaption can be achieved by the retardation time settings.

No.	Parameter	Remarks
012	Power-up Delay	Delay time after power on

9.10. Encoder Splitter Output

The signal (A, /A, B, /B, Z, /Z) from sensor 1 or sensor 2 is emitted, regardless of the input configuration. With the parameter "Split. Level", the output voltage (5V or 24V) can be set. The parameter "Split. Selector" determines whether the signal from sensor 1 or sensor 2 is emitted. Signal and inverted signal are always available, even if the inverted signal is not connected at the input.

No.	Parameter	Remark
214	„Split. Level"	Setting the output voltage
215	„Split. Selector"	Sensor 1 is output = 0, sensor 2 is output = 1

- If the parameter "Split. Level " is set incorrectly, the following device connected to the encoder output can be damaged.

9.11. Analog Output

In case of an unused analog output the output terminals must be bridged. The parameters "Analog Start" and "Analog End" are related to the frequency which is selected by the "F1-F2 Selection" register. The "Analog Gain" setting should be changed only in exceptional cases (e.g. for limitation of the upper current value). The "Analog Offset" parameter serves for fine adjustment.

1. Fluctuation of the analog output signal can be reduced by corresponding setting of Sampling Time and Filter.
2. With very small span (between "Analog Start" and "Analog End") the analog output signal can become stepped due to the low frequency resolution.
3. "Analog Start" and "Analog End2 operate under control of F1-F2 Selection.

Nr.	Parameter	Remark
216	„Analog Start"	Input frequency to produce output of 4 mA
217	„Analog End"	Input frequency to produce output of 20 mA
218	„Analog Gain"	(change only in exceptional cases)
219	„Analog Offset"	Zero Point fine adjustment

9.12. Control Output Settings

The configuration of the control outputs will affect the Safety Integrity Level (SIL).

1. Switching points are affected by the F1-F2 Selection setting
2. Output flattering caused by unstable frequencies must be eliminated by corresponding setting of a hysteresis.
3. No hysteresis setting is required with self-sustaining outputs.

No.	Parameter	Remark
041 – 060	Presel.OUT1.XX	Setting the switching points for OUT 1
061 – 080	Presel.OUT2.XX	Setting the switching points for OUT 2
081 – 100	Presel.OUT3.XX	Setting the switching points for OUT 3
101 - 120	„Presel.OUT4.XX	Setting the switching points for OUT 4
141 - 185	Switching Menu	Definition der Schaltbedingungen für die Ausgänge

9.13. Relay Output Settings

The relay contacts must be embedded into the safety circuit.

1. Switching points are affected by the F1-F2 Selection setting
2. Output flattering caused by unstable frequencies must be eliminated by corresponding setting of a hysteresis.
3. No hysteresis setting is required with self-sustaining outputs.
4. It is mandatory to assign the most important and essential of all safety functions to the relay output.

No.	Parameter	Remark
121 - 140	Presel REL1.XX	Setting of the tripping points
141 - 185	Switching Menu	Definition of switching conditions for the relay

9.14. Control Input Settings

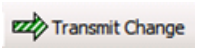
The configuration of the control inputs will affect the Safety Integrity Level (SIL).

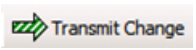
1. With 2-pole control inputs please observe possible difference with regard of the transition times.
   Parameter "GPI Err Time" defines the permissible delay time during illegal conditions.
2. With 1-pole clocked inputs the static triggering characteristics (low/high) should be adapted to the dedicated command according to safety requirements.

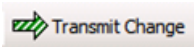
No.	Parameter	Remark
186 - 207	Control Menu	Configuration if the inputs

9.15. Producing an Error

After setting of all relevant parameters an error can be produced for testing purpose. This conduces to force all outputs of the device into the error state and to check function and behavior of the follower units.

- Set the device in error state:
  Set parameter „Error Stimulation“ to 0 and activate 

- Delete/Reset Error state:
  Set parameter „Error Stimulation“ to 2 and activate 

- Set the unit back to normal operation:
  Set parameter „Error Stimulation“ to 1 again and activate 

While in Error State, the safety monitor acts as follows:

- The analog output signal is set to 0 mA
- The relay contact is open (both contacts)
- The control outputs are in LOW state
- The traces of the encoder splitter output are in LOW state.

It is important to check for proper detection of these error indications on site of the target units connected to the monitor.

10. Completion of the Setup Procedure

Finally, all application-specific parameters should once more be reviewed for correctness and plausibility. The safety-relevant relay output falls back to its open state when an error occurs or when the programmed switching condition occurs. Of course the contact is also open in powerless state of the unit. It is mandatory to check the safety behavior of the monitor and all connected follower units carefully.

The following items must be verified:

- Plausibility of the encoder frequencies
- Sense of rotation and proper scaling of the encoder frequencies
- Plausibility of the frequencies themselves
- Correct settings of all necessary parameters
- Plausibility of the parameter settings
- Frequency and level of encoder splitter output
- Detecting the failure at the encoder splitter output
- Control of the analogue output in relation to the frequency range
- Detecting the failure at the analogue output
- Control of the digital outputs
- Detecting the failure at the digital outputs
- Control of the double relay output
- Detecting the failure at the double relay output
- Switching points with regard to correct comportment
- Response times and related parameter settings
- Control inputs regarding proper function and comportment

It is on the responsibility of the operator to ensure that all relevant parts of the whole installation pass over to a safe state as soon as the relay contact of the safety monitor opens.

After commissioning (parameterization and testing), the Programming Mode of the unit must be left by setting slider 3 of the DIL switch back to its ON position. Please observe that for normal operation of the monitor always all 3 sliders of the DIL switch must be set to ON.

- Programming Mode (DIL switch setting) must only be used for Start-up (parameterization and testing)
- Set all DIL switch positions to ON after Start-up
- Protect the DIL switch against later manipulation after conclusion of the Start-up procedure (e. g. by covering with the supplied adhesive tape)
- Normal operation is only permitted while the yellow LED is permanently OFF

11. Error Detection

In order to ensure a maximum of operational safety and reliability, the Safety Monitors are equipped with several and profound monitoring-functions. This monitoring allows immediate recognition and messaging of possible failures and malfunctions.

In case of errors:

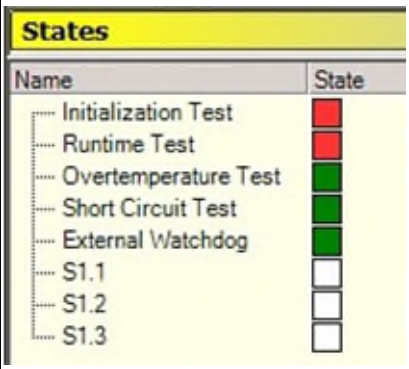
- The relay contact switches to its open (safety) condition (interruption of the safety circuit)
- The analog output sets to 0 mA (which is out of the regular operating range of 4 … 20 mA)
- All control outputs are set to LOW. No more inversion between OUTx and /OUTx (Attention in case of homogenous configuration!)
- Encoder splitter output does not provide any incremental signals (tri-state with pull-down termination)

The following types of error recognition are distinguished:

- Initialization Test Error
- Runtime Test Error

Both error types are described in detail on the following pages.

11.1. Error Representation

Error Representation	Reference
Front LED's	Yellow LED lights continuously
BG200 Operator Unit	The bottom line displays the error when the BG200 is not in the programming mode
Operator surface OS	Initialization Test = red (State field) Runtime Test = red (State field) 

11.2. Initialization Test

These self-monitoring tests are processed automatically when switching the unit on.

Error code BG200	Error OS operator software	Instruction
H' 0000 0001	ADC Error	Internal error
H' 0000 0002	I2C Error	Internal error
H' 0000 0004	OTH Error	Check the BG200 power supply or the encoder supply or internal error
H' 0000 0008	SCI Error	Internal error
H' 0000 0010	DIO Error	Check the digital outputs for short circuit resp. other errors or internal error
H' 0000 0020	GPI Error	Check the connections of the digital inputs and the input configuration or internal error
H' 0000 0040	CAP Error	Internal error
H' 0000 0080	SPI Error	Check the connections of the analog output or internal error
H' 0000 0100	QEP Error	Check the separation or disconnection of the encoder supply at Self-Test or internal error
H' 0000 0200	SCO Error	Check splitter output or internal error
H' 0000 0400	CPU Error	Internal error
H' 0000 0800	RAM Error	Internal error
H' 0000 1000	WDO Error	Internal error
H' 0000 2000	EDM Error	Error in EDM Selftest, ceck connected contactor or relay
H' 0000 4000	FLA Error	Internal error
H' 0000 8000	PRG Error	Adjust and save the parameter set or internal error
H' 0001 0000	POE Error	Saved error active, error must be erased before the device is re-connected.*

For all error messages, the following applies:
Switch the unit OFF and ON again.
If the error message continues, please contact the manufacturer of the unit.

If a Poe error is triggered during the initialization phase, the activated Power-up error will also trigger a run time error, regardless the cause is still there. The deletion sequence can be found in the parameter description under the parameter "Power-up error".

11.3. Runtime Test

These internal monitoring procedures run automatically and continuously in the background:

Error code BG200	Error Message on PC (Operator Software OS)	Instruction
H' 0000 0001	Sense Error 1	Incorrect voltage value at PWR sense input X21 [4] or internal error
H' 0000 0002	Sense Error 2	Incorrect voltage value at PWR sense input X22 [4] or internal error
H' 0000 0004	Encoder Supply Error	Short circuit resp. faulty circuit for encoder supply or BG supply or internal error
H' 0000 0008	Position Error	Position error detected Parameter "Div. Mode" = 1, 2
H' 0000 0010	Encoder Line Error 1	Error in encoder tracks at X21 or internal error
H' 0000 0020	Encoder Line Error 2	Error in encoder tracks at X22 or internal error
H' 0000 0040	EDM Error	Error when controlling or rereading the external relay or internal error
H' 0000 0080	Sensor Overlap Error	Error in sensor cover
H' 0000 0100	Temperature Error	Impermissible high temperature
H' 0000 0200	Digital Output Error	Short circuit resp. faulty circuit at the control outputs or internal error
H' 0000 0400	Analog Error	Open analog output ł
H' 0000 0800	Relais Output Error	Relay control error, contact readback error
H' 0000 1000	Direction Error	Too many change of direction, possibly a encoder track torn off
H' 0000 2000	Digital Input Error	Illegal transition state at the inputs
H' 0000 4000	Signal Error 1	n.a.
H' 0000 8000	Signal Error 2	n.a.
H' 0001 0000	Phase Error 1	Illegal signal change at Encoder 1
H' 0002 0000	Phase Error 2	Illegal signal change at Encoder 2
H' 0004 0000	Frequency Error	Frequency error F1 ≠ F2 Parameter Div. Mode = 0, 2
H' 0008 0000	Drift Error 1	Drift error at Encoder 1
H' 0010 0000	Drift Error 2	Drift error at Encoder 2
H' 0020 0000	Internal Error (ESM)	Internal error
H' 0040 0000	Undervoltage Error	Under Voltage detected
H' 0080 0000	Wrong Parameter Error Simulation	Parameter "Error simulation" ≠ 1 for DIL-switch setting "Normal operation"
H' 0100 0000	Internal Error (REG)	Internal Error
H' 0200 0000	Internal Error (CYC)	Internal Error
H' 0400 0000	Internal Error (CLK)	Internal error
H' 0800 0000	Wrong Parameter Setting	Frequency too high for parameter setting "Sampling Time" (overflow) or ramp time set too high

Continuation „Runtime Test“:

Error code BG200	Error Message on PC (Operator Software OS)	Instruction
H‘ 1000 0000	Internal Error (ADC)	Internal error
H‘ 2000 0000	Internal Error (I2C)	Internal error
H‘ 4000 0000	Initialization Test Error	An initialization test error has been detected (see chapter “Initialization Test”)

With all error messages, the following applies:
Switch the unit OFF and ON again. If the error message continues, please contact the manufacturer of the unit.

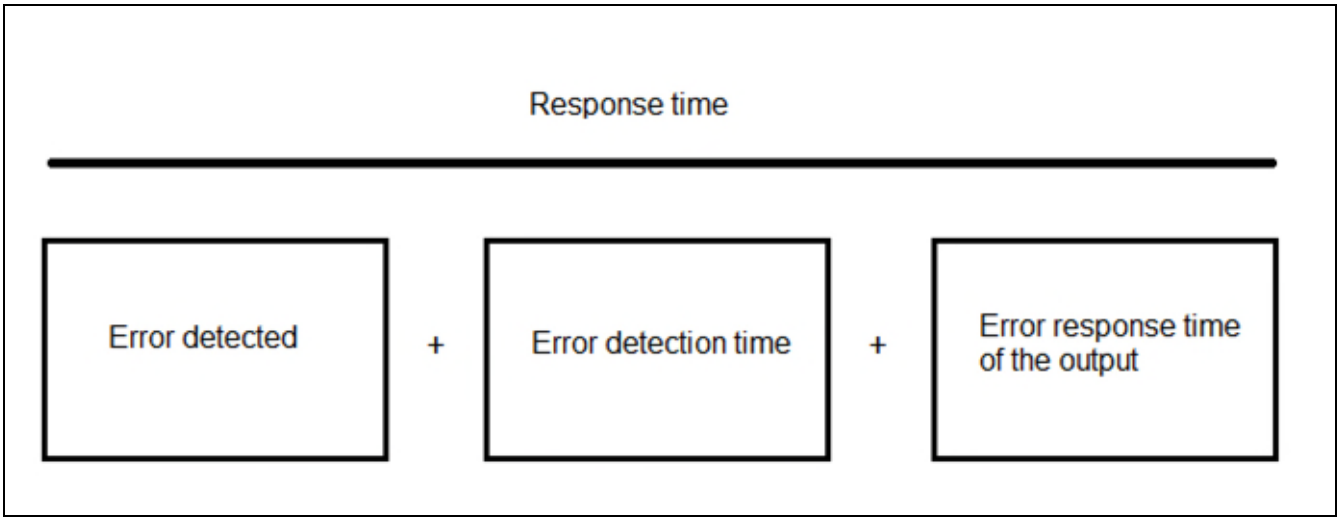
If a Poe error is triggered during the initialization phase, the activated Power-up error will also trigger a run time error, regardless the cause is still there. The deletion sequence can be found in the parameter description under the parameter "Power-up error”.

11.4. Error Clearing

Error states can generally be cleared by switching power off and on again (after the cause of the error has been removed). During commissioning only, errors can also be cleared as described under chapter “Setup / Clearing Errors”. If a Poe error is triggered during the initialization phase, the activated run time error is also raised, regardless the cause is still there. The deletion sequence can be found in the parameter description under the parameter "Power-up Error”

11.5. Error Detection Time

Basically it is not possible to specify an accurate error detection time, since times depend on many factors and error reasons. The time period until a frequency error is detected is another such as for example an analogue error. For simplification, it can be assumed that the errors are detected after 85 ms plus the tripping time. As an exception of this, detection of frequency errors could also take longer, since these times are related to the input frequency and to parameter settings. Typical respond times for various outputs and for frequency errors can be found in chapter “Response time”.



The error detection time depends (amongst others) on the following factors:

- Type of error
- Parameter settings
- External events and actions
- Tnternal events and actions
- Respond time of the output

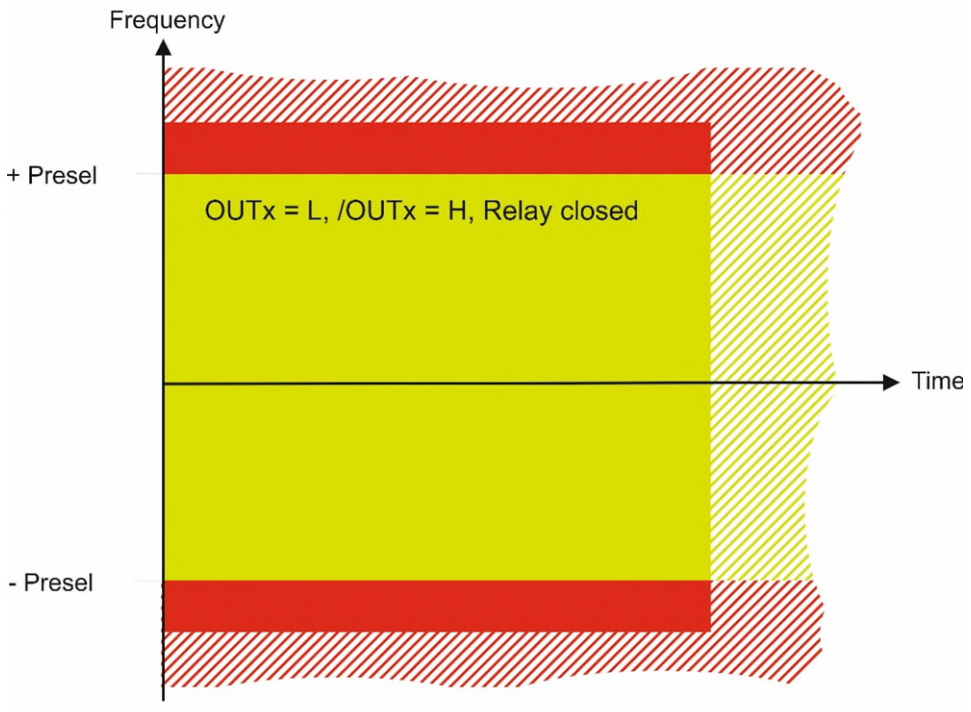
12. Monitoring Functions

The monitoring functions are used to set the properties of digital outputs and relay output.

12.1. Overspeed (Switch Mode = 0)

With parameter setting "Switch Mode" = 0, the frequency is monitored for overspeed.
The function is always active and independent of the direction of rotation. The switching point for overspeed is always at Frequency = Presel (no matter if with or without hysteresis).

Relevant Parameters	Remark
Switch Mode XXXX	= 0
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	hysteresis
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)



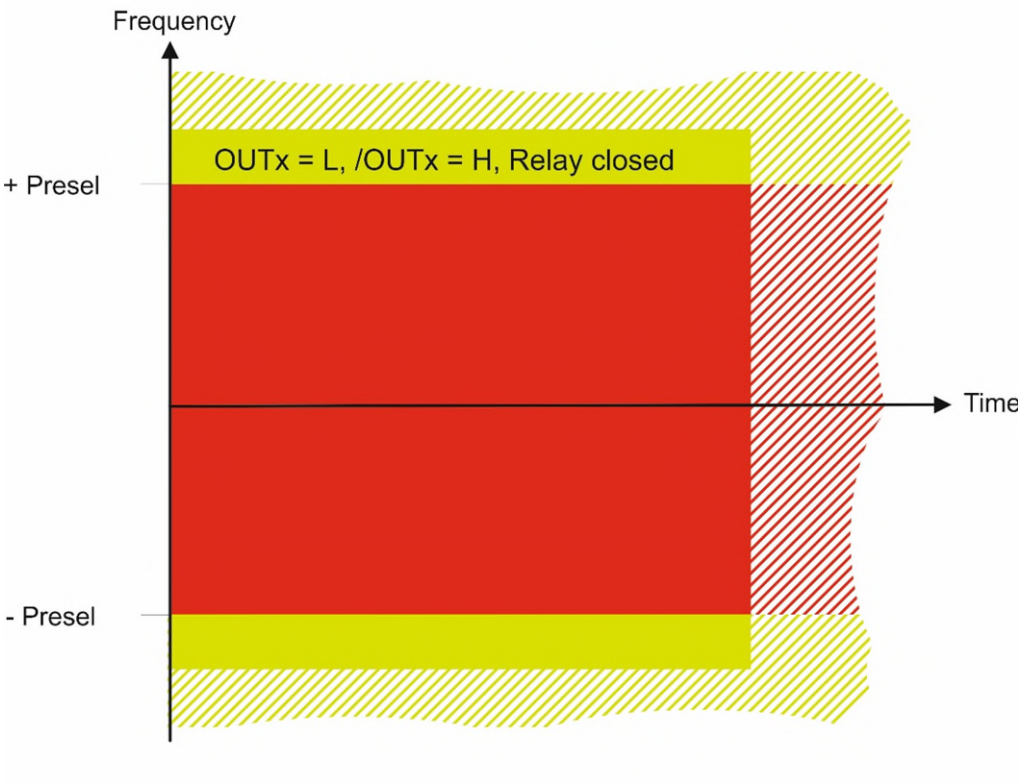
Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

Example:
With Presel = 1000.0 Hz and Hysteresis = 10 %, frequencies $|f| \geq 1000$ Hz are detected as overspeed. The overspeed output will be cleared with frequencies $|f| < 900$ Hz.

12.2. Underspeed (Switch Mode = 1)

With parameter setting "Switch Mode" = 1, the frequency is monitored for underspeed.
The function is always active and independent of the direction of rotation. The switching point for underspeed is always at Frequency = Presel (no matter if with or without hysteresis).

Relevant Parameters	Remark
Switch Mode XXXX	= 1
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	hysteresis
Startup Mode	type of start-up-delay
Startup Output	assignment of the outputs for start-up delay
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)



Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	When lock function is active only
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

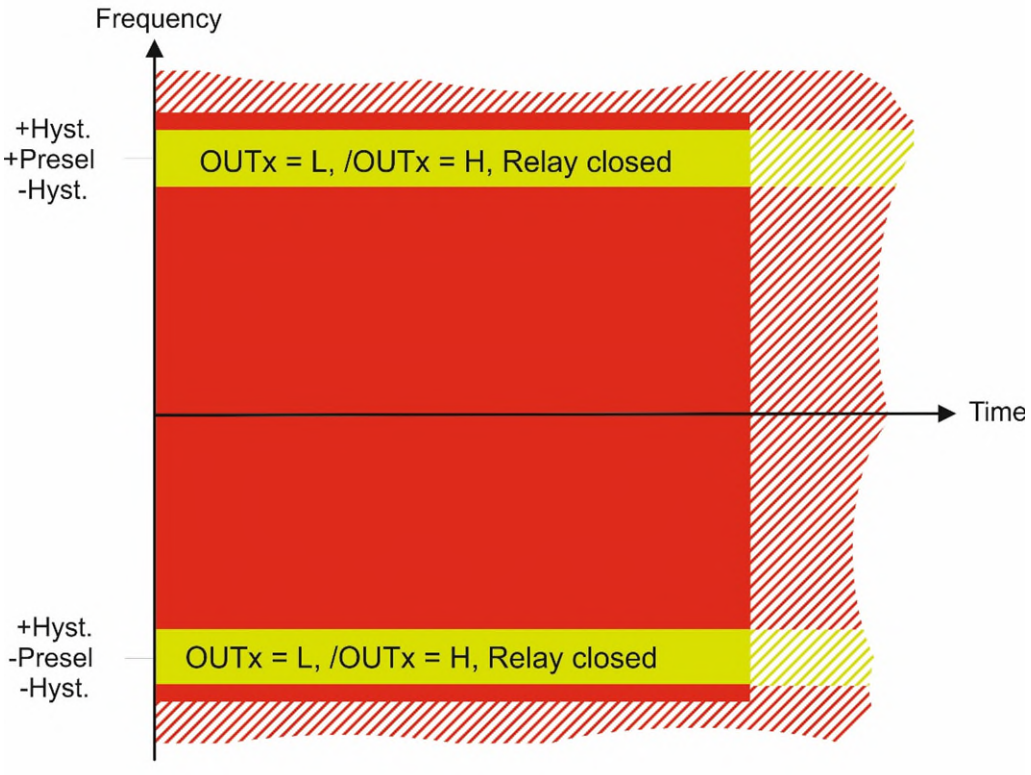
Example:

With Presel = 1000.0 Hz and Hysteresis = 10 %, frequencies |f| < 1000 Hz are detected as underspeed. The underspeed output will be cleared with frequencies |f| > 1100 Hz.

12.3. Frequency Band (Switch Mode = 2)

With parameter setting "Switch Mode" = 2, the frequency is monitored within a frequency band. The function is always active and independent of the direction of rotation. The switching points of the band are located at Presel +/- Hysteresis.

Relevant Parameters	Remark
Switch Mode XXXX	= 2
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	+/- range (center)
Startup Mode	type of start-up delay
Startup Output	output assignment for start-up delai
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	center
Delay XXXX	shutter release delay
Input Mode X	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	Max. permissible delay time during illegal conditions



Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

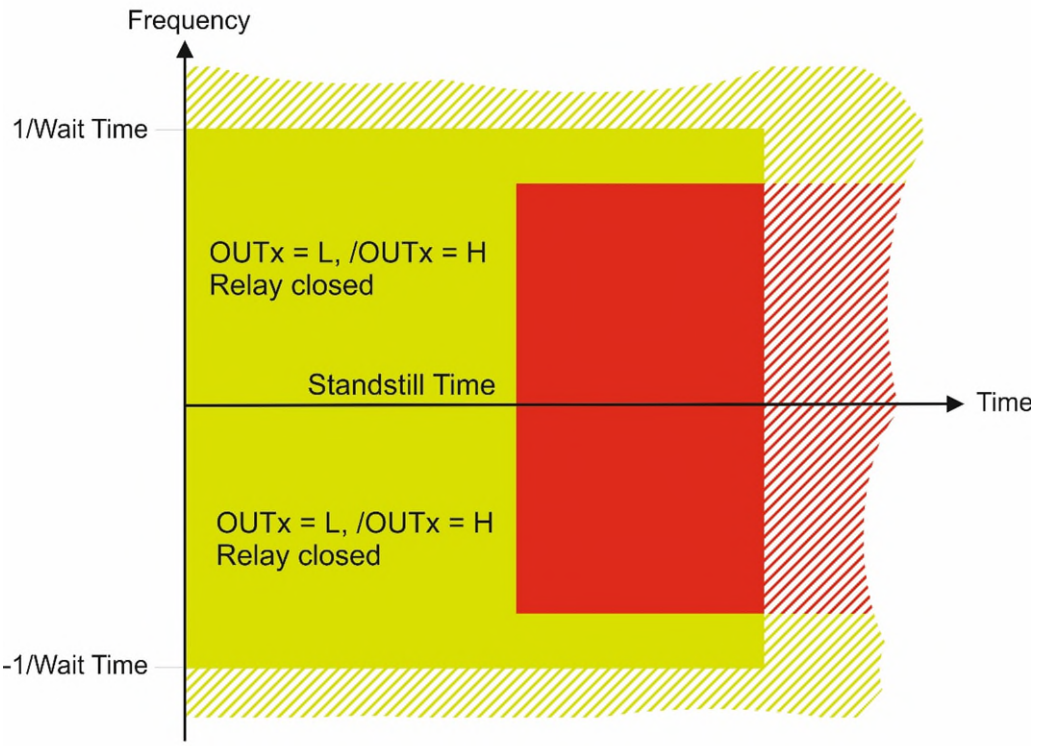
Example:

With Presel = 1000.0 Hz and Hysteresis = 10 %, frequencies |f| < 900 Hz are detected as underspeed and frequencies |f| > 1100 Hz as overspeed.

12.4. Standstill (Switch Mode = 3)

With parameter setting "Switch Mode" = 3, the frequency is monitored for standstill. The function is always active. The output is set after detection of frequency 0 Hz and expiration of the standstill time. When a frequency different from zero is detected, the output will be reset. Parameter "Wait Time" determines the threshold under which a frequency is taken as zero.

Relevant Parameters	Remark
Switch Mode XXXX	= 3
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Standstill Time	standstill time in x seconds
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)



Relevant input functions	Remark
none	none

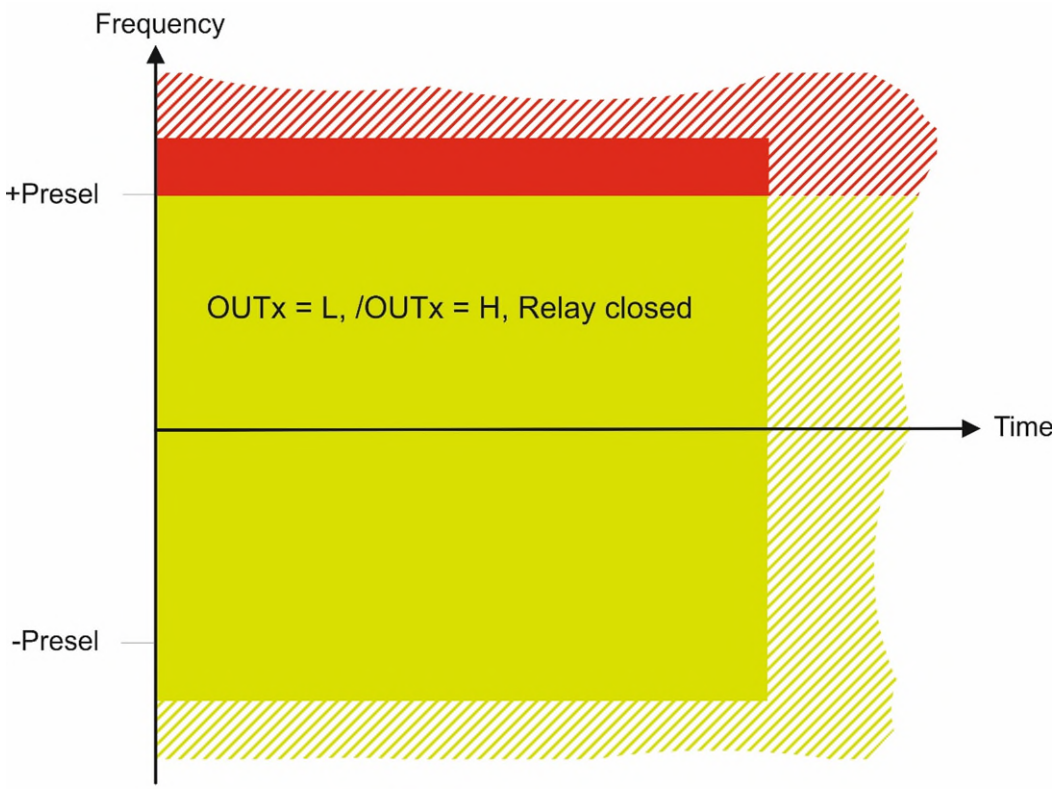
Example:

With a Wait Time setting of 0.01 seconds, all frequencies < 100 Hz will be taken as zero (f = 0).
The expiration of Standstill Time starts as soon both channels report 0 Hz. When this time has expired and both frequencies are still 0 Hz, the standstill output will be set. As soon one of the two frequencies becomes different from zero again, the standstill output will be reset.

12.5. Overspeed (Switch Mode = 4)

With parameter setting "Switch Mode" = 4, the frequency is monitored for overspeed.
The function is always active and considers the direction of rotation. The switching point for overspeed is always at Frequency = Presel (no matter if with or without hysteresis). If hysteresis is used, only positive Presel. values are allowed.

Relevant Parameters	Remark
Switch Mode XXXX	= 4
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	hysteresis
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)



Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

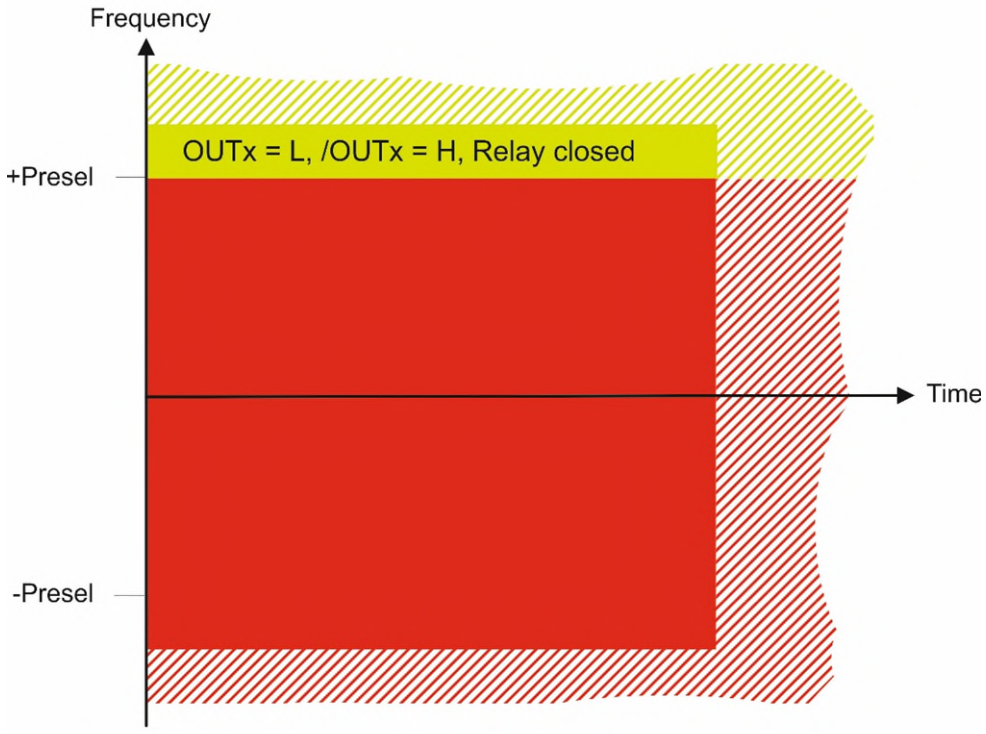
Example:

With Presel = 1000.0 Hz and Hysteresis = 10 %, Frequencies f ≥ 1000 Hz are declared as overspeed.
The overspeed output will be cleared with frequencies f < 900 Hz.

12.6. Underspeed (Switch Mode = 5)

With parameter setting "Switch Mode" = 5, the frequency is monitored for underspeed.
The function is always active and considers the direction of rotation. The switching point for underspeed is always at Frequency = Presel (no matter if with or without hysteresis). If hysteresis is used, only positive Presel. values are allowed.

Relevant Parameters	Remark
Switch Mode XXXX	= 5
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	hysteresis
Startup Mode	type of start-up delay
Startup Output	output assignment for start-up delay
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function"	function of the control input
IN Config"	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)



Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

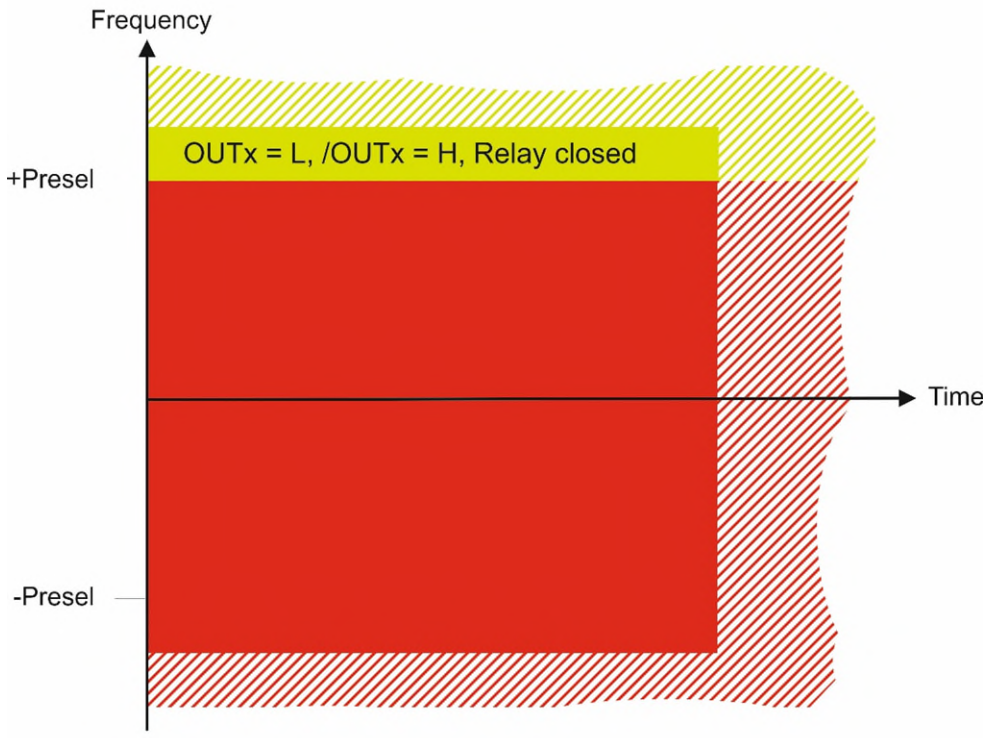
Example:

With Presel = 1000.0 Hz and Hysteresis = 10 %, frequencies f < 1000 Hz are declared as underspeed. The underspeed output will be cleared with frequencies f > 1100 Hz.

12.7. Frequency Band (Switch Mode = 6)

With parameter setting "Switch Mode" = 6, the frequency is monitored within a frequency band. The function is always active. The switching positions inside the frequency band are at Presel +/- Hysteresis. Only positive Presel values are allowed.

Relevant Parameters	Remark
Switch Mode XXXX	= 6
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Hysteresis XXXX	+/-range from the center point (Presel. Value)
Startup Mode	type of start-up delay
Startup Output	output assignment for start-up delay
Lock Output	lock function
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	center
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	Max. permissible delay time during illegal conditions



Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	When lock function is active only
Switchover switching points, e.g. parameter „IN2 Function" = 13	Only when switchover is active

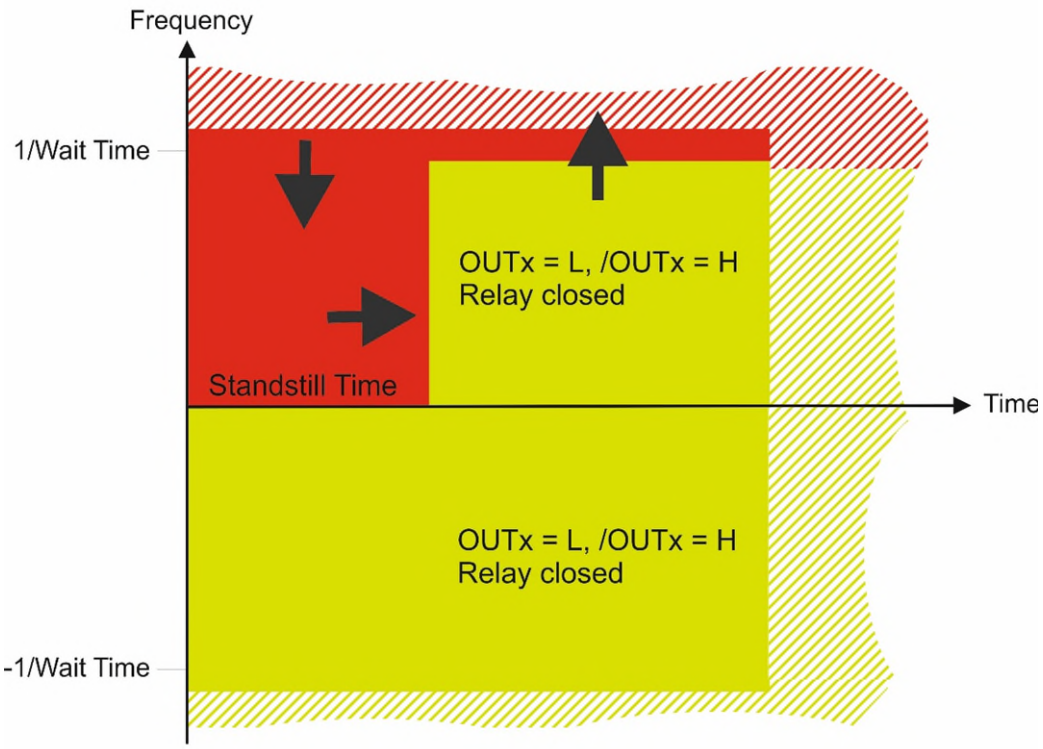
Example:

With Presel = 1000.0 Hz and Hysteresis = 10 %, frequencies f < 900 Hz are declared as underspeed and frequencies f > 1100 Hz as overspeed.

12.8. Frequency > 0 Hz (Switch Mode = 7)

With parameter setting "Switch Mode" = 7, the direction of the frequency is monitored. The function is always active. With positive frequencies (f > 0 Hz), the output is set to ON. The output will reset with negative frequencies (f < 0 Hz) or with standstill (f = 0 Hz) after expiration of the Standstill Time.

Relevant Parameters	Remark
Switch Mode XXXX	= 7
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Standstill Time	standstill time in seconds
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)



Relevant input functions	Remark
none	none

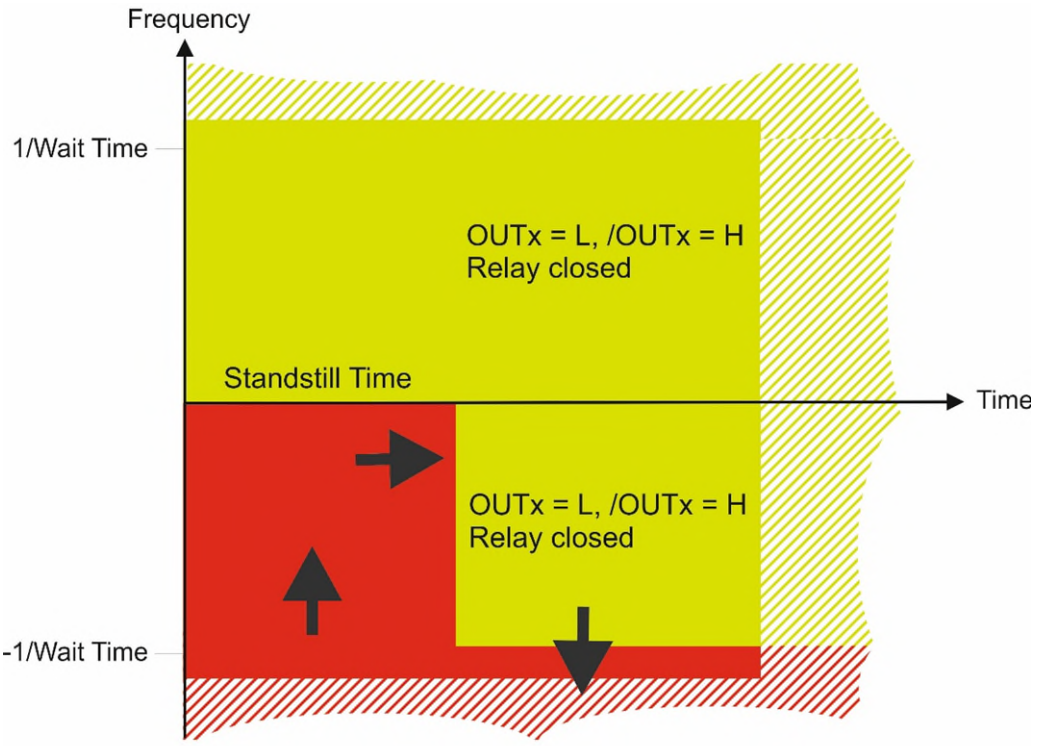
Example:

The transition from a negative to a positive frequency will cause an immediate change of the output state. Only in case of a transition from a positive frequency to zero, the output will not change before Standstill Time has elapsed.

12.9. Frequency < 0 Hz (Switch Mode = 8)

With parameter setting "Switch Mode" = 8, the direction of the frequency is monitored. The function is always active. With negative frequencies (f < 0 Hz), the output is set to ON. The output will reset with positive frequencies (f > 0 Hz) or with standstill (f = 0 Hz) after expiration of the Standstill Time.

Relevant Parameters	Remark
Switch Mode XXXX	= 8
Pulse Time XXXX	statically = 0 or pulse duration in x seconds
Standstill Time	standstill time in seconds
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)



Relevant input functions	Remark
none	none

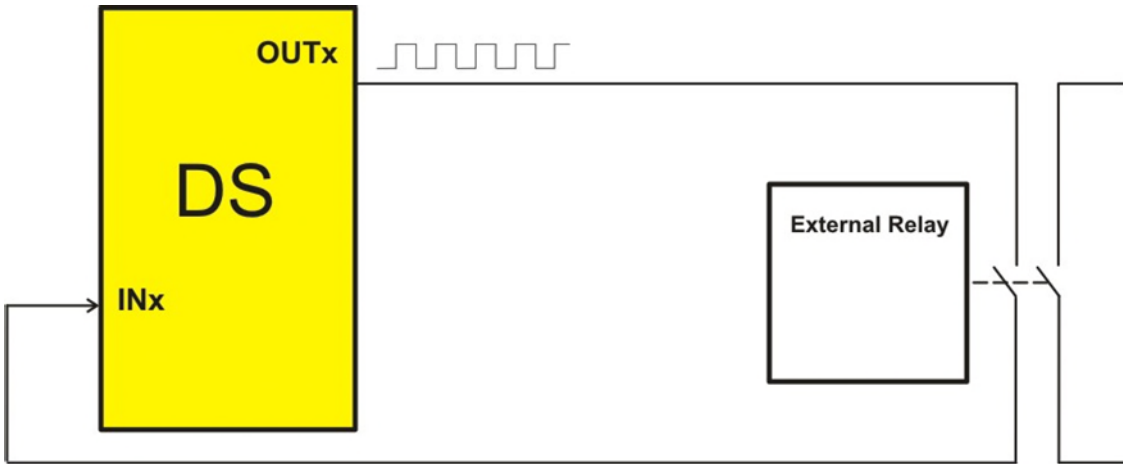
Example:

The transition from a positive to a negative frequency will cause an immediate change of the output state. Only in case of a transition from a negative frequency to zero, the output will not change before Standstill Time has elapsed.

12.10. Clock Generation for Pulsed Readback (Switch Mode = 9)

With parameter setting "Switch Mode" = 9, the output supplies a clock or an inverted clock with a specific frequency. The Output Mode of the output in use must be set to zero. Clock outputs provide different output frequencies. This function is used to monitor the readback contacts of an external relay (see EDM function).

Relevant Parameters	Remark
Switch Mode XXXX	= 9
Output Mode	= 0 for this output (inverse configuration)

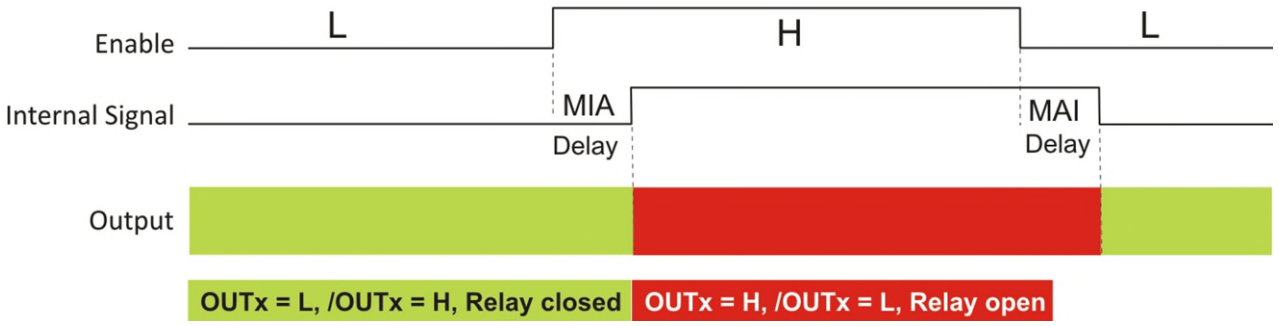


12.11. STO/SBC/SS1 by Input (Switch Mode = 10)

With parameter setting "Switch Mode" = 10, an STO, SBC or SS1 function is assigned to the output. The function requires an enable input signal which is assigned by the „Matrix" parameter. Parameter "Lock Output" can be used to activate a lock function, which can be acknowledged by a further input. Acknowledgement is only possible with deactivated enable signal. There is no frequency or ramp monitoring.

Relevant Parameters	Remark
Switch Mode XXXX	= 10
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0
MAI-Delay XXXX	= 0
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)

STO/SBC Function: Without Selfhold Function and with static high Enable Input



Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function" = 1 … 6	Only when lock function is active

Important: A safety function will not be achieved before the DS250 monitor has been combined with a corresponding actuator unit.

12.11.1. STO/SBC Produced by Situation (Switch Mode = 10)

If an STO should e.g. be triggered by overspeed, a second feedback output, configured as overspeed can be used as enable input (parameter „Matrix“). One of the two functions requires a lock function.

Relevant Parameters	Remark
Switch Mode XXXX	= 10
Matrix XXXX	**feedback output**
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config“	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)

Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

12.12. SS1 Pruced by Input (Switch Mode = 10)

An SS1 funodction can be achieved when the STO function is provided with a MIA Delay. After this safe delay time an STO will be triggered. In this case a lock function must be activated. In case the Enable signal should be reset during the delay period, the output will not trigger. There is no frequency or ramp monitoring.

Relevant Parameters	Remark
Switch Mode XXXX	= 10
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	**delay time**
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config“	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)

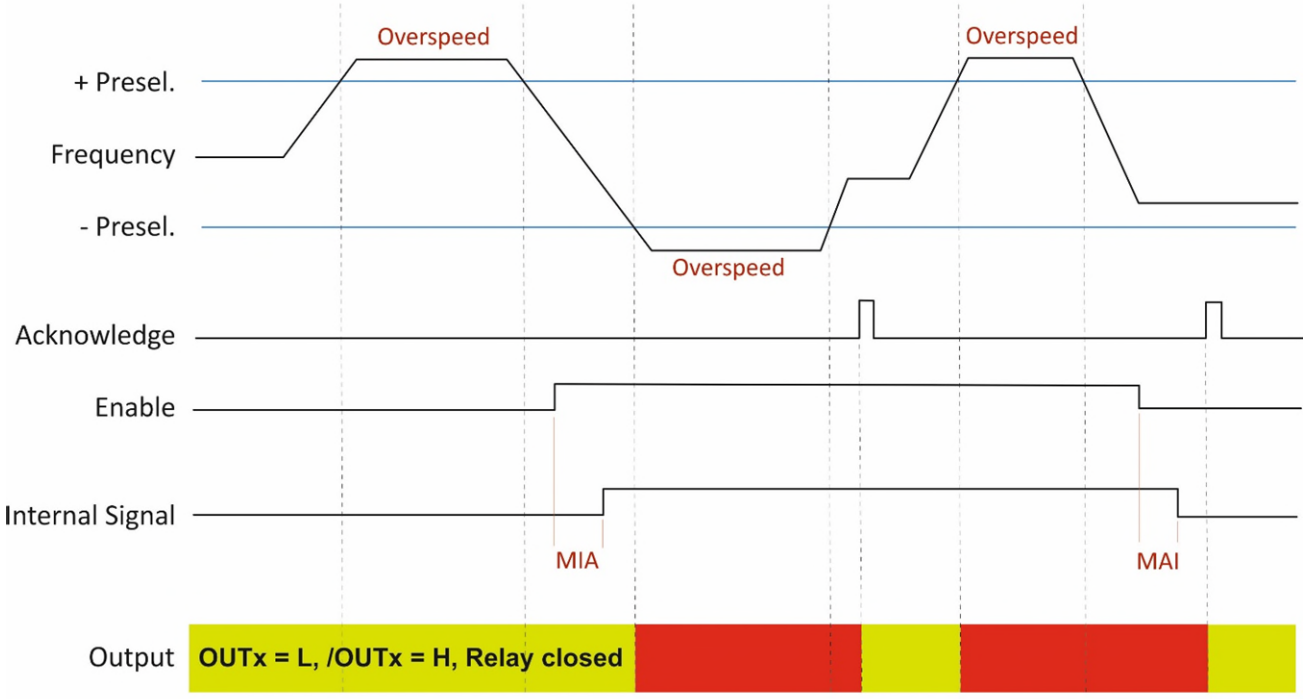
Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

12.13. SLS Produced by Input (Switch Mode = 11)

With parameter setting "Switch Mode" = 11, an SLS function is assigned to the output. The function is triggered, independent of the direction of rotation, at overspeed. The function requires an enable input signal which must be assigned by parameter „Matrix". A clear lock function can be attributed. The lock function can be acknowledged by a further input. Acknowledgement is only possible with frequencies below overspeed, or with the enable signal deactivated. No ramp monitoring is available.

Relevant Parameters	Remark
Switch Mode XXXX	= 11 (SLS = safe limited speed)
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	clear lock function, use only range of 0-31
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions

SLS Function: with static high Enable Input and activated Selfhold



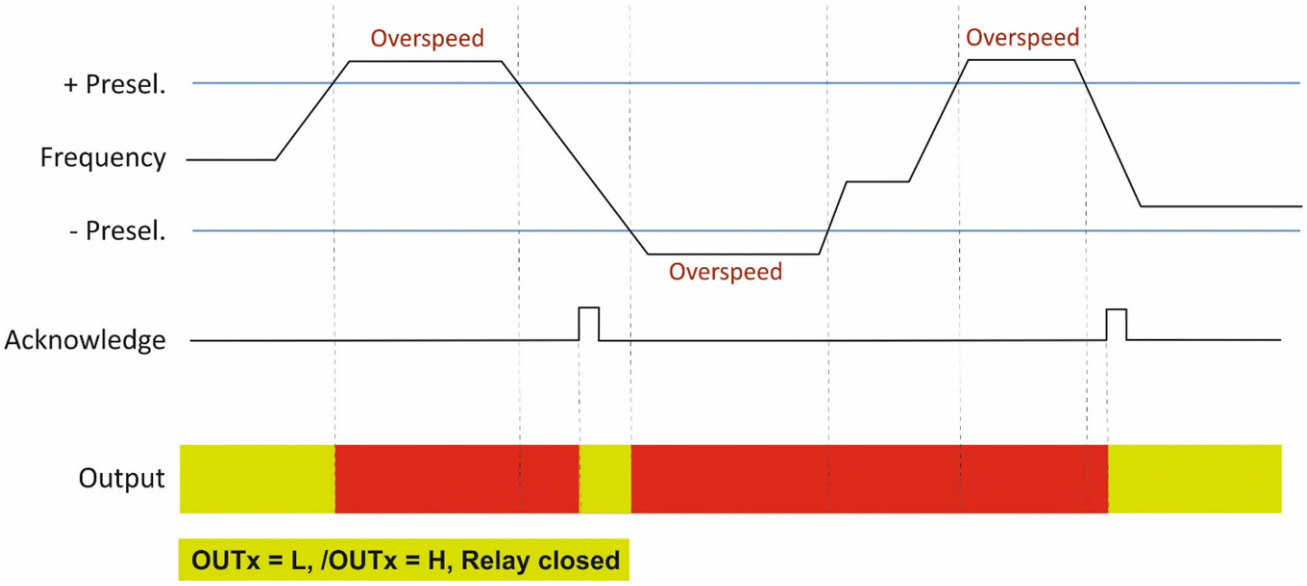
Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function" = 1 … 6	Only when lock function is active

12.14. SMS (Switch Mode = 12)

With parameter setting "Switch Mode" = 12, an SMS function is assigned to the output. The function is triggered, independent of the direction of rotation, at overspeed.
A lock function can be set separately. The lock function can be acknowledged by a further input. Acknowledgement is only possible with frequencies below overspeed. No ramp monitoring is available.

Relevant Parameters	Remark
Switch Mode XXXX	= 12 (SMS = Safe Maximum Speed)
Lock Output	clear lock function, use only range of 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Presel. XXXX. 01/02	switching point
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions

SMS Function: without Enable Signal and activated Selfhold

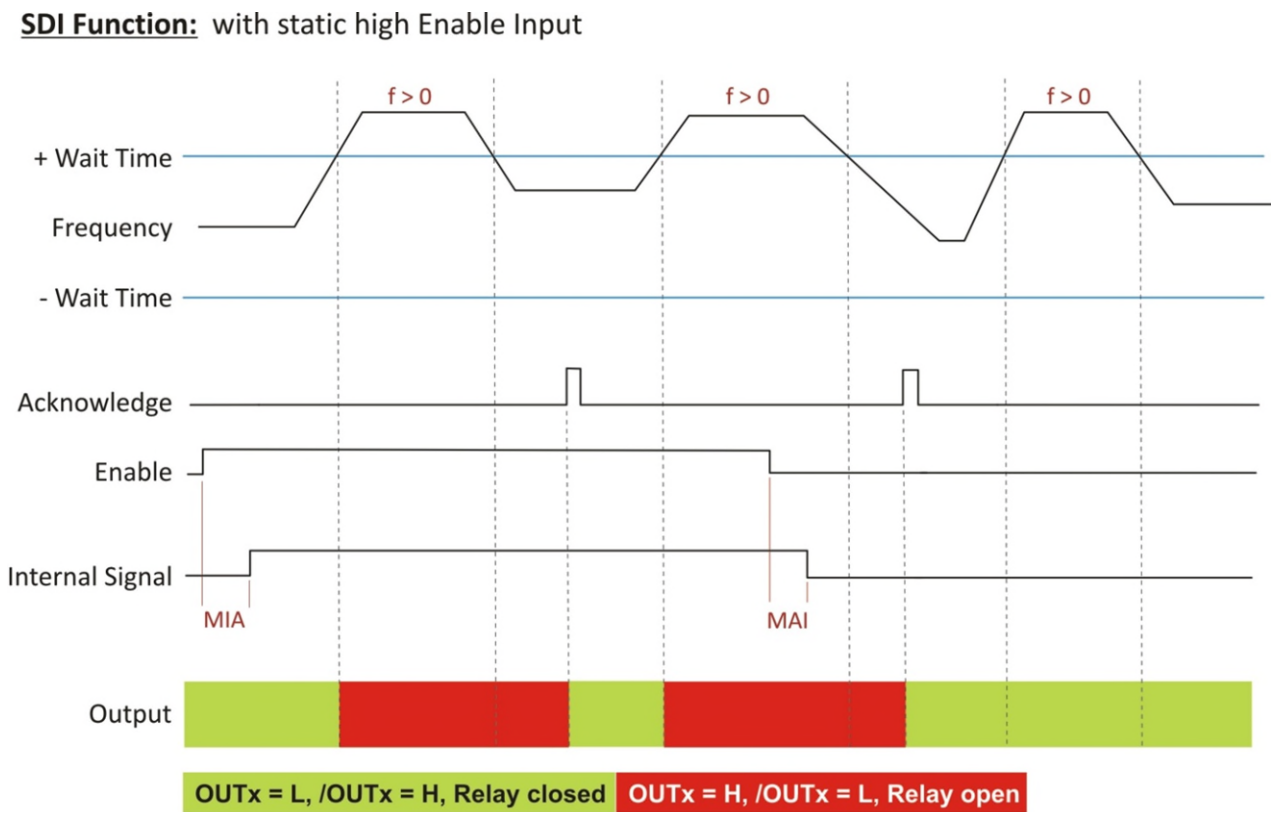


Relevant input functions	Remark
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active

12.15. SDI Produced by Input (f > 0 Hz), (Switch Mode = 13)

With parameter setting "Switch Mode" = 13, an SDI function is assigned to the output. The function is triggered with positive frequency. A clear lock function can be set separately.
The lock function can be acknowledged by a further input. An Acknowledgement is only possible with frequencies lower than or equal to 0 Hz (f ≤ 0 Hz) or with the Enable signal deactivated. The SDI function refers to evaluation of frequency, but not of the position.

Relevant Parameters	Remark
Switch Mode XXXX	= 13 (Safe Direction)
Wait Time	reset time
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	clear lock function, use only range of 0-31
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions

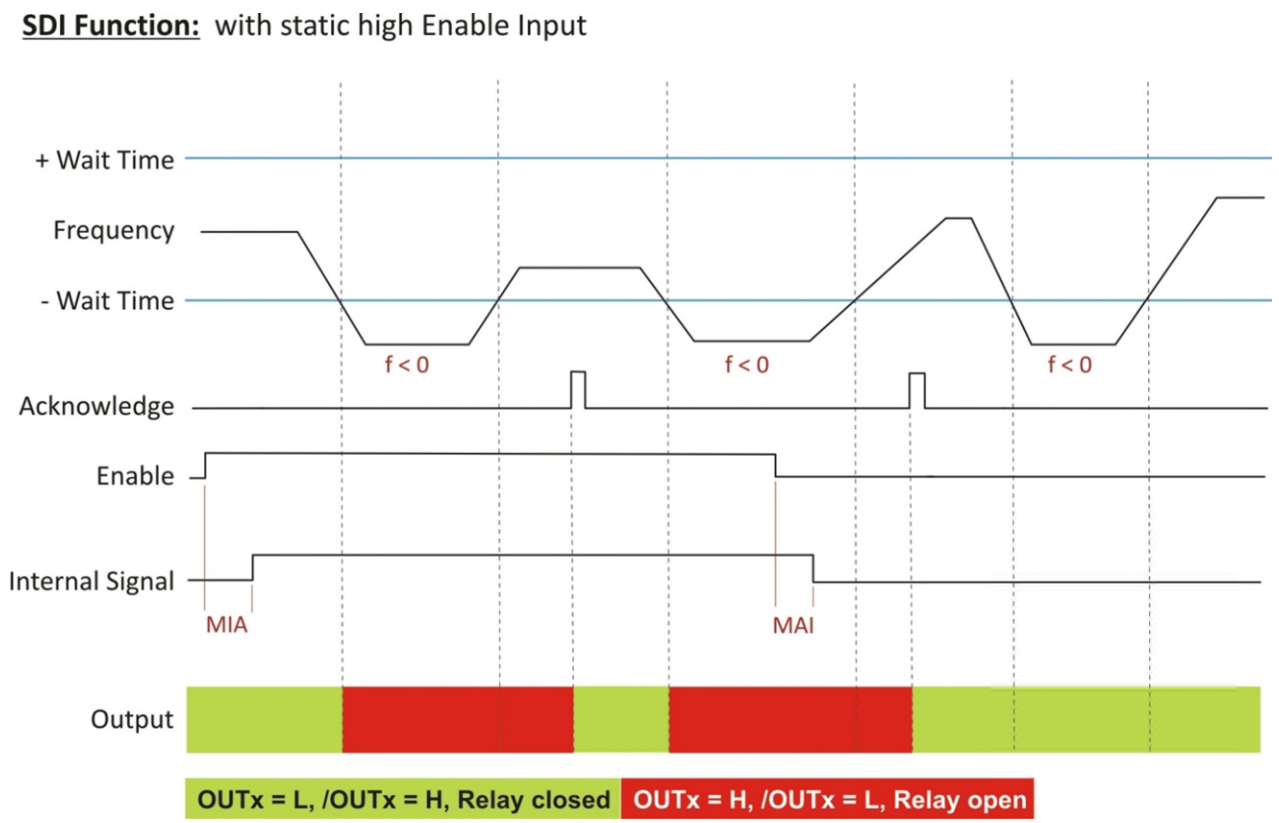


Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN1 Function" = 1 … 6	Only when lock function is active

12.16. SDI Produced by Input (f < 0 Hz) (Switch Mode = 14)

With parameter setting "Switch Mode" = 14, an SDI function is assigned to the output. The function is triggered with negative frequency. A clear lock function can be attributed. The lock function can be acknowledged by a further input. An Acknowledgement is only possible with frequencies higher than or equal to 0 Hz (f ≥ 0 Hz), or with the Enable signal deactivated. The SDI function refers to evaluation of frequency, but not of the position.

Relevant Parameters	Remark
Switch Mode XXXX	= 14 (Safe Direction)
Wait Time	reset time
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	clear lock function, use only range of 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions



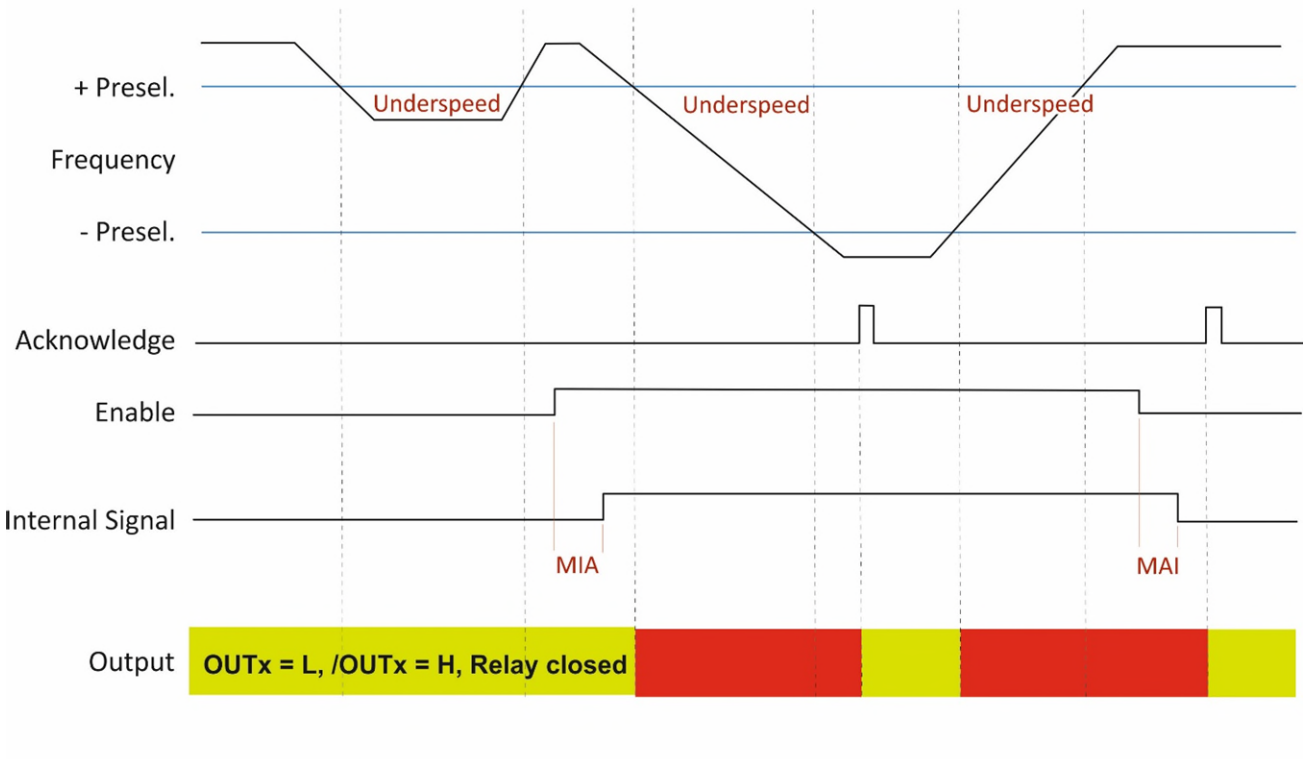
Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function" = 1 … 6	Only when lock function is active

12.17. SSM via Input (Switch Mode = 15)

With parameter setting "Switch Mode" = 15, an SSM function is assigned to the output. The function is triggered by underspeed, independent of the direction of rotation. The function requires an enable input signal which must be assigned by parameter „Matrix"
A lock function can be set separately, which can be acknowledged by a further input.
Acknowledgement is only possible with frequencies higher than underspeed, or with the enable signal deactivated.

Relevant Parameters	Remark
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX. 01/02	switching point
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN* Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions

SSM Function: with static high Enable Input and activated Selfhold

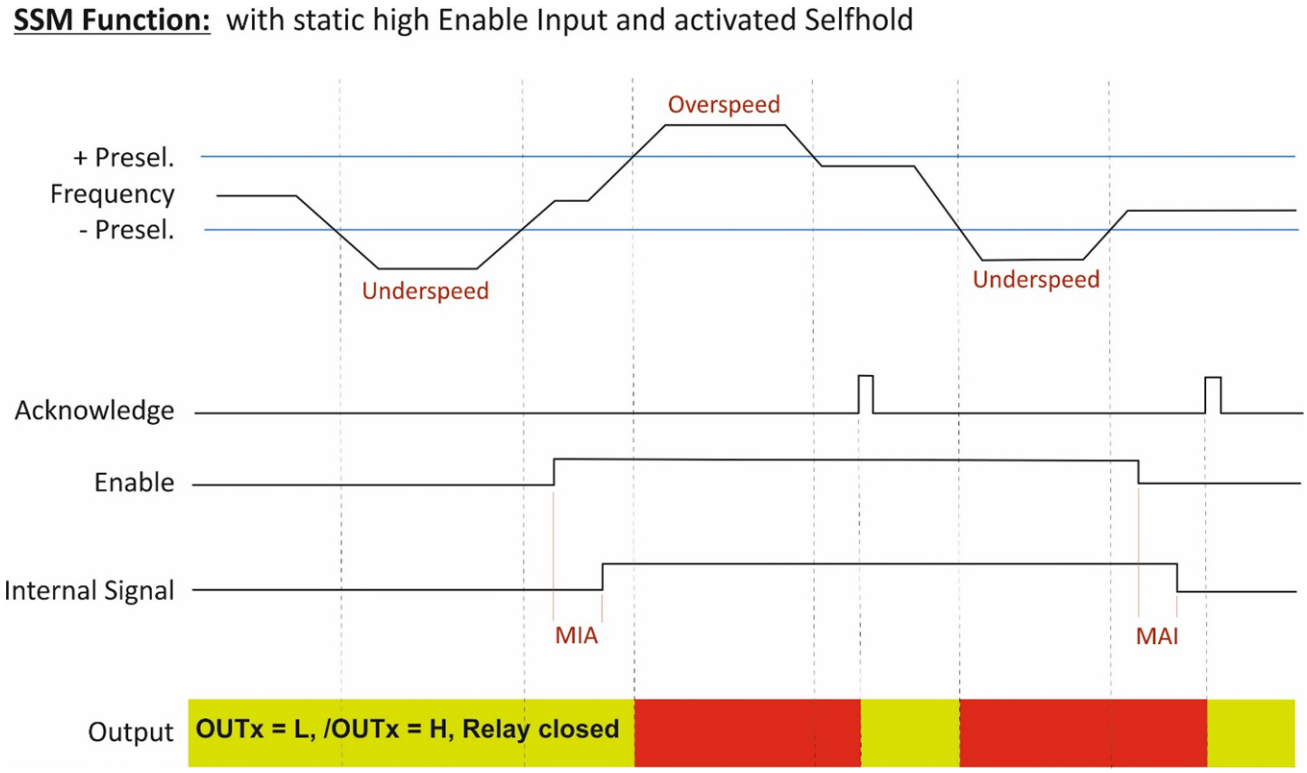


Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function" = 1 … 6	Only when lock function is active

12.18. SSM via Input (Switch Mode = 16)

With parameter setting "Switch Mode" = 16, an SSM function is assigned to the output. The function is triggered when the frequency leaves the frequency band, independent of the direction of rotation. The function requires an enable input signal which must be assigned by parameter „Matrix". A lock function can be set separately, which can be acknowledged by a further input. Acknowledgement is only possible with frequencies inside the frequency band, or with the enable signal deactivated.

Relevant Parameters	Remark
Switch Mode XXXX	= 16 (Safe Speed Monitor)
Hysteresis XXXX	+/- range (center)
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX. 01/02	center
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions



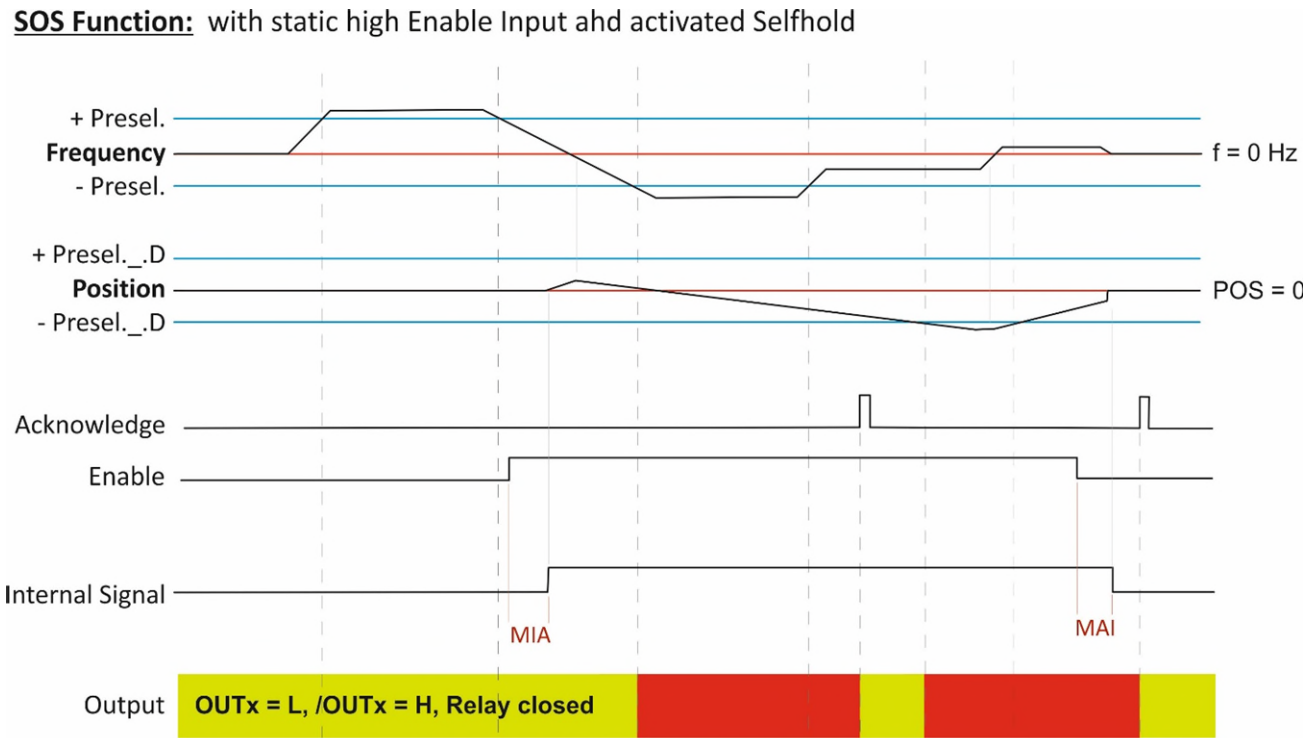
Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function" = 1 … 6	Only when lock function is active

12.19. SOS/SLI/SS2 via Input (Switch Mode = 17)

With parameter setting "Switch Mode" = 17, an SOS/SLI/SS2 function is assigned to the output. This function will be triggered by overspeed or by position error, with no regard of the direction of rotation. An enable input signal is required, which can be assigned by the Matrix „Matrix" parameter. A clear lock function can be attributed The lock function can be acknowledged by a further input. Acknowledgement is only possible with frequencies lower than overspeed, or with the enable signal deactivated. With the switchover the enable signal from inactive to active, the current position is adopted for error evaluation or cached. SLI and SOS are different with regard to the level of the switching points only. While SLI corresponds to a monitored Jog operation, SOS provides standstill monitoring. A position error can be acknowledged only by disabling the Enable signal. Any SOS function with MIA Delay unequal to zero will turn to an SS2 function.

Relevant Parameters	Remark
Switch Mode XXXX	= 17 (Safe Operating Stop)
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need, SS2)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX.D	switch point for cached position
Presel. XXXX. 01/02	switching point for overspeed
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions

Continuation „SOS/SLI/SS2 durch Eingang (Switch Mode = 17)“:



Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

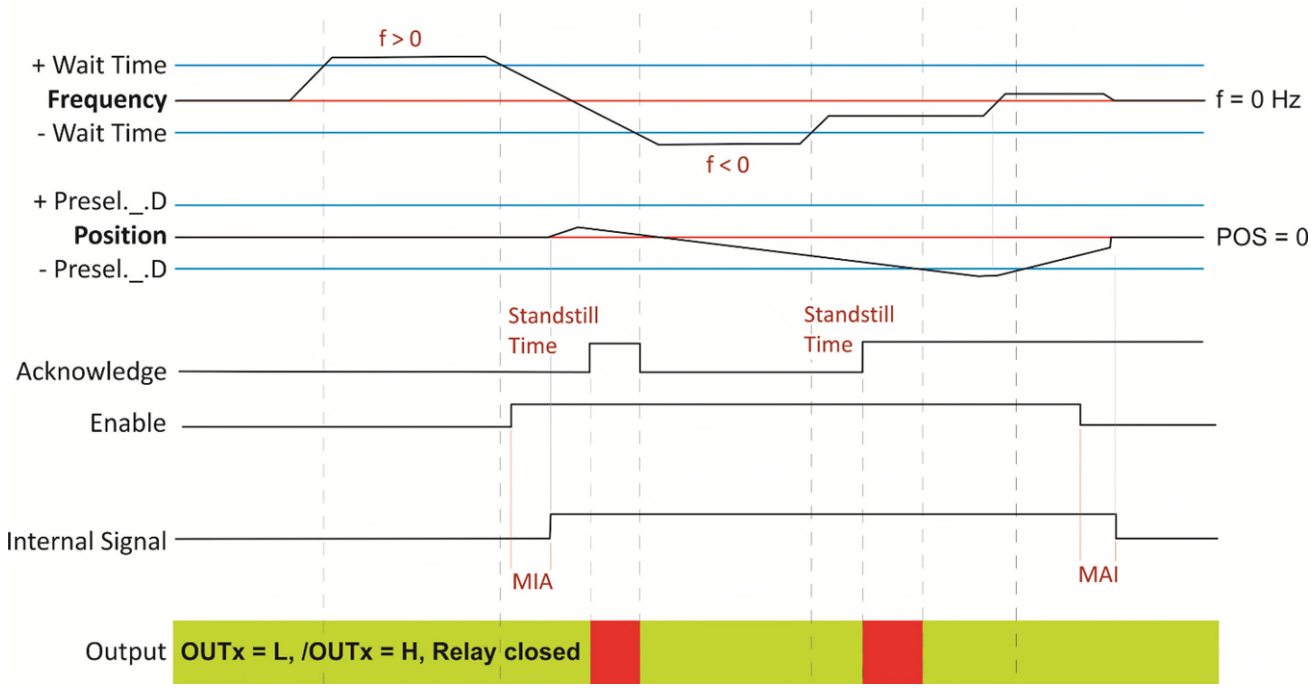
12.20. Standstill via Input (Switch Mode = 18)

With parameter setting “Switch Mode” = 18, a standstill function is assigned to the output. The function is triggered at standstill. The function requires an enable input signal which can be assigned by parameter „Matrix“. There is no lock function implemented. With the switchover the enable signal from inactive to active, the current position will be adopted for error evaluation or cached. The output is set after Standstill Time has elapsed. In case of a position error, or with a frequency unequal to zero, the output will reset. Position errors can be cleared only by deactivation of the Enable signal.

Continuation „Standstill via Input (Switch Mode = 18)"

Relevant Parameters	Remark
Switch Mode XXXX	= 18
Wait Time	reset time
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX.D	switching point for cached position
Standstill Time	time (sec.)
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config"	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time"	max. permissible delay time during illegal conditions

Standstill Monitor: with static high Enable Input

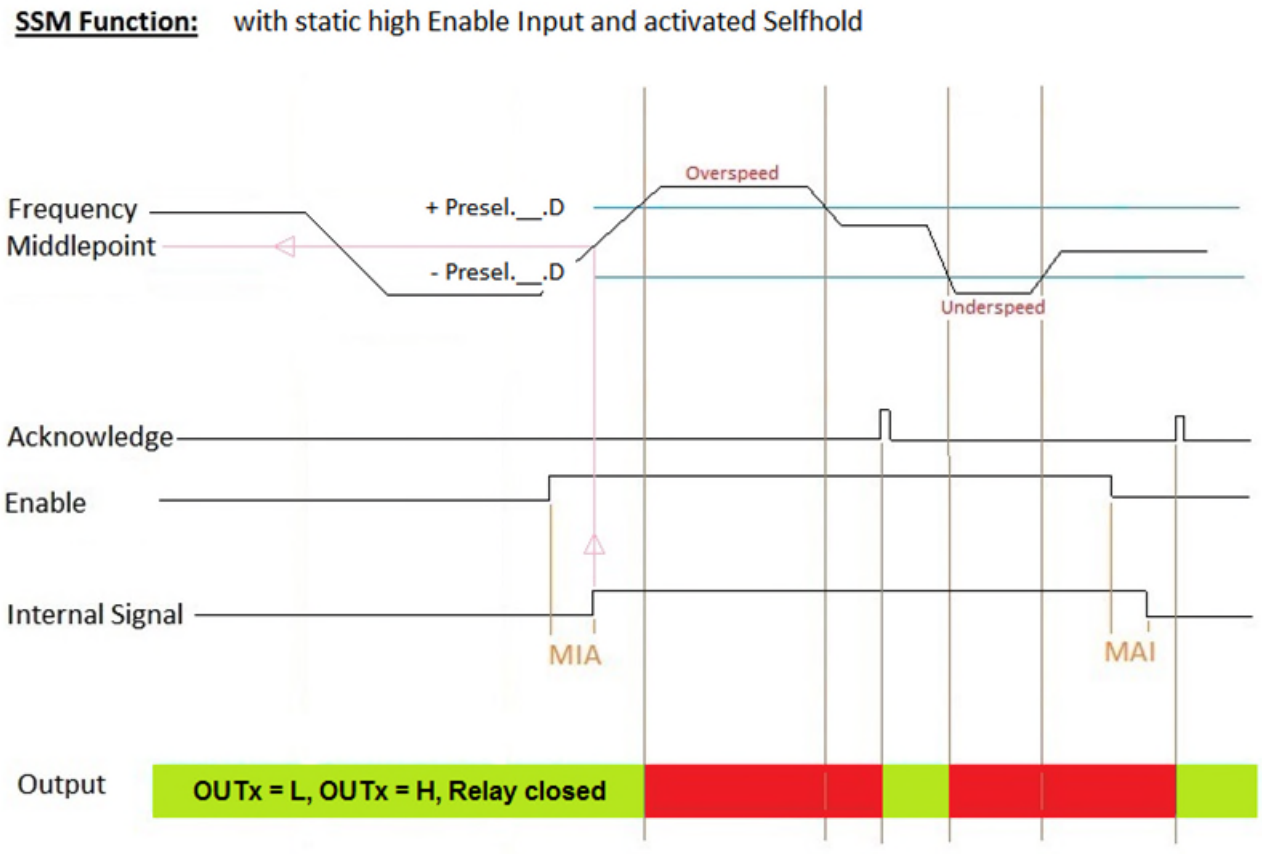


Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function" = 21	activates the function

12.21. SMS (frequency band) via Input (Switch Mode = 19)

With parameter setting “Switch Mode” = 19, an SSM function is assigned to the output. The center point of the switching point corresponds to the current frequency during the transition from inactive to active enable flank and is cached in the device. The function dissolves regardless of the direction of rotation when leaving a frequency band. An enable input signal is required for the function, which is assigned by the parameter "Matrix". A lock function can be attributed. The lock output can be acknowledged by a further input. A receipt is only possible for frequencies within the frequency band or deactivated enable signal.

Relevant Parameters	Remark
Switch Mode XXXX	= 19 (Safe Speed Monitor)
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX.D	+/-range from the cached center point
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions



Continuation „SSM (frequency band) via Input (Switch Mode = 19)“:

Relevant input functions	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

12.22. No Standstill (Switch Mode = 20)

If the parameter „Switch Mode“ is set to 20, the functionality corresponds to the inverted Switch Mode = 3. The function is always active as in the Switch Mode = 3, but the output can only be set up statically.
With this function, the relay output is invertedly controlled to the Switch Mode=3, the relay is closed at standstill and opened for frequencies different to zero. The Standstill Time defines a delay before standstill is detected.

Relevant Parameters	Remark
Switch Mode XXXX	= 20
Pulse Time XXXX	Only statically = 0
Standstill Time	Standstill time in x seconds
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL)

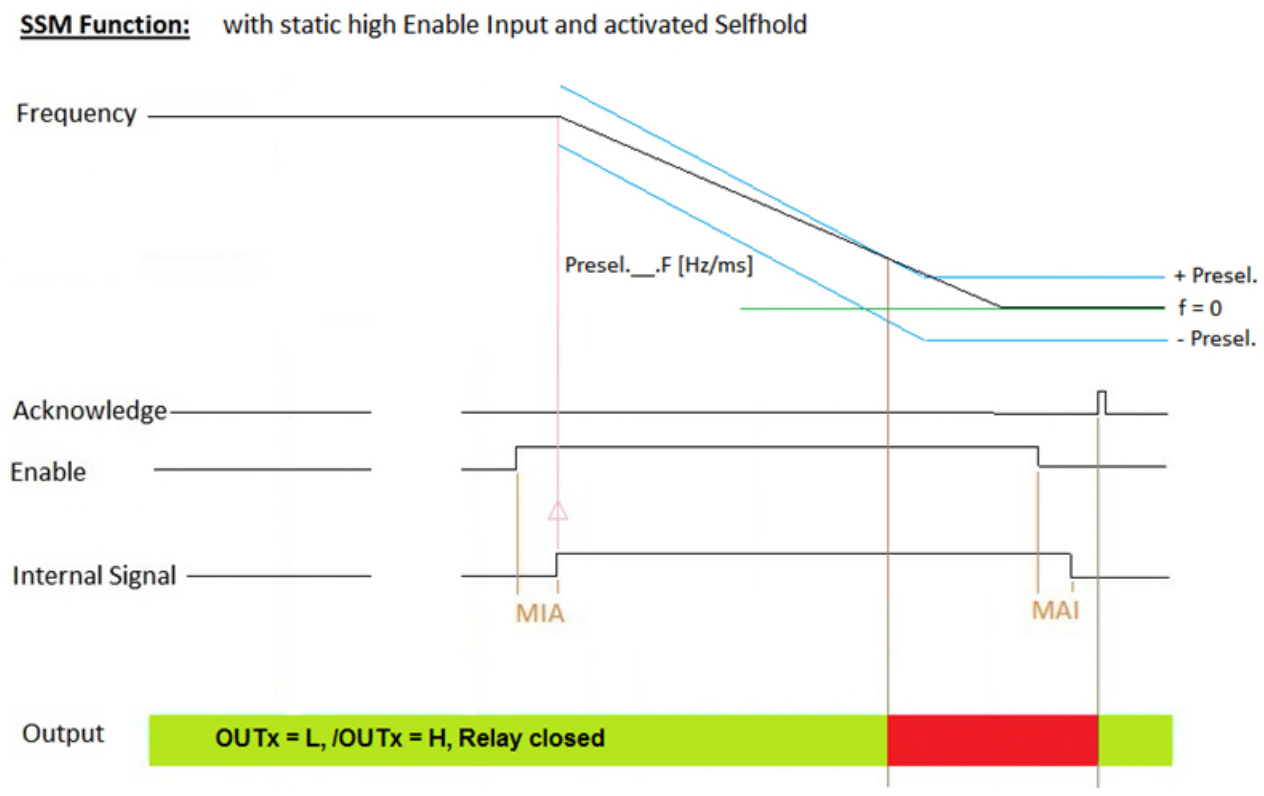
Relevant Input function	Remark
no	no

12.23. Ramp monitoring (Switch Mode = 21)

With parameter setting “Switch Mode” = 21, a ramp monitoring function is assigned to the output. The requirement for ramp monitoring is that the braking behavior follows a linear function of frequency and time. During the transition from inactive to active enable flank, the current frequency is cached in the device and the expected frequency can be determined by the pre-programmed ramp parameter "Presel. XXXX.R". If the current frequency deviates so that the precalculated window "Presel. XXXX. 01/02" is left, the output is set. An enable input signal is required for the function, which is assigned by the parameter "Matrix". A lock function can be attributed. The lock function can be acknowledged by a further input. A confirmation is only possible if the enable signal is disabled.

Continuation „ramp monitoring (Switch Mode = 21)“:

Relevant Parameters	Remark
Switch Mode XXXX	= 21
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX. 01/02	+/-range from the cached center point
Presel. XXXX.R	Entering the brake ramp
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time	max. permissible delay time during illegal conditions



Relevant Input function	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

Continuation „ramp monitoring (Switch Mode = 21)“:

The window is determined by the "Presel. XXXX.01/02" and is entered directly in 0.00 Hz values. An input of 100.00 Hz generates a window of +/-100.00 Hz by the calculated frequency. The parameter "Presel. XXXX.R" indicates the braking ramp.

If lock function has been activated, the Delay parameter must also be activated. It must be set at least to the smallest value of 2ms.

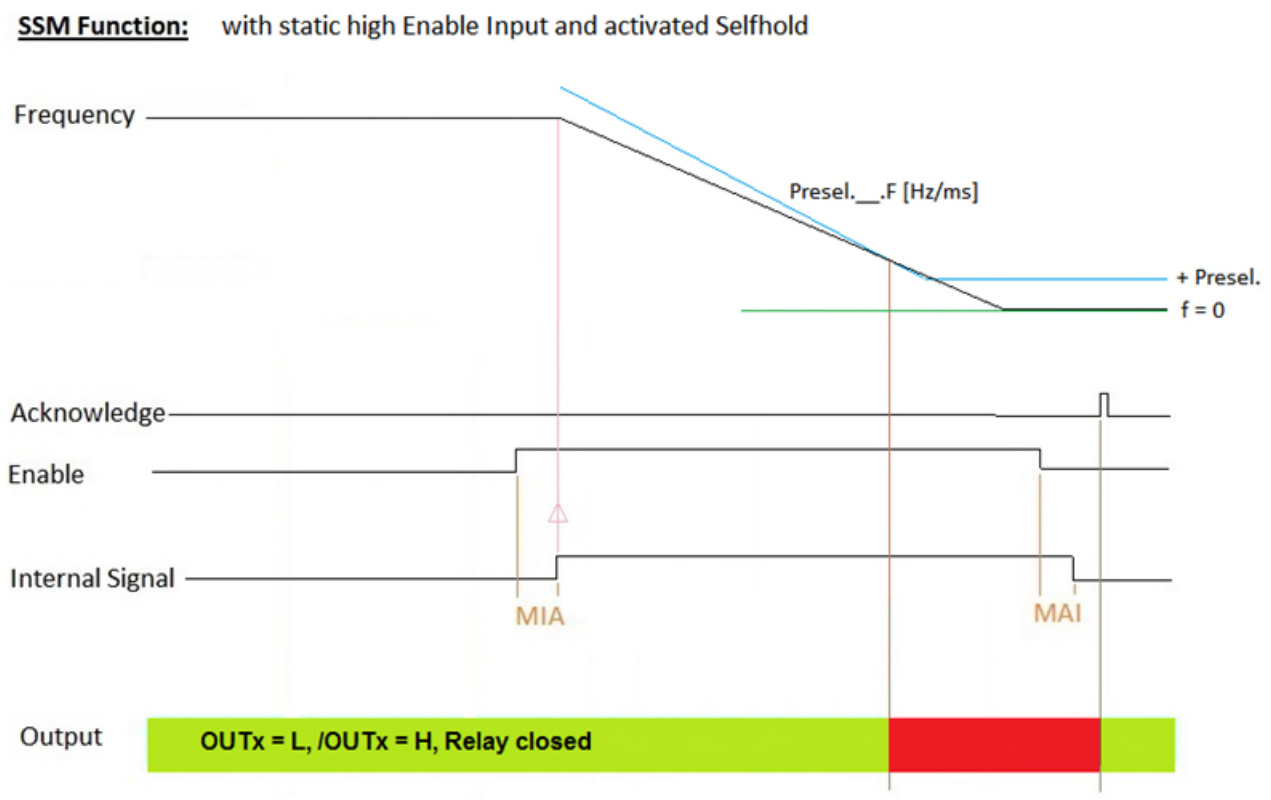
Example:
If a braking ramp is triggered from 0.01 Hz/ms at 1353 Hz, the time to 0 Hz is reached: 1353 Hz/(0.01 Hz/ms) = 135.3 s = 2min 15,3s
To determine the ramp, the drive should be braked at e.g. 1kHz and the time duration measured. The parameter value follows by calculation.

12.24. Ramp monitoring (Switch Mode = 22)

With parameter setting “Switch Mode” = 22, a ramp monitoring function is assigned to the output. The requirement for ramp monitoring is that the braking behavior follows a linear function of frequency and time. During the transition from inactive to active enable flank, the current frequency is cached in the device and the expected frequency can be determined by the pre-programmed ramp parameter "Presel. XXXX.R". In contrast to switch mode = 21, only one monitoring of the ramp is carried out.
If the current frequency is greater, so that the precalculated window "Presel. XXXX.01/02" is left, the output is set. If the current frequency is smaller, so that the calculated window is left, the output is not set. An enable input signal is required for the function, which is assigned by the parameter "Matrix". A lock function can be attributed. The lock function can be acknowledged by a further input. A confirmation is only possible if the enable signal is disabled.

Relevant Parameters	Remark
Switch Mode XXXX	= 22
Matrix XXXX	use only inputs, but no feedback outputs
MIA-Delay XXXX	= 0 (can also be set according to need)
MAI-Delay XXXX	= 0 (can also be set according to need)
Lock Output	for lock function use only range 0-31
Output Mode	homogenous or inverse output configuration (affects the Safety Integrity Level SIL/PL)
Delay XXXX	shutter release delay
Presel. XXXX. 01/02	+/-range from the cached center point
Presel. XXXX.R	Entering the brake ramp
Input Mode	configuration of the control inputs (affects the safety level SIL/PL)
IN Function	function of the control input
IN Config	switching behaviour (single-channel, two-channel, inverse, homogeneous, dynamic, static)
GPI Err Time“	max. permissible delay time during illegal conditions

Continuation „ramp monitoring (Switch Mode = 22)“:



Relevant Input function	Remark
Enable, e.g. Parameter „IN1 Function“ = 21	activates the function
Clear lock function, e.g. parameter „IN2 Function“ = 1 … 6	Only when lock function is active

The window is determined by the "Presel. XXXX.01/02" and is entered directly in 0.00 Hz values. An input of 100.00 Hz generates a range of + 100.00 Hz by the calculated frequency. The parameter "Presel. XXXX.R" indicates the braking ramp.

If lock function has been activated, the Delay parameter must also be activated. It must be set at least to the smallest value of 2ms.

Example:
If a braking ramp is triggered from 0.01 Hz/ms at 1353 Hz, the time to 0 Hz is reached: 1353 Hz/(0.01 Hz/ms) = 135.3 s = 2min 15,3s
To determine the ramp, the drive should be braked at e.g. 1kHz and the time duration measured. The parameter value follows by calculation.

13. Response times

13.1. Response Time of the Relay Output

Hardware delay of the relay itself: 25 ms (max.)

With normal monitoring of overspeed, underspeed or frequency band: (with frequency band please choose the lower frequency, since this produces more delay)	
2 x Sampling Time + 25 ms e.g. f = 10 kHz, Sampling Time = 1 ms	for frequencies > 1 / Sampling Time 10 kHz > 1 kHz -> delay = 27 ms
2 x 1/frequency + 25 ms e.g.. f = 100 Hz, Sampling Time = 1 ms	for frequencies < 1 / Sampling Time 100 Hz < 1 kHz -> delay = 45 ms

With normal monitoring of standstill:	
2 x Wait Time + Standstill Time + 25 ms e. g. Standstill Time = 0 ms, Wait Time = 100 ms	for frequency = 0 delay = 225 ms

These response times are based on a step function.
For this times, the parameter "Filter" is not regarded. If Filter is activated, Sampling Time or 1/frequency has to be multiplied by the factor x 5. (5 = a final value about 100% is reached, 3= a final value about 95% is reached).
With a system error (critical internal error) the response time will be:
85 ms + 25 ms =110 ms.

13.2. Response Time of the Analog Output

Hardware delay of the analog output itself: 1 ms

With normal monitoring of overspeed, underspeed or frequency band: (with frequency band please choose the lower frequency, since this produces more delay)	
2 x Sampling Time + 1 ms e.g. f = 10 kHz, Sampling Time = 1 ms	for frequencies > 1 / Sampling Time 10 kHz > 1 kHz -> delay = 3 ms
2 x 1/frequency + 1 ms e.g. f = 100 Hz, Sampling Time = 1 ms	for frequencies < 1 / Sampling Time 100Hz < 1 kHz -> delay = 21 ms

With normal monitoring of standstill:	
2 x Wait Time + Standstill Time + 1 ms e.g. Standstill Time = 0, Wait Time = 100 m s	for frequency = 0 delay = 201 ms

These response times are based on a step function.
For this times, the parameter "Filter" is not regarded. If Filter is activated, Sampling Time or 1/frequency has to be multiplied by the factor x 5. (5 = a final value about 100% is reached, 3= a final value about 95% is reached).
With a system error (critical internal error) the response time will be:
85 ms + 1 ms =86 ms

13.3. Response Time of the Digital Outputs

Hardware delay of the digital output itself: 1 ms

With normal monitoring of overspeed, underspeed or frequency band: (with frequency band please choose the lower frequency, since this produces more delay)	
2 x Sampling Time + 1 ms e.g. f = 10 kHz, Sampling Time = 1 ms	for frequencies > 1 / Sampling Time 10 kHz > 1 kHz -> delay = 3 ms
2 x 1/frequency + 1 ms e.g. f = 100 Hz, Sampling Time = 1 ms	for frequencies < 1 / Sampling Time 100Hz < 1 kHz -> delay = 21 ms

With normal monitoring of standstill:	
2 x Wait Time + Standstill Time + 1 ms e.g. Standstill Time = 0, Wait Time = 100 ms	for frequency = 0 delay = 201 ms

These response times are based on a step function.
For this times, the parameter "Filter" is not regarded. If Filter is abled, Sampling Time or 1/frequency has to multiplied by the factor x 5. (5 = a final value about 100% is reached, 3= a final value about 95% is reached).
With a system error (critical internal error) the response time will be:
85 ms + 1 ms =86 ms

13.4. Response Time of the Splitter Output:

Hardware delay of the splitter output itself: 1 ms

These response times are based on a step function.
With a system error (critical internal error) the response time will be:
85 ms + 1 ms = 86 ms

13.5. Response Time of the Frequency Error Evaluation

Response time with a sudden frequency drop:

Time calculations in the subsequent tables assume the following settings:
Sampling Time = 10 ms, Wait Time = 100 ms

- Use Sampling Time for the calculation when f > 1/Sampling Time
- Use reciprocal frequency 1/f when f < 1/Sampling Time

In addition to the delay times shown in the tables below, please add also the hardware delay time of the corresponding output (relay = 25 ms, analog output = 1 ms, digital output = 1 ms). The parameter Filter is excluded.

*) Calculated values for response times assume that "Sampling Time" would be greater than the reciprocal frequency 1/f.

Div. Filter = 10	
With „Div. %-Value" = 10:	11 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 210 ms*)
With „Div. %-Value" = 20:	21 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 310 ms*)
With „Div. %-Value" = 30:	31 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 410 ms*)
With „Div. %-Value" = 40:	41 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 510 ms*)

Div. Filter = 5	
With „Div. %-Value" = 10:	5 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 150 ms*)
With „Div. %-Value" = 20:	10 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 200 ms*)
With „Div. %-Value" = 30:	15 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 250 ms*)
With „Div. %-Value" = 40:	21 x (Sampling Time or (1/f)) + 1x Wait Time -> delay = 310 ms*)

Div. Filter = 3	
With „Div. %-Value" = 10:	1 x (Sampling Time or (1/f)) + 1x Wait Time -> delay 110 ms*)
With „Div. %-Value" = 20:	2 x (Sampling Time or (1/f)) + 1x Wait Time -> delay 120 ms*)
With „Div. %-Value" = 30:	3 x (Sampling Time or (1/f)) + 1x Wait Time -> delay 130 ms*)
With „Div. %-Value" = 40:	5 x (Sampling Time or (1/f)) + 1x Wait Time -> delay 150 ms*)

Continuation "**Response Time of the Frequency Error Evaluation**":

Filtering effect with a frequency drop of 10 %	
Div. Filter = 3 and Div. %-Value = 10:	tripping after 9 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)

Filtering effect with a frequency drop of 20 %	
Div. Filter = 3 and Div. %-Value = 20:	tripping after 13 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 10:	tripping after 4 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 20:	tripping after 20 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 20:	tripping after 20 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)

Filtering effect with a frequency drop of 30 %	
Div. Filter = 3 and Div. %-Value = 30:	tripping after 16 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 20:	tripping after 7 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 10:	tripping after 3 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 30:	tripping after 30 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 20:	tripping after 20 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 30:	tripping after 30 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 20:	tripping after 20 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)

Filtering effect at a frequency drop of 40 %	
Div. Filter = 3 and Div. %-Value = 40:	tripping after 18 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 30:	tripping after 9 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 20:	tripping after 5 x (Sampling Time or 1/f)
Div. Filter = 3 and Div. %-Value = 10:	tripping after 2 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 40:	tripping after 36 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 30:	tripping after 26 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 20:	tripping after 16 x (Sampling Time or 1/f)
Div. Filter = 5 and Div. %-Value = 10:	tripping after 6 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 40:	tripping after 40 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 30:	tripping after 30 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 20:	tripping after 20 x (Sampling Time or 1/f)
Div. Filter = 10 and Div. %-Value = 10:	tripping after 10 x (Sampling Time or 1/f)

14. Connection of the inputs

There are different ways to connect the inputs. The DS2xx monitors offer HTL inputs with SIL3 capability, provided that their configuration is set to two-pole-inverse operation. The finally resulting Safety Integration Level (SIL) however also depends on the remote circuit and on the configuration.

Relevant Parameters	Remark
IN Config	Input characteristics (bipolar, unipolar, clocked)
Input Mode	Configuration of inputs (individual input, signal pair, mixed)
Switch Mode XXXX	=9, when an output is used for clock generation with clocked input
Output Mode	Clock output must be set to "inverse"
GPI Err Time	Max. permissible delay time during illegal conditions

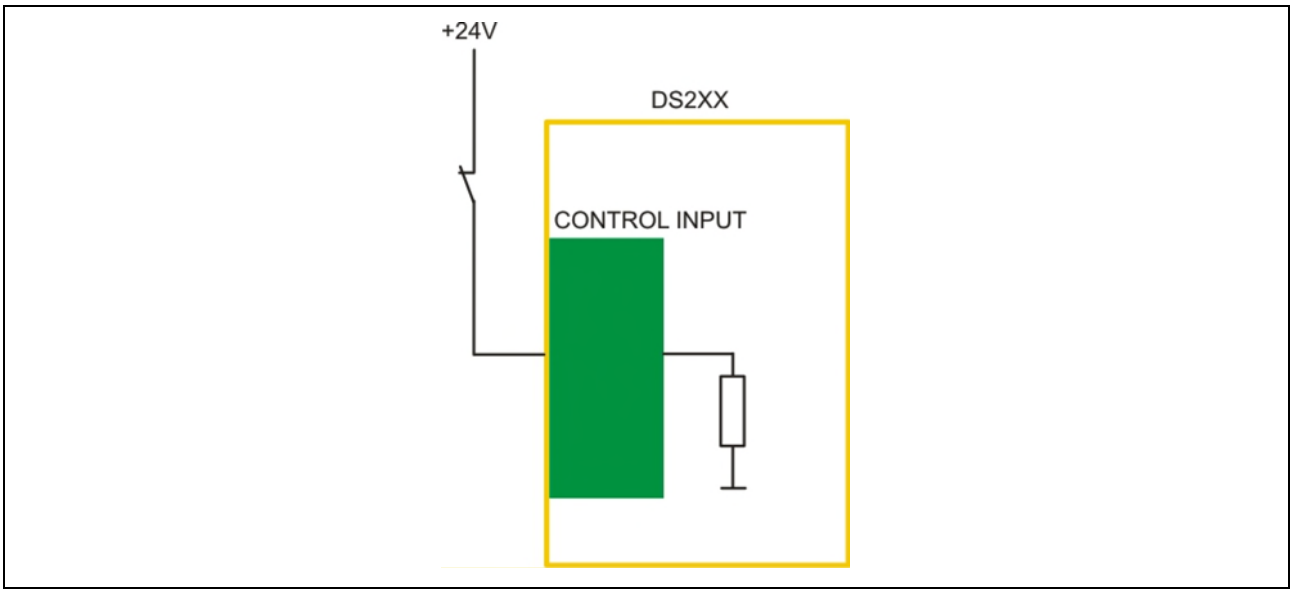
- Unipolar, un-clocked inputs provide SIL = 1 only
- Unipolar, clocked inputs can reach SIL = 1 - 2
- Bipolar, un-clocked inputs can reach SIL = 2 - 3

Where you utilize clocked inputs, for the clock generation you should use OUT1, OUT2 and OUT3 first, and lastly OUT4. The clock outputs are different regarding the output frequency, and OUT1 is able to emit the highest frequency.

Both output tracks can be used due to the 180° phase displacement (please observe parameter „Output Mode")

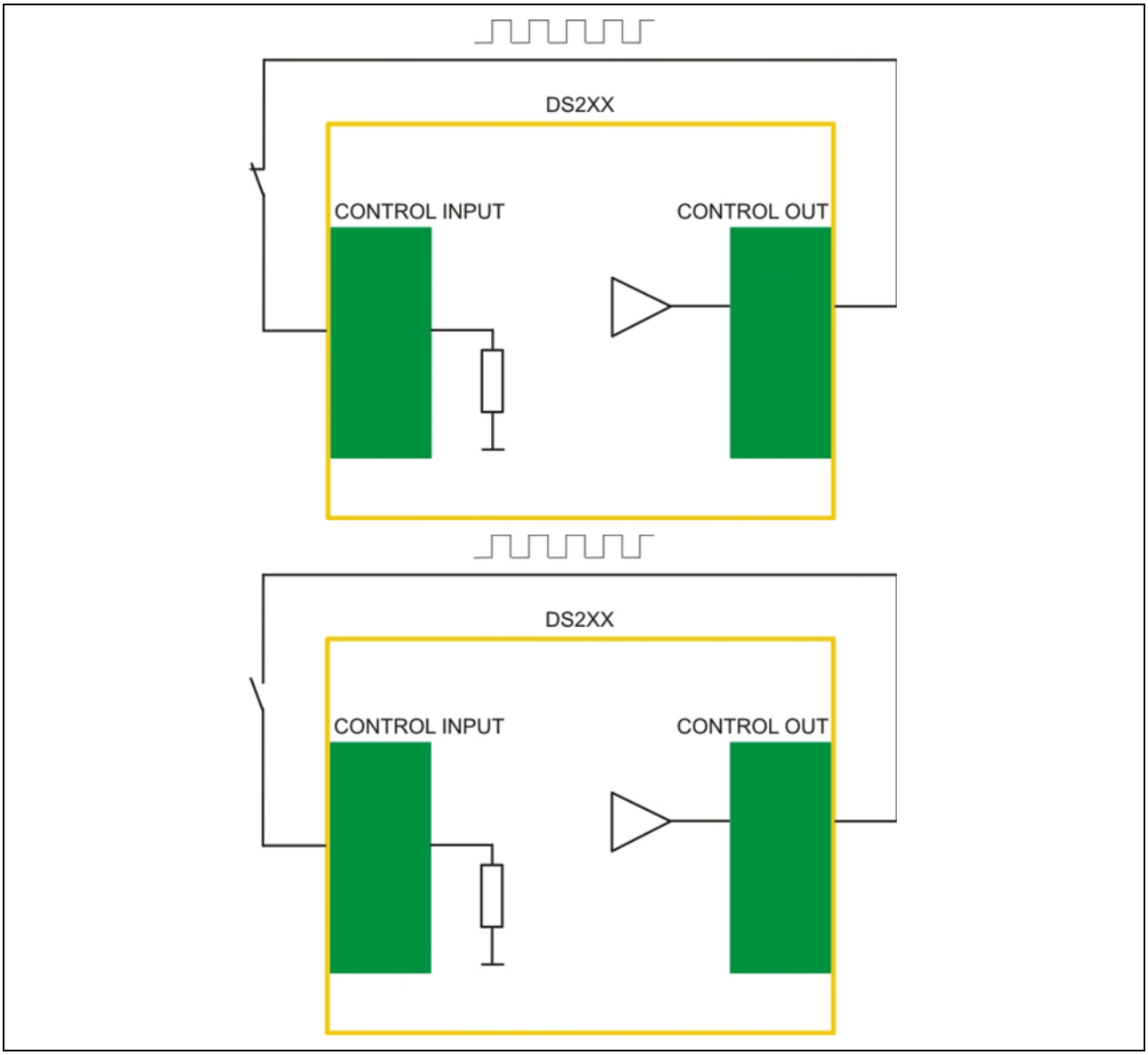
14.1. Connection: unipolar, un-clocked inputs

Unipolar, un-clocked inputs are connected as shown below. Alternatively a change-over contact can be used, toggling between GND and +24 V. Unipolar, un-clocked inputs provide Safety Integrity Level (SIL) = 1. Parameter "*IN* Config" must be set to a value between 8 and 11. Parameter "Input Mode" must be set to 1 or 2. No errors can be detected, the response time is not affected.



14.2. Connection: unipolar, clocked inputs

Unipolar, clocked inputs are connected as shown below. This type of input reaches a Safety Integrity Level (SIL) = 1 - 2. Parameter "*IN* Config" must be set to a value between 20 and 35. Parameter "Input Mode" must be set to 1 or 2. For clock generation, one of the outputs must be available. In case of incorrect or missing clock signal, the tripping function (static high/low) must be chosen in a way that no safety risk can come up (line interruption and switching failure cannot be detected). In case of error, a Runtime Readback Digital Output Error will result and the response time will be approx. 20 ms.

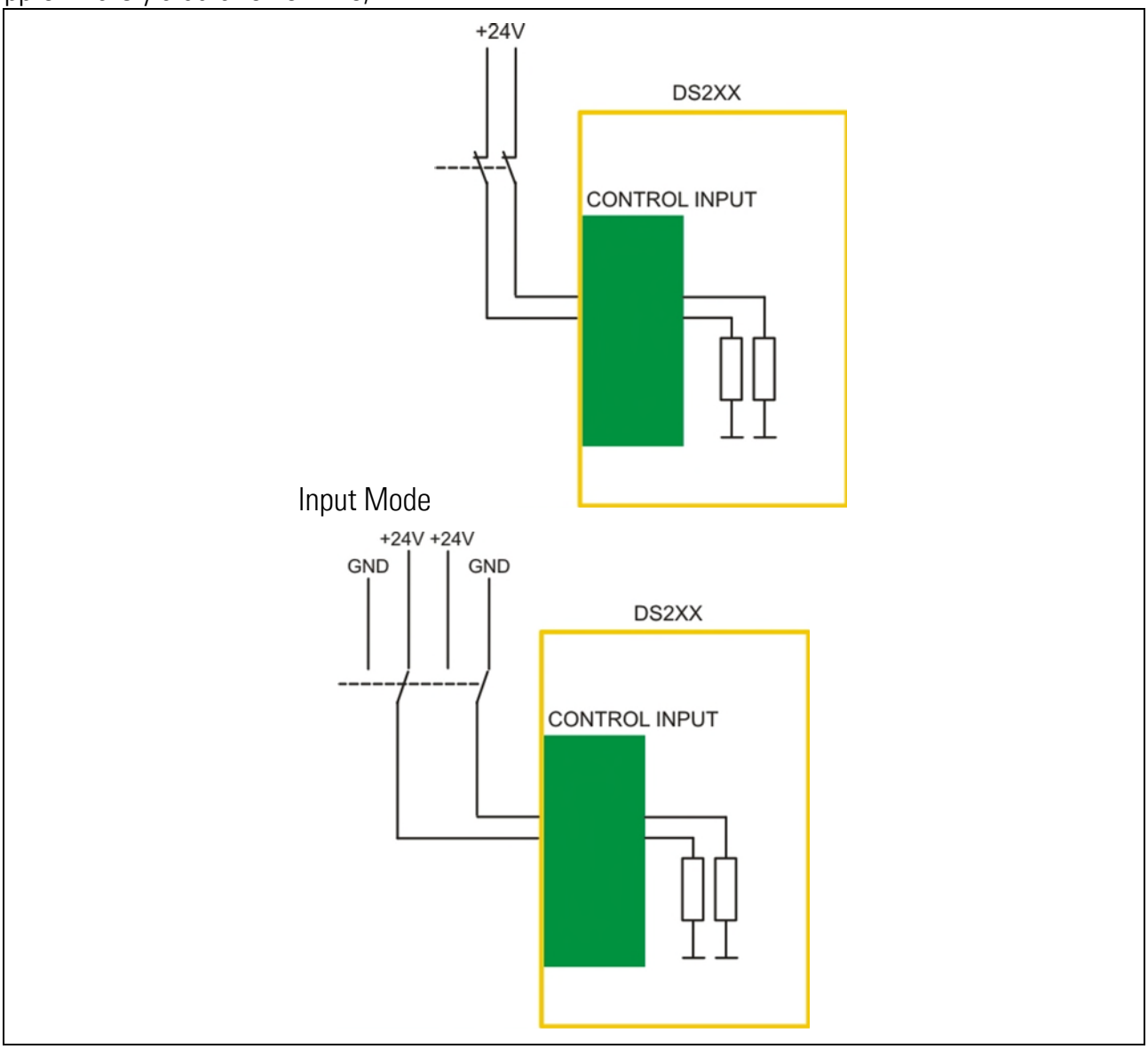


Impacts to the final Safety Integrity Level (SIL):

- Separate areas for cable leads of switch cables
- Forcibly guided and redundant series contacts
- Protected switch terminals to avoid short circuits and shunt faults
- MTTFd specification if the switch

14.3. Connection: bipolar, un-clocked inputs

Bipolar, un-clocked inputs can be connected as shown below. This type of input reaches a Safety Integrity Level (SIL) = 2 - 3. (homogenous = 2 - 3, inverse = 3). Parameter "*IN* Config" must be set to a value between 0 and 7. Parameter "Input Mode" must be set to 0 or 1.
In the case of an enable function, the input low should be active so that the function is always activated in the event of an error. When switching point switchover, for example, the smallest switching points should be selected for a low-active input at overspeed. The GPI err time parameter defines the maximum permissible delay time during the illegal conditons. (1 corresponds to approximately a duration of 1ms).



Impacts to the final Safety Integrity Level (SIL):

- Separate areas for cable leads of switch cables
- Forcibly guided and redundant series contacts
- Protected switch terminals to avoid short circuits and shunt faults
- MTTFd specification if the switch

14.4. Connection: switching point switchover

If a switching point switchover is to occur only between two different switching points, a shift command can be assigned to a control input. Therefore, the parameter "*IN* Function " must be set to 13 and both parameters "Input Mode“ are not equal to 3. The input can be configured as any control input. (See Chapter 14.1-3).

The inputs at X23 or X24 can also be used for the switchover from more than 2 switching points. The corresponding parameter "Input Mode" for the respective input must be set to 3.

Gray Format with 4 switching points:

The parameter "Presel. XXXX.M" is used in the corresponding Presel. XXXX menu to define the function of the output. For example, the parameter "Presel. XXXX.M " is set to 1 if the switching points should be switched at the input X23 in gray format for this output. If the parameter is set to 3, the input X24 is used.
In gray format, only 4 states are valid for the 4 inputs, all others trigger a runtime GPI error. The “GPI Err time” parameter defines the maximum permissible delay time during the illegal intermediate state. (1 corresponds to approximately a duration of 1ms).

Binary format with 16 switching points:

The parameter "Presel. XXXX.M" is used in the corresponding Presel. XXXX menu to define the function of the output. For example, the parameter "Presel. XXXX.M" is set to 2 if the switching points should be switched at the input X23 in binary format for this output. If the parameter is set to 4, the input X24 is used.
In binary format, no error can be raised because all states are allowed. The switching function and the possible faults must be observed at the sequence of the switching points. In the case of overspeed and the risk of a possible demolition, the order can be chosen that the smaller switching point becomes relevant when demolished.

Combinations:

It is possible that one or more outputs can be switched to 4 switching points, while the others have fixed switching points. It is also possible to form two groups of outputs by using both inputs X23 and X24, switchover the switching points at different times which stimulate externally, or have 4 or 16 switching points.

15. Connection of the Outputs

There are different ways to connect the outputs. The DS2xx monitors offers HTL outputs with SIL3 capability, provided that their configuration is set to two-pole-inverse operation. The finally resulting Safety Integration Level (SIL) also depends on the remote circuit and on the configuration.

Relevant Parameters	Remarks
Output Mode	Output configuration (homogenous / inverse)

- Unipolar outputs provide SIL = 1
- Bipolar homogenous outputs can reach SIL = 2 - 3
- Bipolar inverse outputs can reach SIL = 3

- In case of error, all switching outputs control a LOW level (no more inverting).

16. EDM Function

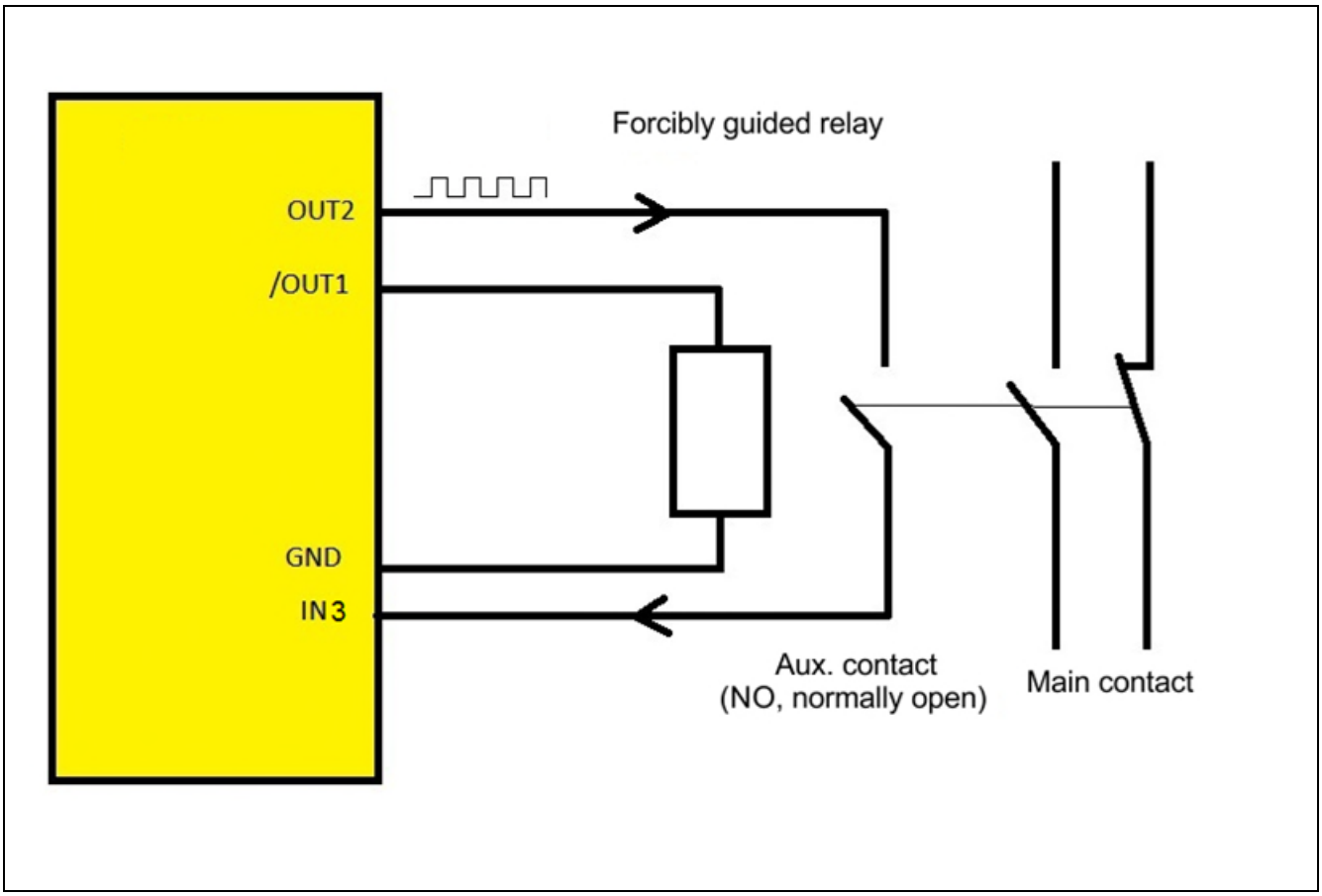
The EDM function (External Device Monitoring) provides special surveillance of faulty operation of remote relay or contactors by means of a separate feedback circuit. For feedback a clocked output signal is used, which is lead back to an input by a positively driven relay contact. This means that the DS2xx monitor has to allocate one output to drive the relay coil, another output to generate the clock signal, and an input for reading back of the clock signal.
Parameter „*IN* Function" appoints the output to be used for control of the relay. Possible settings are from 17 – 20 and 22. Parameter „*IN* Config" appoints the output to be used for clock generation.
Possible settings are from 12 to 19.
The finally resulting Safety Integration Level (SIL) also depends on the remote circuit and on the configuration. In case of error, a Runtime External RB Error signal will be produced.

Relevant Parameters	Remarks
Read Back OUT	Possible inversion of the relay control
Switch Mode XXXX	Output for controlling the relay coil
Switch Mode XXXX	Clock output
Output Mode	= 0
IN Function	Specification of the relay control
IN Config	Specification of the clock read back
Input Mode	Configuration of the read back input (single input for read back)

- • X24 (IN3,/IN3, IN4,/IN4) must be used for clock read back

16.1. EDM: 1 external relay on x4 with SIL1

Precondition: 1 relay, 2 control outputs, 1 control input, auxiliary contact NO:



Parameter	Setting	Description
Switch Mode OUT	0	OUT1 to detect overspeed
Switch Mode OUT2	9	OUT2 to generate clock signal
Read Back OUT	1	Inversion (connection to /OUT1 via NO contact)
IN3 Function	17	Adaption to OUT1 (overspeed)
IN3 Config	14	Adaption to clock output OUT2 (via X24/2 contact)
Input Mode 2	2	4 single inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse configuration

Function:

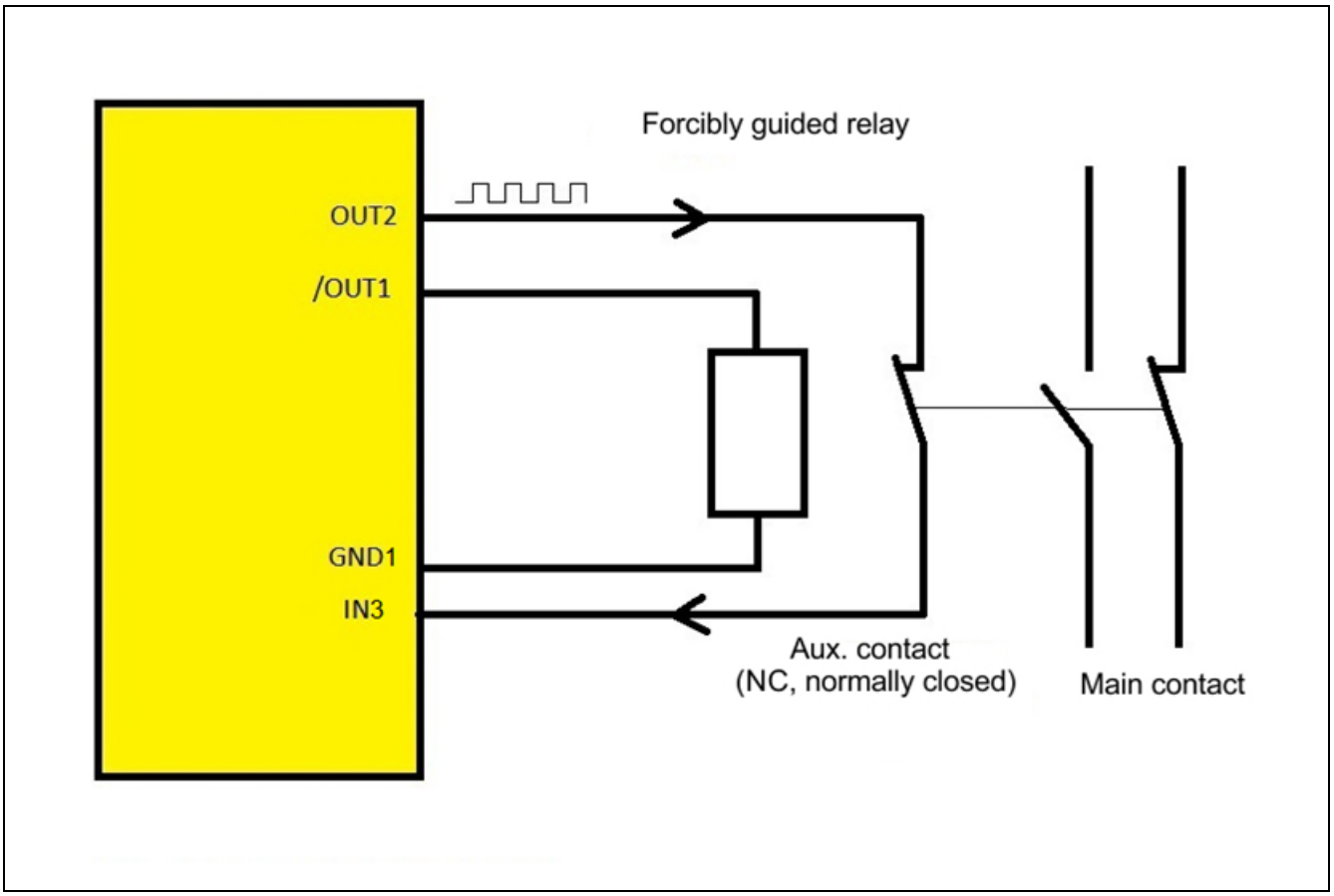
With normal operation speed the inverted output /OUT1 is in HIGH state and the relay is energized. The forcibly guided aux. contact therefore is closed and the clock signal is conducted to the input. Upon overspeed output /OUT1 will descend to LOW and the remote relay will drop.

Errors in the clock circuit can only be detected while the relay is energized. Under error condition the DS2xx monitor will set all digital outputs to LOW, i.e. the remote relay will be de-energized, which will signal "overspeed". With errors occurring under normal operating speed, the unit will take an error state which signals "overspeed" again (Safety Integrity Level = 1).

The main contacts can be used as opener or closer depending on the application.

16.2. EDM: External relay at X4 with SIL1.

Precondition: 1 relay, 2 control outputs, 1 control input, auxiliary contact NC:



Parameter	Setting	Description
Switch Mode OUT1	0	OUT1 to detect overspeed
Switch Mode OUT2	9	OUT2 to generate clock signal
Read Back OUT	0	No inversion (connection to /OUT1 via NC contact)
IN3 Function	17	Adaption to OUT1 (overspeed)
IN3 Config	14	Adaption to clock output OUT2 (via X24/2) contact)
Input Mode 2	2	4 single inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse configuration

Function:

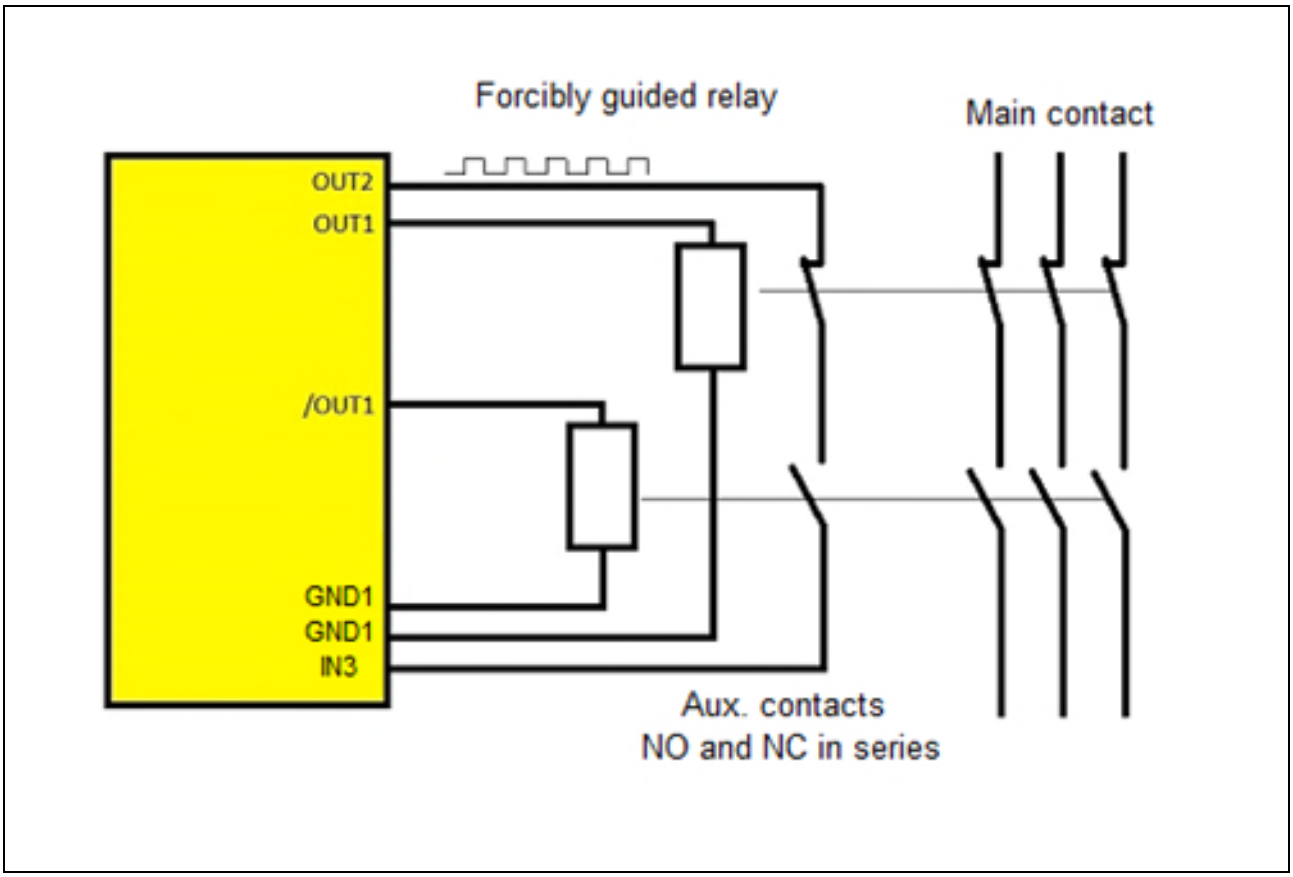
With normal operation speed the inverted output /OUT1 is in HIGH state and the relay is energized. The forcibly guided aux. contact therefore is open and the clock signal is disconnected from to the input. Upon overspeed output /OUT1 will descend to LOW and the remote relay will drop.

Errors in the clock circuit can only be detected while the relay is de-energized. Under error condition the DS2xx monitor will set all digital outputs to LOW, i.e. the remote relay will be de-energized, which will signal "overspeed". With errors occurring under overspeed conditions, the unit will take an error state which signals "overspeed" again (Safety Integrity Level = 1).

The main contacts can be used as opener or closer depending on the application.

16.3. EDM: 2 external relays at X4 with SIL2

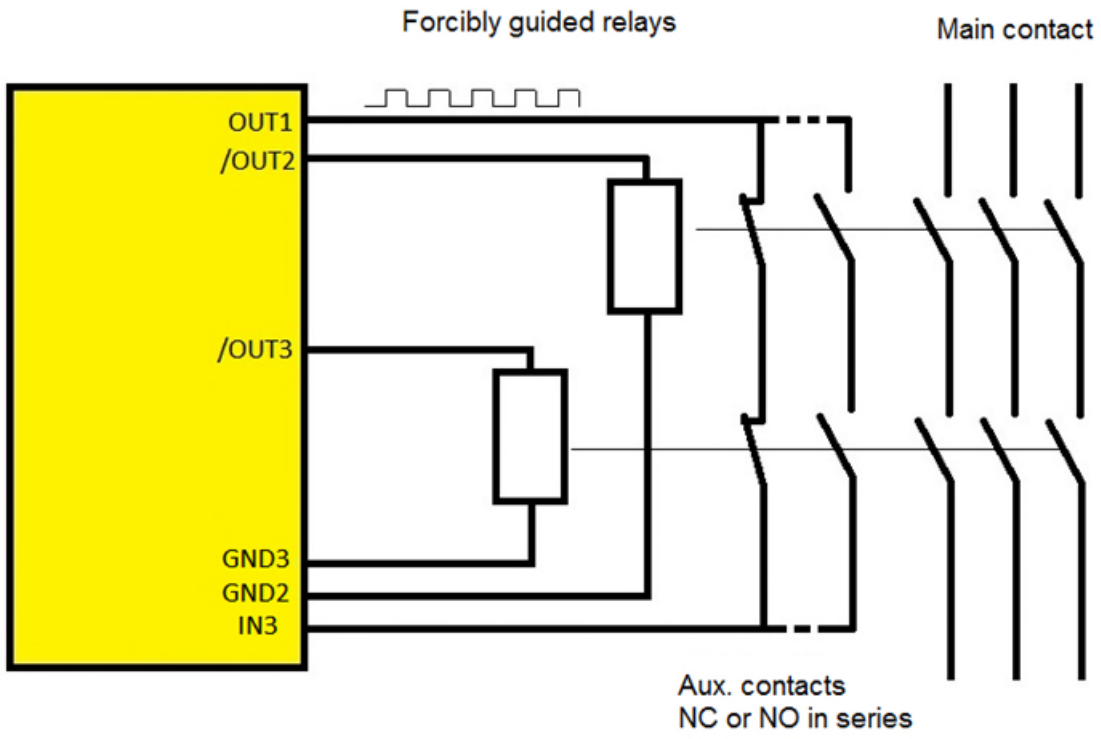
Precondition: 2 relays, 2 control outputs, 1 control input, auxiliary contact NC, NO:



Parameter	Setting	Description
Switch Mode OUT1	0	OUT1 to detect overspeed
Switch Mode OUT2	9	OUT2 to generate clock signal
Read Back OUT	1	Inversion
IN3 Function	17	Adaption to OUT1 (overspeed)
IN3 Config	14	Adaption to clock output OUT2 (via X24/2 contact)
Input Mode 2	2	4 single control-inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse configuration

Function:
With normal operation speed, output /OUT1 is in HIGH state and output OUT1 is in LOW state. With overspeed, output /OUT1 is in LOW state and output OUT1 is in HIGH state. Therefore, at any time one of the relays is energized while the other one is de-energized.
The clock loop is closed with normal speed and interrupted with overspeed.
The GND lines of the two relays must be independent one from each other.
Errors in the clock circuit can only be detected with the clock loop closed. In case of errors the DS2xx monitor will set all digital outputs to LOW, i.e. both relays will drop and overspeed will be indicated. In case of errors in the clock loop during overspeed, an error signal will be produced and overspeed will be indicated. (Safety Integrity Level = 2).
The main contacts can be used as opener or closer depending on the application.

16.4. EDM: 2 external relays at X4 with SIL2

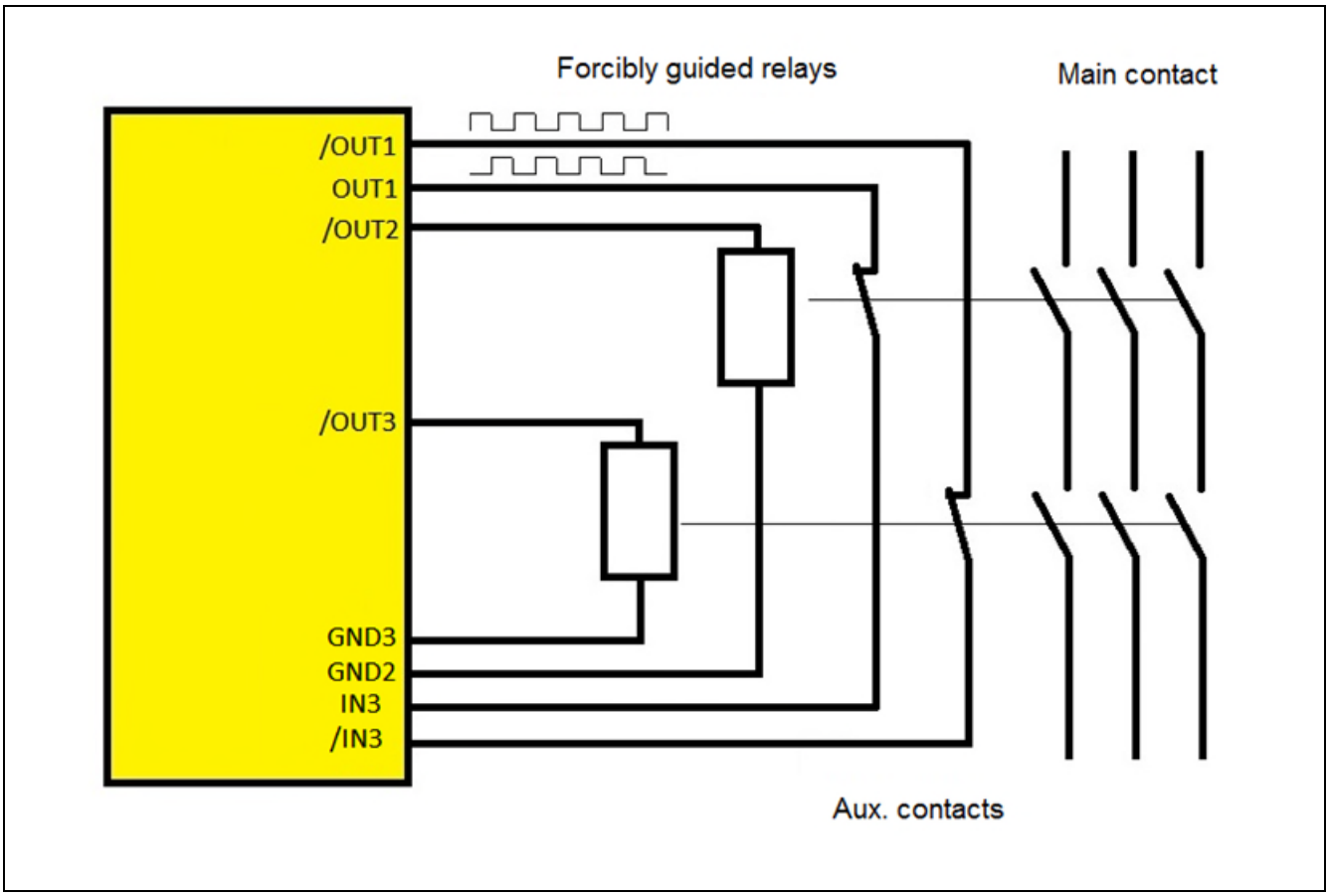


Parameter	Setting	Description
Switch Mode OUT1	9	OUT1 to generate clock signal
Switch Mode OUT2	0	OUT2 to signal overspeed
Switch Mode OUT3	0	OUT3 to detect overspeed
Read Back OUT	0/6	Inversion yes or no, depending on type of aux. contact
IN3 Function	18/19	Adaption to OUT2 or OUT3 (overspeed)
IN3 Config	12	Adaption to clock output OUT1 (via X24/2 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse operation

Function:
This application uses two independent outputs /OUT2 and /OUT3 with fully identical configuration concerning their switching characteristics. The basic function is similar to the application with one relay. The auxiliary contacts of both relays are connected in series to conduct the clock signal to an input. Parameter *IN2 Function* can be set to 18 or 19, since the switching behavior of both outputs must be identical. The GND lines of the two relays must be independent one from each other (Safety Integrity Level = 2).
The main contacts can be used as opener or closer depending on the application.

16.5. EDM: 2 external relays at X4 with SIL3

Precondition: 2 relays, 3 control outputs, 2 control inputs, auxiliary contact NC:



Parameter	Setting	Description
Switch Mode OUT1	9	OUT1 to generate clock signal
Switch Mode OUT2	0	OUT2 to signal overspeed
Switch Mode OUT3	0	OUT3 to detect overspeed
Read Back OUT	0	No inversion (connection via NC contact)
IN3 Function	18	Adaption to OUT2 (overspeed)
IN3 Config	12	Adaption to clock output OUT1 (via X24/2 contact)
/IN3 Function	19	Adaption to OUT3 (overspeed)
/IN3 Config	13	Adaption to clock output /OUT1 (via X24/3 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse operation

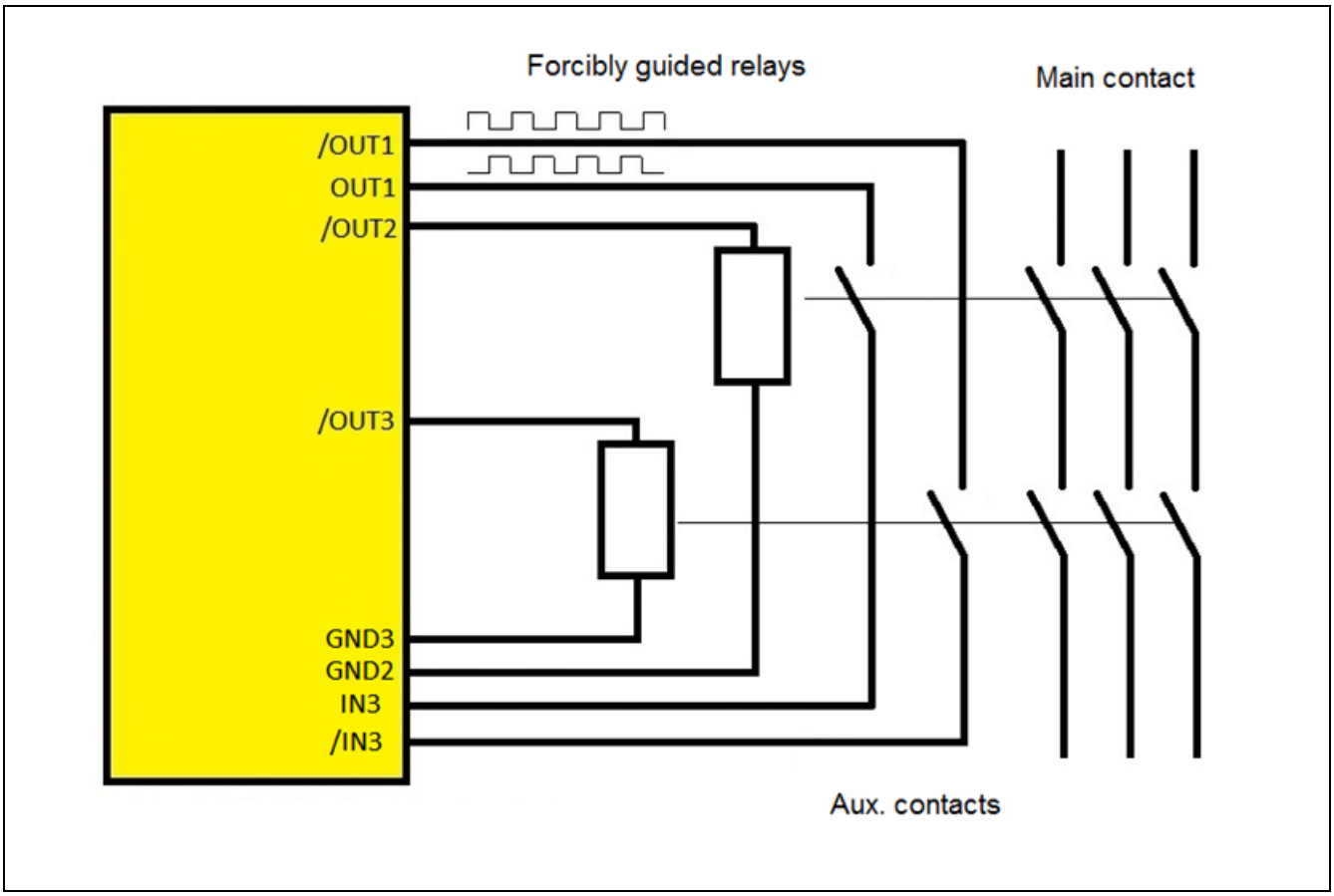
Function:

This application uses two independent outputs /OUT2 and /OUT3 with fully identical configuration concerning their switching characteristics. The basic function is similar to the application with one relay. The auxiliary contacts of both relays are individually connected to a separate input each. The GND lines of the two relays must be independent one from each other (Safety Integrity Level = 3).

The main contacts can be used as opener or closer depending on the application.

16.6. EDM: 2 external relays at X4 with SIL3

Precondition: 2 relays, 3 control outputs, 2 control inputs, auxiliary contact NO:



Parameter	Setting	Description
Switch Mode OUT1	9	OUT1 to generate clock signal
Switch Mode OUT2	0	OUT2 to signal overspeed
Switch Mode OUT3	0	OUT3 to detect overspeed
Read Back OUT	6	Inversion (connection via NO contact)
IN3 Function	18	Adaption to OUT2 (overspeed)
IN3 Config	12	Adaption to clock output OUT1 (via X24/2 contact)
/IN3 Function	19	Adaption to OUT3 (overspeed)
/IN3 Config	13	Adaption to clock output /OUT1 (via X24/3 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse operation

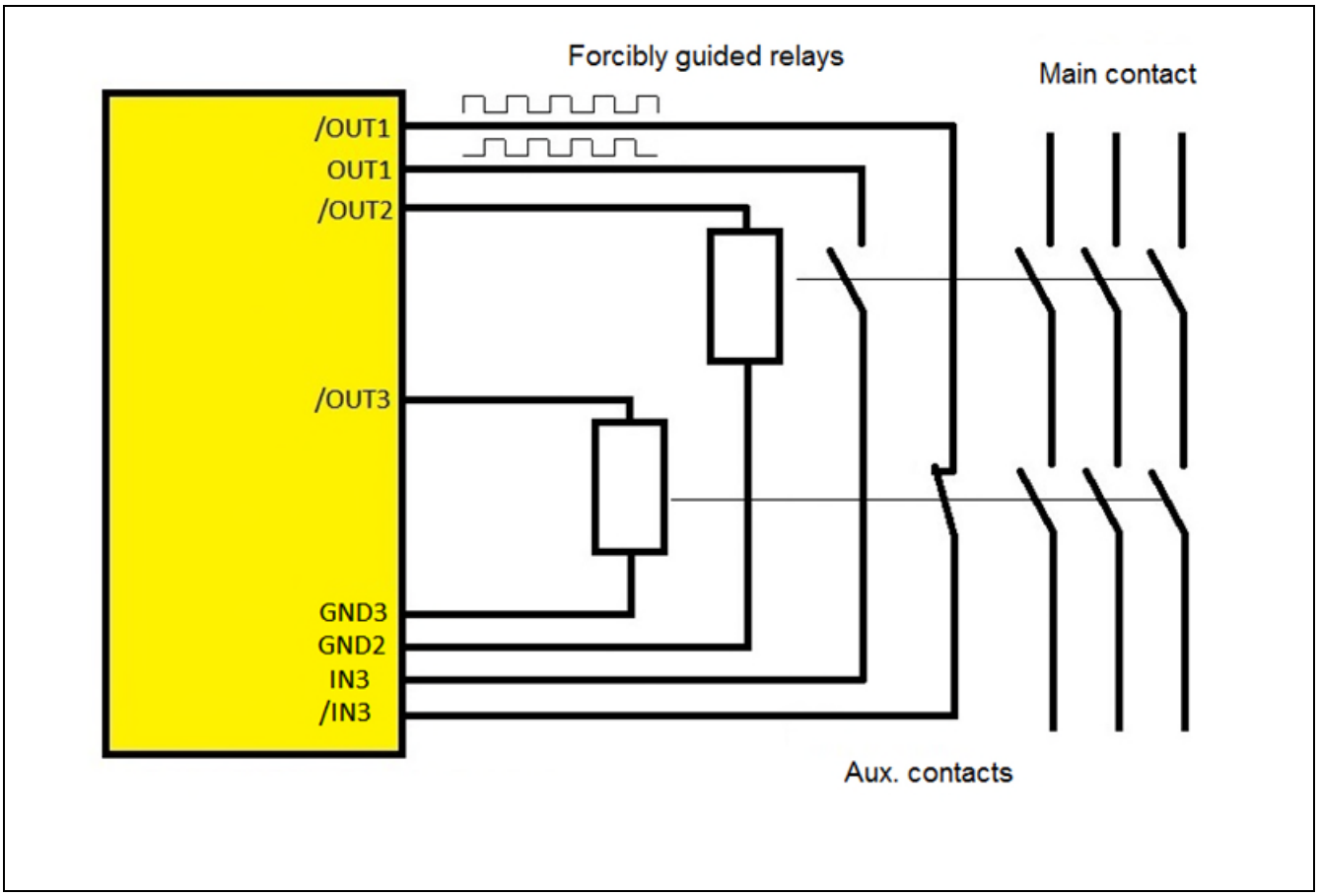
Function:

This application uses two independent outputs /OUT2 and /OUT3 with fully identical configuration concerning their switching characteristics. The basic function is similar to the application with one relay. The auxiliary contacts of both relays are individually connected to a separate input each. The GND lines of the two relays must be independent one from each other (Safety Integrity Level = 3).

The main contacts can be used as opener or closer depending on the application.

16.7. EDM: 2 external relays at X4 with SIL3

Precondition: 2 relays, 3 control outputs, 2 control inputs, auxiliary contact No and NC:



Parameter	Setting	Description
Switch Mode OUT1	9	OUT1 to generate clock signal
Switch Mode OUT2	0	OUT2 to signal overspeed
Switch Mode OUT3	0	OUT3 to detect overspeed
Read Back OUT	2	Inversion (connection via NO, NC contact)
IN3 Function	18	Adaption to OUT2 (overspeed)
IN3 Config	12	Adaption to clock output OUT1 (via X24/2 contact)
/IN3 Function	19	Adaption to OUT3 (overspeed)
/IN3 Config	13	Adaption to clock output /OUT1 (via X24/3)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,050	Delay 50 ms to obviate contact bouncing
Output Mode	0	Inverse operation

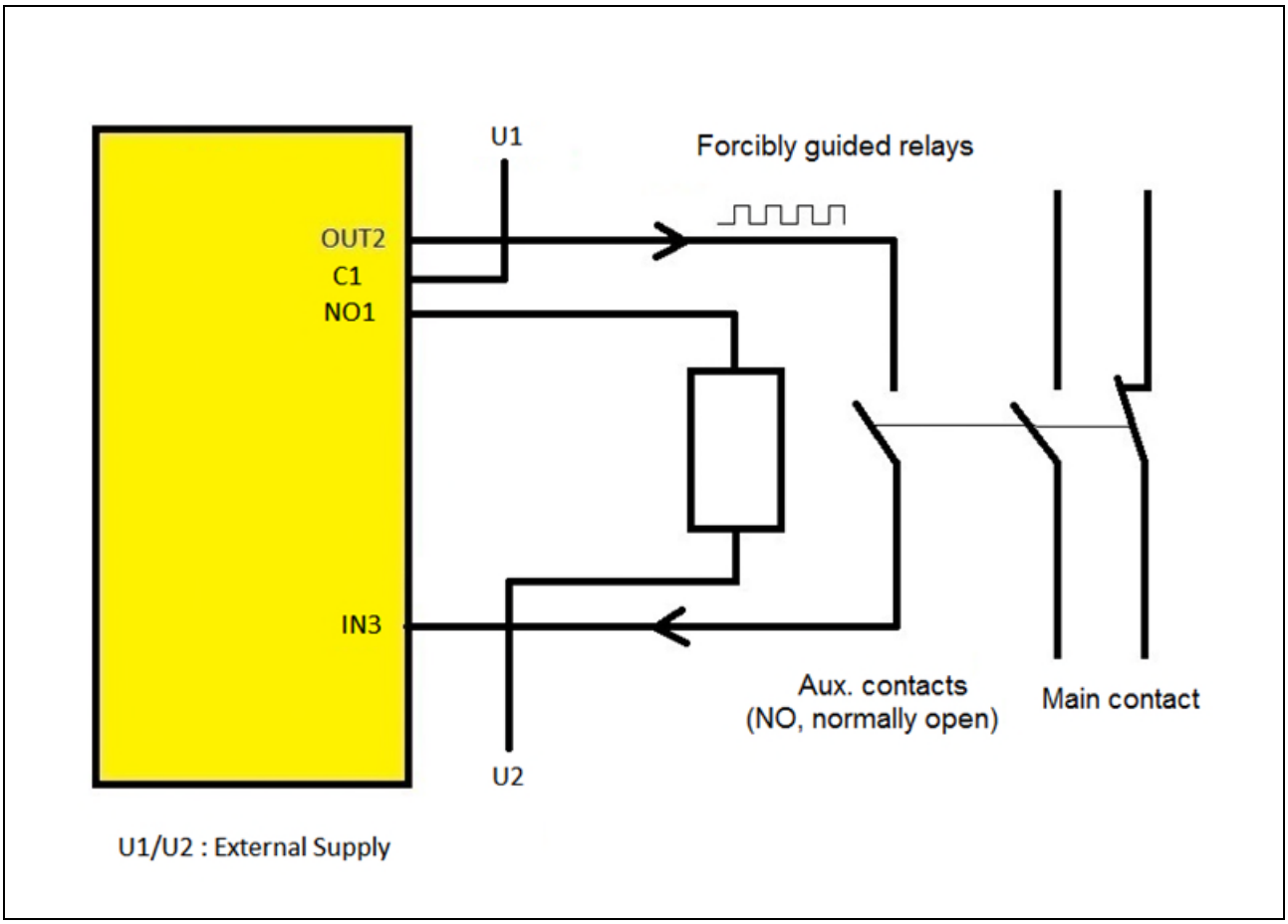
Function:

This application uses two independent outputs /OUT2 and /OUT3 with fully identical configuration concerning their switching characteristics. The basic function is similar to the application with one relay. The auxiliary contacts of both relays are individually connected to a separate input each. The GND lines of the two relays must be independent one from each other (Safety Integrity Level = 3).

The main contacts can be used as opener or closer depending on the application.

16.8. EDM: 1 external relay at X1/2 with SIL1

Precondition: 1 relay, 1 control and 1 relay output, 1 control input, contact NO:

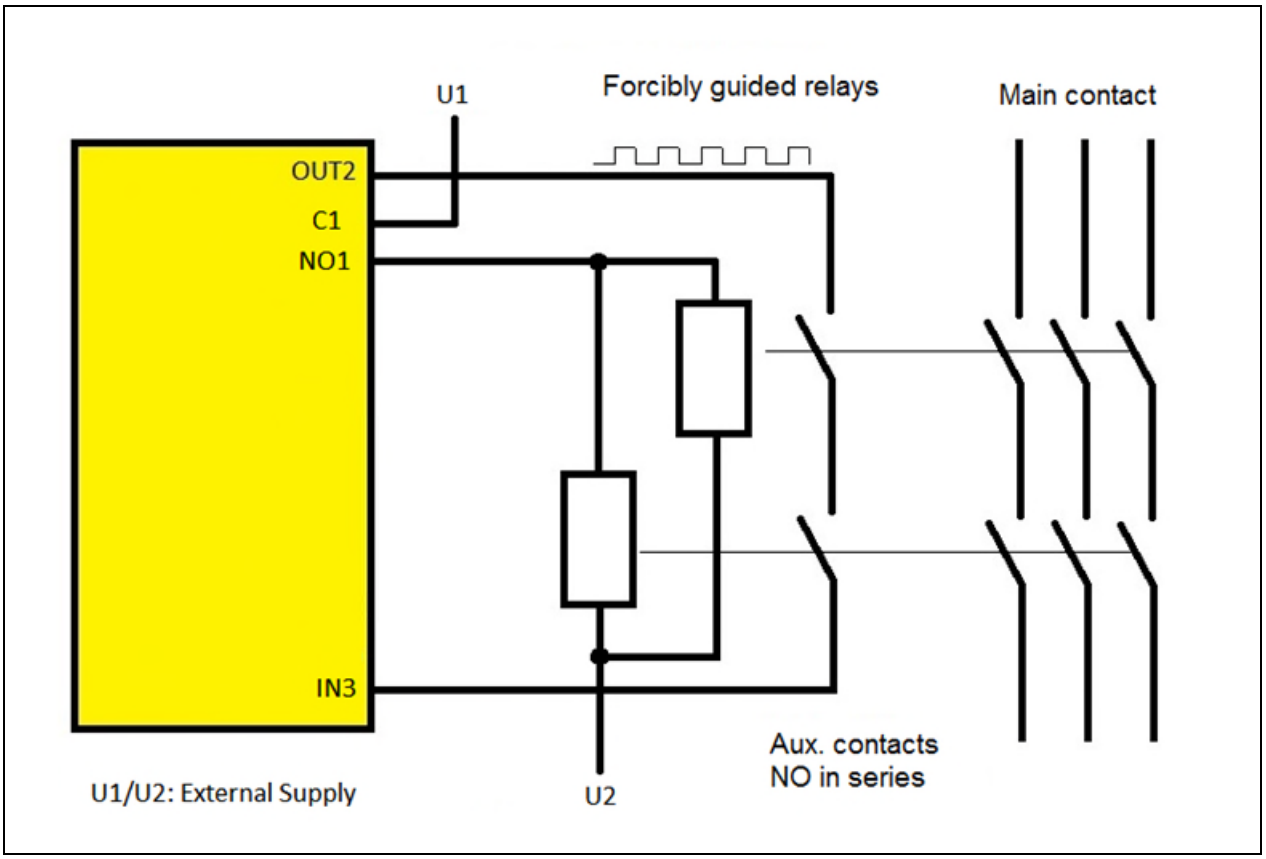


Parameter	Setting	Description
Switch Mode REL1	0	REL1 to detect overspeed
Switch Mode OUT2	9	OUT2 to generate clock signal
Read Back OUT	16	Inversion (connection to X1/2 via NO contact)
IN3 Function	22	Adaption to REL1 (overspeed)
IN3 Config	14	Adaption to clock output OUT2 (via X1/2 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,100	Delay 100 ms to obviate double contact bouncing
Output Mode	0	Inverse configuration

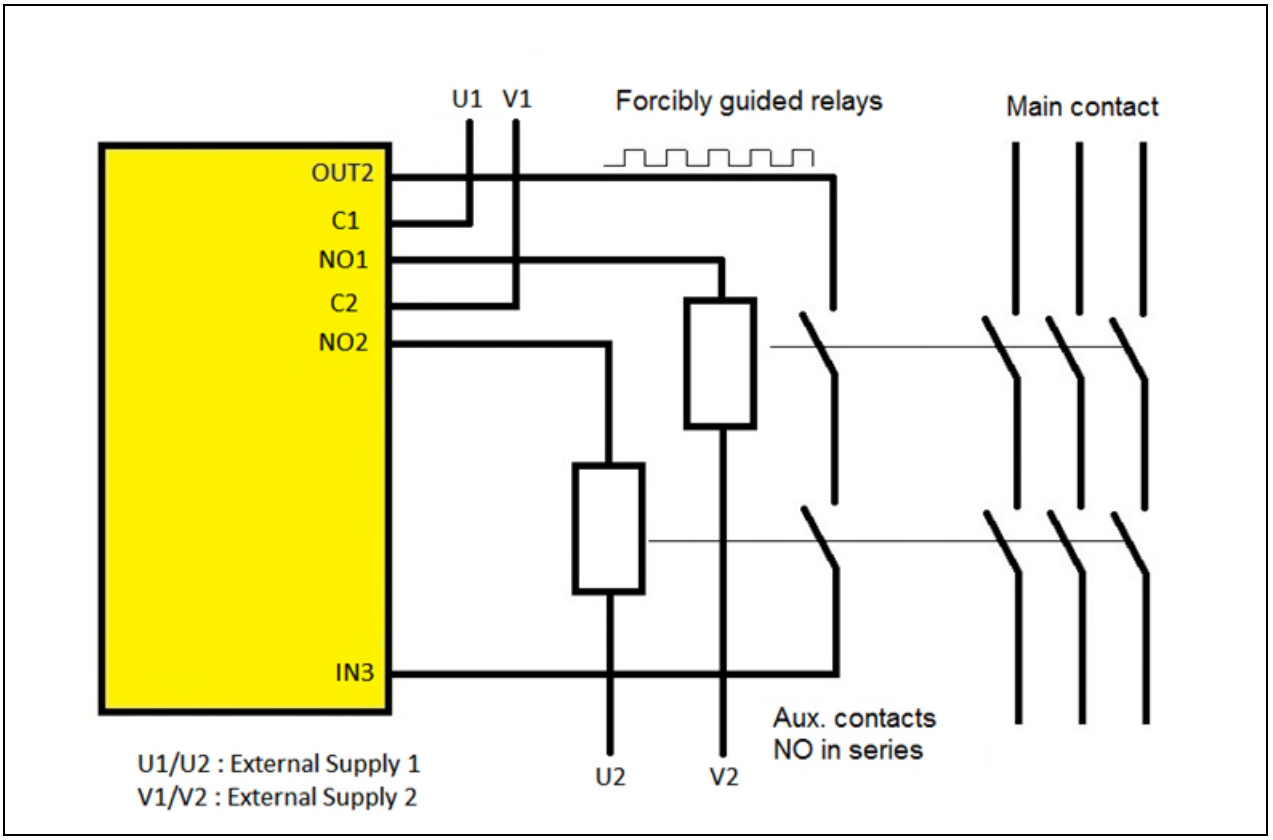
Function:
With normal operation speed the relay output X1 is closed, the external relay therefore is energized. Upon overspeed the relay output X1 is open and the remote relay will drop. The forcibly guided aux. contact is closed, when the relay output X1 is energized and the clock signal is conducted to the input.
Under error condition the DS2xx monitor will open the relay output X1, the remote relay will be de-energized, which will signal "overspeed". With errors occurring under normal operating speed, the unit will take an error state which signals "overspeed" again (Safety Integrity Level = 1).
The main contacts can be used as opener or closer depending on the application.

16.9. EDM: 2 external relays at X1/2 with SIL2

Precondition: 2 relays, 1 control and 1 relay output, 2 control inputs, auxiliary contact NO:



Precondition: 2 relays, 1 control and 2 relay outputs, 2 control inputs, auxiliary contact NO:

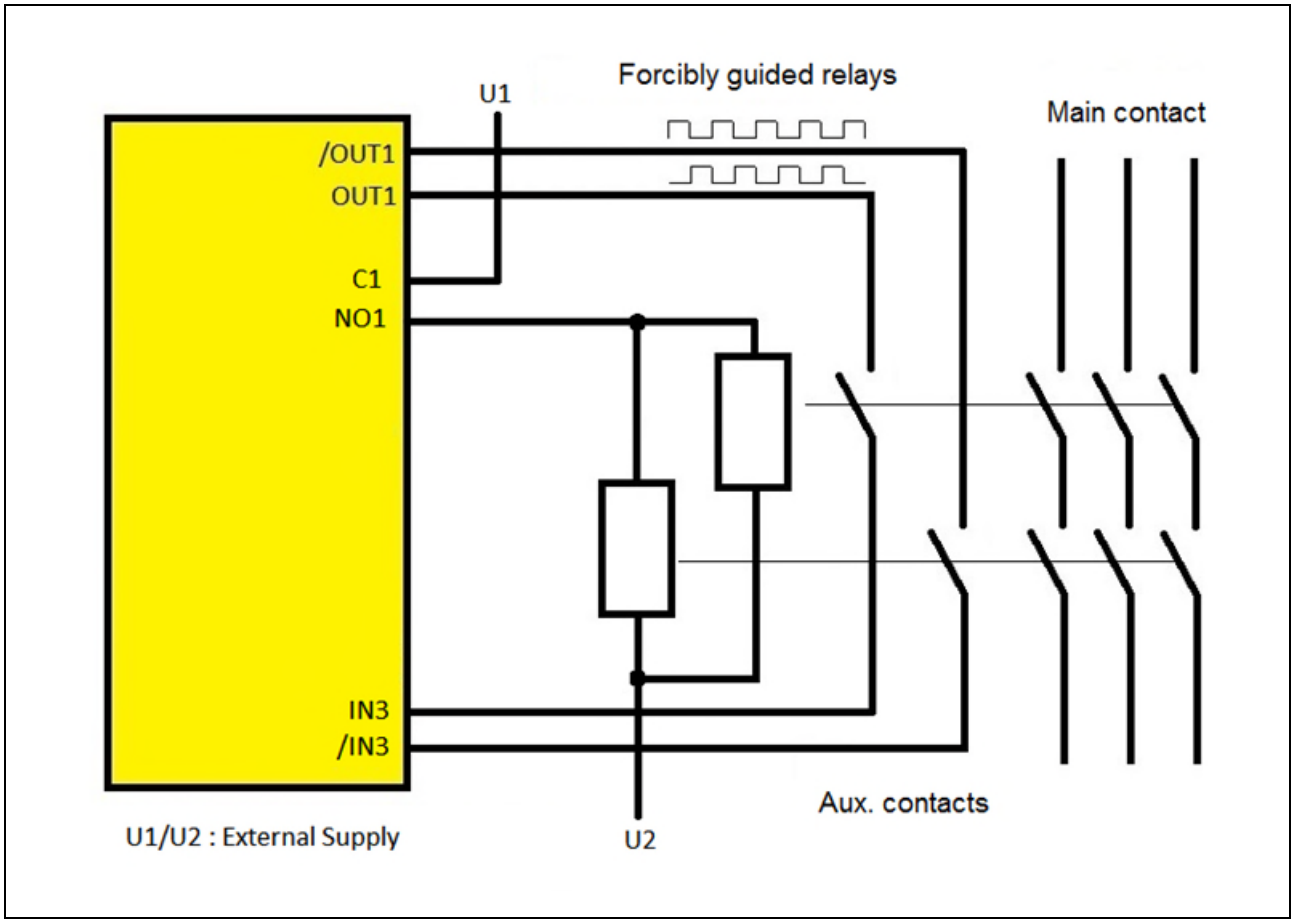


Continuation „EDM: 2 external relays at X1/2 with SIL2”:

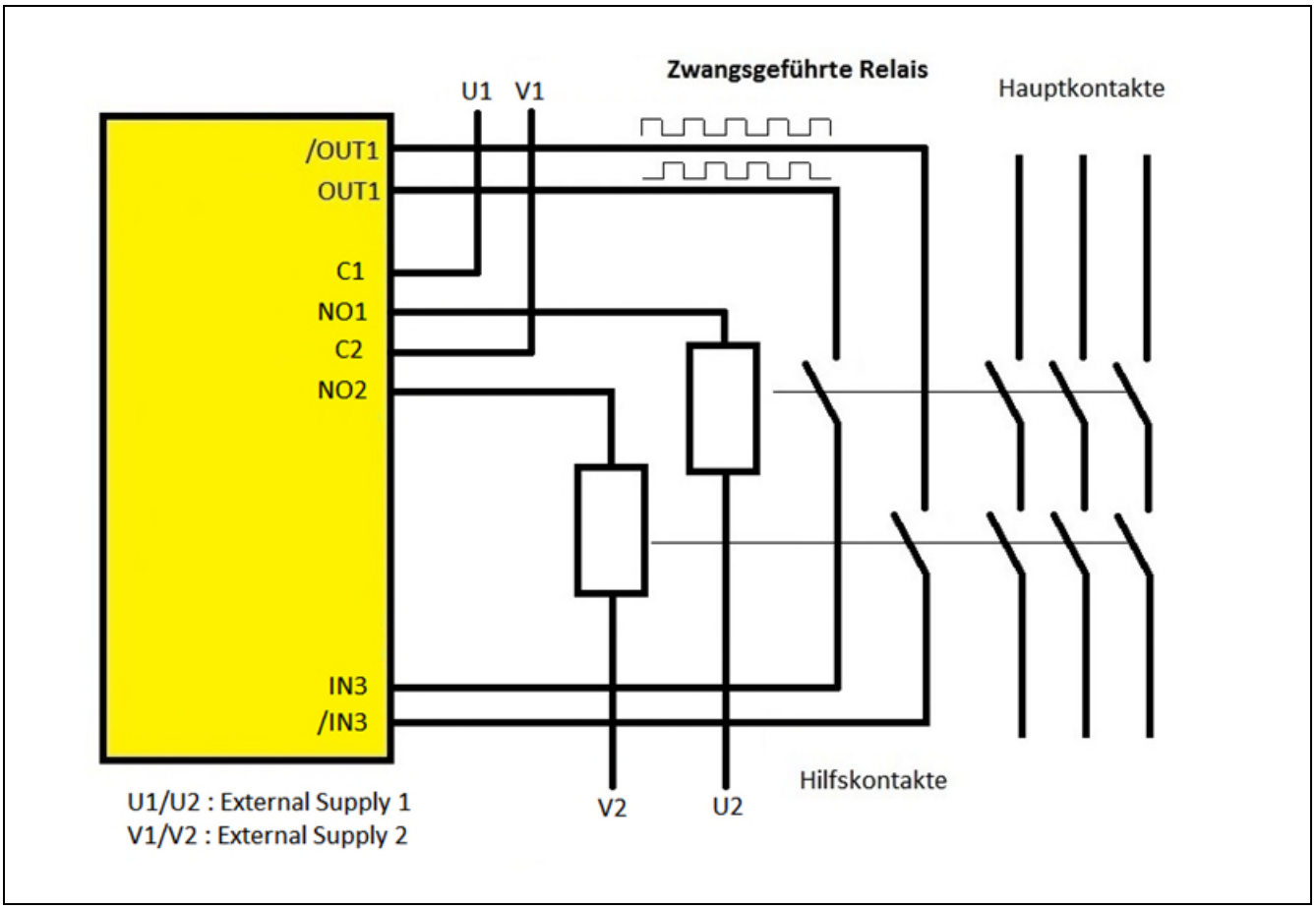
Parameter	Setting	Description
Switch Mode REL1	0	REL1 to detect overspeed
Switch Mode OUT2	9	OUT2 to generate clock signal
Read Back OUT	16	Inversion (connection to X1/2 via NO contact)
IN3 Function	22	Adaption to REL1 (overspeed)
IN3 Config	14	Adaption to clock output OUT2 (via X1/2 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,100	100ms delay due to the double relay bounce
Output Mode	0	Inverse circuit

16.10. EDM: 2 externe Relais an X1/2 mit SIL3

Precondition: 2 relays, 2 control and 1 relay output, 2 control inputs, auxiliary contact NO:



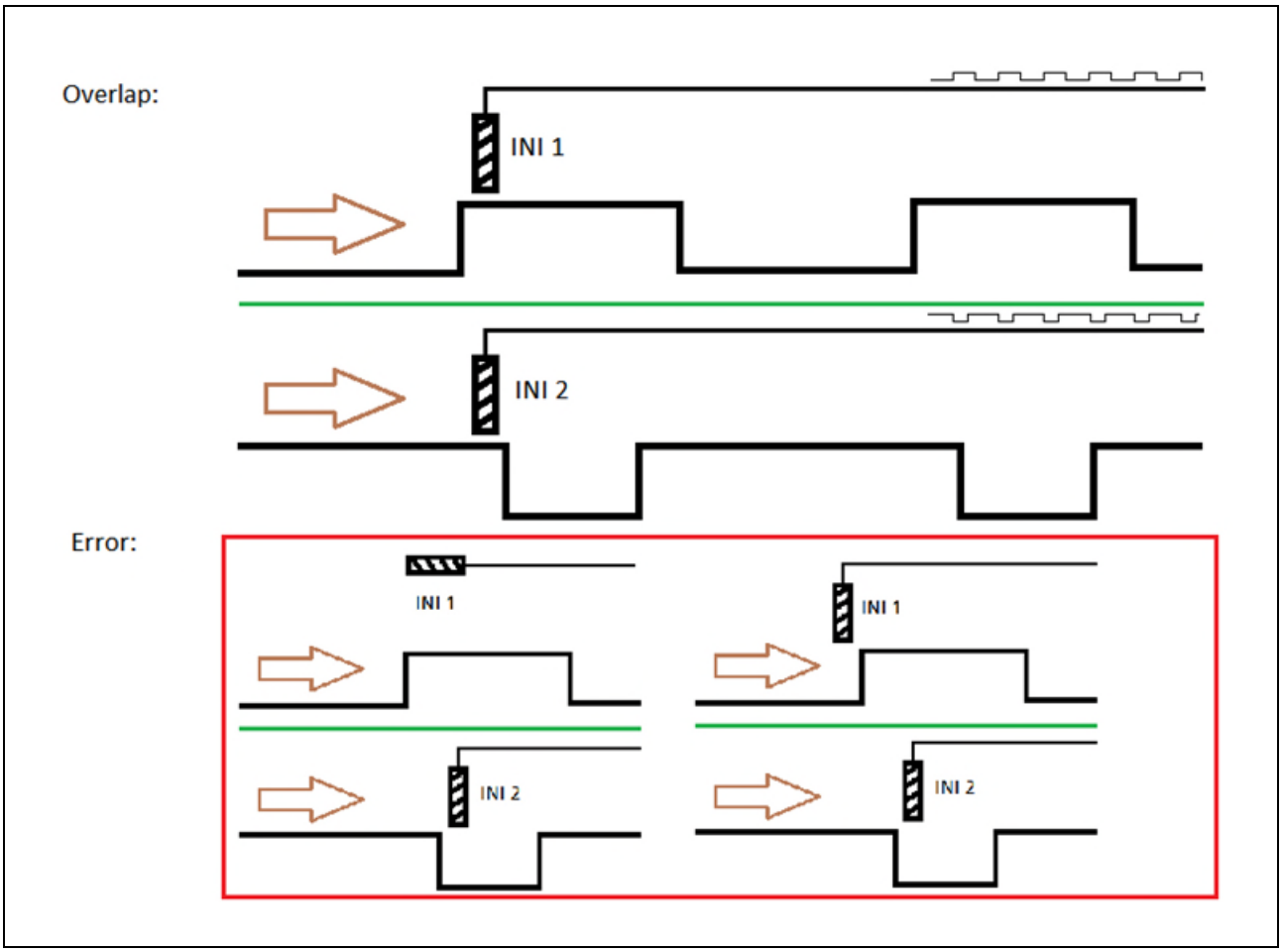
Precondition: 2 relays, 2 control and 2 relay outputs, 2 control inputs, auxiliary contact NO:



Parameter	Setting	Description
Switch Mode REL1	0	REL1 to detect overspeed
Switch Mode OUT1	9	OUT1 to generate clock signal
Read Back OUT	16	Inversion (connection to X1/2 via NO contact)
IN3 Function	22	Adaption to REL1 (overspeed)
IN3 Config	12	Adaption to clock output OUT2 (via X1/2 contact)
/IN3 Function	22	Adaption to REL1 (overspeed)
/IN3 Config	13	Adaption to clock output OUT2 (via X1/2 contact)
Input Mode 2	2	4 single control inputs for free use
Read Back Delay	0,100	100ms delay due to the double relay bounce
Output Mode	0	Inverse circuit

17. Overlap

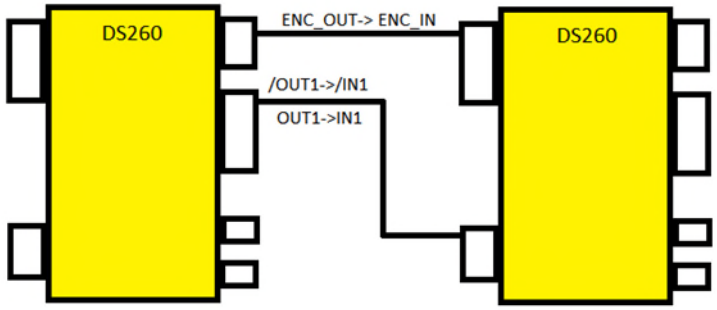
Using the sensor parameter „Sensor Overlap“, Overlap monitoring can be activated. The Overlap function can only be performed if the "Op Mode“= 3 is activated, i.e. both sensors work with a HTL signals.
If the sensors are proximity switch, the recesses of both sensors must be installed in such a way that only three of the four possible output states occur during the run-off.
The picture below shows that there is never a condition where both proximity switch are uncovered. If a sensor fails, an error can be triggered in the uncovered phase of the other sensor, because both sensors display the state uncovered. Removing both sensors or a cable break can also cause an error.
The type of recess can cause an error while at the same time covered or at the same time uncovered state. By choosing the proximity switch PNP opener or PNP closer, the polarity can be adjusted to the input of the DS. (DS input open corresponds to low).



18. Cascading

By cascading two units, the number of control inputs and outputs can be increased. Errors of the first stage are forwarded via the Encoderausgang or via the digital output. Both connections must be present. The parameter "Split. Level" of the first unit must be set to 0 (5V) and the parameter "Power-CAS delay" must also be set to zero. The „Power-Cas Delay" parameter of the second unit should be set to about 20s.

Cascade Two Units:



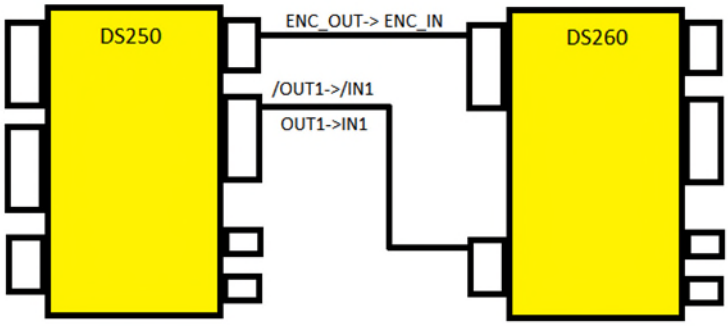
1x Encoder In
4x2 Inputs

1x Analog Out
3x Digital Out
2x Parallel Relay Contacts

3x2 Inputs

1x Encoder Out
1x Analog Out
4x Digital Out
2x Parallel Relay Contacts

Cascade Two Units:



2x Encoder In
4x2 Inputs

1x Analog Out
3x Digital Out
2x Parallel Relay Contacts

3x2 Inputs

1x Encoder Out
1x Analog Out
4x Digital Out
2x Parallel Relay Contacts

19. Technical Specifications

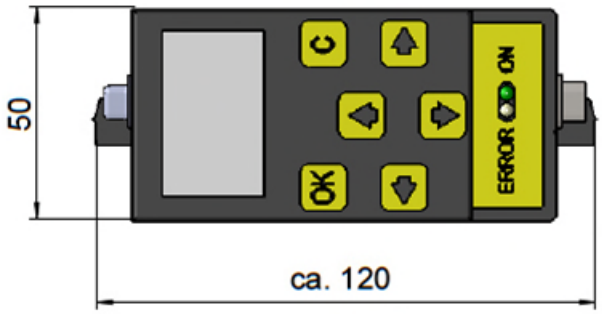
Technical Specifications:		
Power supply:	Input voltage:	18 … 30 VDC
	Protective circuit:	reverse polarity protection
	Ripple:	max 10 % at 24 VDC
	Power consumption:	approx. 150 mA (unloaded), approx. 2000 mA (loaded)
	Protection:	external fuse (3.15 A, medium time-lag) necessary
	Connections:	screw terminal, 1.5 mm² / AWG 16
Encoder supply:	Number:	2
	Output voltage:	5 VDC / 24 VDC (approx. 2 VDC … 3DVC less the input voltage)
	Output current:	max 200 mA per encoder
	Protective circuit:	short-circuit-proof
Incremental inputs:	Number of inputs:	2 Encoder (A, /A, B, /B, Z, /Z), (1 Encoder at DS260)
	Format:	HTL differential - U_{Diff} = min. 5V / HTL single ended - U_H > 14V , U_L < 5V / RS422 - U_{Diff} = min. 1,5V
	Frequency:	max 500 kHz
	Connections:	screw terminal, 1.5 mm² / AWG 16
Control inputs:	Number of inputs:	8 (single lane) or 4 (two-channel, inverse/homogeneous)
	Application:	Control signals
	Signal level:	HTL PNP (10 ... 30 V)
	Load:	max. 15 mA
	Frequency:	max. 1 kHz
	Connections:	screw terminal, 1.5 mm² / AWG 16
Incremental output: (safety related)	Splitter output:	1 Endcoder (A, /A, B, /B, Z, /Z)
	Format:	HTL differential/ HTL single ended/ RS422
	Frequency:	max 500 kHz
	Connections:	screw terminal, 1.5 mm² / AWG 16
Analogue output: (safety related)	Current output:	4 ... 20 mA (load max. 270 Ohm)
	Resolution:	14 Bit
	Accuracy:	± 0,1 %
	Connections:	screw terminal, 1.5 mm² / AWG 16
Control outputs: (safety related)	Number of outputs:	8 (single lane) or 4 (two-channel, inverse/homogeneous)
	Output voltage:	HTL (approx. 2 … 3 VDC less than input voltage)
	Output current:	max 500 mA per output, shared max 1000 mA
	Switching characteristic:	push-pull
	Protective circuit:	short-circuit-proof
	Connections:	screw terminal, 1.5 mm² / AWG 16
Relay output: (safety related)	Number of relays:	1 double relay output, force-actuated (2x NO)
	Switching capability:	5 ... 250 VAC/ VDC
	Switching capacity:	5 mA ... 5 A
	Connections:	screw terminal, 1.5 mm² / AWG 16
USB interface:	Version / connection:	USB 1.0 / Type B (female)
	Operating System:	WIN7 /8 / 10 (tested with (1511 build 10586.104)
LEDs:	Green / yellow:	„ON“ / „ERROR“
Switches:	DIL switch:	1 x 3-pin

Technical Specifications:		
Conformity and standards:	MR 2006/42/EC: EMC 2014/30/EU: Vibration resistance: Shock resistance: RoHS (II) 2011/65/EU RoHS (III) 2015/863:	EN ISO 13849-1, EN 61508, EN 62061, EN 60947-5-1 EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61326-3-1, EN 61326-3-2 EN 60068-2-6 (sine, 7 g, 10 – 200 Hz, 20 cycles) EN 60068-2-27 (half sine, 30 g, 11 ms, 3 shocks) EN 60068-2-27 (half sine, 17 g, 6 ms, 4000 shocks) EN IEC 63000
Safety characteristic data:	Classification: Approved Safety Function: System structure: System architecture: DC_{avg}: SFF: $MTTF_D$: PFH: λ_{SD} / λ_{SU} / λ_{DD} / λ_{DU}: Safety functions:	Up to SIL3/PLe (depends on the used encoder/sensor arrangement) Certification No.: 44 207 14018601 dual-channel Cat. 3 / HFT = 1 98,7 % 98,99 % 156,5 Jahre 5,73 * 10^{-9} h^{-1} 1,29 * 10^{-7} h^{-1} / 5,3 * 10^{-8} h^{-1} / 7,2 * 10^{-7} h^{-1} / 9,22 * 10^{-9} h^{-1} equivalent to EN 61800-5-2 for SS1, SS2, SOS, SLS, SDI, SSM, SLI, SBC, STO, SMS (depending on the used encoder input signals)
Classification test impulses:	Classification: Class: Test Pulse Duration: Test Pulse interval: Input impedance: Input capacity:	by ZVEI CB24I drain: C1 / source: C1 C2 C3 max. 1 ms min. 2,5 ms min. 18 kOhm max. 1 nF
Enclosure:	Material: Mounting: Dimensions: Protection class: Weight:	plastic 35 mm top hat rail (according to EN 60715) 50 x 100 x 165 mm, 1,97 x 3,94 x 6,49 inch, (w x h x d) IP20 ca. 400 g
Ambient temperature:	Operation: Storage:	-20 °C ... +55 °C / -4 °F … +131 °F (without condensation) -25 °C ... +70 °C / -13 °F … +158 °F (without condensation)
Maintenance:	Interval:	Switch on/off for at least 1 times a year (at continuous operation)
BG200 unit: (optional)	Display / Operation:	OLED-Display / Touch screen

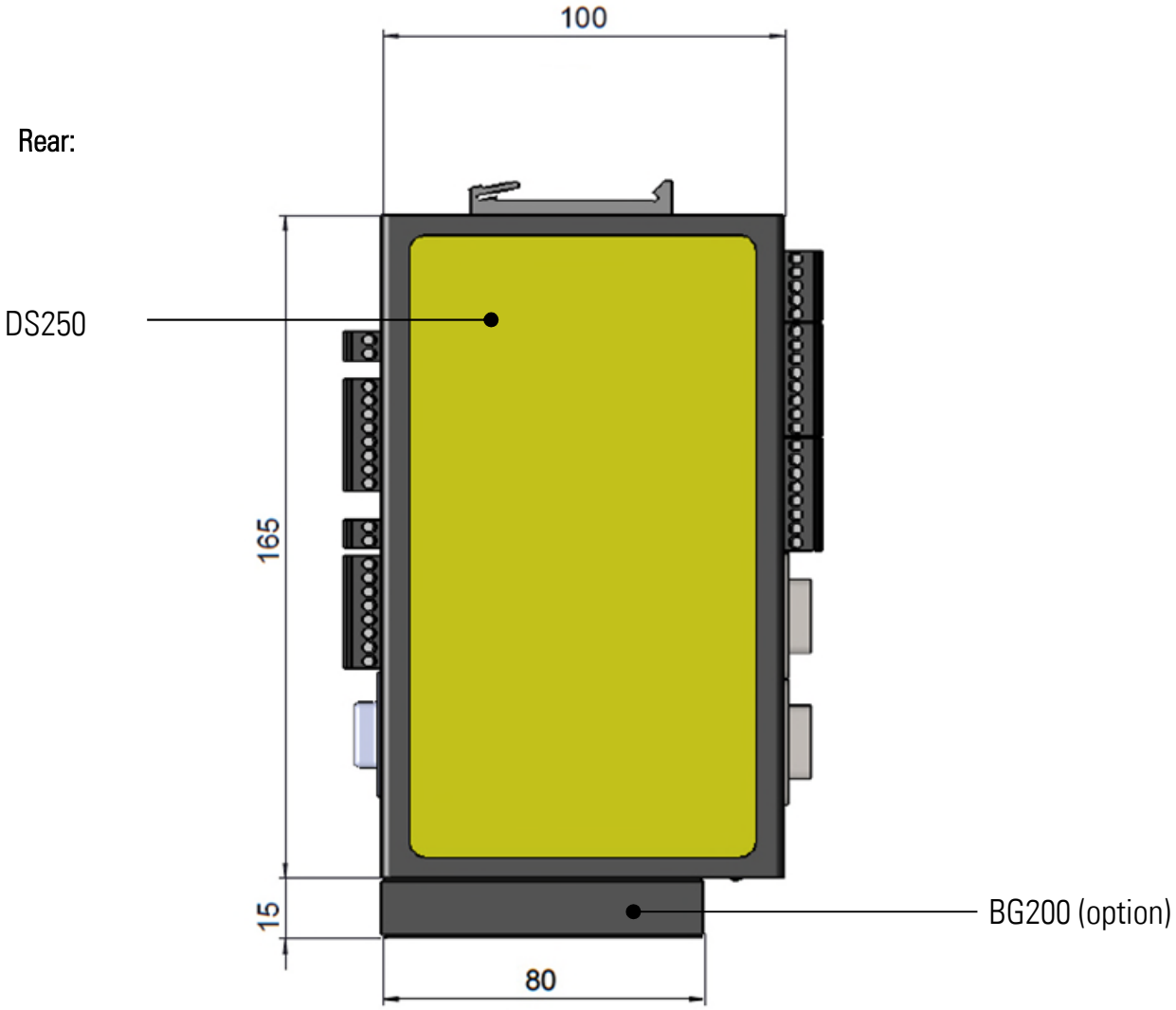
19.1. Dimensions

(incl. BG200 on front)

Front:



Rear:



20. Certificate

TÜV NORD

ZERTIFIKAT
CERTIFICATE

Hiermit wird bescheinigt, dass die Firma / *This is to certify, that the company*

motrona GmbH
Zeppelinstraße 16
78244 Gottmadingen
Deutschland

berechtigt ist, das unten genannte Produkt mit dem abgebildeten Zeichen zu kennzeichnen.
is authorized to provide the product described below with the mark as illustrated.

Fertigungsstätte: *Manufacturing plant:*	**motrona GmbH** **Zeppelinstraße 16** **78244 Gottmadingen** **Deutschland**
Beschreibung des Produktes: (Details s. Anlage 1) *Description of product:* *(Details see Annex 1)*	**Ds2xx Wächterserie zur sicherheitsgerichteten Überwachung von Drehzahl, Stillstand und Drehrichtung** *DS2xx monitor series for safety-related monitoring of speed, standstill and direction of rotation*
Geprüft nach: *Tested in accordance with:*	**EN ISO 13849-1:2015 – Kat. 3 PL e** **EN 61508:2010 – SIL 3** **EN 62061:2005 + Cor. 2010 + A1:2013 + A2:2015 – SILCL 3**

TÜV NORD
TÜV NORD CERT GmbH
Approved Safety Function
EN ISO 13849-1
EN 61508
EN 62061
PL 'e'
SIL 3
SIL_{CL} 3

Registrier-Nr. / *Registered No.* 44 207 14018601
Prüfbericht Nr. / *Test Report No.* 3527 1535
Aktenzeichen / *File reference* 8003019827

Gültigkeit / Validity
von / *from* 2020-06-11
bis / *until* 2025-06-10

F. Hegenfeld

Zertifizierungsstelle der TÜV NORD CERT GmbH
Certification body of TÜV NORD CERT GmbH

Essen, 2020-06-11

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de machinery@tuev-nord.de

Bitte beachten Sie auch die umseitigen Hinweise
Please also pay attention to the information stated overleaf

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ANLAGE
ANNEX

Anlage 1, Seite 1 von 1
Annex 1, page 1 of 1

zum Zertifikat Registrier-Nr. / *to Certificate Registration No.* 44 207 14018601

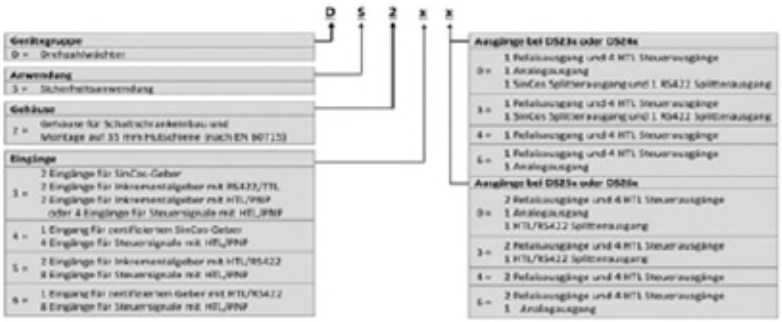
Produktbeschreibung:
Product description:

Redundante Auswerteeinheit zum Erfassen, Verarbeiten und Weiterleiten von sicherheitsgerichteten Ein- und Ausgangsgrößen in sicherheitsgerichteten Applikationen bezogen auf Drehzahl, Stillstand und Drehrichtung
Redundant safety monitor for measuring, processing and forwarding safety-related input and output values on safety related applications with regards to speed, standstill and direction of rotation

Typbezeichnung:
Type designation:

DS23x, DS24x, DS25x oder DS26x

Technische Daten:
Technical data:



Weitere Technische Daten sind dem zugehörigen Safety-Manual zu entnehmen
Further technical data can be found in the corresponding Safety Manual
Zur Realisierung einer SIL 3 / SILCL 3 / PL e bzw. SIL 2 / SILCL 2 / PL d Sicherheitsfunktion ist bei der Variante DS24x und DS26x ein gleichermaßen zertifizierter Sensor zu verwenden
To implement a SIL 3 / SILCL 3 / PL e or SIL 2 / SILCL 2 / PL d safety function, an equally certified sensor must be used with the DS24x and DS26x versions.

F. Hegenfeld

Zertifizierungsstelle der TÜV NORD CERT GmbH — Essen, 2020-06-11
Certification body of TÜV NORD CERT GmbH

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de machinery@tuev-nord.de

Parameter Description

For the DS250 / DS260 safety units

- Supplement to the DS operating manual
- Describes the DS parameter functions
- incl. Parameter list as short overview
- For setup and commissioning procedure
- Overview of all registers
-

Version:	Description:
Ds250_01a_pd_e.doc/ Jan-18/af/cn	First separated version as parameter description
Ds250_01b_pd_e.doc/ Apr-18/af/cn	Small additions
Ds250_01c_pd_e.doc/ Apr-18/af/cn	New parameter Power-Cas Delay
Ds250_01d_pd_e.doc/July-18/af/cn	Additions
Ds250_01e_pd_e.doc/May-19/mbo	Next revised version
Ds250_02a_pd_e.doc/Nov-19/af/mbo	New parameter and parameter range magnification
Ds250_02b_pd_e.doc/Jun-20/af/mbo	Revised version
Ds250_02c_pd_e.docx/Dec.-21/mbo	Revision in chapter 11.2 / Safety Manual --> PRG Error
Ds250_03a_pd_e.docx/May-24/mbo	Revision in chapter 2.7, added chapter "Init Menu"

General

This parameter description was created as a separate document for an optimum overview.
It contains information about the entire DS250 / DS260 registers as well as a parameter list at the end of the document.

Table of contents

1. Parameter / Menu Overview

The parameterization of the device is realized via USB interface with a PC and the operating software OS. The link to the free download can be found on page 2.
This section provides an overview of the menus and their assignments to the different unit functions. The menu names are printed bold and associated Parameters are arrayed directly under the menu names.

Nr.	Menu / Parameter
	Main Menu
000	Sampling Time
001	Wait Time
002	F1-F2 Selection
003	Div. Mode
004	Div. Switch %-f
005	Div. %-Value
006	Div. f-Value
007	Div. Calculation
008	Div. Filter
009	Div. Filter Time
010	Div. Inc-Value
011	Error Simulation
012	Power-up Delay
013	Filter
014	Power-up Error
015	Sensor Overlap
016	Power-Cas Delay
	Sensor1 Menu
017	Op-Mode 1
018	Edge 1
019	Direction 1
020	Multiplier 1
021	Divisor 1
022	Position Drift 1
023	Sense Value 1
024	Sense Tol. 1
025	Phase Error 1
026	Set Frequency 1
027	Error Mask 1
028	Dir Changes 1

Nr.	Menu / Parameter
	Sensor2 Menu
029	Op-Mode 2
030	Edge 2
031	Direction 2
032	Multiplier 2
033	Divisor 2
034	Position Drift 2
035	Sense Value 2
036	Sense Tol. 2
037	Phase Error 2
038	Set Frequency 2
039	Error Mask 2
040	Dir Changes 2

Continuation "Parameter / Menu-Overview":

Nr.	Menu / Parameter
	Presel.OUT1 Menu
041	Presel.OUT1.01
042	Presel.OUT1.02
043	Presel.OUT1.03
044	Presel.OUT1.04
045	Presel.OUT1.05
046	Presel.OUT1.06
047	Presel.OUT1.07
048	Presel.OUT1.08
049	Presel.OUT1.09
050	Presel.OUT1.10
051	Presel.OUT1.11
052	Presel.OUT1.12
053	Presel.OUT1.13
054	Presel.OUT1.14
055	Presel.OUT1.15
056	Presel.OUT1.16
057	Presel.OUT1.D
058	Presel.OUT1.M
059	Presel.OUT1.R
060	Reserved
	Presel.OUT2 Menu
061	Presel.OUT2.01
062	Presel.OUT2.02
063	Presel.OUT2.03
064	Presel.OUT2.04
065	Presel.OUT2.05
066	Presel.OUT2.06
067	Presel.OUT2.07
068	Presel.OUT2.08
069	Presel.OUT2.09
070	Presel.OUT2.10
071	Presel.OUT2.11
072	Presel.OUT2.12
073	Presel.OUT2.13
074	Presel.OUT2.14
075	Presel.OUT2.15
076	Presel.OUT2.16
077	Presel.OUT2.D
078	Presel.OUT2.M
079	Presel.OUT2.R
080	Reserved

Nr.	Menu / Parameter
	Presel.OUT3 Menu
081	Presel.OUT3.01
082	Presel.OUT3.02
083	Presel.OUT3.03
084	Presel.OUT3.04
085	Presel.OUT3.05
086	Presel.OUT3.06
087	Presel.OUT3.07
088	Presel.OUT3.08
089	Presel.OUT3.09
090	Presel.OUT3.10
091	Presel.OUT3.11
092	Presel.OUT3.12
093	Presel.OUT3.13
094	Presel.OUT3.14
095	Presel.OUT3.15
096	Presel.OUT3.16
097	Presel.OUT3.D
098	Presel.OUT3.M
099	Presel.OUT3.R
100	Reserved
	Presel.OUT4 Menu
101	Presel.OUT4.01
102	Presel.OUT4.02
103	Presel.OUT4.03
104	Presel.OUT4.04
105	Presel.OUT4.05
106	Presel.OUT4.06
107	Presel.OUT4.07
108	Presel.OUT4.08
109	Presel.OUT4.09
110	Presel.OUT4.10
111	Presel.OUT4.11
112	Presel.OUT4.12
113	Presel.OUT4.13
114	Presel.OUT4.14
115	Presel.OUT4.15
116	Presel.OUT4.16
117	Presel.OUT4.D
118	Presel.OUT4.M
119	Presel.OUT4.R
120	Reserved

Continuation **"Parameter / Menu-Overview"**:

Nr.	Menu / Parameter
	Presel.REL1 Menu
121	Presel.REL1.01
122	Presel.REL1.02
123	Presel.REL1.03
124	Presel.REL1.04
125	Presel.REL1.05
126	Presel.REL1.06
127	Presel.REL1.07
128	Presel.REL1.08
129	Presel.REL1.09
130	Presel.REL1.10
131	Presel.REL1.11
132	Presel.REL1.12
133	Presel.REL1.13
134	Presel.REL1.14
135	Presel.REL1.15
136	Presel.REL1.16
137	Presel.REL1.D
138	Presel.REL1.M
139	Presel.REL1.R
140	Reserved
	Switching Menu
141	Switch Mode OUT1
142	Switch Mode OUT2
143	Switch Mode OUT3
144	Switch Mode OUT4
145	Switch Mode REL1
146	Pulse Time OUT1
147	Pulse Time OUT2
148	Pulse Time OUT3
149	Pulse Time OUT4
150	Pulse Time REL1
151	Hysteresis OUT1
152	Hysteresis OUT2
153	Hysteresis OUT3
154	Hysteresis OUT4
155	Hysteresis REL1
156	Matrix OUT1
157	Matrix OUT2
158	Matrix OUT3
159	Matrix OUT4
160	Matrix REL1

Nr.	Menu / Parameter
161	MIA-Delay OUT1
162	MIA-Delay OUT2
163	MIA-Delay OUT3
164	MIA-Delay OUT4
165	MIA-Delay REL1
166	MAI-Delay OUT1
167	MAI-Delay OUT2
168	MAI-Delay OUT3
169	MAI-Delay OUT4
170	MAI-Delay REL1
171	Delay OUT 1
172	Delay OUT 2
173	Delay OUT 3
174	Delay OUT 4
175	Delay REL 1
176	Startup Mode
177	Startup Output
178	Standstill Time
179	Lock Output
180	Action Output
181	Action Polarity
182	Read Back OUT
183	Output Mode
184	EDM Error Count
185	*Reserved*
	Control Menu
186	Input Mode 1
187	Input Mode 2
188	IN1 Function
189	IN1 Config
190	/IN1 Function
191	/IN1 Config
192	IN2 Function
193	IN2 Config
194	/IN2 Function
195	/IN2 Config
196	IN3 Function
197	IN3 Config
198	/IN3 Function
199	/IN3 Config

Continuation "Parameter / Menu-Overview":

Nr.	Menu / Parameter
	Control Menu
200	IN4 Function
201	IN4 Config
202	/IN4 Function
203	/IN4 Config
204	Read Back Delay
205	GPI Err Time
206	*Reserved*
207	*Reserved*
	Serial Menu
208	Serial Unit Nr.
209	Serial Baud Rate
210	Serial Format
211	Serial Page
212	Serial Init
213	Reserved
	Splitter Menu
214	Split.Level
215	Split.Selector
	Analog Menu
216	Analog Start
217	Analog End
218	Analog Gain
219	Analog Offset
220	*Reserved*
	OPU Menu
221	X Factor 1
222	/ Factor 1
223	+/- Value 1
224	Units 1
225	Decimal Point 1
226	X Factor 2
227	/ Factor 2
228	+/- Value 2
229	Units 2
230	Decimal Point 2
231	*Reserved*
232	*Reserved*
233	*Reserved*
234	*Reserved*
235	*Reserved*

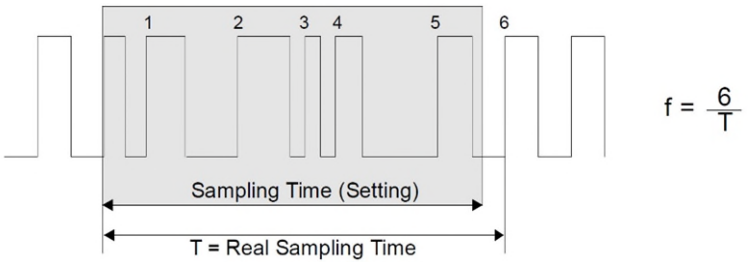
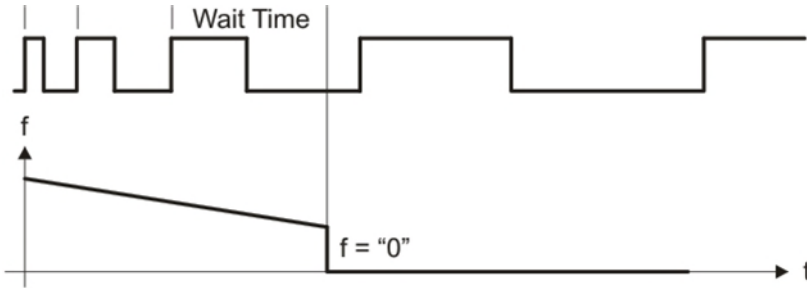
2. Parameter Description

2.1. Important notes for DS260

When using a DS260 variant, the following hints must be observed:
(DS250 is the execution for two independent encoders, DS260 is the execution for a secure encoder)

Nr.	Parameter	Hinweis für DS260
002	F1-F2 Selection	Both settings have the same effect
017	Op-Mode 1	Op-Mode 1 and Op-Mode 2 must be equal
018	Edge 1	Edge 1 and Edge 2 must be equal
019	Direction 1	Direction1 and Direction2 must be equal
020	Multiplier 1	The setting must be „1“
021	Divisor 1	The setting must be „1
022	Position Drift 1	Position Drift 1 and Position Drift 2 must be equal
025	Phase Error 1	Phase Err Count1 and Phase Err Count2 must be equal
027	Error Mask 1	Error Mask 1 and Error Mask 2 must be equal
188 - 203	*IN* Function	To clear drift errors, Clear Drift 1&2 must be used
215	Split. Selector	Both settings have the same effect

2.2. Main Menu

No.	Parameter	Range	Default
000	**Sampling Time** (minimale Frequenz Messzeit): The configured value corresponds to the minimum measurement time. The Parameter is used as a filter in case of irregular frequencies. This parameter directly affects the response time of the unit. The setting is valid for both inputs channels. 	0.001 – 9.999 (sec.)	0.001
001	**Wait Time** (Zeroing): Defines the period time of the lowest frequency resp. the waiting time between 2 rising edges, which is detected as frequency = 0 Hz by the unit.  All frequencies with a period longer than the Wait Time value will be interpreted as frequency = 0 Hz. 0.010 – Frequency = 0 Hz with frequencies smaller than 100 Hz … 9.999 – Frequency = 0 Hz with frequencies smaller than 0.1 Hz The setting is valid for both inputs channels.	0.010 – 9.999 (sec.)	0.100
002	**F1-F2 Selection** (Basic Frequency Selection): This parameter determines which of the two input frequencies of sensor 1 or sensor 2 is subsequently monitored and evaluated as a base frequency. The basic frequency selection affects the following outputs: - Analog output - Control outputs - Relay outputs 0 – Frequency of Sensor 1 serves as basic frequency 1 – Frequency of Sensor 2 serves as basic frequency	0 - 1	0

Continuation **"Main Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>003</td><td>Div. Mode (Type of comparison):

This parameter defines the type of comparison for sensor evaluation. Frequency comparison compares the two sensor frequencies. Parameters 004 - 008 are relevant. Sensor Position Comparison compares the two sensor positions. Parameter 013 is relevant.

<table>
<tr><td>0</td><td>Frequency Comparison:
Differences between the two sensor frequencies results in a Run Time error.</td></tr>
<tr><td>1</td><td>Sensor Position Comparison:
Differences between the two sensor positons results in a Run Time error.</td></tr>
<tr><td>2</td><td>Frequency und Sensor Position Comparison:
Differences between the two sensor frequencies and the sensor positions results in a Run Time error.</td></tr>
</table>
Strongly fluctuating frequencies caused by step motors or elastic connections between the encoders, Sensor Position Comparison could be more stable.
Relationship between the encoders which are not adjusted by the parameter Multiplier and Divisor could cause cumulative errors. In this case Frequency comparison is more stable.
The DS260 is normally used with Position Comparison.</td><td>0 - 2</td><td>0</td></tr>
<tr><td>004</td><td>Div. Switch %-f (Divergence switching point %-Hz):

Parameters for frequency comparison:
The DS unit constantly compares the frequencies of Sensor 1 and Sensor 2 to the adjusted maximum allowed divergence. Application-specific a percentage comparison can be problematic with lower frequencies, so that a direct monitoring of the difference frequency in Hz can deliver better results.

This Parameter allows to define a limit. When undershooting the adjusted value the comparison will proceed no more percentages, but absolute in Hz.</td><td>0 - 9999,99
(Hz)</td><td>100.00</td></tr>
<tr><td>005</td><td>Div. %-Value (maximum Divergence %):

Defines the maximum allowed percentage divergence between the frequencies of Sensor 1 and Sensor 2. If this value is exceeded, the unit switches to an error state. The calculation is specified by parameter "Div. Calculation ".</td><td>0 - 100
(%)</td><td>10</td></tr>
</table>

Continuation **"Main Menu":**

<table>
<tr><td>006</td><td><u>Div. f-Value</u> <u>(maximum Divergence Hz)</u>:

Defines the maximum allowed absolute divergence in Hz between the frequencies of Sensor 1 and Sensor 2. If the adjusted value is exceeded, the unit switches to an error status.</td><td>0 - 999,99
(Hz)</td><td>30.00</td></tr>
<tr><td>007</td><td><u>Div. Calculation</u> <u>(Divergence Calculation Mode)</u>:

Parameters for frequency comparison:
This parameter will calculate the percentage divergence.
<table><tr><td>0</td><td>Reference value is the frequency of Sensor1:
△(%) = (Sensor 1 – Sensor) : Sensor 1 x 100 %</td></tr><tr><td>1</td><td>Reference value is the frequency of Sensor2:
△(%) = (Sensor 2 – Sensor 1) : Sensor 2 x 100 %</td></tr></table></td><td>0 - 1</td><td>0</td></tr>
<tr><td>008</td><td><u>Div. Filter</u> <u>(Divergenz-Filter)</u>:

Parameters for frequency comparison:
This digital filter parameter evaluates the divergence between Sensor 1 and Sensor 2.
<table><tr><td>0</td><td>The filter is not active:
The unit reacts immediately to each frequency deviation</td></tr><tr><td>5</td><td>Medium filter effect:
The unit tolerates temporary deviations and fluctuations, e g. caused from torsion or mechanical vibrations and reacts delayed to deviations between both input frequencies</td></tr><tr><td>10</td><td>Higher filter effect:
The unit tolerates temporary deviations and fluctuations, e g. caused from torsion or mechanical vibrations and reacts with a very long delay to prolonged deviations between both input frequencies</td></tr></table></td><td>0 - 20</td><td>1</td></tr>
<tr><td>009</td><td><u>Div. Filter Time</u> <u>(maximum filter time)</u>:

Parameter for Div. Filter:
If the Div. Filter Time = 0 is set, the Div. Filter is updated after each sampling time period or after the completion of a period (at low frequencies greater than the sampling time). This parameter allows a fixed time base for updating the Div. Filters are used.
(Sampling Time <= Div. Filter Time)</td><td>0 – 1,000
(sec.)</td><td>0,000</td></tr>
</table>

Continuation **"Main Menu":**

<table>
<tr><td>010</td><td><u>Div. Inc-Value</u> (absolute deviation in increments):

Parameters for frequency comparison:
This parameter defines the maximum acceptable deviation in increments by Sensor Position Comparison.
If value 1000 is set, a position deviation higher than 1000 or lower than -1000 increments results in a Run-Time error.
This parameter is only used by Sensor Position Comparison.

If the parameter is set to 0, no error is recognized.</td><td>0 - 9999999</td><td>0</td></tr>
<tr><td>011</td><td><u>Error Simulation</u>

This Parameter is only allowed in Programming Mode and serves exclusively for test purposes during the commissioning procedure. It allows to simulate and suppress error messages as follows:
<table><tr><td>0</td><td>Error state:
Sets the unit into error status. By using this parameter it is possible to check, if the entire follow-up system reacts correctly in case of errors.</td></tr><tr><td>1</td><td>Normal state:
Before exiting the Programming Mode,
this parameter always must be set to 1.</td></tr><tr><td>2</td><td>Error clearing:
All errors reported by the unit will be reset.</td></tr></table>A direct changeover between 0 and 2 should be avoided.

After the test, this parameter must be reset to default (=1).</td><td>0 - 2</td><td>0</td></tr>
<tr><td>012</td><td><u>Power-up Delay:</u>

A delay time setting is recommended to ensure a safely power up and enough time for stabilization after switching the encoder supply for all connected encoders. The evaluation of the encoder signals will start after the selected delay time has been elapsed.
This parameter can also be used to compensate different start-up times at power up.</td><td>0,001 - 19,999
(sec.)</td><td>0.100</td></tr>
</table>

Continuation **"Main Menu":**

013	Filter (filtering the input frequencies): If value is set to 0, smoothing and filtering of the input frequencies will not be executed. The higher the value setting, the stronger the smoothing of the input frequencies, the lower the dynamic within frequency chances. A combination of Sampling Time and filtering is the best for smoothed input frequencies The Sampling Time affects more on high-frequency range (period time shorter than the Sampling Time). Filtering affects the frequency value determined after the Sampling Time resp. frequencies with period times longer than the Sampling Time. Frequencies > 1/Sampling Time: For Sampling Time = 1ms and Filter = 10, a value approx. 63 % is reached after 10 ms, 95 % after 30 ms and the final value is reached after 50 ms. A tenfold of the Sampling Time occurs a tenfold of the filtering time. Same for a tenfold of Parameter Filter and filtering time. The min. filter time is approx. 100 µs, up to two sampling periods. T (63 %) = Sampling Time x Filter T (95 %) = 3 x Sampling Time x Filter T (100 %) = 5 x Sampling Time x Filter Frequencies < 1/Sampling Time: In this case, you have to look at the period time = 1/f. For Filter = 10, after 10 periods a final value approx. 63 %, and after 30 periods a final value approx. 95 % is reached. T (63 %) = 1/f x Filter T (95 %) = 3 x 1/f x Filter T (100 %) = 5 x 1/f x Filter	0 - 999	0

Continuation **"Main Menu":**

<table>
<tr><td>014</td><td><u>Power-up Error</u> (saved error):

With this parameter, an error can be stored permanently so that the error is retained even after a renewed power-up.
Only part of the run time error can be saved permanently. If the value = 0 is set, there will be no error storage at power-down.
A POE error is triggered during the initialization phase if the error was triggered, saved and activated by this parameter.
(corresponding bit = 1 set)
The stored error is also activated in the Run Time Error, independently of the cause of the error still exists.

For delation switch to programming mode. For delete the errors using the parameter "error stimulation" and then switch off the DS250. At next turn on, the error no longer exists.
Delete sequence:
- DIL Switch to Programming mode
- Set parameter error stimulation to 2
- Press transmit change on the OS
- Set parameter error stimulation to 1
- Press transmit change on the OS
- Now no more errors are visible, otherwise the cause of the error must be corrected first.
- Switch off the DS250 (30s)
- Switch on the DS250
- Now there should be no more errors visible, otherwise the cause of the error still exists.</td><td>0 - 2097151</td><td>0</td></tr>
<tr><td>015</td><td><u>Sensor Overlap:</u>
The overlap of the two sensors can be defined with this parameter in Op.-Mode 1= 3 (A1 Single) and Op. Mode 2 = 3 (A2 Single)

<table><tr><td>0</td><td>Off:
The overlap is disabled. No error evaluation occurs.</td></tr><tr><td>1</td><td>Error at low:
The overlap for both signals of the encoder is active. An error is triggered when both sensors are controlled with low.</td></tr><tr><td>2</td><td>Error at high:
The overlap for both signals of the encoder is active. An error is triggered when both sensors are controlled with high.</td></tr></table></td><td>0 - 2</td><td>0</td></tr>
<tr><td>016</td><td><u>Power-Cas Delay</u> (Power-up Delay in cascade mode):
This parameter can be used to set the power-on delay in cascade mode.</td><td>0 -99,999</td><td>0,000</td></tr>
</table>

2.3. Sensor 1 Menu

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>017</td><td><u>Op-Mode 1</u> (operation mode):

At DS260 version: Op-Mode 1 = Op-Mode 2

This parameter defines wich input type is assigned to sensor input 1.

<table>
<tr><td>0</td><td>RS-422 differentiel (A,/A,B,/B,Z,/Z with A/B 90°)</td></tr>
<tr><td>1</td><td>HTL differentiel (A,/A,B,/B,Z,/Z with A/B 90°)</td></tr>
<tr><td>2</td><td>HTL single-lane (A,B,Z with A/B 90°)</td></tr>
<tr><td>3</td><td>HTL single-lane (A Single, B Direction)</td></tr>
</table></td><td>0 - 3</td><td>1</td></tr>
<tr><td>018</td><td><u>Edge 1</u> (edge evaluation):

At DS260 version: Edge 1 = Edge 2

This parameter defines which edge evaluation is assigned to sensor input 1 in Operational Mode = 3.
The parameter refers to the A-single signal processing. Each edge (Edge 1 = 0) or every second edge (Edge 1 = 1) can be evaluated here. For signals with different pulse-pause times, the parameter must be set to 1, so that a quiet frequency is detected. A faster reaction time can be achieved with the setting = 0.</td><td>0 - 1</td><td>0</td></tr>
<tr><td>019</td><td><u>Direction 1</u> (direction of Sensor1):

At DS260 version: Direction1 = Direction2

Parameter to assign the direction of Sensor1

<table>
<tr><td>0</td><td>No changes</td></tr>
<tr><td>1</td><td>Changes the sign of the direction</td></tr>
</table>
This allows to reverse direction of Sensor 1 in order to adapt Sensor 1 to direction of Sensor 2.</td><td>0 - 1</td><td>0</td></tr>
<tr><td>020</td><td><u>Multiplier1</u> (proportional pulse scaling factor):

At DS260 version: Multiplier1 = 1, Multiplier2 = 1

Is used to modulate the frequencies of Sensor 1 and Sensor 2.
This scaling affects only the calculation of the divergence.</td><td>1 - 10 000</td><td>1</td></tr>
<tr><td>021</td><td><u>Divisor1</u> (reciprocal pulse scaling factor):

At DS260 version: Divisor1 = 1, Divisor = 1

To adjust the frequencies of Sensor 1 and Sensor 2.
This scaling affects only the calculation of the divergence.</td><td>1 - 10 000</td><td>1</td></tr>
</table>

Continuation **"Sensor 1 Menu":**

<table>
<tr><td>022</td><td><u>Position Drift 1</u> (drift monitoring at standstill):

At DS260 version: PositionDrift 1 = PositionDrift 2

This parameter handles drift movements at standstill. If the period time of the input frequency exceeds the adjusted „Wait-Time" parameter, the sensor is assigned to frequency = 0 Hz, even if a slow drift movement is present.

In case of an illegal drift, this parameter allows to preset an error threshold (symmetrical position window +/- xxx pulses). An error status is triggered if the adjusted value is exceeded.

The monitoring is only performed at standstill and begins at position 0, immediately when frequency = 0 Hz is detected.

<table><tr><td>0</td><td>Drift monitoring is not active</td></tr><tr><td>xxx</td><td>An error message appears, if the position is drifting out of the adjusted window of +/- xxx pulses (single edge evaluation).</td></tr></table></td><td>0 - 100 000</td><td>0</td></tr>
<tr><td>023</td><td><u>Sense Value 1</u> (mean value for Sense triggering):

This value returns the mean value. The tolerance range is set by the parameter "Sense Tol. 1".
If the area is left, an error is triggered.
A setting of Sense Value 1 = 24.00 and Sense Tol. 1 of 2.00 triggers an error below 24V-2V = 22V and above 24V + 2V = 26V</td><td>0 – 30.00</td><td>24.00</td></tr>
<tr><td>024</td><td><u>Sense Tol. 1</u> (window for Sence triggering):

This value reflects the tolerance range, the mean value to which the tolerance range relates is determined by the parameter Sense Value1.
If the area is left, an error is triggered.
A setting of Sense Value 1 = 24.00 and Sense Tol. 1 of 2.00 triggers an error below 24V-2V = 22V and above 24V + 2V = 26V.</td><td>0 – 5.00</td><td>1.00</td></tr>
<tr><td>025</td><td><u>Phase Error 1</u> (faulty pulse counting limit):

At DS260 version: Phase Error 1 = Phase Error 2

The DS unit is able to detect incorrect pulse sequences as well as faulty phase positions.

Normally, the parameter should remain set to 10. A different setting is useful only in special cases.

The error status will be released if the adjusted number of faulty pulses is exceeded.

Incorrect pulses can be caused by faulty wirings, EMC-problems, incorrect mode settings, when turn up the encoder supply or when reverse the direction Parameter.</td><td>1 - 1000</td><td>10</td></tr>
</table>

Continuation **"Sensor 1 Menu"**:

026	**Set Frequency 1** (simulation of a fixed encoder frequency): This Parameter is used for test purposes and allows to substitute the real encoder frequency by a fixed frequency. The parameter is only effective, while the unit is in the Programming Mode and if the input is assigned to this function.	-500 000.00 - 500 000.00 (Hz)	0
027	**Error Mask 1** (error suppression A/B/Z signals): **At DS260 version:** Error Mask 1 = Error Mask 2 The parameter allows the evaluation of errors on the A, B, Z track. With single HTL configuration no error can be evaluated. For all differential signals, tearing off a track can trigger an error. If the zero track signals are not connected in differential configuration, the Z Spur error must be suppressed Error Mask = 0 All errors are suppressed Error Mask = 1 Evaluation of an error on the A track Error Mask = 2 Evaluation of an error on the B-lane Error Mask = 4 Evaluation of an error on the Z-lane Error Mask = 7 All errors are evaluated	0 - 7	3
028	**Dir Changes 1** (Direction changes): If this value is set to 0, no monitoring of the direction changes occurs. The value indicates the number of consecutive direction changes that raise an error. This can occur in the case of a demolition of a line, so that at the DS260, for example, only the B signal arrives, while the A signal is constantly static. The error counter again gradually degrades to zero, if no direction changes occurs within the sampling time.	0-9999	0

When using two encoders with differing pulse rates or in case of a mechanical reduction between both encoders, the higher frequency must be converted to the lower frequency by using the scaling factors.

2.4. Sensor 2 Menu

No.	Parameter		Range	Default
029	Op-Mode 2:	The functions of the Sensor2 parameters are identical to Sensor1 menu, but all settings are related to Sensor2.	0 - 3	1
030	Edge 2:		0 - 1	0
031	Direction 2:		0 - 1	0
032	Multiplier 2:		1- 10 000	1
033	Divisor 2:		1 - 10 000	1
034	Position Drift 2:		0 - 100 000	0
035	Sense Value 2:		0 – 30.0	24.00
036	Sense Tol. 2:		0 – 5.00	1.00
037	Phase Error 2:		1 - 1000	10
038	Set Frequency 2:		-500 000.00 - 500 000.00 (Hz)	0
039	Error Mask 2:		0 – 7	3
040	Dir Changes 2		0 - 9999	0

When using 2 encoders with differing pulse rates or in case of a mechanical reduction between both encoders, the higher frequency must be converted to the lower frequency by using the scaling factors..

2.5. Presel.XXXX Menu

This menu is used to set the switching points of the following outputs:

- 1x relay output [X1/X2 | RELAY OUT]
- 4x control output [X4 | CONTROL OUT]

All limit values are related to the selected basic frequency (parameter “F1-F2 Selection”).
The adjustment of the frequencies to each other by the parameter "Multipier" and "Divisor" has no effect on the switching points

By default a switching point is available for each output.

If more switching points are required for an output, the control inputs can switch between different switching points. Than up to 16 switching points are available for each output.

-> 2x Control inputs [X23/X24 | CONTROL IN]

Using the input function Preselection Change: (2 switching points):

The function "Preselection Change" must be assigned to a control input (parameter "* IN * Function"). Both parameters "Input Mode 1" and "Input Mode 2" must be set to 1 or 2.
It can be switched between the first and the second switching point. (e.g., between "Presel.OUT1.01" and "Presel.OUT1.02")

Switching between the switching points can only be done by an external command via the control input. The changeover affects all outputs.
If a switchover at an output is not required, the same threshold can be specified for both values.

Using the input mode X = 3: (4-16 switching points)

A combination of the parameters "Input Mode X" and the parameter "Presel.XXXX.M "determines whether 4 switching states or 16 switching states are evaluated and whether the Control Input 1 [X23] or the Control Input 2 [X24] is used for the switching point switchover. In addition, no input function Preselection Change may be programmed.

This results in the following settings:

Control input for switching	Parameter setting
CONTROL IN 1 [X23] (IN1,/IN1,IN2,/IN2)	Input Mode 1 = 3 Presel.XXX.M = 1 (4 switching point) Presel.XXX.M = 1 (16 switching point)
CONTROL IN 2 [X24] (IN3,/IN3,IN4,/IN4)	Input Mode 2 = 3 Presel.XXX.M = 3 (4 switching point) Presel.XXX.M = 4 (16 switching point)

With 4 switching states, the evaluation of the signals takes place in the Gay Code. If intermediate states are selected, the old state remains until the "GPI Err Time" has elapsed, then an error is triggered.

For 16 switching points, the order must be arranged in ascending order (for example, OUT1.01 minimum overspeed, OUT1.16 largest overspeed) so that the smaller value is always selected at power break.

- The operator must correctly assign the values to the switching points. The function (for example, overspeed, underspeed), the fault behavior and the safety status of the system must be taken into account.
- The drift depends on the parameter "F1-F2 Selection" and refers to the selected encoder channel. A drift error can set the output depending on the setting (Switch Mode = 17, 18), but does not lead to an error condition.

2.5.1. Presel.OUT1 Menu

No.	Parameter	Range	Default
041	Presel.OUT1.01: Switching point 1 of output OUT1 [X4:1,3]	-500 000.00 - 500 000.00 (Hz) (defined by the "F1-F2 Selection" parameter)	1 000.00
042	Presel.OUT1.02: Switching point 2 of output OUT1 [X4:1,3]		2 000.00
043	Presel.OUT1.03: Switching point 3 of output OUT1 [X4:1,3]		1 000.00
044	Presel.OUT1.04: Switching point 4 of output OUT1 [X4:1,3]		2 000.00
045	Presel.OUT1.05: Switching point 5 of output OUT1 [X4:1,3]		1 000.00
046	Presel.OUT1.06: Switching point 6 of output OUT1 [X4:1,3]		2 000.00
047	Presel.OUT1.07: Switching point 7 of output OUT1 [X4:1,3]		1 000.00
048	Presel.OUT1.08: Switching point 8 of output OUT1 [X4:1,3]		2 000.00
049	Presel.OUT1.09: Switching point 9 of output OUT1 [X4:1,3]		1 000.00
050	Presel.OUT1.10: Switching point 10 of output OUT1 [X4:1,3]		2 000.00
051	Presel.OUT1.11: Switching point 11 of output OUT1 [X4:1,3]		1 000.00
052	Presel.OUT1.12: Switching point 12 of output OUT1 [X4:1,3]		2 000.00
053	Presel.OUT1.13: Switching point 13 of output OUT1 [X4:1,3]		1 000.00
054	Presel.OUT1.14: Switching point 14 of output OUT1 [X4:1,3]		2 000.00
055	Presel.OUT1.15: Switching point 15 of output OUT1 [X4:1,3]		1 000.00
056	Presel.OUT1.16: Switching point 16 of output OUT1 [X4:1,3]		2 000.00
057	Presel.OUT1.D: Maximum drift if parameter Switch Mode OUT1 = 17 or 18 Drift values are indicated in ¼ increments		0

Continuation **"Presel.OUT1 Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>058</td><td><u>Presel.OUT1.M</u>:
Mode Parameter for setting the active switching points with parameter "Input Mode X" = 3
<table>
<tr><td>0</td><td>No switching points, only Presel.Out 1.01</td></tr>
<tr><td>1</td><td>4 switching points (OUT1.01-05) Gray Coded; at [X23]
X[23: 2;5]
1000 : modulation with OUT1.01 (IN1)
0100 : modulation with OUT1.02 (/IN1)
0010 : modulation with OUT1.03 (IN2)
0001 : modulation with OUT1.04 (/IN2)
other controls create a GPI error</td></tr>
<tr><td>2</td><td>16 switching points (OUT1.01-16) at [X23]
no fault can be detected on the inputs</td></tr>
<tr><td>3</td><td>4 switching points (OUT1.01-05) Gray Coded; at [X24]
X[24: 2;5]
1000 : modulation with OUT1.01 (IN3)
0100 : modulation with OUT1.02 (/IN3)
0010 : modulation with OUT1.03 (IN4)
0001 : modulation with OUT1.04 (/IN4)
other controls create a GPI error</td></tr>
<tr><td>4</td><td>16 switching points (OUT1.01-16) at [X24]
no fault can be detected on the inputs</td></tr>
</table></td><td>0-3</td><td>0</td></tr>
<tr><td>059</td><td><u>Presel.OUT1.R</u>:
This parameter is for setting the frequency difference per unit of time for "Switch Mode OUT1" = 21 and 22.

Time = frequency [Hz] / setting [Hz/ms]

It follows: 1000 Hz / 0,1 [Hz/ms] = 10 000ms = 10s
<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>10Hz</td><td>00,0010</td><td>10s</td></tr>
<tr><td>100Hz</td><td>00,0100</td><td>10s</td></tr>
<tr><td>1kHz</td><td>00,1000</td><td>10s</td></tr>
<tr><td>10kHz</td><td>01,0000</td><td>10s</td></tr>
<tr><td>100kHz</td><td>10,0000</td><td>10s</td></tr>
</table>
<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>1kHz</td><td>1,0000</td><td>1s</td></tr>
<tr><td>1kHz</td><td>0,1000</td><td>10s</td></tr>
<tr><td>1kHz</td><td>0,0100</td><td>100s</td></tr>
</table></td><td>0 – 5000,0000</td><td>0,0000</td></tr>
<tr><td>060</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.5.2. Presel.OUT2 Menu

No.	Parameter	Range	Default
061	Presel.OUT2.01: Switching point 1 of output OUT2 [X4:4,6]	-500 000.00 - 500 000.00 (Hz) (defined by the "F1-F2 Selection" parameter)	3 000.00
062	Presel.OUT2.02: Switching point 2 of output OUT2 [X4:4,6]		4 000.00
063	Presel.OUT2.03: Switching point 3 of output OUT2 [X4:4,6]		3 000.00
064	Presel.OUT2.04: Switching point 4 of output OUT2 [X4:4,6]		4 000.00
065	Presel.OUT2.05: Switching point 5 of output OUT2 [X4:4,6]		3 000.00
066	Presel.OUT2.06: Switching point 6 of output OUT2 [X4:4,6]		4 000.00
067	Presel.OUT2.07: Switching point 7 of output OUT2 [X4:4,6]		3 000.00
068	Presel.OUT2.08: Switching point 8 of output OUT2 [X4:4,6]		4 000.00
069	Presel.OUT2.09: Switching point 9 of output OUT2 [X4:4,6]		3 000.00
070	Presel.OUT2.10: Switching point 10 of output OUT2 [X4:4,6]		4 000.00
071	Presel.OUT2.11: Switching point 11 of output OUT2 [X4:4,6]		3 000.00
072	Presel.OUT2.12: Switching point 12 of output OUT2 [X4:4,6]		4 000.00
073	Presel.OUT2.13: Switching point 13 of output OUT2 [X4:4,6]		3 000.00
074	Presel.OUT2.14: Switching point 14 of output OUT2 [X4:4,6]		4 000.00
075	Presel.OUT2.15: Switching point 15 of output OUT2 [X4:4,6]		3 000.00
076	Presel.OUT2.16: Switching point 16 of output OUT2 [X4:4,6]		4 000.00
077	Presel.OUT2.D: Maximum drift if parameter Switch Mode OUT2 = 17 or 18 Drift values are indicated in ¼ increments		0

Continuation **"Presel.OUT2 Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>078</td><td><u>Presel.OUT2.M</u>:
Mode Parameter for setting the active switching points with parameter "Input Mode X" = 3
<table>
<tr><td>0</td><td>No switching points, only Presel.Out 2.01</td></tr>
<tr><td>1</td><td>4 switching points (OUT2.01-05) Gray Coded; at [X23]
X[23: 2;5]
1000 : modulation with OUT2.01 (IN1)
0100 : modulation with OUT2.02 (/IN1)
0010 : modulation with OUT2.03 (IN2)
0001 : modulation with OUT2.04 (/IN2)
other controls create a GPI error</td></tr>
<tr><td>2</td><td>16 switching points (OUT2.01-16) at [X23]
no fault can be detected on the inputs</td></tr>
<tr><td>3</td><td>4 switching points (OUT2.01-05) Gray Coded; at [X24]
X[24: 2;5]
1000 : modulation with OUT2.01 (IN3)
0100 : modulation with OUT2.02 (/IN3)
0010 : modulation with OUT2.03 (IN4)
0001 : modulation with OUT2.04 (/IN4)
other controls create a GPI error</td></tr>
<tr><td>4</td><td>16 switching points (OUT2.01-16) at [X24]
no fault can be detected on the inputs</td></tr>
</table></td><td>0 - 3</td><td>0</td></tr>
<tr><td>079</td><td><u>Presel.OUT2.R</u>:
This parameter is for setting the frequency difference per unit of time for "Switch Mode OUT2" = 21 and 22.

Time = frequency [Hz] / setting [Hz/ms]

It follows: 1000 Hz / 0,1 [Hz/ms] = 10 000ms = 10s

<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>10Hz</td><td>00,0010</td><td>10s</td></tr>
<tr><td>100Hz</td><td>00,0100</td><td>10s</td></tr>
<tr><td>1kHz</td><td>00,1000</td><td>10s</td></tr>
<tr><td>10kHz</td><td>01,0000</td><td>10s</td></tr>
<tr><td>100kHz</td><td>10,0000</td><td>10s</td></tr>
</table>
<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>1kHz</td><td>1,0000</td><td>1s</td></tr>
<tr><td>1kHz</td><td>0,1000</td><td>10s</td></tr>
<tr><td>1kHz</td><td>0,0100</td><td>100s</td></tr>
</table></td><td>0 – 5000,0000</td><td>0,00</td></tr>
<tr><td>080</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.5.3. Presel.OUT3 Menu

No.	Parameter	Range	Default
081	Presel.OUT3.01: Switching point 1 of output OUT3 [X4:7,9]	-500 000.00 - 500 000.00 (Hz) (defined by the "F1-F2 Selection" parameter)	5 000.00
082	Presel.OUT3.02: Switching point 2 of output OUT3 [X4:7,9]		6 000.00
083	Presel.OUT3.03: Switching point 3 of output OUT3 [X4:7,9]		5 000.00
084	Presel.OUT3.04: Switching point 4 of output OUT3 [X4:7,9]		6 000.00
085	Presel.OUT3.05: Switching point 5 of output OUT3 [X4:7,9]		5 000.00
086	Presel.OUT3.06: Switching point 6 of output OUT3 [X4:7,9]		6 000.00
087	Presel.OUT3.07: Switching point 7 of output OUT3 [X4:7,9]		5 000.00
088	Presel.OUT3.08: Switching point 8 of output OUT3 [X4:7,9]		6 000.00
089	Presel.OUT3.09: Switching point 9 of output OUT3 [X4:7,9]		5 000.00
090	Presel.OUT3.10: Switching point 10 of output OUT3 [X4:7,9]		6 000.00
091	Presel.OUT3.11: Switching point 10 of output OUT3 [X4:7,9]		5 000.00
092	Presel.OUT3.12: Switching point 12 of output OUT3 [X4:7,9]		6 000.00
093	Presel.OUT3.13: Switching point 13 of output OUT3 [X4:7,9]		5 000.00
094	Presel.OUT3.14: Switching point 14 of output OUT3 [X4:7,9]		6 000.00
095	Presel.OUT3.15: Switching point 15 of output OUT3 [X4:7,9]		5 000.00
096	Presel.OUT3.16: Switching point 16 of output OUT3 [X4:7,9]		6 000.00
097	Presel.OUT3.D: Maximum drift if parameter Switch Mode OUT3 = 17 or 18 Drift values are indicated in ¼ increments		0

Continuation **"Presel.OUT3 Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>098</td><td><u>Presel.OUT3.M</u>:
Mode Parameter for setting the active switching points with parameter "Input Mode X" = 3

<table>
<tr><td>0</td><td>No switching points, only Presel.Out 3.01</td></tr>
<tr><td>1</td><td>4 switching points (OUT3.01-05) Gray Coded; at [X23]
X[23 : 2;5]
1000 : modulation with OUT3.01 (IN1)
0100 : modulation with OUT3.02 (/IN1)
0010 : modulation with OUT3.03 (IN2)
0001 : modulation with OUT3.04 (/IN2)
other controls create a GPI error</td></tr>
<tr><td>2</td><td>16 switching points (OUT3.01-16) at [X23]
no fault can be detected on the inputs</td></tr>
<tr><td>3</td><td>4 switching points (OUT3.01-05) Gray Coded; at [X24]
X[24 : 2;5]
1000 : modulation with OUT3.01 (IN3)
0100 : modulation with OUT3.02 (/IN3)
0010 : modulation with OUT3.03 (IN4)
0001 : modulation with OUT3.04 (/IN4)
other controls create a GPI error</td></tr>
<tr><td>4</td><td>16 switching points (OUT3.01-16) at [X24]
no fault can be detected on the inputs</td></tr>
</table></td><td>0 - 3</td><td>0</td></tr>
<tr><td>099</td><td><u>Presel.OUT3.R</u>:
This parameter is for setting the frequency difference per unit of time for "Switch Mode OUT3" = 21 and 22.

Time = frequency [Hz] / setting [Hz/ms]

It follows: 1000 Hz / 0,1 [Hz/ms] = 10 000ms = 10s

<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>10Hz</td><td>00,0010</td><td>10s</td></tr>
<tr><td>100Hz</td><td>00,0100</td><td>10s</td></tr>
<tr><td>1kHz</td><td>00,1000</td><td>10s</td></tr>
<tr><td>10kHz</td><td>01,0000</td><td>10s</td></tr>
<tr><td>100kHz</td><td>10,0000</td><td>10s</td></tr>
</table>
<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>1kHz</td><td>1,0000</td><td>1s</td></tr>
<tr><td>1kHz</td><td>0,1000</td><td>10s</td></tr>
<tr><td>1kHz</td><td>0,0100</td><td>100s</td></tr>
</table></td><td>0 – 5000,0000</td><td>0,00</td></tr>
<tr><td>100</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.5.4. Presel.OUT4 Menu

No.	Parameter	Range	Default
101	Presel.OUT4.01: Switching point 1 of output OUT4 [X4:10-12]	-500 000.00 - 500 000.00 (Hz) (defined by the "F1-F2 Selection" parameter)	7 000.00
102	Presel.OUT4.02: Switching point 2 of output OUT4 [X4:10-12]		8 000.00
103	Presel.OUT4.03: Switching point 3 of output OUT4 [X4:10-12]		7 000.00
104	Presel.OUT4.04: Switching point 4 of output OUT4 [X4:10-12]		8 000.00
105	Presel.OUT4.05: Switching point 5 of output OUT4 [X4:10-12]		7 000.00
106	Presel.OUT4.06: Switching point 6 of output OUT4 [X4:10-12]		8 000.00
107	Presel.OUT4.07: Switching point 7 of output OUT4 [X4:10-12]		7 000.00
108	Presel.OUT4.08: Switching point 8 of output OUT4 [X4:10-12]		8 000.00
109	Presel.OUT4.09: Switching point 9 of output OUT4 [X4:10-12]		7 000.00
110	Presel.OUT4.10: Switching point 10 of output OUT4 [X4:10-12]		8 000.00
111	Presel.OUT4.11: Switching point 11 of output OUT4 [X4:10-12]		7 000.00
112	Presel.OUT4.12: Switching point 12 of output OUT4 [X4:10-12]		8 000.00
113	Presel.OUT4.13: Switching point 13 of output OUT4 [X4:10-12]		7 000.00
114	Presel.OUT4.14: Schaltpunkt 14 von Ausgang OUT4 [X4:10-12]		8 000.00
115	Presel.OUT4.15: Schaltpunkt 15 von Ausgang OUT4 [X4:10-12]		7 000.00
116	Presel.OUT4.16: Schaltpunkt 16 von Ausgang OUT4 [X4:10-12]		8 000.00
117	Presel.OUT4.D: Maximum drift if parameter Switch Mode OUT4 = 17 or 18 Drift values are indicated in ¼ increments		0

Continuation **"Presel.OUT4 Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>118</td><td><u>Presel.OUT4.M</u>:
Mode Parameter for setting the active switching points with parameter "Input Mode X" = 3

<table>
<tr><td>0</td><td>No switching points, only Presel.Out 4.01</td></tr>
<tr><td>1</td><td>4 switching points (OUT4.01-05) Gray Coded; at [X23]
X[23 : 2;5]
1000 : modulation with OUT4.01 (IN1)
0100 : modulation with OUT4.02 (/IN1)
0010 : modulation with OUT4.03 (IN2)
0001 : modulation with OUT4.04 (/IN2)
other controls create a GPI error</td></tr>
<tr><td>2</td><td>16 switching points (OUT4.01-16) at [X23]
no fault can be detected on the inputs</td></tr>
<tr><td>3</td><td>4 switching points (OUT4.01-05) Gray Coded; at [X24]
X[24 : 2;5]
1000 : modulation with OUT4.01 (IN3)
0100 : modulation with OUT4.02 (/IN3)
0010 : modulation with OUT4.03 (IN4)
0001 : modulation with OUT4.04 /IN4)
other controls create a GPI error</td></tr>
<tr><td>4</td><td>16 switching points (OUT4.01-16) at [X24]
no fault can be detected on the inputs</td></tr>
</table></td><td>0 - 3</td><td>0</td></tr>
<tr><td>119</td><td><u>Presel.OUT4.R</u>:
This parameter is for setting the frequency difference per unit of time for "Switch Mode OUT4" = 21 and 22.

Time = frequency [Hz] / setting [Hz/ms]

It follows: 1000 Hz / 0,1 [Hz/ms] = 10 000ms = 10s

<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>10Hz</td><td>00,0010</td><td>10s</td></tr>
<tr><td>100Hz</td><td>00,0100</td><td>10s</td></tr>
<tr><td>1kHz</td><td>00,1000</td><td>10s</td></tr>
<tr><td>10kHz</td><td>01,0000</td><td>10s</td></tr>
<tr><td>100kHz</td><td>10,0000</td><td>10s</td></tr>
</table>
<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>1kHz</td><td>1,0000</td><td>1s</td></tr>
<tr><td>1kHz</td><td>0,1000</td><td>10s</td></tr>
<tr><td>1kHz</td><td>0,0100</td><td>100s</td></tr>
</table></td><td>0 – 5000,0000</td><td>0,00</td></tr>
<tr><td>120</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.5.5. Presel.REL1 Menu

No.	Parameter	Range	Default
121	Presel.REL1.01: Switching point 1 of output REL1 [X1/2:1-2]	-500 000.00 - 500 000.00 (Hz) (defined by the "F1-F2 Selection" parameter)	100.00
122	Presel.REL1.02: Switching point 2 of output REL1 [X1/2:1-2]		200.00
123	Presel.REL1.03: Switching point 3 of output REL1 [X1/2:1-2]		100.00
124	Presel.REL1.04: Switching point 4 of output REL1 [X1/2:1-2]		200.00
125	Presel.REL1.05: Switching point 5 of output REL1 [X1/2:1-2]		100.00
126	Presel.REL1.06: Switching point 6 of output REL1 [X1/2:1-2]		200.00
127	Presel.REL1.07: Switching point 7 of output REL1 [X1/2:1-2]		100.00
128	Presel.REL1.08: Switching point 8 of output REL1 [X1/2:1-2]		200.00
129	Presel.REL1.09: Switching point 9 of output REL1 [X1/2:1-2]		100.00
130	Presel.REL1.10: Switching point 10 of output REL1 [X1/2:1-2]		200.00
131	Presel.REL1.11: Switching point 11 of output REL1 [X1/2:1-2]		100.00
132	Presel.REL1.12: Switching point 12 of output REL1 [X1/2:1-2]		200.00
133	Presel.REL1.13: Switching point 13 of output REL1 [X1/2:1-2]		100.00
134	Presel.REL1.14: Switching point 14 of output REL1 [X1/2:1-2]		200.00
135	Presel.REL1.15: Switching point 15 of output REL1 [X1/2:1-2]		100.00
136	Presel.REL1.16: Switching point 16 of output REL1 [X1/2:1-2]		200.00
137	Presel.REL1.D: Maximum drift if parameter Switch Mode REL1 = 17 oder 18 Drift values are indicated in ¼ increments		0

Continuation **"Presel.REL1 Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>138</td><td><u>Presel.REL1.M</u>:
Mode Parameter for setting the active switching points with parameter "Input Mode X" = 3
<table>
<tr><td>0</td><td>No switching points, only Presel.REL1.01</td></tr>
<tr><td>1</td><td>4 switching points (REL1.01-05) Gray Coded; at [X23]
[X23 : 2;5]
1000 : modulation with REL1.01 (IN1)
0100 : modulation with REL1.02 (/IN1)
0010 : modulation with REL1.03 (IN2)
0001 : modulation with REL1.04 (/IN2)
other controls create a GPI error</td></tr>
<tr><td>2</td><td>16 switching points (REL1.01-16) at [X23]
no fault can be detected on the inputs</td></tr>
<tr><td>3</td><td>4 switching points (REL1.01-05) Gray Coded; at [X24]
[X24 : 2;5]
1000 : modulation with REL1.01 (IN3)
0100 : modulation with REL1.02 (/IN3)
0010 : modulation with REL1.03 (IN4)
0001 : modulation with REL1.04 (/IN4)
other controls create a GPI error</td></tr>
<tr><td>4</td><td>16 switching points (REL1.01-16) at [X24]
no fault can be detected on the inputs</td></tr>
</table></td><td>0 - 3</td><td>0</td></tr>
<tr><td>139</td><td><u>Presel.REL1.R</u>:
This parameter is for setting the frequency difference per unit of time for "switch mode REL1" = 21 and 22.

Time = frequency [Hz] / setting [Hz/ms]

It follows: 1000 Hz / 0,1 [Hz/ms] = 10 000ms = 10s

<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>10Hz</td><td>00,0010</td><td>10s</td></tr>
<tr><td>100Hz</td><td>00,0100</td><td>10s</td></tr>
<tr><td>1kHz</td><td>00,1000</td><td>10s</td></tr>
<tr><td>10kHz</td><td>01,0000</td><td>10s</td></tr>
<tr><td>100kHz</td><td>10,0000</td><td>10s</td></tr>
</table>

<table>
<tr><th>Frequency</th><th>Setting</th><th>Time</th></tr>
<tr><td>1kHz</td><td>1,0000</td><td>1s</td></tr>
<tr><td>1kHz</td><td>0,1000</td><td>10s</td></tr>
<tr><td>1kHz</td><td>0,0100</td><td>100s</td></tr>
</table></td><td>0 – 5000,0000</td><td>0,00</td></tr>
<tr><td>140</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.6. Switching Menu

This menu is used to set the switching conditions of the following outputs:

- 1 x relay output [X1/2 | RELAY OUT]
- 4 x control output [X4 | CONTROL OUT]

The following form of writing is used:

|f| = absolute value of the basic frequency
|Preselection| = absolute value of the switching point
f = direction dependent, direction signed basic frequency
Preselection = direction dependent, direction signed switching point

Additional output features:

{S} = self-locking function
{H} = switching hysteresis
{A} = start up delay
{U} = Switching the preselection affects the function

- With an active self-locking function no hysteresis setting is necessary, because no bouncing is possible.
- With an inactive self-locking function a hysteresis setting is always useful.
- When using Switch Mode 7 or 8, the specified standstill-time must be higher than the adjusted wipe period. This is helpful to prevent a breakdown of the wipe signal before the wipe period has been elapsed.
- With Switch Mode 2, 6 and 16, the parameter "Hysteresis" is used for determining the frequency band.

No.	Parameter			Range	Default
0141	Switch Mode OUT1 (switching conditions for OUT1):			0 - 22	0
	0	|f| >= |Preselection| Output switches in event of overspeed.	{S, H, U}		
	1	|f| <= |Preselection| Output switches in event of underspeed.	{S, H, A, U}		
	2	|f| == |Preselection| Output switches in event of leaving the frequency band (Preselection +/- Hysteresis).	{S, A, U}		
	3	Stillstand Output switches in event of standstill.			
	4	f >= Preselection Output switches in event of overspeed. May only be used with positive preselection values!	{S, H, U}		
	5	f <= Preselection Output switches in event of underspeed. May only be used with positive preselection values!	{S, H, A, U}		
	6	f == Preselection Output switches in event of leaving the frequency band (Preselection +/- Hysteresis). Only used with positive preselection values!	{S, A, U}		
	7	f > 0 Output switches, if a positive frequency (e.g. clockwise direction) is detected. The directional information will be deleted immediately when „Standstill“ is detected.			
	8	f < 0 Output switches, if a negative frequency (e.g. anticlockwise direction) is detected. The directional information will be deleted immediately when „Standstill“ is detected.			
	9	Clock generation for pulsed readback EDM and pulse monitored inputs			
	10	STO/SBC/SS1 Enable + external self-locking, without ramp monitoring	{S}		
	11	SLS |f| >= |Preselection| Overspeed + enable + external self-locking, without ramp monitoring	{S,U}		
	12	SMS |f| >= |Preselection| Overspeed without enable + external self-locking	{S,U}		

Continuation **"Switching Menu"**:

No.	Parameter			Range	Default
141	13	SDI1 f > 0 Enable + external self-holding, frequency monitoring, no position monitoring	{S}	0 - 22	0
	14	SDI2 f < 0 Enable + external self-locking, frequency monitoring, no position monitoring	{S}		
	15	SSM1 |f| <= |Preselection| Underspeed + enable + external self-locking	{S,U}		
	16	SSM2 |f| innerhalb |Preselection +/- Hysterese| Underspeed + overspeed + enable + external self-locking	{S,U}		
	17	SOS/SLI/SS2 |f| > |Preselection| oder Position Error Overspeed + position + enable + external self-locking	{S,U}		
	18	Stillstand (bei Stillstand und kein Position Error) Standstill + position + enable + external self-locking	{S}		
	19	Reserved			
	20	Kein Stillstand This Mode operates like Mode 3, but only statically and the output is inverted. Here the inverted relay control is important. Output switches if f is not equal to Zero (no standstill)			
	21	Ramp monitoring 2 Under Speed + Overspeed + Enable + External self-locking The condition is that the braking behaviour is linear. The parameter "Presel. xxx. F" describes the slope. The parameter "Presel. xxx. xx describes the +/- deviation.	{U}		
	22	Ramp monitoring 2 Under Speed + Overspeed + Enable + External self-locking The condition is that the braking behaviour is linear. The parameter "Presel. xxx. F" describes the slope. The parameter "Presel. xxx. xx describes the +/- deviation.	{U}		

Continuation **"Switching Menu"**:

No.	Parameter	Range	Default
142	**Switch Mode OUT2** (switching condition for OUT2): Settings are analogous to parameter „Switch Mode OUT1"	0 – 22	0
143	**Switch Mode OUT3** (switching condition for OUT3): Settings are analogous to parameter „Switch Mode OUT1"	0 – 22	0
144	**Switch Mode OUT4** (switching condition for OUT4): Settings are analogous to parameter „Switch Mode OUT1"	0 – 22	0
145	**Switch Mode REL1** (switching condition for the relay output): Settings are analogous to parameter „Switch Mode OUT1"	0 - 22	0

- With an active self-locking function no hysteresis setting is necessary, because no bouncing is possible.
- With an inactive self-locking function a hysteresis setting is always useful.
- When using Switch Mode 7 or 8, the specified standstill-time must be higher than the adjusted wipe period. This is helpful to prevent a breakdown of the wipe signal before the wipe period has been elapsed.
- With Switch Mode 2, 6 and 16, the parameter "Hysteresis" is used for determining the frequency band.

Continuation **"Switching Menu"**:

No.	Parameter	Range	Default
146	**Pulse Time OUT1** (Wipe Signal Period of OUT1): 0: static wipe signal ≠0: wipe signal period in seconds	0 – 9.999 (sec.)	0
147	**Pulse Time OUT2** (Wipe Signal Period of OUT2): Settings are analogous to parameter „Pulse Time OUT1"		
148	**Pulse Time OUT3** (Wipe Signal Period of OUT3): Settings are analogous to parameter „Pulse Time OUT1"		
149	**Pulse Time OUT4** (Wipe Signal Period of OUT4): Settings are analogous to parameter „Pulse Time OUT1"		
150	**Pulse Time REL1** (Wipe Signal Period of the relay): Settings are analogous to parameter „Pulse Time OUT1"(min. 25 ms)		
	• The minimum wipe period of the control outputs is 1 msec. The minimum wipe period of the relay is 25 msec. • If a wipe signal is adjusted, no self-locking function can be assigned to the corresponding output.		
151	**Hysteresis OUT1** (switching hysteresis for OUT1): Percental hysteresis of the adjusted switching point of parameter „Preselect OUT1"	0 – 100.0 (%)	0
152	**Hysteresis OUT2** (switching hysteresis for OUT2): Percental hysteresis of the adjusted switching point of parameter „Preselect OUT2"		
153	**Hysteresis OUT3** (switching hysteresis for OUT3): Percental hysteresis of the adjusted switching point of parameter „Preselect OUT3"		
154	**Hysteresis OUT4** (switching hysteresis for OUT4): Percental hysteresis of the adjusted switching point of parameter „Preselect OUT4"		
155	**Hysteresis REL1** (switching hysteresis for Relais): Percental hysteresis of the adjusted switching point of parameter „Preselect REL1"		

- Due to the variance of the frequency measurement an output-bouncing around the limit value can occur. This behavior can be prevented by setting a hysteresis. A reasonable hysteresis value is approximately 1%.

Continuation **"Switching Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>156</td><td><u>Matrix OUT1</u> <u>(Enable matrix for output OUT1)</u><u>:</u>
Defines the enable signal (for Switch Mode 10 … 22) of output OUT1 by input selection at terminal X23 or X24 as well as the remaining feedback outputs (see table below). An input as well as a feedback output can be used as enable signal (OR operation in case of several signals).

<table>
<tr><td>Bit 0</td><td>Input IN1</td><td>[X23: 2]</td><td>[X23: 2,3]</td></tr>
<tr><td>Bit 1</td><td>Input /IN1</td><td>[X23: 3]</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Input IN2</td><td>[X23: 4]</td><td>[X23: 4,5]</td></tr>
<tr><td>Bit 3</td><td>Input /IN2</td><td>[X23: 5]</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Input IN3</td><td>[X24: 2]</td><td>[X24: 2,3]</td></tr>
<tr><td>Bit 5</td><td>Input /IN3</td><td>[X24: 3]</td><td>-</td></tr>
<tr><td>Bit 6</td><td>Input IN4</td><td>[X24: 4]</td><td>[X24: 4,5]</td></tr>
<tr><td>Bit 7</td><td>Input /IN4</td><td>[X24: 5]</td><td>-</td></tr>
<tr><td>Bit 8</td><td>Output OUT1</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Bit 9</td><td>Output OUT2</td><td></td><td></td></tr>
<tr><td>Bit 10</td><td>Output OUT3</td><td></td><td></td></tr>
<tr><td>Bit 11</td><td>Output OUT4</td><td></td><td></td></tr>
<tr><td>Bit 12</td><td>Output REL1</td><td></td><td></td></tr>
</table></td><td>0 - 8191</td><td>0</td></tr>
<tr><td>157</td><td><u>Matrix OUT2</u> <u>(Enable matrix for output OUT2)</u><u>:</u>

<table>
<tr><td>Bit 0</td><td>Input IN1</td><td>[X23: 2]</td><td>[X23: 2,3]</td></tr>
<tr><td>Bit 1</td><td>Input /IN1</td><td>[X23: 3]</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Input IN2</td><td>[X23: 4]</td><td>[X23: 4,5]</td></tr>
<tr><td>Bit 3</td><td>Input /IN2</td><td>[X23: 5]</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Input IN3</td><td>[X24: 2]</td><td>[X24: 2,3]</td></tr>
<tr><td>Bit 5</td><td>Input /IN3</td><td>[X24: 3]</td><td>-</td></tr>
<tr><td>Bit 6</td><td>Input IN4</td><td>[X24: 4]</td><td>[X24: 4,5]</td></tr>
<tr><td>Bit 7</td><td>Input /IN4</td><td>[X24: 5]</td><td>-</td></tr>
<tr><td>Bit 8</td><td>Output OUT1</td><td></td><td></td></tr>
<tr><td>Bit 9</td><td>Output OUT2</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Bit 10</td><td>Output OUT3</td><td></td><td></td></tr>
<tr><td>Bit 11</td><td>Output OUT4</td><td></td><td></td></tr>
<tr><td>Bit 12</td><td>Output REL1</td><td></td><td></td></tr>
</table></td><td>0 – 8191</td><td>0</td></tr>
</table>

Continuation **"Switching Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>158</td><td>Matrix OUT3 (Enable matrix for output OUT3):
<table>
<tr><td>Bit 0</td><td>Input IN1</td><td>[X23: 2]</td><td>[X23: 2,3]</td></tr>
<tr><td>Bit 1</td><td>Input /IN1</td><td>[X23: 3]</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Input IN2</td><td>[X23: 4]</td><td>[X23: 4,5]</td></tr>
<tr><td>Bit 3</td><td>Input /IN2</td><td>[X23: 5]</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Input IN3</td><td>[X24: 2]</td><td>[X24: 2,3]</td></tr>
<tr><td>Bit 5</td><td>Input /IN3</td><td>[X24: 3]</td><td>-</td></tr>
<tr><td>Bit 6</td><td>Input IN4</td><td>[X24: 4]</td><td>[X24: 4,5]</td></tr>
<tr><td>Bit 7</td><td>Input /IN4</td><td>[X24: 5]</td><td>-</td></tr>
<tr><td>Bit 8</td><td>Output OUT1</td><td></td><td></td></tr>
<tr><td>Bit 9</td><td>Output OUT2</td><td></td><td></td></tr>
<tr><td>Bit 10</td><td>Output OUT3</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Bit 11</td><td>Output OUT4</td><td></td><td></td></tr>
<tr><td>Bit 12</td><td>Output REL1</td><td></td><td></td></tr>
</table></td><td>0 - 8191</td><td>0</td></tr>
<tr><td>159</td><td>Matrix OUT4 (Enable matrix for output OUT4):
<table>
<tr><td>Bit 0</td><td>Input IN1</td><td>[X23: 2]</td><td>[X23: 2,3]</td></tr>
<tr><td>Bit 1</td><td>Input /IN1</td><td>[X23: 3]</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Input IN2</td><td>[X23: 4]</td><td>[X23: 4,5]</td></tr>
<tr><td>Bit 3</td><td>Input /IN2</td><td>[X23: 5]</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Input IN3</td><td>[X24: 2]</td><td>[X24: 2,3]</td></tr>
<tr><td>Bit 5</td><td>Input /IN3</td><td>[X24: 3]</td><td>-</td></tr>
<tr><td>Bit 6</td><td>Input IN4</td><td>[X24: 4]</td><td>[X24: 4,5]</td></tr>
<tr><td>Bit 7</td><td>Input /IN4</td><td>[X24: 5]</td><td>-</td></tr>
<tr><td>Bit 8</td><td>Output OUT1</td><td></td><td></td></tr>
<tr><td>Bit 9</td><td>Output OUT2</td><td></td><td></td></tr>
<tr><td>Bit 10</td><td>Output OUT3</td><td></td><td></td></tr>
<tr><td>Bit 11</td><td>Output OUT4</td><td>Not available</td><td>Not available</td></tr>
<tr><td>Bit 12</td><td>Output REL1</td><td></td><td></td></tr>
</table></td><td>0 - 8191</td><td>0</td></tr>
<tr><td>160</td><td>Matrix REL1 (Enable matrix for output REL1):
<table>
<tr><td>Bit 0</td><td>Input IN1</td><td>[X23: 2]</td><td>[X23: 2,3]</td></tr>
<tr><td>Bit 1</td><td>Input /IN1</td><td>[X23: 3]</td><td>-</td></tr>
<tr><td>Bit 2</td><td>Input IN2</td><td>[X23: 4]</td><td>[X23: 4,5]</td></tr>
<tr><td>Bit 3</td><td>Input /IN2</td><td>[X23: 5]</td><td>-</td></tr>
<tr><td>Bit 4</td><td>Input IN3</td><td>[X24: 2]</td><td>[X24: 2,3]</td></tr>
<tr><td>Bit 5</td><td>Input /IN3</td><td>[X24: 3]</td><td>-</td></tr>
<tr><td>Bit 6</td><td>Input IN4</td><td>[X24: 4]</td><td>[X24: 4,5]</td></tr>
<tr><td>Bit 7</td><td>Input /IN4</td><td>[X24: 5]</td><td>-</td></tr>
<tr><td>Bit 8</td><td>Output OUT1</td><td></td><td></td></tr>
<tr><td>Bit 9</td><td>Output OUT2</td><td></td><td></td></tr>
<tr><td>Bit 10</td><td>Output OUT3</td><td></td><td></td></tr>
<tr><td>Bit 11</td><td>Output OUT4</td><td></td><td></td></tr>
<tr><td>Bit 12</td><td>Output REL1</td><td>Not available</td><td>Not available</td></tr>
</table></td><td>0 - 8191</td><td>0</td></tr>
</table>

Continuation **"Switching Menu"**:

No.	Parameter	Range	Default
161	**MIA-Delay OUT1** (delay for transition inactive to active): Matrix delay inactive to active for output OUT1 (in seconds). This setting will delay the enable function, if the enable input or the feedback output changes from inactive to active.	0 – 99.999	0
162	**MIA-Delay OUT2** (delay for transition inactive to active):	0 – 99.999	0
163	**MIA-Delay OUT3** (delay for transition inactive to active):	0 – 99.999	0
164	**MIA-Delay OUT4** (delay for transition inactive to active):	0 – 99.999	0
165	**MIA-Delay REL1** (delay for transition inactive to active):	0 – 99.999	0
166	**MAI-Delay OUT1** (delay for transition inactive to active): Matrix delay active to inactive for output OUT1 (in seconds). This setting will delay the enable function, if the enable input or the feedback output changes from active to inactive.	0 – 99.999	0
167	**MAI-Delay OUT2** (delay for transition inactive to active):	0 – 99.999	0
168	**MAI-Delay OUT3** (delay for transition inactive to active):	0 – 99.999	0
169	**MAI-Delay OUT4** (delay for transition inactive to active):	0 – 99.999	0
170	**MAI-Delay REL1** (delay for transition inactive to active):	0 – 99.999	0
171	**Delay OUT1** (Delay of triggering for OUT1): Triggering delay for the output OUT1 in seconds. This delay delays the release of OUT1. If the output has been reset before the delay time has elapsed, no change in the state of OUT1 takes place. The cancellation is made immediately. Oscillating triggering and their cancellation ensure a new delay time refresh. When a wiping time is activated, a new wiper pulse can be emitted only after the cancellation and after the delay period has elapsed. Does not apply for switch mode = 3, 9, 10, and 20	0 - 9,999	0
172	**Delay OUT2** (Delay of triggering for OUT1):	0 - 9,999	0
173	**Delay OUT3** (Delay of triggering for OUT2):	0 - 9,999	0
174	**Delay OUT4** (Delay of triggering for OUT3):	0 - 9,999	0
175	**Delay REL1** (Delay of triggering for OUT4):	0 - 9,999	0

Continuation **"Switching Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>176</td><td><u>Startup Mode</u> <u>(start-up delay time window)</u>:

Window for delay time until the monitoring function is activated.
Only useful in combination with parameter setting
„Switch Mode“ = 1, 2, 5 or 6.

To use the start-up delay, it must be assigned to an output.

The start-up delay will be activated:
- with next power-up
- always when after standstill a frequency is detected again

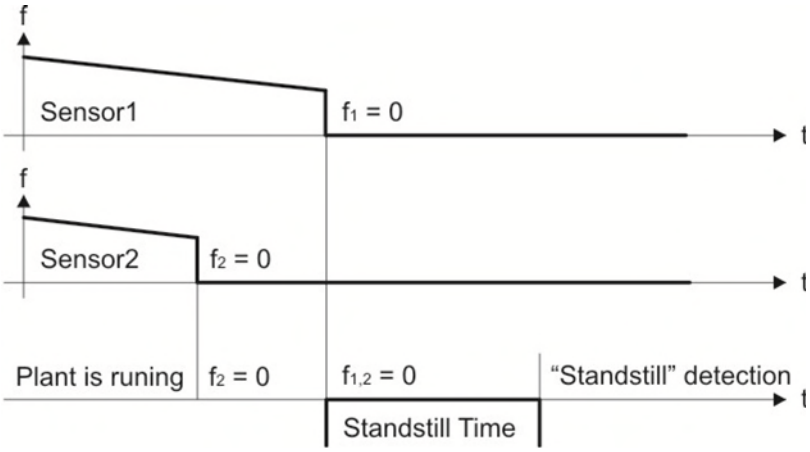
<table>
<tr><td>0</td><td>no start-up delay</td></tr>
<tr><td>1</td><td>start-up delay 1 second</td></tr>
<tr><td>2</td><td>start-up delay 2 seconds</td></tr>
<tr><td>3</td><td>start-up delay 4 seconds</td></tr>
<tr><td>4</td><td>start-up delay 8 seconds</td></tr>
<tr><td>5</td><td>start-up delay 16 seconds</td></tr>
<tr><td>6</td><td>start-up delay 32 seconds</td></tr>
<tr><td>7</td><td>start-up delay 64 seconds</td></tr>
<tr><td>8</td><td>start-up delay 128 seconds</td></tr>
<tr><td>9</td><td>automatically, until the value has been exceeded
for the first time</td></tr>
</table>
The defined delay time window is valid for all outputs.</td><td>0 - 9</td><td>0</td></tr>
<tr><td>177</td><td><u>Startup Output</u> <u>(assignment of a start-up delay to outputs)</u>:

By using a 5 bit binary code the start-up delay function can be assigned to an output. Settings see below:

<table>
<tr><td>Output:</td><td>Ausgang</td><td>RELAY</td><td>OUT4</td><td>OUT3</td><td>OUT2</td><td>OUT1</td></tr>
<tr><td>Bit:</td><td>Bit:</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Binary:</td><td>Binär:</td><td>10000</td><td>01000</td><td>00100</td><td>00010</td><td>00001</td></tr>
<tr><td>Value:</td><td>Wert:</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
</table>
Example: A setting of Startup Output = 17 (binary 10001) means that
a start-up delay is assigned to OUT1 and to the RELAY output.</td><td>0 - 31</td><td>0</td></tr>
</table>

Continuation **"Switching Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>178</td><td><u>Standstill Time</u> (delay time for standstill detection):

This parameter defines the delay time until the unit detects a standstill after detecting frequency = 0 Hz.
 

Prior condition is that both input frequencies are detected as „Zero" ($f_{1,2}$ = 0 Hz). From that moment, the standstill period runs off and indicates a standstill when elapsed.</td><td>0 – 9.999 (sec.)</td><td>0</td></tr>
<tr><td>179</td><td><u>Lock Output</u> (assignment of a lock-function to an output):

The assignment of a self-locking-function to an output can be adjusted by using a 6 bit binary code as follows:
<table>
<tr><td>Output:</td><td>*</td><td>RELAY</td><td>OUT4</td><td>OUT3</td><td>OUT2</td><td>OUT1</td></tr>
<tr><td>Bit</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Binary:</td><td>100000</td><td>010000</td><td>001000</td><td>000100</td><td>000010</td><td>000001</td></tr>
<tr><td>Value:</td><td>32</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
</table>
Bits 1 to 5 are used to assign the lock function to the respective outputs.
*) The highest valued bit 6 determines if a locked output can be released exclusively by an external input signal via parameter "*IN* Function" (bit 6 = 0) or additionally by an automatic reset when standstill is indicated (bit 6 = 1).

Example:
An adjustment of Lock Output = 17 (binary 10001) means that a lock is assigned to output OUT1 and to the relay, which can be deactivated exclusively by an external input signal.

Further the adjustment Lock Output = 49 (binary 110001) means that the lock-functions of OUT1 and the relay are deleted additionally when standstill is detected.

Please note: With an active wipe time setting, no self-locking function can be assigned to the corresponding output.</td><td>0 - 63</td><td>0</td></tr>
</table>

Continuation **"Switching Menu"**:

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>180</td><td><u>Action Output</u> <u>(output selection for overwriting)</u>:

The function to set fixed output conditions for OUT1 to OUT4 is only effective in the Programming Mode. It is used for test purposes and allows to force each output to a defined switching condition. It is not allowed that an error has been occured.

The „Action Output" parameter selects the outputs to be tested.
The next Parameter „Action Polarity" is used to assign the desired switching conditions to the selected outputs.

The outputs are selectable by using a 5 bit binary code:

<table>
<tr><td>Output:</td><td>RELAY</td><td>OUT4</td><td>OUT3</td><td>OUT2</td><td>OUT1</td></tr>
<tr><td>Bit</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Binary:</td><td>10000</td><td>01000</td><td>00100</td><td>00010</td><td>00001</td></tr>
<tr><td>Value:</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
</table>
After the test this parameter must be reset to default (= 0).</td><td>0 - 31</td><td>0</td></tr>
<tr><td>181</td><td><u>Action Polarity</u> <u>(setting the output conditions)</u>:

This setting-function is only effective in the Programming Mode and requires a selection of the corresponding outputs by the parameter "Action Output".

The output-conditions are assignable by a 9 bit binary code:

<table>
<tr><td>OUT:</td><td>REL</td><td>4</td><td>/4</td><td>3</td><td>/3</td><td>2</td><td>/2</td><td>1</td><td>/1</td></tr>
<tr><td>Bit:</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>Binär:</td><td>1 0000 0000</td><td>0 1000 0000</td><td>0 0100 0000</td><td>0 0010 0000</td><td>0 0001 0000</td><td>0 0000 1000</td><td>0 0000 0100</td><td>0 0000 0010</td><td>0 0000 0001</td></tr>
<tr><td>Value:</td><td>256</td><td>128</td><td>64</td><td>32</td><td>16</td><td>8</td><td>4</td><td>2</td><td>1</td></tr>
</table>
After the test, this parameter must be reset to default (= 0).</td><td>0 - 511</td><td>0</td></tr>
</table>

Continuation **"Switching Menu"**:

<table>
<tr><th>No</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>182</td><td><u>Read Back OUT</u> (output for the EDM function):
Defines the read back output for the EDM function - with respect to inverting or non-inverting.
<table>
<tr><td>Bit 0</td><td>= 0 EDM function of OUT1
= 1 EDM function of /OUT1</td></tr>
<tr><td>Bit 1</td><td>= 0 EDM function of OUT2
= 1 EDM function of /OUT2</td></tr>
<tr><td>Bit 2</td><td>= 0 EDM function of OUT3
= 1 EDM function of /OUT3</td></tr>
<tr><td>Bit 3</td><td>= 0 EDM function of OUT4
= 1 EDM function of /OUT4</td></tr>
<tr><td>Bit 4</td><td>= 0 EDM function of REL1
= 1 EDM function of REL1 (inverted)</td></tr>
</table></td><td>0 - 31</td><td>0</td></tr>
<tr><td>183</td><td><u>Output Mode</u> (output configuration):
Defines the configuration of the outputs:
<table>
<tr><td>Bit 0</td><td>= 0 OUT1 and /OUT1 are inverse
= 1 OUT1 and /OUT1 are homogeneously)</td></tr>
<tr><td>Bit 1</td><td>= 0 OUT2 and /OUT2 are inverse
= 1 OUT2 and /OUT2 are homogeneously</td></tr>
<tr><td>Bit 2</td><td>= 0 OUT3 and /OUT3 are inverse
= 1 OUT3 and /OUT3 are homogeneously)</td></tr>
<tr><td>Bit 3</td><td>= 0 OUT3 and /OUT4 are inverse
= 1 OUT3 and /OUT4 are homogeneously)</td></tr>
</table></td><td>0 - 99</td><td>0</td></tr>
<tr><td>184</td><td><u>EDM Error Count</u> (number of allowed EDM errors):
Returns the maximum allowed number of EDM errors before an EDM Run Time error is triggered. The actual number may well be higher, because in the meantime also errors can be reduced.</td><td></td><td></td></tr>
<tr><td>185</td><td>Reserved</td><td></td><td></td></tr>
</table>

- With homogeneous outputs, all inputs will be pulled down to GND in case of power or hardware failure. Thereby an error state cannot be clearly transmitted to another device by these outputs.
- Using homogeneous outputs will reduce the Safety Integrity Level (SIL).

2.7. Control Menu

This chapter describes the features and configuration options of the control inputs
Depending on the parameter „Input Mode 1“ four different input configurations can be set:

- Input Mode 1 = 0: two 2-pole inputs (IN1, /IN1 + IN2, /IN2)
  The control inputs are either homogeneous or inversely. In this case each input requires a dual signal.

Signal pair 1	[X23: 2] LOW	[X23: 3] LOW	Error if inverse	Configuration by parameter „IN1 Function“ and „IN1 Config“
	[X23: 2] LOW	[X23: 3] HIGH	Error if homogeneously	
	[X23: 2] HIGH	[X23: 3] LOW	Error if homogeneously	
	[X23: 2] HIGH	[X23: 3] HIGH	Error if inverse	
Signal pair 2	[X23: 4] LOW	[X23: 5] LOW	Error if inverse	Configuration by parameter „IN2 Function“ and „IN2 Config“
	[X23: 4] LOW	[X23: 5] HIGH	Error if homogeneously	
	[X23: 4] HIGH	[X23: 5] LOW	Error if homogeneously	
	[X23: 4] HIGH	[X23: 5] HIGH	Error if inverse	

- Input Mode 1 = 1: one 2-pole (IN1, /IN1) and two 1-pole inputs (IN2 + /IN2)
  The 2-pole input is either homogeneous or inversely. The 2-pole control input requires a dual signal, while the 1-pole inputs only require a single signal. Thus three independent inputs are available.

Signal pair 1	[X23: 2] LOW	[X23: 3] LOW	Error if inverse	Configuration by parameter „IN1 Function“ and „IN1 Config““
	[X23: 2] LOW	[X23: 3] HIGH	Error if homogeneously	
	[X23: 2] HIGH	[X23: 3] LOW	Error if homogeneously	
	[X23: 2] HIGH	[X23: 3] HIGH	Error if inverse	
Signal 2	[X23: 4] LOW		Configuration by parameter „IN2 Function“ and „IN2 Config“	
	[X23: 4] HIGH			
Signal 3	[X23: 5] LOW		Configuration by parameter „/IN2 Function“ and „/IN2 Config“	
	[X23: 5] HIGH			

- Input Mode 1 = 2: four 1-pole inputs (IN1 + /IN1 + IN2 + /IN2)
  The 1-pole inputs require only a single signal. Thus four independent inputs are available.

Signal 1	[X23: 2] LOW	Configuration by parameter „IN1 Function“ and „IN1 Config““
	[X23: 2] HIGH	
Signal 2	[X23: 3] LOW	Configuration by parameter „/IN1 Function“ and „/IN1 Config“
	[X23: 3] HIGH	
Signal 3	[X23: 4] LOW	Configuration by parameter „IN2 Function“ and „IN2 Config“
	[X23: 4] HIGH	
Signal 4	[X23: 5] LOW	Configuration by parameter „/IN2 Function“ and „/IN2 Config“
	[X23: 5] HIGH	

- Input Mode 1 = 3: A 4-pole preselection input (IN1 + / IN1 + IN2 + / IN2)
  The 4-pole preselection inputs are used to switch the switching points. Four switching points (gray format) or sixteen are usable.

Signal 1-4	[X23: 2-5] LOW / HIGH	Configuration by parameter "Presel.XXX.M"

The parameter "Input Mode 2" can be used to create four different input configurations:

- Input Mode 2 = 0: Two 2-pole inputs (IN3, /IN3 + IN4, /IN4)
  The control inputs are either homogeneous or inversely. In this case each input requires a dual signal.

Signal pair 1	[X24: 2] LOW	[X24: 3] LOW	Error if inverse	Configuration by parameter „IN3 Function" and „IN3 Config"
	[X24: 2] LOW	[X24: 3] HIGH	Error if homogeneously	
	[X24: 2] HIGH	[X24: 3] LOW	Error if homogeneously	
	[X24: 2] HIGH	[X24: 3] HIGH	Error if inverse	
Signal pair 2	[X24: 4] LOW	[X24: 5] LOW	Error if inverse	Configuration by parameter „IN4 Function" and „IN4 Config"
	[X24: 4] LOW	[X24: 5] HIGH	Error if homogeneously	
	[X24: 4] HIGH	[X24: 5] LOW	Error if homogeneously	
	[X24: 4] HIGH	[X24: 5] HIGH	Error if inverse	

- Input Mode 2 = 1: Ein 2-poliger Eingang (IN3, /IN3) und zwei 1-polige Eingänge (IN4 + /IN4)
  The 2-pole input is either homogeneous or inversely. The 2-pole control input requires a dual signal, while the 1-pole inputs only require a single signal. Thus three independent inputs are available.

Signal pair 1	[X24: 2] LOW	[X24: 3] LOW	Error if inverse	Configuration by parameter „IN3 Function" und „IN3 Config"
	[X24: 2] LOW	[X24: 3] HIGH	Error if homogeneously	
	[X24: 2] HIGH	[X24: 3] LOW	Error if homogeneously	
	[X24: 2] HIGH	[X24: 3] HIGH	Error if inverse	
Signal 2	[X24: 4] LOW		Configuration by parameter „IN4 Function" und „IN4 Config"	
	[X24: 4] HIGH			
Signal 3	[X24: 5] LOW		Configuration by parameter „/IN4 Function" und „/IN4 Config"	
	[X24: 5] HIGH			

- Input Mode 2 = 2: Vier 1-polige Eingänge (IN3 + /IN3 + IN4 + /IN4)
  The 1-pole inputs require only a single signal. Thus four independent inputs are available

Signal 1	[X24: 2] LOW	Configuration by parameter „IN3 Function" und „IN3 Config"
	[X24: 2] HIGH	
Signal 2	[X24: 3] LOW	Configuration by parameter „/IN3 Function" und „/IN3 Config"
	[X24: 3] HIGH	
Signal 3	[X24: 4] LOW	Configuration by parameter „IN4 Function" und „IN4 Config"
	[X24: 4] HIGH	
Signal 4	[X24: 5] LOW	Configuration by parameter „/IN4 Function" und „/IN4 Config"
	[X24: 5] HIGH	

- **Input Mode 2 = 3: A 4-pole preselection input (IN3 + /IN3 + IN4 + /IN4)**
  The 4-pole preselection inputs are used to switch the switching points. Four switching points (gray format) or sixteen are usable.

Signal 1-4	[X24: 2-5] **LOW / HIGH**	Configuration by parameter "Presel.XXX.M"

- The use of homogeneous 1-pole inputs reduces the Safety Integrity Level (SIL). The use of 16 switching points reduces the Safety Integrity Level (SIL).

No.	Parameter	Range	Default
186	**Input Mode 1** (Configuration of the inputs): Defines the type of inputs at [X23]. 0 – Two 2-channel input pairs 1 – A 2-channel input pair and two single inputs 2 – Four single inputs 3 – [X23] is used for switching point switching	0 – 3	0
187	**Input Mode 2** (Configuration of the inputs): Defines the type of inputs at [X24]. 0 – Two 2-channel input pairs 1 – A 2-channel input pair and two single inputs 2 – Four single inputs 3 – [X24] is used for switching point switching	0 - 3	0

Continuation **"Control Menu":**

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>188</td><td><u>IN1 Function</u> (Assignment of a function at input <u>[X23 : 2]</u>):

This parameter defines the input function when the corresponding "Input Mode 1" = 0 - 2 is set.
The respective switching behavior can be specified by using the "IN1 Config" parameter.

<table>
<tr><td>0</td><td>No function assigned</td><td></td></tr>
<tr><td>1</td><td>Release lock of output OUT1</td><td>[dyn]</td></tr>
<tr><td>2</td><td>Release lock of output OUT2</td><td>[dyn]</td></tr>
<tr><td>3</td><td>Release lock of output OUT3</td><td>[dyn]</td></tr>
<tr><td>4</td><td>Release lock of output OUT4</td><td>[dyn]</td></tr>
<tr><td>5</td><td>Release lock of output REL1</td><td>[dyn]</td></tr>
<tr><td>6</td><td>Release all output locks together</td><td>[dyn]</td></tr>
<tr><td>7</td><td>Set Frequency1
Frequency simulation of Sensor 1</td><td>[stat]
[PRG]</td></tr>
<tr><td>8</td><td>Set Frequency2
Frequency simulation of Sensor 2</td><td>[stat]
[PRG]</td></tr>
<tr><td>9</td><td>Set Frequency12
Frequency simulation of Sensor 1 und Sensor 2</td><td>[stat]
[PRG]</td></tr>
<tr><td>10</td><td>Freeze Frequency1
Freezes the actual encoder frequency of Sensor 1</td><td>[stat]
[PRG]</td></tr>
<tr><td>11</td><td>Freeze Frequency2
Freezes the actual encoder frequency of Sensor 2</td><td>[stat]
[PRG]</td></tr>
<tr><td>12</td><td>Freeze Frequency12
Freezes the encoder frequency of Sensor 1 and Sensor 2</td><td>[stat]
[PRG]</td></tr>
<tr><td>13</td><td>Preselection Change
Switchover between the upper and lower switching point. The changeover takes effect to all outputs.</td><td>[stat]</td></tr>
<tr><td>14</td><td>Clear Drift 1
Clears the counter of position drift 1</td><td>[dyn]</td></tr>
<tr><td>15</td><td>Clear Drift 2
Clears the counter of position drift 2</td><td>[dyn]</td></tr>
<tr><td>16</td><td>Clear Drift 12
Clears the counter of position drift 1 and drift 2</td><td>[dyn]</td></tr>
<tr><td>17-20</td><td>N.N.</td><td></td></tr>
<tr><td>21</td><td>Enable input for the output function of parameter „Switch Mode“ = 10 - 22</td><td>[stat]</td></tr>
<tr><td>22</td><td>N.N.</td><td></td></tr>
</table>
</td><td>0 - 24</td><td>0</td></tr>
</table>

Continuation **"Control Menu":**

No.	Parameter	Range	Default
	0 - 24	0	

23	Inhibit Frequency / Position Error If an encoder is defect, the machine can no longer be moved because of a frequency or position error. When this happens, the following must be done: - Set DS250 in programming mode (no safety) - Apply a high signal to the associated programmed input - This clears the frequency, position and drift error and the machine can be moved.	[stat]
24	Reset of the position difference If the input is set dynamically, the position difference should be deleted. A position error is not cleared. This applies to the parameter setting Div. Mode = 1.2.	[dyn]

[dyn] = dynamic function if a rising edge appears at the input
[stat] = static permanent function
[PRG] = function only in the "Programming Mode" active

Continuation "Control Menu":

In case of simultaneous commands "Set Frequency" and "Frequency freeze" via both control inputs, the function "Set Frequency" has priority.

No.	Parameter	Range	Default
189	IN1 Config (switching behavior of input [X23 : 2]): This parameter defines the switching behavior of the input, when the corresponding "Input Mode 2" = 0-2 is set. The respective function assignment can be specified by using the "IN1 Function" parameter. 0 – Inverse dual channel input (statically, LOW) 1 – Inverse dual channel input (statically, HIGH) 2 – Inverse dual channel input (dynamically, LOW) 3 – Inverse dual channel input (dynamically, HIGH) 4 – Homogeneous dual channel input (statically, LOW) 5 – Homogeneous dual channel input (statically, HIGH) 6 – Homogeneous dual channel input (dynamically, LOW) 7 – Homogeneous dual channel input (dynamically, HIGH) 8 – Single channel input (statically, LOW) 9 – Single channel input (statically, HIGH) 10 – Single channel input (dynamically, LOW) 11 – Single channel input (dynamically, HIGH)	0 - 11	0
190	/IN1 Function (Assignment of a function at input [X23 : 3): The function is identical to parameter „IN1 Function"	0 – 22	0
191	/IN1 Config (Switching behavior at the input [X23 : 3]: The configuration is identical to parameter „IN1 Config"	0 – 11	0
192	IN2 Function (Assignment of a function at input [X23 : 4]: The function is identical to parameter „IN1 Function"	0 – 22	0
193	IN2 Config (Switching behavior at the input [X23 : 4]): The configuration is identical to parameter „IN1 Config"	0 – 11	0
194	/IN2 Function (Assignment of a function at input [X23 : 5]: The function is identical to parameter „IN1 Function"	0 – 22	0
195	/IN2 Config (Switching behavior of the input [X23 : 5]: The configuration is identical to parameter „IN1 Config"	0 – 11	0

Continuation **"Control Menu":**

<table>
<tr><th>Nr.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>196</td><td><u>IN3 Function</u> (Assignment of a function at input <u>[X24 : 4]</u>):
This parameter defines the input function when the corresponding "Input Mode 2" = 0 - 2 is set.
The respective switching behavior can be specified by using the "IN3 Config" parameter.
<table>
<tr><td>0</td><td>No function assigned</td><td></td></tr>
<tr><td>1</td><td>Release lock of output OUT1</td><td>[dyn]</td></tr>
<tr><td>2</td><td>Release lock of output OUT2</td><td>[dyn]</td></tr>
<tr><td>3</td><td>Release lock of output OUT3</td><td>[dyn]</td></tr>
<tr><td>4</td><td>Release lock of output OUT4</td><td>[dyn]</td></tr>
<tr><td>5</td><td>Release lock of output REL1</td><td>[dyn]</td></tr>
<tr><td>6</td><td>Release all output locks together</td><td>[dyn]</td></tr>
<tr><td>7</td><td>Set Frequency1
Frequency simulation of Sensor1</td><td>[stat]
[PRG]</td></tr>
<tr><td>8</td><td>Set Frequency2
Frequency simulation of Sensor2</td><td>[stat]
[PRG]</td></tr>
<tr><td>9</td><td>Set Frequency12
Frequency simulation of Sensor1 und Sensor2</td><td>[stat]
[PRG]</td></tr>
<tr><td>10</td><td>Freeze Frequency1
Freezes the actual encoder frequency of Sensor1</td><td>[stat]
[PRG]</td></tr>
<tr><td>11</td><td>Freeze Frequency2
Freezes the actual encoder frequency of Sensor2</td><td>[stat]
[PRG]</td></tr>
<tr><td>12</td><td>Freeze Frequency12
Freezes the encoder frequency of Sensor1 and Sensor2</td><td>[stat]
[PRG]</td></tr>
<tr><td>13</td><td>Switch between two switching points. Switching affects all outputs (only if Input mode 1 & 2 are not set to 3).
The switch is made between the parameters "Presel.xxxx.01" and "Presel.xxxx.02".</td><td>[stat]</td></tr>
<tr><td>14</td><td>Clear Drift 1
Clears the counter of position drift 1</td><td>[dyn]</td></tr>
<tr><td>15</td><td>Clear Drift 2
Clears the counter of position drift 2</td><td>[dyn]</td></tr>
<tr><td>16</td><td>Clear Drift 2
Clears the counter of position drift 1 and drift 2</td><td>[dyn]</td></tr>
<tr><td>17</td><td>EDM function of OUT1 OUT1 or /OUT1</td><td></td></tr>
<tr><td>18</td><td>EDM function of OUT2 or /OUT2</td><td></td></tr>
<tr><td>19</td><td>EDM function of OUT3 or /OUT3</td><td></td></tr>
<tr><td>20</td><td>EDM function of OUT4 or /OUT4</td><td></td></tr>
<tr><td>21</td><td>Enable input for the output function of parameter „Switch Mode" = 10 - 22</td><td>[stat]</td></tr>
<tr><td>22</td><td>EDM function of REL1</td><td></td></tr>
</table>
[dyn] = dynamic function if a rising edge appears at the input
[stat] = static permanent function
[PRG] = function only in the "Programming Mode" active</td><td>0 – 22</td><td>0</td></tr>
</table>

Continuation **"Control Menu":**

Nr.	Parameter	Range	Default
197	**IN3 Config** (switching behavior of input [X24 : 4]): This parameter defines the switching behavior of the input, when the corresponding "Input Mode 2" = 0 - 2 is set. The respective function assignment can be specified by using the "IN3 Function" parameter.	0 – 35	0

0	Inverse dual channel input (statically, LOW)
1	Inverse dual channel input (statically, HIGH)
2	Inverse dual channel input (dynamically, LOW)
3	Inverse dual channel input (dynamically, HIGH)
4	Homogeneous dual channel input (statically, LOW)
5	Homogeneous dual channel input (statically, HIGH)
6	Homogeneous dual channel input (dynamically, LOW)
7	Homogeneous dual channel input (dynamically, HIGH)
8	Single channel input (statically, LOW)
9	Single channel input (statically, HIGH)
10	Single channel input (dynamically, LOW)
11	Single channel input (dynamically, HIGH)
12	Single channel input EDM-clock of OUT1
13	Single channel input EDM- clock of /OUT1
14	Single channel input EDM- clock of OUT2
15	Single channel input EDM- clock of /OUT2
16	Single channel input EDM- clock of OUT3
17	Single channel input EDM- clock of /OUT3
18	Single channel input EDM- clock of OUT4
19	Single channel input EDM- clock of /OUT4
20	Single channel pulsed input of OUT1 (statically, HIGH)
21	Single channel pulsed input of /OUT1 (statically, HIGH)
22	Single channel pulsed input of OUT2 (statically, HIGH)
23	Single channel pulsed input of /OUT2 (statically, HIGH)
24	Single channel pulsed input of OUT3 (statically, HIGH)
25	Single channel pulsed input of /OUT3 (statically, HIGH)
26	Single channel pulsed input of OUT4 (statically, HIGH)
27	Single channel pulsed input of /OUT4 (statically, HIGH)
28	Single channel pulsed input of OUT1 (statically, LOW)
29	Single channel pulsed input of /OUT1 (statically, LOW)
30	Single channel pulsed input of OUT2 (statically, LOW)
31	Single channel pulsed input of /OUT2 (statically, LOW)
32	Single channel pulsed input of OUT3 (statically, LOW)
33	Single channel pulsed input of /OUT3 (statically, LOW)
34	Single channel pulsed input of OUT4 (statically, LOW)
35	Single channel pulsed input of /OUT4 (statically, LOW)

Continuation **"Control Menu":**

Nr.	Parameter	Range	Default
198	/IN3 Function (Assignment of a function at input [X24 : 4]): The function is identical to parameter „IN3 Function"	0 – 22	0
199	/IN3 Config (Schaltverhalten des Eingangs [X24 : 4]): The configuration is identical to parameter „IN3 Config"	0 - 35	0
200	IN4 Function (Assignment of a function at input [X24 : 4]): The function is identical to parameter „IN3 Function"	0 - 22	0
201	IN4 Config (Schaltverhalten des Eingangs [X24 : 4]): The configuration is identical to parameter „IN3 Config"	0 - 35	0
202	/IN4 Function (Assignment of a function at input [X24 : 4]): The function is identical to parameter „IN3 Function"	0 - 22	0
203	/IN4 Config (Schaltverhalten des Eingangs [X24 : 4]): The configuration is identical to parameter „IN3 Config"	0 - 35	0
204	Read Back Delay (Time until the readback is active again): Bounce-time bypass for an external relay of the EDM function	0.000 - 1.000 (sec.)	0
205	GPI Err Time (Setting 1 corresponds to the error time of approx. 1 ms): Time until an illegal state at the GPI input leads to the error. The default value of 10 corresponds to an error time of approx. 10 ms.	1 - 9999	10
206	*Reserved*		
207	*Reserved*		

If the "Set frequency" and "Freeze frequency"are applied at the two control inputs, the "Set frequency" function is prioritized.
If input mode x = 3 is used, all affected function parameters must be set to 0.

2.8. Serial Menu

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>208</td><td><u>Serial Unit No.</u> (assigns a serial unit number):

The devices can be assigned by unit numbers between 11 and 99 (default = 11).

Please note: Unit numbers must not contain a 0 because these numbers are reserved for group- or bulk-addressing.</td><td>11 - 99</td><td>11</td></tr>
<tr><td>209</td><td><u>Serial Baud Rate</u> (serial transmission speed):

<table>
<tr><td>0</td><td>9 600 Baud</td></tr>
<tr><td>1</td><td>4 800 Baud</td></tr>
<tr><td>2</td><td>2 400 Baud</td></tr>
<tr><td>3</td><td>1 200 Baud</td></tr>
<tr><td>4</td><td>600 Baud</td></tr>
<tr><td>5</td><td>19 200 Baud</td></tr>
<tr><td>6</td><td>38 400 Baud</td></tr>
<tr><td>7</td><td>56 000 Baud</td></tr>
<tr><td>8</td><td>57 600 Baud</td></tr>
<tr><td>9</td><td>76 800 Baud</td></tr>
<tr><td>10</td><td>115 200 Baud</td></tr>
</table></td><td>0 - 10</td><td>0</td></tr>
<tr><td>210</td><td><u>Serial Format</u> (ormat of the serial data):

<table>
<tr><td>0</td><td>7 data bits,</td><td>parity even,</td><td>1 stop bit</td></tr>
<tr><td>1</td><td>7 data bits,</td><td>parity even,</td><td>2 stop bits</td></tr>
<tr><td>2</td><td>7 data bits,</td><td>parity odd,</td><td>1 stop bit</td></tr>
<tr><td>3</td><td>7 data bits,</td><td>parity odd,</td><td>2 stop bits</td></tr>
<tr><td>4</td><td>7 data bits,</td><td>no parity*,</td><td>1 stop bit</td></tr>
<tr><td>5</td><td>7 data bits,</td><td>no parity*,</td><td>2 stop bits</td></tr>
<tr><td>6</td><td>8 data bits,</td><td>parity even,</td><td>1 stop bit</td></tr>
<tr><td>7</td><td>8 data bits,</td><td>parity odd,</td><td>1 stop bit</td></tr>
<tr><td>8</td><td>8 data bits,</td><td>no parity*,</td><td>1 stop bit</td></tr>
<tr><td>9</td><td>8 data bits,</td><td>no parity*,</td><td>2 stop bits</td></tr>
</table></td><td>0 - 9</td><td>0</td></tr>
</table>

*) With setting „no parity“ no secure data transmission guaranteed.
For a secure data transmission „Parity even“ or „Parity odd“ must be selected.

Continuation "Serial Menu"

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>211</td><td><u>Serial Page:</u>
The Parameter serves only for diagnosis purposes by the manufacturer.</td><td>0 - 20</td><td>0</td></tr>
<tr><td>212</td><td><u>Serial Init:</u>
This parameter determines the baud rate for the transmission of the initialization values to the operator surface OS respectively to the BG200 programming and display unit.
<table><tr><td>0</td><td>The initialization values will be transmitted with 9600 baud. After that, the unit returns back to the baud rate set by the user.</td></tr><tr><td>1</td><td>The initialization values will be transmitted with the user setting. After that, the unit continues with this baud rate.</td></tr></table>With settings higher than 9600 baud the duration of the initialization can be shortened.</td><td>0 - 1</td><td>0</td></tr>
<tr><td>213</td><td>Reserved</td><td></td><td></td></tr>
</table>

2.9. Splitter Menu

(Looping of Sensor Signals for further Target Units)

<table>
<tr><th>No.</th><th>Parameter</th><th>Range</th><th>Default</th></tr>
<tr><td>214</td><td><u>Split.Level:</u> (Determination of the output voltage)
This parameter defines the output voltage of the splitter output [X5 | ENCODER OUT].
<table><tr><td>0</td><td>5.2V
Connection with RS-422 compatible inputs possible</td></tr><tr><td>1</td><td>18-30V
Connection with HTL compatible inputs possible</td></tr></table></td><td>0 - 1</td><td>0</td></tr>
<tr><td>215</td><td><u>Split.Selector</u> (determination of the RS422 output source):
This parameter defines which input frequency (Sensor1 or Sensor2) at [X5 | ENCODER OUT] is output.
<table><tr><td>0</td><td>Sensor1
At [X5 | ENCODER OUT], the frequency of the input signal from Sensor1 is output.</td></tr><tr><td>1</td><td>Sensor2
At [X5 | ENCODER OUT], the frequency of the input signal from Sensor2 is output</td></tr></table></td><td>0 - 1</td><td>0</td></tr>
</table>

If the parameter “Split Level” is set incorrectly the connected device can be demaged. (if setting the output to 18-30V a 5V input can be destroyed).

2.10. Init Menu

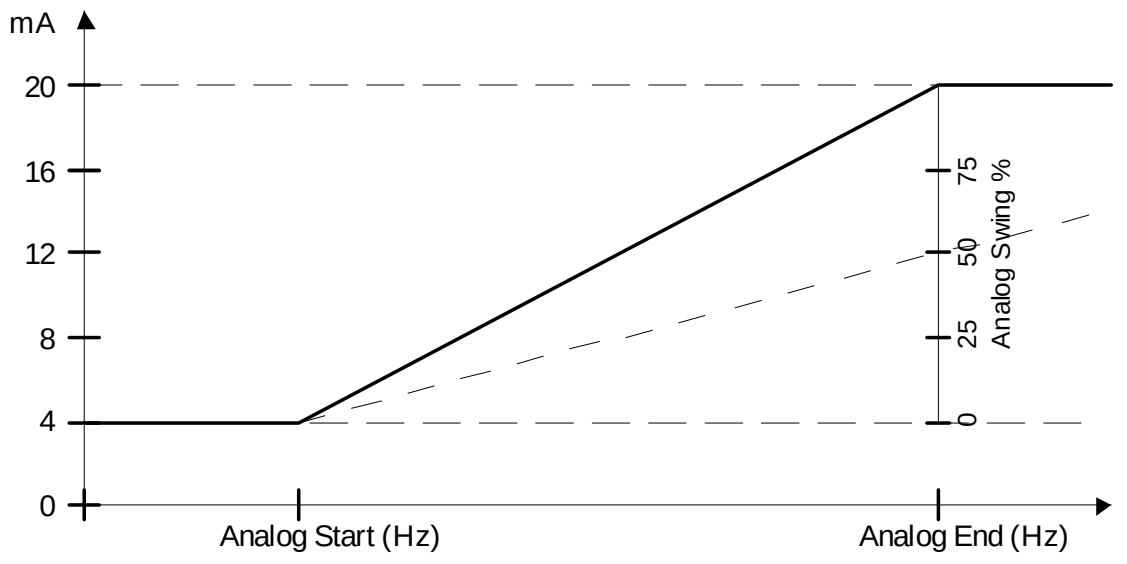
No.	Parameter	Range	Default
216	<u>Init EDM Error:</u> <u>(Switching EDM initialization on and off)</u> Default = 0, Initialization is performed Setzung = 1, Initialization is skipped	0 - 1	0

2.11. Analog Menu

(Analog Output Configuration)

The setting of parameter "F1-F2-Selection" determines whether the frequency of Sensor 1 or Sensor 2 is used to generate the analog output signal.

No.	Parameter	Range	Default
217	**Analog Start** (initial value of the conversion range in Hz): Defines the initial frequency, at which the analog output should set its initial value of 4 mA.	-500 000.00 - 500 000.00 (Hz)	0
218	**Analog End** (final value of the conversion range in Hz): Defines the final frequency, at which the analog output should set its final value of 20 mA.		1 000.00
219	**Analog Gain** (gain of the D/A converter): With a setting of 100, the frequency curve between the parameters „Analog Start" and „Analog End" corresponds to the whole stroke of 16 mA (20 mA – 4 mA). With a setting of e. g. 50 the stroke would be only 8 mA and the analog output supplies a value of 4 + 8 = 12 mA when reaching the end frequency of parameter „Analog End".	1 - 1 000	100
220	**Analog Offset** (fine adjustment of the zero point in µA): Accurate adjustment of the analog offset within a fine range.	-25 … +25 (µA)	0
221	*Reserved*		



2.12. OPU Menu

(Operational Unit Menu in case of a connected BG200)

No.	Parameter	Range	Default
222	X Factor 1 (no function for DS, internal BG parameter)	1 - 999 999	1
223	/ Factor 1 (no function for DS, internal BG parameter)	1 - 999 999	1
224	+/- Value 1 (no function for DS, internal BG parameter)	-999 999 - 999 999	0
225	Units 1 (no function for DS, internal BG parameter)	0 - 12	0
226	Decimal Point 1 (no function for DS, internal BG parameter)	0 - 5	0
227	X Factor 2 (no function for DS, internal BG parameter)	1 - 999 999	1
228	/ Factor 2 (no function for DS, internal BG parameter)	1 - 999 999	1
229	+/- Value 2 (no function for DS, internal BG parameter)	-999 999 - 999 999	0
230	Units 2 (no function for DS, internal BG parameter)	0 - 12	0
231	Decimal Point 2 (no function for DS, internal BG parameter)	0 - 5	0
232	*Reserved*		
233	*Reserved*		
234	*Reserved*		
235	*Reserved*		
236	*Reserved*		

Hint: The actual BG200 operating manual describes further details about these parameters.

3. Parameter List

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
000	Sampling Time	1	9999	1	4	3	A0
001	Wait Time	10	9999	100	4	3	A1
002	F1-F2 Selection	0	1	0	1	0	A2
003	Div. Mode	0	2	0	1	0	A3
004	Div. Switch %-f	0	999999	10000	5	2	A4
005	Div. %-Value	1	100	10	3	0	A5
006	Div. f-Value	0	99999	3000	4	2	A6
007	Div. Calculation	0	1	0	1	0	A7
008	Div. Filter	0	20	1	2	0	A8
009	Div. Filter Time	0	1000	0	4	3	N5
010	Div. Inc-Value	0	9999999	0	7	0	A9
011	Error Simulation	0	2	0	1	0	D0
012	Power-up Delay	1	19999	100	5	3	D1
013	Filter	0	999	0	3	0	D2
014	Power-up Error	0	2097151	0	7	0	D3
015	Sensor Overlap	0	2	0	1	0	D4
016	Power-Cas Delay	0	99999	0	5	3	D5
017	Op-Mode 1	0	3	1	1	0	D6
018	Edge 1	0	1	0	1	0	D7
019	Direction 1	0	1	0	1	0	B3
020	Multiplier 1	1	10000	1	5	0	B4
021	Divisor 1	1	10000	1	5	0	B5
022	Position Drift 1	0	100000	0	6	0	E0
023	Sense Value 1	0	3000	2400	4	2	E1
024	Sense Tol. 1	0	500	100	4	2	E2
025	Phase Error 1	1	1000	10	4	0	E3
026	Set Frequency 1	-50000000	50000000	0	88	2	E4
027	Error Mask 1	0	7	3	1	0	E5
028	Dir.Changes 1	0	9999	0	4	0	E6
029	Op-Mode 2	0	3	1	1	0	E7
030	Edge 2	0	1	0	1	0	E8
031	Direction 2	0	1	0	1	0	C0
032	Multiplier 2	1	10000	1	5	0	C1
033	Divisor 2	1	10000	1	5	0	C2
034	Position Drift 2	0	100000	0	6	0	F0
035	Sense Value 2	0	3000	2400	4	2	F1
036	Sense Tol. 2	0	500	100	4	2	F2
037	Phase Error 2	1	1000	10	4	0	F3
038	Set Frequency 2	-50000000	50000000	0	88	2	F4
039	Error Mask 2	0	7	3	1	0	F5
040	Dir.Changes 2	0	9999	0	4	4	F6

Continuation **"Parameter List"**:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
041	Presel.OUT1.01	-50000000	50000000	100000	88	2	a0
042	Presel.OUT1.02	-50000000	50000000	200000	88	2	a1
043	Presel.OUT1.03	-50000000	50000000	100000	88	2	a2
044	Presel.OUT1.04	-50000000	50000000	200000	88	2	a3
045	Presel.OUT1.05	-50000000	50000000	100000	88	2	a4
046	Presel.OUT1.06	-50000000	50000000	200000	88	2	a5
047	Presel.OUT1.07	-50000000	50000000	100000	88	2	a6
048	Presel.OUT1.08	-50000000	50000000	200000	88	2	a7
049	Presel.OUT1.09	-50000000	50000000	100000	88	2	a8
050	Presel.OUT1.10	-50000000	50000000	200000	88	2	a9
051	Presel.OUT1.11	-50000000	50000000	100000	88	2	b0
052	Presel.OUT1.12	-50000000	50000000	200000	88	2	b1
053	Presel.OUT1.13	-50000000	50000000	100000	88	2	b2
054	Presel.OUT1.14	-50000000	50000000	200000	88	2	b3
055	Presel.OUT1.15	-50000000	50000000	100000	88	2	b4
056	Presel.OUT1.16	-50000000	50000000	200000	88	2	b5
057	Presel.OUT1.D	0	9999999	0	07	0	b6
058	Presel.OUT1.M	0	4	0	1	0	b7
059	Presel.OUT1.R	1	50000000	10000000	8	4	b8
060	*Reserved*	0	10000	1000	5	0	b9
061	Presel.OUT2.01	-50000000	50000000	300000	88	2	c0
062	Presel.OUT2.02	-50000000	50000000	400000	88	2	c1
063	Presel.OUT2.03	-50000000	50000000	300000	88	2	c2
064	Presel.OUT2.04	-50000000	50000000	400000	88	2	c3
065	Presel.OUT2.05	-50000000	50000000	300000	88	2	c4
066	Presel.OUT2.06	-50000000	50000000	400000	88	2	c5
067	Presel.OUT2.07	-50000000	50000000	300000	88	2	c6
068	Presel.OUT2.08	-50000000	50000000	400000	88	2	c7
069	Presel.OUT2.09	-50000000	50000000	300000	88	2	c8
070	Presel.OUT2.10	-50000000	50000000	400000	88	2	c9
071	Presel.OUT2.11	-50000000	50000000	300000	88	2	d0
072	Presel.OUT2.12	-50000000	50000000	400000	88	2	d1
073	Presel.OUT2.13	-50000000	50000000	300000	88	2	d2
074	Presel.OUT2.14	-50000000	50000000	400000	88	2	d3
075	Presel.OUT2.15	-50000000	50000000	300000	88	2	d4
076	Presel.OUT2.16	-50000000	50000000	400000	88	2	d5
077	Presel.OUT2.D	0	9999999	0	07	0	d6
078	Presel.OUT2.M	0	4	0	01	0	d7
079	Presel.OUT2.R	1	50000000	10000000	8	4	d8
080	*Reserved*	0	10000	1000	5	0	d9

Continuation **"Parameter List"**:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
081	Presel.OUT3.01	-50000000	50000000	500000	88	2	e0
082	Presel.OUT3.02	-50000000	50000000	600000	88	2	e1
083	Presel.OUT3.03	-50000000	50000000	500000	88	2	e2
084	Presel.OUT3.04	-50000000	50000000	600000	88	2	e3
085	Presel.OUT3.05	-50000000	50000000	500000	88	2	e4
086	Presel.OUT3.06	-50000000	50000000	600000	88	2	e5
087	Presel.OUT3.07	-50000000	50000000	500000	88	2	e6
088	Presel.OUT3.08	-50000000	50000000	600000	88	2	e7
089	Presel.OUT3.09	-50000000	50000000	500000	88	2	e8
090	Presel.OUT3.10	-50000000	50000000	600000	88	2	e9
091	Presel.OUT3.11	-50000000	50000000	500000	88	2	f0
092	Presel.OUT3.12	-50000000	50000000	600000	88	2	f1
093	Presel.OUT3.13	-50000000	50000000	500000	88	2	f2
094	Presel.OUT3.14	-50000000	50000000	600000	88	2	f3
095	Presel.OUT3.15	-50000000	50000000	500000	88	2	f4
096	Presel.OUT3.16	-50000000	50000000	600000	88	2	f5
097	Presel.OUT3.D	0	9999999	0	07	0	f6
098	Presel.OUT3.M	0	4	0	01	0	f7
099	Presel.OUT3.R	1	50000000	10000000	8	4	f8
100	*Reserved*	0	10000	1000	5	0	f9
101	Presel.OUT4.01	-50000000	50000000	700000	88	2	g0
102	Presel.OUT4.02	-50000000	50000000	800000	88	2	g1
103	Presel.OUT4.03	-50000000	50000000	700000	88	2	g2
104	Presel.OUT4.04	-50000000	50000000	800000	88	2	g3
105	Presel.OUT4.05	-50000000	50000000	700000	88	2	g4
106	Presel.OUT4.06	-50000000	50000000	800000	88	2	g5
107	Presel.OUT4.07	-50000000	50000000	700000	88	2	g6
108	Presel.OUT4.08	-50000000	50000000	800000	88	2	g7
109	Presel.OUT4.09	-50000000	50000000	700000	88	2	g8
110	Presel.OUT4.10	-50000000	50000000	800000	88	2	g9
111	Presel.OUT4.11	-50000000	50000000	700000	88	2	h0
112	Presel.OUT4.12	-50000000	50000000	800000	88	2	h1
113	Presel.OUT4.13	-50000000	50000000	700000	88	2	h2
114	Presel.OUT4.14	-50000000	50000000	800000	88	2	h3
115	Presel.OUT4.15	-50000000	50000000	700000	88	2	h4
116	Presel.OUT4.16	-50000000	50000000	800000	88	2	h5
117	Presel.OUT4.D	0	9999999	0	07	0	h6
118	Presel.OUT4.M	0	4	0	01	0	h7
119	Presel.OUT4.R	1	50000000	10000000	8	4	h8
120	*Reserved*	0	10000	1000	5	0	h9

Continuation **"Parameter List"**:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
121	Presel.REL1.01	-50000000	50000000	10000	88	2	i0
122	Presel.REL1.02	-50000000	50000000	20000	88	2	i1
123	Presel.REL1.03	-50000000	50000000	10000	88	2	i2
124	Presel.REL1.04	-50000000	50000000	20000	88	2	i3
125	Presel.REL1.05	-50000000	50000000	10000	88	2	i4
126	Presel.REL1.06	-50000000	50000000	20000	88	2	i5
127	Presel.REL1.07	-50000000	50000000	10000	88	2	i6
128	Presel.REL1.08	-50000000	50000000	20000	88	2	i7
129	Presel.REL1.09	-50000000	50000000	10000	88	2	i8
130	Presel.REL1.10	-50000000	50000000	20000	88	2	i9
131	Presel.REL1.11	-50000000	50000000	10000	88	2	j0
132	Presel.REL1.12	-50000000	50000000	20000	88	2	j1
133	Presel.REL1.13	-50000000	50000000	10000	88	2	j2
134	Presel.REL1.14	-50000000	50000000	20000	88	2	j3
135	Presel.REL1.15	-50000000	50000000	10000	88	2	j4
136	Presel.REL1.16	-50000000	50000000	20000	88	2	j5
137	Presel.REL1.D	0	9999999	0	07	0	j6
138	Presel.REL1.M	0	4	0	01	0	j7
139	Presel.REL1.R	1	50000000	10000000	8	4	j8
140	*Reserved*	0	10000	1000	5	0	j9
141	Switch Mode OUT1	0	20	0	2	0	G0
142	Switch Mode OUT2	0	20	0	2	0	G1
143	Switch Mode OUT3	0	20	0	2	0	G2
144	Switch Mode OUT4	0	20	0	2	0	G3
145	Switch Mode REL1	0	20	0	2	0	G4
146	Pulse Time OUT1	0	9999	0	4	3	G5
147	Pulse Time OUT2	0	9999	0	4	3	G6
148	Pulse Time OUT3	0	9999	0	4	3	G7
149	Pulse Time OUT4	0	9999	0	4	3	G8
150	Pulse Time REL1	0	9999	0	4	3	G9
151	Hysteresis OUT1	0	1000	0	4	1	H0
152	Hysteresis OUT2	0	1000	0	4	1	H1
153	Hysteresis OUT3	0	1000	0	4	1	H2
154	Hysteresis OUT4	0	1000	0	4	1	H3
155	Hysteresis REL1	0	1000	0	4	1	H4
156	Matrix OUT1	0	8191	0	4	0	H5
157	Matrix OUT2	0	8191	0	4	0	H6
158	Matrix OUT3	0	8191	0	4	0	H7
159	Matrix OUT4	0	8191	0	4	0	H8
160	Matrix REL1	0	8191	0	4	0	H9

Continuation **"Parameter List"**:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
161	MIA-Delay OUT1	0	99999	0	5	3	I0
162	MIA-Delay OUT2	0	99999	0	5	3	I1
163	MIA-Delay OUT3	0	99999	0	5	3	I2
164	MIA-Delay OUT4	0	99999	0	5	3	I3
165	MIA-Delay REL1	0	99999	0	5	3	I4
166	MAI-Delay OUT1	0	99999	0	5	3	I5
167	MAI-Delay OUT2	0	99999	0	5	3	I6
168	MAI-Delay OUT3	0	99999	0	5	3	I7
169	MAI-Delay OUT4	0	99999	0	5	3	I8
170	MAI-Delay REL1	0	99999	0	5	3	I9
171	Delay OUT1	0	9999	0	4	3	J0
172	Delay OUT2	0	9999	0	4	3	J1
173	Delay OUT3	0	9999	0	4	3	J2
174	Delay OUT4	0	9999	0	4	3	J3
175	Delay REL1	0	9999	0	4	3	J4
176	Startup Mode	0	9	0	1	0	J5
177	Startup Output	0	31	0	2	0	J6
178	Standstill Time	0	9999	0	4	3	J7
179	Lock Output	0	63	0	2	0	J8
180	Action Output	0	31	0	2	0	J9
181	Action Polarity	0	511	0	3	0	K0
182	Read Back OUT	0	31	0	2	0	K1
183	Output Mode	0	15	0	2	0	K2
184	EDM Error Count	0	99	0	2	0	K3
185	*Reserved*	0	10000	1000	5	0	K4
186	Input Mode 1	0	3	0	1	0	K5
187	Input Mode 2	0	3	0	1	0	K6
188	IN1 Function	0	24	0	2	0	K7
189	IN1 Config	0	11	0	2	0	K8
190	/IN1 Function	0	22	0	2	0	K9
191	/IN1Config	0	11	0	2	0	L0
192	IN2 Function	0	22	0	2	0	L1
193	IN2 Config	0	11	0	2	0	L2
194	/IN2 Function	0	22	0	2	0	K5
195	/IN2 Config	0	11	0	2	0	L4
196	IN3 Function	0	22	0	2	0	L5
197	IN3 Config	0	35	0	2	0	L6
198	/IN3 Function	0	22	0	2	0	L7
199	/IN3 Config	0	35	0	2	0	L8
200	IN4 Function	0	22	0	2	0	L9
201	IN4 Config	0	35	0	2	0	M0
202	/IN4 Function	0	22	0	2	0	M1
203	/IN4 Config	0	35	0	2	0	M2

Continuation **"Parameter List"**:

No.	Parameter	Min. Value	Max. Value	Default	Characters	Decimal Places	Serial Code
204	Read Back Delay	0	1000	0	4	3	M3
205	GPI Err Time	1	999	10	4	0	M4
206	*Reserved*	0	10000	1000	5	0	M5
207	*Reserved*	0	10000	1000	5	0	M6
208	Serial Unit Nr.	11	99	11	2	0	90
209	Serial Baud Rate	0	10	0	2	0	91
210	Serial Format	0	9	0	1	0	92
211	Serial Page	0	20	0	2	0	~0
212	Serial Init	0	1	0	1	0	9~
213	*Reserved*	0	10000	1000	5	0	M7
214	Split.Level	0	1	0	1	0	M8
215	Split.Selector	0	1	0	1	0	M9
216	Init EDM Error	0	1	0	1	0	N6
217	Analog Start	-50000000	50000000	0	88	2	N0
218	Analog End	-50000000	50000000	100000	88	2	N1
219	Analog Gain	1	1000	100	4	0	N2
220	Analog Offset	-25	25	0	82	0	N3
221	*Reserved*	0	10000	1000	5	0	N4
222	X Factor 1	1	999999	1	6	0	z0
223	/ Factor 1	1	999999	1	6	0	z1
224	+/- Value 1	-999999	999999	0	86	0	z2
225	Units 1	0	12	0	2	0	z3
226	Decimal Point 1	0	5	0	1	0	z4
227	X Factor 2	1	999999	1	6	0	z5
228	/ Factor 2	1	999999	1	6	0	z6
229	+/- Value 2	-999999	999999	0	86	0	z7
230	Units 2	0	12	0	2	0	z8
231	Decimal Point 2	0	5	0	1	0	z9
232	*Reserved*	0	10000	1000	5	0	N6
233	*Reserved*	0	10000	1000	5	0	N7
234	*Reserved*	0	10000	1000	5	0	N8
235	*Reserved*	0	10000	1000	5	0	N9
236	*Reserved*	0	10000	1000	5	0	00