SIEB & MEYER

# Drive Controller SD2

## Safety Functions SFM/SLOF (03624xx)

### Description of the safety functions SFM and SLOF (version 2) in SD2 devices 03624xx

D-00000408.1
2024-11-28

# 1 About this Manual

This chapter descirbes symbols, signal words and abbreviations possibly used in this manual.

***Note***

You can download more documentation from the SIEB & MEYER website under https://www.sieb-meyer.com/downloads.

## 1.1 Illustration of Warnings

In this manual, the warnings listed below are used. Depending on their degree of risk, the risk levels listed below exist:

**⚠ DANGER**

**Imminent risk of injury**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

→ Follow the instructions in this manual to avoid danger.

**⚠ WARNING**

**Risk of injury**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

→ Follow the instructions in this manual to avoid danger.

**⚠ CAUTION**

**Slight risk of injury**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

→ Follow the instructions in this manual to avoid danger.

***NOTICE***

**Notice**

Indicates a hazardous situation which, if not avoided, may result in property damage.

→ Follow the instructions in this manual to avoid danger.

# 2 General Information

This document describes the optional safety “Safe Frequency Monitor” (SFM) and “Safe Limited Output Frequency” (SLOF) in version 2. This SFM/SLOF version is integrated in drive controllers of series SD2 with article number 03624xx.

Both safety functions comply with the requirements of SIL 3 according to .

***Note***

Read the hardware documentation of your drive and pay attention to the safety instructions.

# 3 Safe Frequency Monitor (SFM)

The function “Safe Frequency Monitor” (SFM) allows detecting a standstill of an electric motor. In this case a standstill corresponds to a rotating field frequency up to the parameterized limit value.

This safety function is used for rotating axes, e.g. drilling and routing spindles. You can parameterize the SFM function, for example, with a limit frequency of 10 Hz – up to this frequency the risk of injury due to rotating tools, e.g. drilling or routing tools, is considered low. Thus, entering the danger area is deemed 'safe'.

The threshold of the frequency monitor depends on the used spindle and must be determined according to the specific application.

The function is implemented as sensor signal. That means, the function can detect the actual frequency of the motor but cannot limit the rotating field frequency. For this purpose you can use the function SLOF (see page 11) or STO (see ).

## 3.1 Functional Description

The SFM function is based on a frequency-dependent voltage that is induced by the motor or the remanence. This voltage can be measured at the motor terminals, regardless whether a synchronous motor or an asynchronous motor is used.

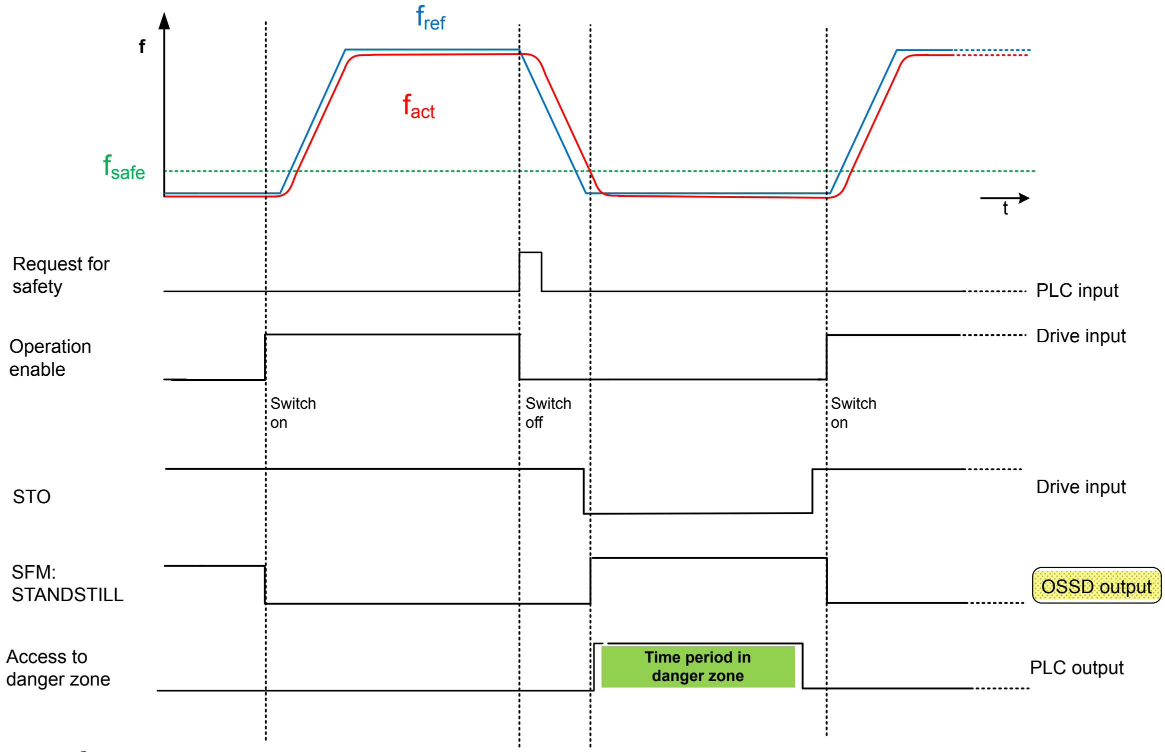
From that voltage the drive determines the actual rotating field frequency and compares it with the parameterized limit value (see chapter 5 “Parameterization of the Limit Frequency”, page 17). If the rotating field frequency is within the parameterized range, the drive generates the status signal STANDSTILL and the OSSD relays are closed.

The drive only generates the standstill signal when the output stage is deactivated. When the output stage is activated, the status is always NO_STANDSTILL and the OSSD relays are open.

***Note***

If you parameterize the limit value zero, standstill monitoring is deactivated and the OSSD relays are closed.

The following diagram shows the timing of the SFM function:




$f_{ref}$ Reference frequency

$f_{act}$ Actual frequency

$f_{safe}$ Safe limit frequency (must be set in *drivemaster2* or in PLC)

*Fig. 1: Timing diagram of the SFM function*

## 3.2 Application

The SFM function is used to allow access to a danger zone for maintenance and service staff. Usually, a protective door or a protective cover prevents access to the danger zone.

Sequence:

- Control and drive operate in normal mode.
- Machine operator requests access to danger zone.
  - Control initiates “Switch off” sequence of drive.
  - Drive stops all spindles.
  - Control waits for the drive status “ready to switch on”.
  - Control activates the function STO to prevent restart.
  - Control waits for the status message STANDSTILL from SFM function.
  - Control unlocks the protective door.
- Access to danger zone is unlocked.
  While the machine operator works in the danger zone, the function STO prevents a restart of the spindles.
- After leaving the danger zone, normal operation can restart.
  - Control locks the protective door.
  - Control deactivates the function STO to enable restart.
  - Control initiates “Switch on” sequence of drive.
- Control and drive operate in normal mode again.

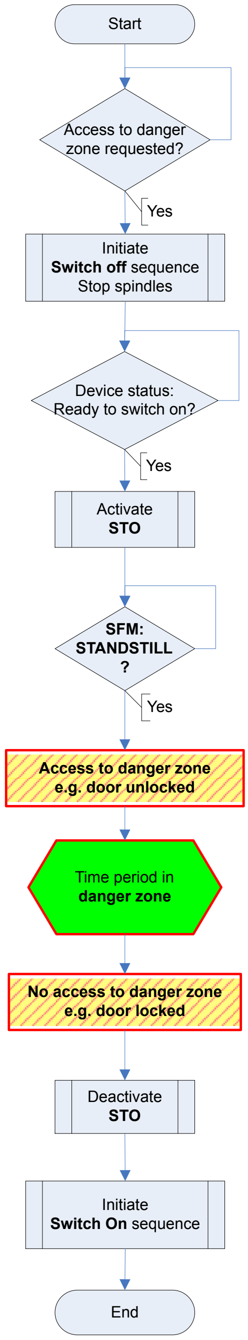



*Fig. 2: Flow chart*

## 3.3 Parameters of the Safety Function SFM

The following parameters are achieved within the scope of the SFM function according to :

- system 1oo2
- SFF > 90 %
- PFH = $1.07 \times 10^{-9}$ 1/h
- PFD = $4.75 \times 10^{-6}$

- SIL 3 (corresponds to PLe in )
- reaction time: typical value < 150 ms, max. value = 2000 ms

## 3.4 Transmission of the Status Message

The status of the SFM function can be transmitted via two outputs (as 2-channel OSSD signal) and via fieldbus.

### 3.4.1 Status Message via OSSD Signal

The drive controller SD2 provides the standstill status at connector X66 for a safety PLC (connector pin assignment see page 48).

The safety PLC sends a 2-channel OSSD signal to the drive. This signal passes through the signal chain of the safety function in the drive. Then, the signal is read back by the PLC and checked for integrity.

The drive closes the signal circuit as soon as the status STANDSTILL is reached. Thereby, the drive adds monitoring pulses to the OSSD signal which must be filtered by the PLC. These monitoring pulses are used to check the hardware components. If any faulty behavior occurs, the signal circuit is immediately opened.

In the status NO_STANDSTILL, the circuit is open, i.e. the PLC cannot read its OSSD signal back.

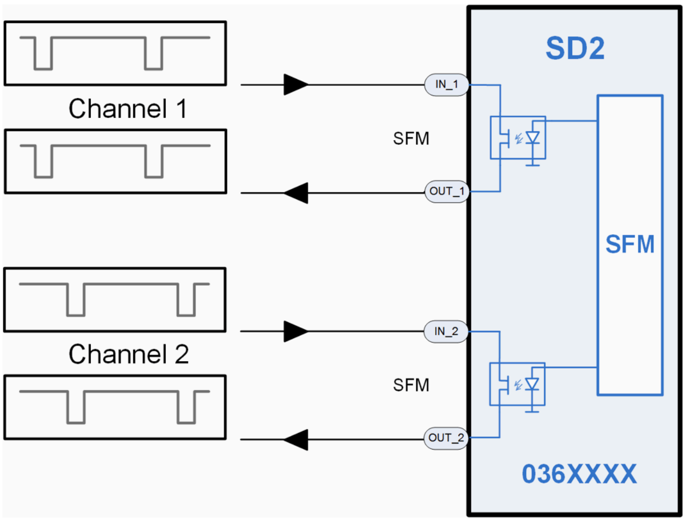



*Fig. 3: Status Transmission via OSSD Signal*

If several drives should be evaluated, a signal chain can be created (see page 10). You can connect up to 16 drives (or 8 double-axis drives) in one signal chain.

## 3.4.2 Status Message via Fieldbus

The following example shows the connection of the SFM function via a 2-channel OSSD signal and via fieldbus (blue):

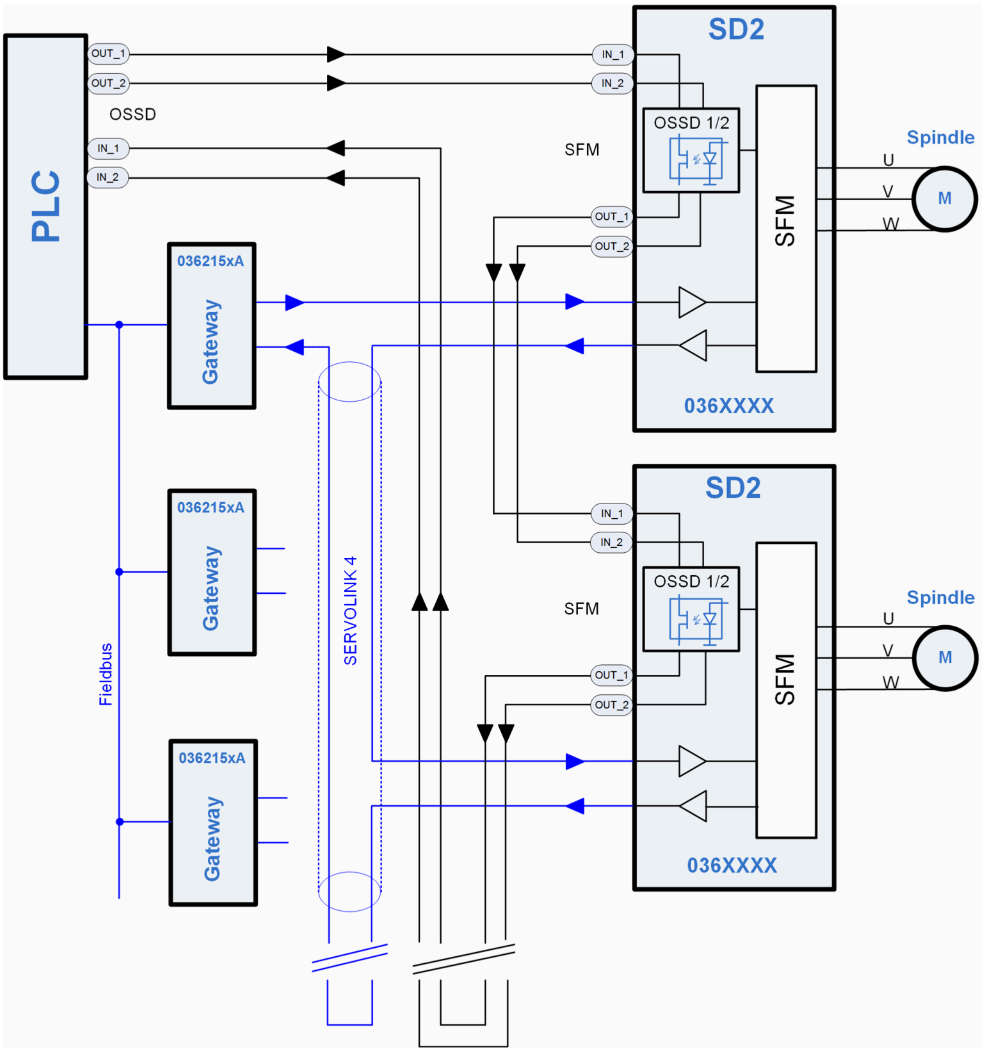



*Fig. 4: Status transmission via OSSD signal and fieldbus*

For this purpose a communication between the software modules of the safety PLC and the safety modules of the frequency monitor in the drive must be established. The communication between safety PLC and drive takes place on the layers 7 and 8 of the ISO communication model. An example program is available for programming.

For a brief description of the communication refer to chapter 6 "Fieldbus Communication", page 20.

# 4 Safe Limited Output Frequency (SLOF)

The function “Safe Limited Output Frequency” (SLOF) allows defining a safe limit for the rotating field of a motor. The function prevents that the drive actively accelerates the connected motor to a too high frequency.

**⚠ WARNING**

**External acceleration of the motor**

The SLOF function does **not** prevent exceeding the limit frequency, when an external system actively accelerates the motor.

→ If an external system can actively accelerate the motor, the machine manufacturer must take suitable safety measures to avoid personal injuries and damage to the device.

The function is activated or deactivated via the OSSD inputs or the bus system. Via the bus system the function is activated with the data transmission of subindex 6. By default the function is activated via the OSSD inputs.

### Activation via OSSD inputs

A safety PLC can activate the frequency limitation with an OSSD signal via the connector X67 of the drive controller SD2 (see chapter 9 “Connector Pin Assignment”, page 48).

For this purpose the PLC sends a 2-channel active HIGH OSSD signal to the inputs of the drive. The signals must be pulsed OSSD signals. Static signals are not safe.

- If the signal is active HIGH, the frequency limitation is activated.
- If the signal is active LOW, the frequency limitation is deactivated.

**⚠ WARNING**

**OSSD inputs not connected**

→ The OSSD inputs must be connected. Otherwise, the input levels are LOW and the frequency limitation is deactivated.

### Activation via the bus system

The SLOF function is activated with the data transmission of subindex 6.

| Byte 0 | | Meaning |
|---|---|---|
| Bit 1 | Bit 0 | |
| X | 0 | Activation via OSSD hardware<br>Frequency limitation is activated/deactivated via the OSSD inputs |
| 0 | 1 | Activation via bus system, frequency limitation deactivated |
| 1 | 1 | Activation via bus system, frequency limitation activated |

## 4.1 Functional Description

The SLOF function determines the actual rotating field frequency and compares it with the parameterized limit value (see chapter 5 “Parameterization of the Limit Frequency”, page 17). If the rotating field frequency is below the limit value, the drive generates the status FREQUENCY_IN_LIMITS. If the limit frequency is exceeded, the drive stops generating more torque. Therefore, the spindle is not accelerated anymore. In this case, the function status is FREQUENCY_OUT_OF_LIMITS. The drive generates the according error message E46-8 (Frequency exceeded).

The following diagram shows the timing of the SLOF function:

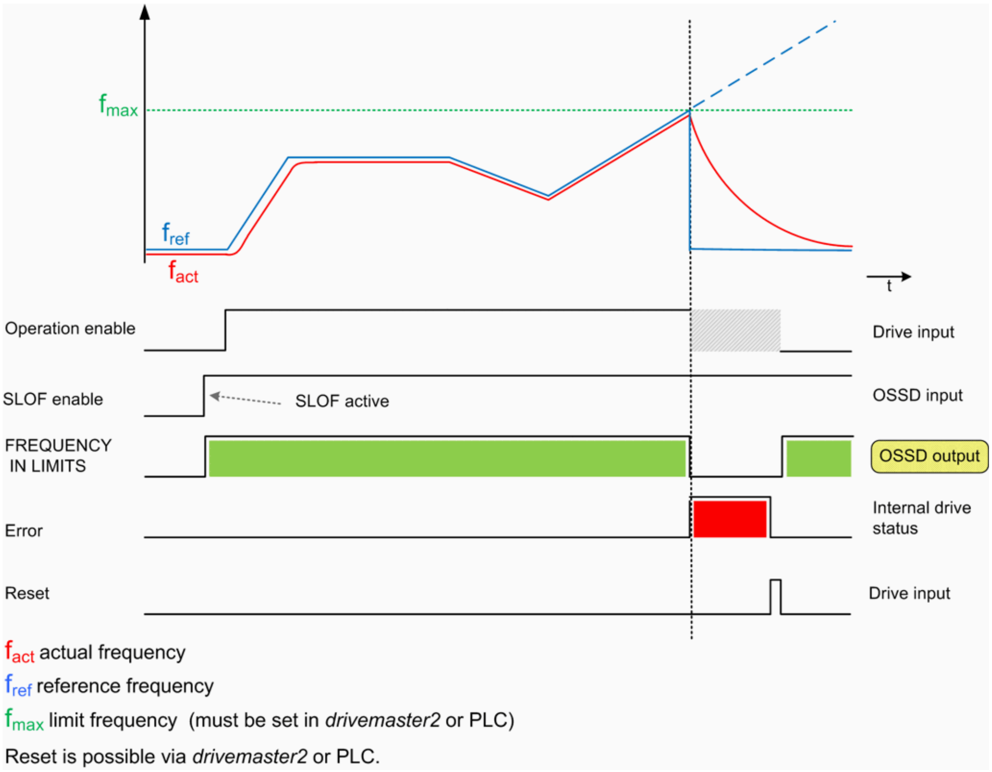



*Fig. 5: Timing diagram of the SLOF function*

### 4.1.1 Time Point of Function Activation (SLOF)

The following diagram shows the timing of the SLOF function, when the function is activated at the wrong point in time. In the time period marked with ⚠ the function status is FREQUENCY_IN_LIMITS, although the actual frequency of the motor is higher than the parameterized limit value:

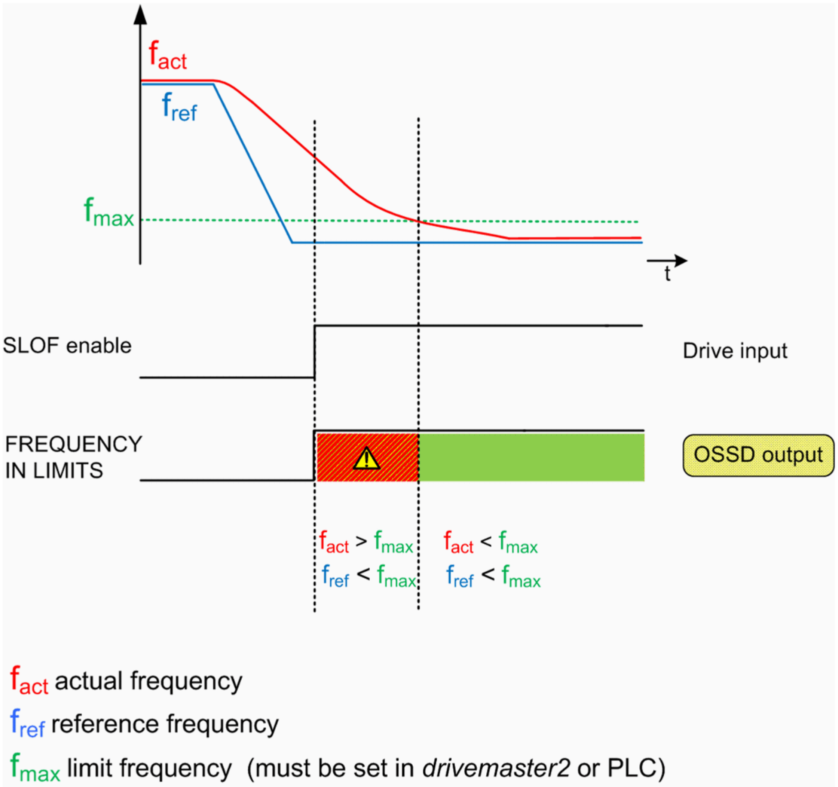



*Fig. 6: Timing diagram of the SLOF function – wrong time point of activation*

**⚠ WARNING**

**Time point of function activation (SLOF)**

If the SLOF function is activated when the reference frequency is already below the parameterized limit frequency but the actual frequency of the motor is still above that limit value, the drive already generated the status signal FREQUENCY_IN_LIMITS.

→ To prevent material damage and personal injury the SLOF function must only be activated during the following states:

→ Reference and actual frequency are both below the parameterized limit frequency.

→ Reference and actual frequency are both above the parametrized limit frequency.

## 4.2 Application

The limitation of the rotating field frequency can be used as follows:

- to limit the tool speed (drill/cutter)
- to protect maintenance and service staff
- as burst protection for grinding and dressing wheels

**Example: "Flying restart" and SLOF**

***Note***

For information on the concept and parameterization of the function "Flying restart" refer to the documentation "SD2S Setup Instructions – V/f Operation".

Task: A spindle is coasting to standstill when the command "Switch on" is triggered again. The spindle shall restart from its actual speed.

In order to synchronize the spindle (flying restart) the drive tests out the frequency range from high to low and determines the actual spindle speed by means of the corresponding active current. From that value the spindle will reach the target speed. If SLOF is active, the drive uses the SLOF limit frequency minus 2 % as starting value for the flying restart (considering measuring tolerances of SLOF).

Sequence:

- Control and drive operate in normal mode.
- Switch-off
  - Control initiates "Switch off" sequence of drive.
  - Spindle coasts to standstill (must be set in the parameter set).
  - Drive signals the status "Ready to switch on".
- Switch-on
  - Control initiates "Switch on" sequence of drive.
  - Drive signals the status "Switched on".
  - Drive determines the actual speed of the spindle and reaches the target speed from that point.
- Control and drive operate in normal mode again.

## 4.3 Parameters of the Safety Function SLOF

The following parameters are achieved within the scope of the SLOF function according to :

- system 1oo2
- SFF > 90 %
- PFH = $2.83 \times 10^{-8}$ 1/h
- PFD = $1.26 \times 10^{-4}$
- SIL 3 (corresponds to PLe in )
- reaction time: typical value < 150 ms, max. value = 2000 ms

## 4.4 Transmission of the Status Message

The status of the SLOF function can be transmitted via two outputs (as 2-channel OSSD signal) and via fieldbus.

### 4.4.1 Status Message via OSSD Signal

A safety PLC can activate the frequency limitation with an OSSD signal via the connector X67 of the drive controller SD2 (connector pin assignment see page 49).

For this purpose the PLC sends a 2-channel active HIGH OSSD signal to the inputs of the drive. In the drive the signals are forwarded to the outputs via electronic relays. The outputs of the drive are, in turn, connected to the PLC and can be evaluated there.

When the frequency limitation is active, the relays of the signal circuit are closed (status FREQUENCY_IN_LIMITS). If the actual frequency is not within the valid frequency range or an error occurs in the signal circuit, the relay opens. Thus, the output signal is deactivated (status FREQUENCY_OUT_OF_LIMITS), i.e. the PLC cannot read its OSSD signal back.

In addition, the drive adds monitoring pulses to the OSSD signal which must be filtered by the PLC. These monitoring pulses are used to check the hardware components. If any faulty behavior occurs, the signal circuit is immediately opened.

The signals must be pulsed OSSD signals. Static signals are not safe.

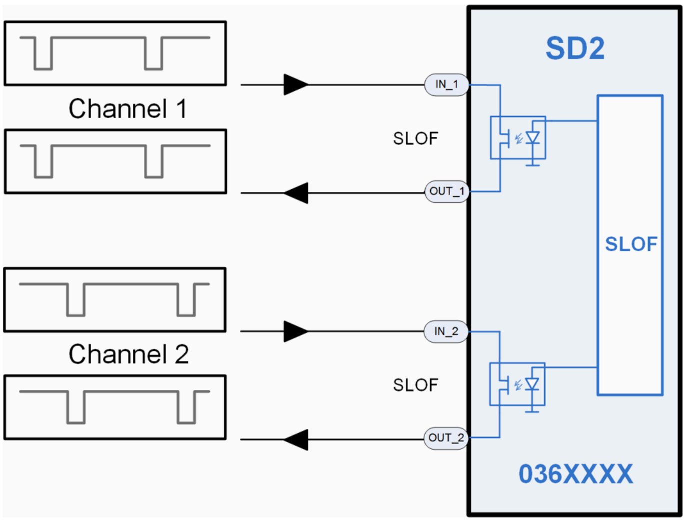



*Fig. 7: Status Transmission via OSSD Signal*

If several drives should be evaluated, a signal chain can be created (see page 16). You can connect up to 16 drives (or 8 double-axis drives) in one signal chain.

### 4.4.2 Status Message via Fieldbus

The following example shows the connection of the SLOF function via a 2-channel OSSD signal and via fieldbus (blue):

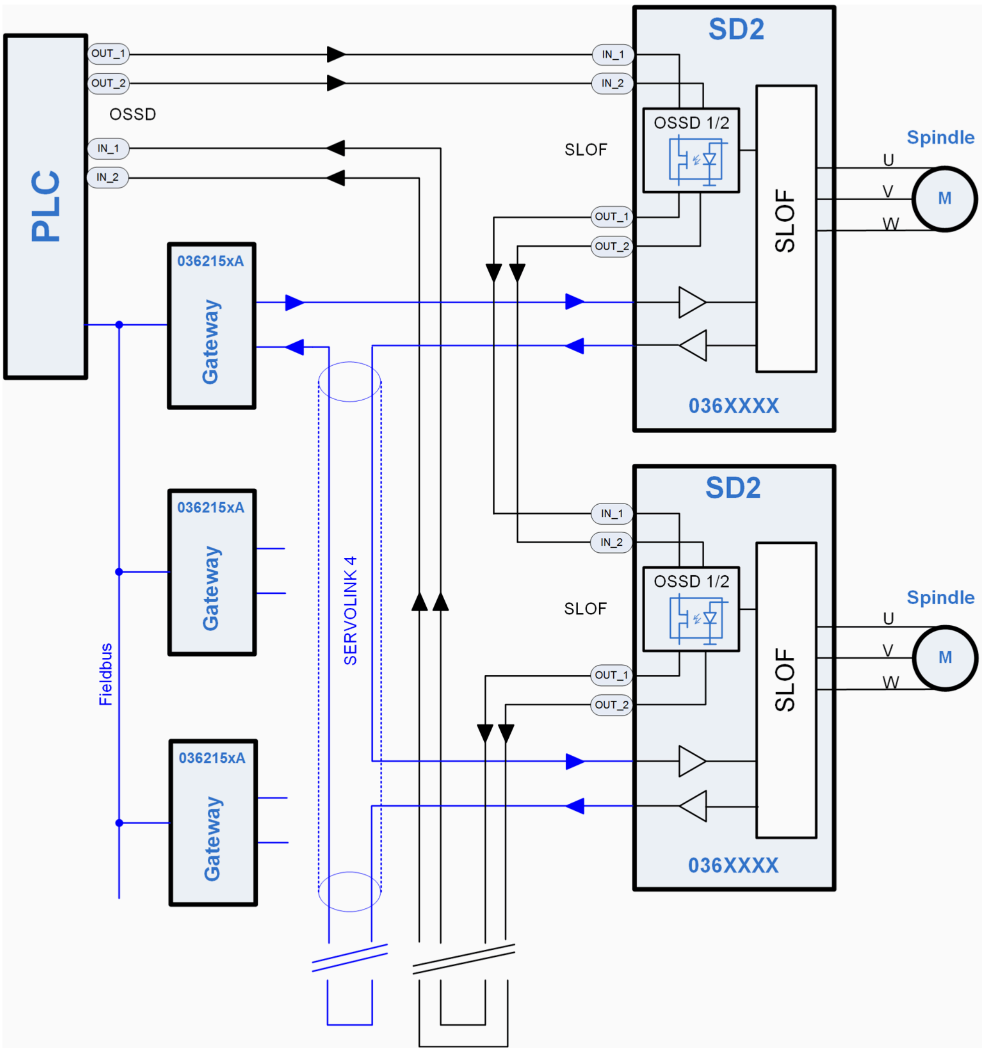



*Fig. 8: Status transmission via OSSD signal and fieldbus*

For this purpose a communication between the software modules of the safety PLC and the safety modules of the frequency limitation in the drive must be established. The communication between safety PLC and drive takes place on the layers 7 and 8 of the ISO communication model. An example program is available for programming.

For a brief description of the communication refer to chapter 6 “Fieldbus Communication”, page 20.

# 5 Parameterization of the Limit Frequency

In order to use the safety functions you must specify the respective limit frequency protected against unauthorized access. There are 2 options for this purpose:

1. Set limit frequency in the parameter file
2. Set limit frequency via fieldbus

***Note***

If you parametrize the limit value zero for speed zero detection, standstill monitoring (SFM function) is deactivated.

**Set limit frequency in the parameter file**

The user sets the limit frequency to a fix value in the parameter file of the drive. The user must protect the parameter file against unauthorized changes. For this purpose, the user assigns a password in the software *drivemaster2*. Thus, only users knowing the password can change and overwrite the parameter file.

For more information on the parameterization of the drive refer to the manual “drivemaster2 - User Manual”.

***Note***

A higher-ranking PLC can overwrite the parameter set values in the safety controllers via fieldbus. After a restart of the SD2 firmware or a parameter set download, the parameter set values are valid again.

**Set limit frequency via fieldbus**

Setting the limit frequency via fieldbus is required in automated processes, when the limit value depends on the status of the system (tool/access control). In addition, it is possible to use the same parameter set for different applications. The user must protect the program of the safety PLC against unauthorized access.

A higher-ranking PLC sets the limit frequency via fieldbus during runtime. The PLC can read the parameter back at any time. In order to ensure the correct parameterization, we recommend reading the parameter cyclically back.

***Note***

After a restart of the SD2 firmware or a parameter set download via the *drivemaster2* software, the parameter set values are valid again.

## 5.1 System-inherent deviation of the measurable output frequency of the converter

When measuring the output frequency of the converter, a system-inherent deviation occurs through the quantization of the measured values, which is due to the time measurement and the 1/T calculation shown below. The reciprocal of the switching frequency of the converter is the smallest measurable unit of time. Moreover, the measurement accuracy is subject to tolerances.

### Formula for calculating the system-inherent deviation

The following formulas apply for the system-inherent deviation:

- Switching frequency of the converter: $f_{pwm}$ = 16 kHz
- Minimum measuring resolution: 62.5 µs
- Output frequency of the converter: $f_{out}$ = 1 - 2000 Hz

### Absolute deviation

$$f_{err} = \frac{f_{pwm}}{Integer(\frac{f_{pwm}}{f_{out}})} - f_{out}$$

### Percentage deviation

$$f_{perr} = \frac{f_{err}}{f_{out}} * 100$$

### Graphic display of the system-inherent deviation

The deviation between the real and the measured output frequency of the converter increases with increasing output frequency, i.e. for high output frequencies, significantly greater reserves of speed thresholds to be monitored must be provided.

The following diagram shows the system-inherent deviation of the measurable output frequencies in dependence of the real output frequency of the converter.

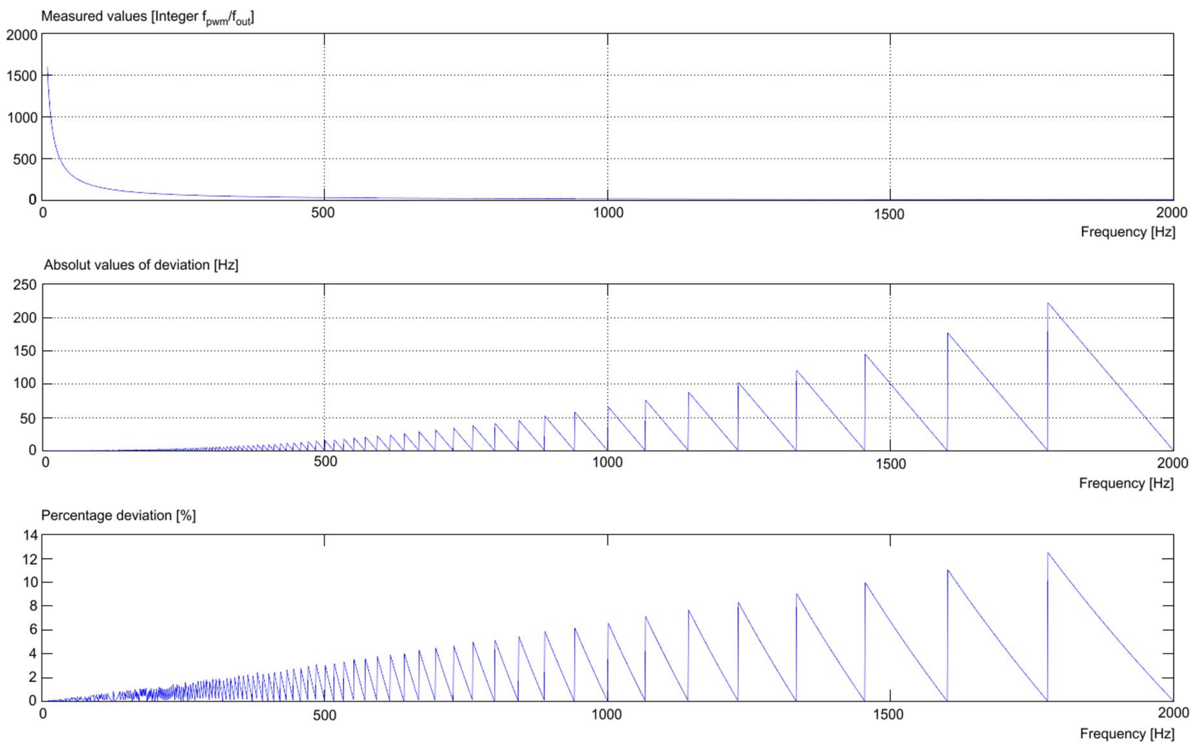



*Fig. 9: System-inherent deviation of the measurable output frequency of the converter*

### Example for a system-inherent deviation

The clock frequency of 16 kHz is the base frequency.

At a rotary frequency of 2000 Hz, thera are 8 measuring pulses per revolution:

- 16000 Hz / 2000 Hz = 8

If you set the rotary frequency to 1778 Hz, there would be exactly 8.99 measuring pulses per revolution according to the set clock frequency of 16 kHz:

- 16000 / 1778 = 8,9989

Since the number of pulses is always measured as integer, in the current example, either 8 or 9 measuring pulses per revolution can be measured:

- 16000 / 8 = 2000.00 Hz
- 16000 / 9 = 1777.78 Hz

Thus, the maximum deviation corresponds to a pulse of 1/8 = 12.5 %.

# 6 Fieldbus Communication

The safety PLC communicates via several layers with the drives. The PLC program sends the reference data via fieldbus interface to each SD2 drive controller. The actual values are transmitted in reverse direction.

The SD2 software detects the following errors:

- bit error
- timeout
- telegram failure
- addressing (COB-ID)
- test pattern

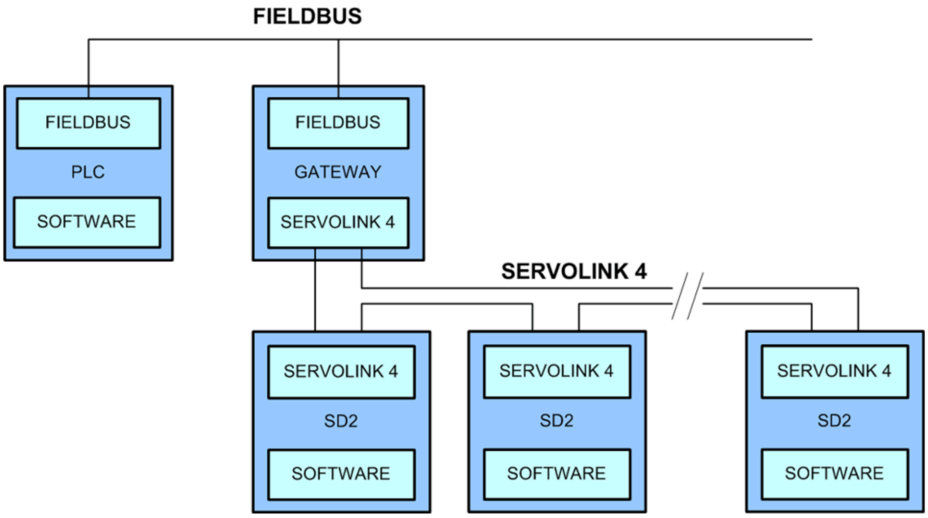



*Fig. 10: Fieldbus communication*

The communication between PLC program and SD2 software takes place on the layers 7 and 8. of the ISO communication model. Therefore, the in-between transmission layers are not relevant for the safety of the communication path.

To prevent configuration errors of the bus system the data to be transmitted contain the COB-ID (communication object identifier). Thus, the software can check the COB-ID and detect any configuration errors immediately.

For detailed information on fieldbus communication contact SIEB & MEYER.

***Note***

The safety functions SFM and SLOF are monitored in the SD2 module by two safety controllers (SC0 and SC1). Together the safety controllers monitor both safety functions (SFM and SLOF) for both drives (A and B) of the module. For full data transmission and evaluation the PLC must always address both safety controllers (SC0 and SC1).

## 6.1 Data Transmission

The data are transmitted via the acyclic service data channel of the respective bus protocol.

For data input the safety objects 467 and 468 are required. For the reply the safety objects 469 and 470 are required.

| Index | Object name | Meaning |
|---|---|---|
| 467 | SAFE_SPEED_MONITOR_DEMAND_DATA_OBJECT | Input of parameter value |

| Index | Object name | Meaning |
|---|---|---|
| 468 | SAFE_SPEED_MONITOR_DEMAND_CTRL_OBJECT | Input of control parameters including check sum |
| 469 | SAFE_SPEED_MONITOR_REPLY_DATA_OBJECT | Return value |
| 470 | SAFE_SPEED_MONITOR_REPLY_STATUS_OBJECT | Status return including error code |

The following commands are send one after the other:
- Write object: 4 bytes (reference value) in object 467
- Write object: 4 bytes (control data) in object 468
- Read object: 4 bytes (actual value) from object 469
- Read object: 4 bytes (status data) from object 470

Thus, each data exchange requires 4 object accesses.

By means of the two write commands the PLC sends the prompt telegram to the according safety controller of the module.

With the two read commands the PLC reads the response telegram of the according safety controller.

#### Sequence of the data transmission

The PLC processes the data step-by-step for each drive of an SD2 module:
1. Write reference value “limit speed zero”, SC0
2. Write reference value “limit speed zero”, SC1
3. Write reference value “safe limited output frequency”, SC0
4. Write reference value “safe limited output frequency”, SC1
5. Read actual value “limit speed zero”, SC0
6. Read actual value “limit speed zero”, SC1
7. Read actual value “safe limited output frequency”, SC0
8. Read actual value “safe limited output frequency”, SC1
9. Read status SC0
10. Read status SC1
11. Customized data transmission

Afterwards the list items 5 to 11 are repeated.

***Tip***

You can define default values for “speed zero” and “safe limited output frequency” in the parameter sets of the SD2 module. These values are send to the safety controllers when the der SD2 firmware is started or the parameters are loaded. If you use the default values, the PLC can skip writing the values (list items 1 to 4). Instead the PLC can directly read the actual values from the safety controllers when they are required.

## 6.2 Data Structure

The transmitted data have always the same structure.

The PLC can write data to the safety controllers or read date from the safety controllers. The service data channel allows sending only 4 bytes at once. Therefore, the access must be carried out in two steps via the objects 467 and 468 as well as via the objects 469 and 470.

Data structure:
- data array (4 bytes)
- address (1 byte)
- index (1 byte)

- pattern (1 byte)
- check (1 byte)

| Byte | Bits | Name | Meaning |
|---|---|---|---|
| 0 … 3 | 0 … 31 | Data array | Parameter value |
| 4 | 0 … 6 | Module ID | Drive of the module:<br>▸ even value: drive A<br>▸ odd value: drive B |
| | 7 | Controller ID | ARM microprocessor:<br>▸ 0: controller SC0<br>▸ 1: controller SC1 |
| 5 | 0 … 6 | Subindex | Parameter index<br>▸ 0: repeat telegram<br>▸ 1: limit value for speed zero<br>▸ 2: limit value for safe limited output frequency<br>▸ 3: status, error code<br>▸ 4: software version<br>▸ 5: COB-ID |
| | 7 | R/W | Read/Write:<br>▸ 0: read<br>▸ 1: write |
| 6 | 0 … 7 | Pattern | Pattern |
| 7 | 0 … 7 | Check | Check sum |

## 6.2.1 Data Array

The data array is used to transmit different parameters.

The type of the parameter is defined by the subindex.

## 6.2.2 Address

The address is made up of the module ID of the drive and the controller address. Hereby, the lowest bit defines the drive, A (= 0) or B (= 1). The highest bit defines the controller, SC0 or SC1.

## 6.2.3 Index

The index is made up of the subindex and the read/write command.

The subindex indicates the index of the parameter whose value is transmitted in the data array.

The R/W command indicates whether data are read or written.

### 6.2.3.1 Subindex 0: Repeat Telegram

**Write:**

No function

The data array of the next response telegram will contain zero.

**Read:**

Repeat telegram

Sending the telegram is repeated to get a response telegram.

### 6.2.3.2 Subindex 1: Limit Value for Speed Zero

**Write:**

Reference value for speed zero limit

***Note***

If you parameterize the limit value zero, standstill monitoring (SFM function) is deactivated.

The next response telegram will transmit the value that is entered in the drive data.

**Read:**

Current limit for speed zero

### 6.2.3.3 Subindex 2: Limit Value for Safe Limited Output Frequency

**Write:**

Reference value for Safe Limited Output Frequency

The next response telegram will transmit the value that is entered in the drive data.

**Read:**

Current limit value for Safe Limited Output Frequency

### 6.2.3.4 Subindex 3: Status

**Write:**

Delete error

| Byte | Bit | Meaning |
|---|---|---|
| 0 | 0 | Delete error |
| | 1 … 4 | Reserved |
| | 5 … 7 | Not used |
| 1 … 3 | 0 … 23 | Reserved |

After the error is deleted the next response telegram will transmit the current status.

**Read:**

Status and error query

<table>
<tr><th>Byte</th><th>Name</th><th colspan="2">Meaning</th></tr>
<tr><td rowspan="9">0</td><td rowspan="9">StatusFlags</td><td>Bit</td><td>Meaning</td></tr>
<tr><td>0</td><td>Processor ready</td></tr>
<tr><td>1</td><td>Reference values received</td></tr>
<tr><td>2</td><td>Speed zero detected</td></tr>
<tr><td>3</td><td>Sector 0 or 7 detected</td></tr>
<tr><td>4</td><td>Safe Limited Output Frequency detected</td></tr>
<tr><td>5</td><td>Error occurred</td></tr>
<tr><td>6</td><td>Control of output stage released</td></tr>
<tr><td>7</td><td>Speed lower than frequency limit</td></tr>
<tr><td>1</td><td>Error code</td><td colspan="2">Error code</td></tr>
</table>

| Byte | Name | Meaning | |
|---|---|---|---|
| 2 | LevelBits | Bit | Meaning |
| | | 0 | Status of MxON output for drive A |
| | | 1 | Status of MxON output for drive B |
| | | 2 | PWM speed monitoring and MUX test permitted |
| | | 3 | Frequency limit via OSSD signals activated |
| | | 4 | Comparison from PWM data structure: Speed < SpeedLimit |
| | | 5 | Standstill monitoring (SFM function) is deactivated |
| | | 6 | Not used |
| | | 7 | Not used |
| 3 | ConfigBits | Bit | Meaning |
| | | 0 | Watchdog monitoring activated |
| | | 1 | Debug output activated |
| | | 2 | OSSD self test activated |
| | | 3 | Flash check activated |
| | | 4 | Motor phases test activated |
| | | 5 | Muxer test activated |
| | | 6 | Not used |
| | | 7 | Not used |

**Hint**

The bytes in the object 475 (Safe_Speed_Status) are displayed in the following order.

| Byte | Explanation |
|---|---|
| Byte 3, 2 | Processor 0 (Configbits, LevelFlags) |
| Byte 1, 0 | Processor 0 (error code, StatusFlags) |
| Byte 3, 2 | Processor 1 (Configbits, LevelFlags) |
| Byte 1, 0 | Processor 1 (error code, StatusFlags) |

### 6.2.3.5 Subindex 4: Software Version

**Write:**

No function

The next response telegram will transmit the current software version.

**Read:**

Depending on the set value the next response telegram will transmit either the version number or the check sum of the controller software.

Set value:

| Value | Meaning |
|---|---|
| 0 | Version number |
| 1 | Program check sum |

Response version number:

| Byte | Name | Meaning |
|---|---|---|
| 0 | Build number | Number of the test version<br>Incremented within test phase |
| 1 | Patch level | Revision number<br>Incremented with bug-fix |
| 2 | Minor release | Secondary version number<br>Incremented with functional extension |

| Byte | Name | Meaning |
|---|---|---|
| 3 | Major release | Main version number<br>Incremented with complete review |

Response check sum:

| Byte | Name | Meaning |
|---|---|---|
| 0 … 1 | Check sum | 16-bit check sum of the program |
| 1 … 3 | Reserve | Not used = 0 |

## 6.2.3.6 Subindex 5: COB-ID

**Write:**

Set value for COB-ID

**Read:**

Return value for COB-ID

The address is made up of the COB-ID, the drive number and the controller number.

| Module | COB-ID | Drive | Controller | Address |
|---|---|---|---|---|
| 0 | 0 | A | SC0 | 0x00 |
| | | | SC1 | 0x80 |
| | | B | SC0 | 0x01 |
| | | | SC1 | 0x81 |
| 1 | 2 | A | SC0 | 0x02 |
| | | | SC1 | 0x82 |
| | | B | SC0 | 0x03 |
| | | | SC1 | 0x83 |
| 2 | 4 | A | SC0 | 0x04 |
| | | | SC1 | 0x84 |
| | | B | SC0 | 0x05 |
| | | | SC1 | 0x85 |
| ⋮ | | | | |
| 63 | 126 | A | SC0 | 0x7E |
| | | | SC1 | 0xFE |
| | | B | SC0 | 0x7F |
| | | | SC1 | 0xFF |

## 6.2.3.7 Subindex 6: Activation of Safe Limited Output Frequency

This subindex is available for software version s01001v09004 and higher.

**Write**

Presetting of the activation channel and the activation.

| Byte | Bit | Meaning |
|---|---|---|
| 0 | 0 | 0 = activation via OSSD hardware |
| | | 1 = activation via the bus system |
| | 1 | In case of activation via the bus system: |
| | | 0 = deactivate monitoring of the rotating field |
| | | 1 = activate monitoring of the rotating field |
| | 2 .. 7 | Not used |
| 1 .. 3 | 0 .. 23 | Reserved |

**Read**

Status of the activation

| Byte | Bit | Meaning |
|---|---|---|
| 0 | 0 | 0 = activation via OSSD hardware |
| | | 1 = activation via the bus system |
| | 1 | 0 = monitoring of the rotating field deactivated |
| | | 1 = monitoring of the rotating field activated |
| | 2 .. 7 | Not used |
| 1 .. 3 | 0 .. 23 | Reserved |

### 6.2.3.8 Subindex 7: Version Information

This subindex is available for software version s01001v09004 and higher.

**Write**

No function.

The error code ERR_SPI_SUBINDEX is returned.

**Read**

Depending on the set value the next response telegram will return 4 bytes of the information block of the controller software.

| Default value | Response | Exemplary data |
|---|---|---|
| 0 | Version | 0x00090003 = 9.003 |
| 1 | ID | 0x00010001 = 1.001 |
| 2 | Date | (YYYYMMDD) 0x07E00802 = 02.08.2016 |
| 3 | Time | (00HHMMSS) 0x000B1E01 = 11:31:01 |
| | | “**s01001v09003**” |
| 4 | File name [3..0] | 0x30313073 = “010s” |
| 5 | File name [7..4] | 0x30763130 = “0v10” |
| 6 | File name [11..8] | 0x33303039 = “3009” |
| | | “**SFM/SLOF**” |
| 7 | Comment [3..0] | 0x2F4D4653 = „/MFS“ |
| 8 | Comment [7..4] | 0x464F4C53 = „FOLS“ |
| ... | | |
| 22 | Comment [63..60] | |

## 6.2.4 Pattern

The PLC can generate any pattern byte. A new pattern can be sent with each transmission.

The received pattern is incremented by 1 in the controller and returned with the next telegram. The PLC can check both patterns.

### 6.2.5 Check

Check contains the check sum that is calculated from the bytes 0 to 6.

To calculate the check sum the bytes 0 to 6 must be added byte-by-byte and subtracted from the value 0xFF.

$$Check = 0xFF - \sum_{i=0}^{6} Byte\ i$$

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Sum | Check = 0xFF − Sum |
|---|---|---|---|---|---|---|---|---|
| 0x81 | 0x03 | 0x01 | 0x02 | 0x03 | 0x04 | 0xAA | 0x38 | 0xFF − 0x38 = **0xC7** |

## 6.3 Examples for Data Transmission

For data transmission adhere to the following order of object accesses:

- Write object: 4 bytes (reference value) in object 467
- Write object: 4 bytes (control data) in object 468
- Read object: 4 bytes (actual value) from object 469
- Read object: 4 bytes (status data) from object 470

### 6.3.1 Setting: Limit “Speed Zero” = 10 Hz

Set value for drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x0000000A | 10 |
| 468 | 0x74008100 | 1946190080 |
| 469 | 0x0000000A | 10 |
| 470 | 0x73018100 | 1929478400 |

Set value for drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x0000000A | 10 |
| 468 | 0xF4008180 | 4093673856 |
| 469 | 0x0000000A | 10 |
| 470 | 0xF3018180 | 4076962176 |

Set value for drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x0000000A | 10 |
| 468 | 0x73008101 | 1929412865 |
| 469 | 0x0000000A | 10 |
| 470 | 0x72018101 | 1912701185 |

Set value for drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x0000000A | 10 |
| 468 | 0xF3008181 | 4076896641 |
| 469 | 0x0000000A | 10 |
| 470 | 0xF2018181 | 4060184961 |

### 6.3.2 Query: Limit of “Speed Zero”

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFE000100 | 4261413120 |
| 469 | 0x0000000A | 10 |
| 470 | 0xF3010100 | 4076929280 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7E000180 | 2113929600 |
| 469 | 0x0000000A | 10 |
| 470 | 0x73010180 | 1929445760 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFD000101 | 4244635905 |
| 469 | 0x0000000A | 10 |
| 470 | 0xF2010101 | 4060152065 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7D000181 | 2097152385 |
| 469 | 0x0000000A | 10 |
| 470 | 0x72010181 | 1912668545 |

### 6.3.3 Set Value: Limit “Safe Limited Output Frequency” = 200 Hz

Set value for drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x000000C8 | 200 |
| 468 | 0xB5008200 | 306709376 |
| 469 | 0x000000C8 | 200 |
| 470 | 0xB4018200 | 3019997696 |

Set value for drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x000000C8 | 200 |
| 468 | 0x35008280 | 889225856 |
| 469 | 0x000000C8 | 200 |
| 470 | 0x34018280 | 872514176 |

Set value for drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x000000C8 | 200 |
| 468 | 0xB4008201 | 3019932161 |
| 469 | 0x000000C8 | 200 |
| 470 | 0xB3018201 | 3003220481 |

Set value for drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x000000C8 | 200 |
| 468 | 0x34008281 | 872448641 |
| 469 | 0x000000C8 | 200 |
| 470 | 0x33018281 | 855736961 |

## 6.3.4 Query: Limit “Safe Limited Output Frequency”

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFD000200 | 4244636160 |
| 469 | 0x000000C8 | 200 |
| 470 | 0x34010200 | 872481280 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7D000280 | 2097152640 |
| 469 | 0x000000C8 | 200 |
| 470 | 0xB4010280 | 3019965056 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFC000201 | 4227858945 |
| 469 | 0x000000C8 | 200 |
| 470 | 0x33010201 | 855704065 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7C000281 | 2080375425 |
| 469 | 0x000000C8 | 200 |
| 470 | 0xB3010281 | 3003187841 |

## 6.3.5 Query: Status

Depending on the states of the drives and the processors the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFC000300 | 4227859200 |
| 469 | 0x000036A7 | 13991 |
| 470 | 0x1E010300 | 503382784 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 468 | 0x7C000380 | 2080375680 |
| 469 | 0x00000087 | 135 |
| 470 | 0xF4010380 | 4093707136 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFB000301 | 4211081985 |
| 469 | 0x000039A7 | 14759 |
| 470 | 0x1A010301 | 436273921 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7B000381 | 2063598465 |
| 469 | 0x00000003 | 3 |
| 470 | 0x77010381 | 1996555137 |

## 6.3.6 Query: Address of the Faulty RAM Cell

Depending on the states of the drives and the processors the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xFB000300 | 4211081984 |
| 469 | 0x200006F8 | 536872696 |
| 470 | 0xDD010300 | 3707831040 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x7B000380 | 2063598464 |
| 469 | 0x200006F8 | 536872696 |
| 470 | 0x5D010380 | 1560347520 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xFA000301 | 4194304769 |
| 469 | 0x200006F8 | 536872696 |
| 470 | 0xDC010301 | 3691053825 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x7A000381 | 2046821249 |
| 469 | 0x200006F8 | 536872696 |
| 470 | 0x5C010381 | 1543570305 |

## 6.3.7 Query: Test Pattern of the Faulty RAM Cell

Depending on the states of the drives and the processors the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000002 | 2 |
| 468 | 0xFA000300 | 4194304768 |
| 469 | 0x55555555 | 1431655765 |
| 470 | 0xA7010300 | 2801861376 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000002 | 2 |
| 468 | 0x7A000380 | 2046821248 |
| 469 | 0x55555555 | 1431655765 |
| 470 | 0x27010380 | 654377856 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000002 | 2 |
| 468 | 0xF9000301 | 4177527553 |
| 469 | 0x55555555 | 1431655765 |
| 470 | 0xA6010301 | 2785084161 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000002 | 2 |
| 468 | 0x79000381 | 2030044033 |
| 469 | 0x55555555 | 1431655765 |
| 470 | 0x26010381 | 637600641 |

## 6.3.8 Query: Value of the Faulty RAM Cell

Depending on the states of the drives and the processors the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0xF9000300 | 4177527552 |
| 469 | 0x55555554 | 1431655764 |
| 470 | 0xA8010300 | 2818638592 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0x79000380 | 2030044032 |
| 469 | 0x55555554 | 1431655764 |
| 470 | 0x28010380 | 671155072 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0xF8000301 | 4160750337 |
| 469 | 0x55555554 | 1431655764 |
| 470 | 0xA7010301 | 2801861377 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0x78000381 | 2013266817 |
| 469 | 0x55555554 | 1431655764 |
| 470 | 0x27010381 | 654377857 |

### 6.3.9 Delete Error

Delete error in drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x7B008300 | 2063631104 |
| 469 | 0x000000C7 | 199 |
| 470 | 0xB4018300 | 3019997952 |

Delete error in drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xFB008380 | 4211114880 |
| 469 | 0x000000C7 | 199 |
| 470 | 0x34018380 | 872514432 |

Delete error in drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x7A008301 | 2046853889 |
| 469 | 0x000000C7 | 199 |
| 470 | 0xB3018301 | 3003220737 |

Delete error in drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xFA008381 | 4194337665 |
| 469 | 0x000000C7 | 199 |
| 470 | 0x33018381 | 855737217 |

### 6.3.10 Query: Software Version

Depending on the software version the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 468 | 0xFB000400 | 4211082240 |
| 469 | 0x00000005 | 5 |
| 470 | 0xF5010400 | 4110484480 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7B000480 | 2063598720 |
| 469 | 0x00000005 | 5 |
| 470 | 0x75010480 | 1963000960 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFA000401 | 4194305025 |
| 469 | 0x00000005 | 5 |
| 470 | 0xF4010401 | 4093707265 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7A000481 | 2046821505 |
| 469 | 0x00000005 | 5 |
| 470 | 0x74010481 | 1946223745 |

## 6.3.11 Query: Program Check Sum

Depending on the check sum the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xFA000400 | 4194305024 |
| 469 | 0x0000129C | 4764 |
| 470 | 0x4C010400 | 1275134976 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x7A000480 | 2046821504 |
| 469 | 0x0000129C | 4764 |
| 470 | 0xCC010480 | 3422618752 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0xF9000401 | 4177527809 |
| 469 | 0x0000129C | 4764 |
| 470 | 0x4B010401 | 1258357761 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000001 | 1 |
| 468 | 0x79000481 | 2030044289 |
| 469 | 0x0000129C | 4764 |
| 470 | 0xCB010481 | 3405841537 |

## 6.3.12 Query: COB-ID

Depending on the COB-ID the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query to drive A in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xFA000500 | 4194305280 |
| 469 | 0x00000000 | 0 |
| 470 | 0xF9010500 | 4177593600 |

Query to drive A in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x7A000580 | 2046821760 |
| 469 | 0x00000000 | 0 |
| 470 | 0x79010580 | 2030110080 |

Query to drive B in processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xF9000501 | 4177528065 |
| 469 | 0x00000000 | 0 |
| 470 | 0xF8010501 | 4160816385 |

Query to drive B in processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x79000581 | 2030044545 |
| 469 | 0x00000000 | 0 |
| 470 | 0x78010581 | 2013332865 |

## 6.3.13 Setting: Activation of the Safely Limited Rotating Field

Presetting the activation is done via the bus system. Monitoring shall be activated at the same time.

For axis A in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0x76008600 | 1979745792 |
| 469 | 0x00000003 | 3 |
| 470 | 0x75018600 | 1963034112 |

For axis A in the processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0xF6008680 | 4127229568 |
| 469 | 0x00000003 | 3 |
| 470 | 0xF5018680 | 4110517888 |
| | | |

For axis B in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0x75008601 | 1962968577 |
| 469 | 0x00000003 | 3 |
| 470 | 0x74018601 | 1946256897 |

For axis B in the processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0xF5008681 | 4110452353 |
| 469 | 0x00000003 | 3 |
| 470 | 0xF4018681 | 4093740673 |

### 6.3.14 Query: Activation of the Safely Limited Rotating Field

Depending on the activation status the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

For axis A in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xF9000600 | 4177528320 |
| 469 | 0x00000002 | 2 |
| 470 | 0xF6010600 | 4127262208 |

For axis A in the processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x79000680 | 2030044800 |
| 469 | 0x00000002 | 2 |
| 470 | 0x76010680 | 1979778688 |

For axis B in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0xF8000601 | 4160751105 |
| 469 | 0x00000002 | 2 |
| 470 | 0xF5010601 | 4110484993 |

For axis B in the processor M1:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000000 | 0 |
| 468 | 0x78000681 | 2013267585 |
| 469 | 0x00000002 | 2 |

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 470 | 0x75010681 | 1963001473 |

## 6.3.15 Query: Version Information

Depending on the information value the return value in object 469 and the corresponding status bytes in object 470 can differ from the values given below.

Query of the creation date (01.08.2016) for the axis A in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000002 | 2 |
| 468 | 0xF6000700 | 4127196928 |
| 469 | 0x07E00801 | 132122625 |
| 470 | 0x07010700 | 117507840 |

Query of the creation time (11:31:01) for the axis A in the processor M0:

| Index | Hexadecimal value | Decimal value |
|---|---|---|
| 467 | 0x00000003 | 3 |
| 468 | 0xF5000700 | 4110419712 |
| 469 | 0x000B1E01 | 728577 |
| 470 | 0xCD010700 | 3439396608 |

# 7 safety object converter

The tool *safety object converter* is available in *drivemaster2* version 1.18 and higher. Using this tool you can trigger the communication with the safety controllers manually. This way you can read data from the controllers for analyzing purposes or send settings to the controllers.

Open the tool *safety object converter* in the software *drivemaster2* via the menu “Extras”. Requirement: You must work with an online device that supports the functions SFM and SLOF.

The input in the following figures match the examples in the preceding chapters.

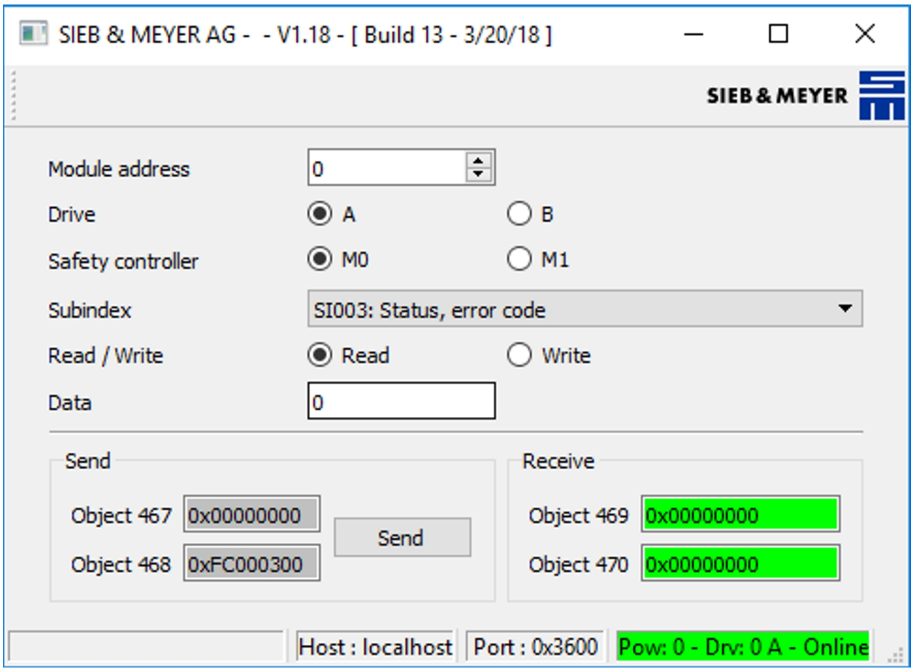



*Fig. 11: safety object converter: settings*

The program expects the settings of the module address, the drive and the controller. Via subindex and read/write option you can select the desired action. In the field “Data” you can enter transfer parameter.

While editing the program creates the data for the objects 467 and 468 from the settings. These data have a gray background.

Click the button “Send” to send the data to the selected controller.

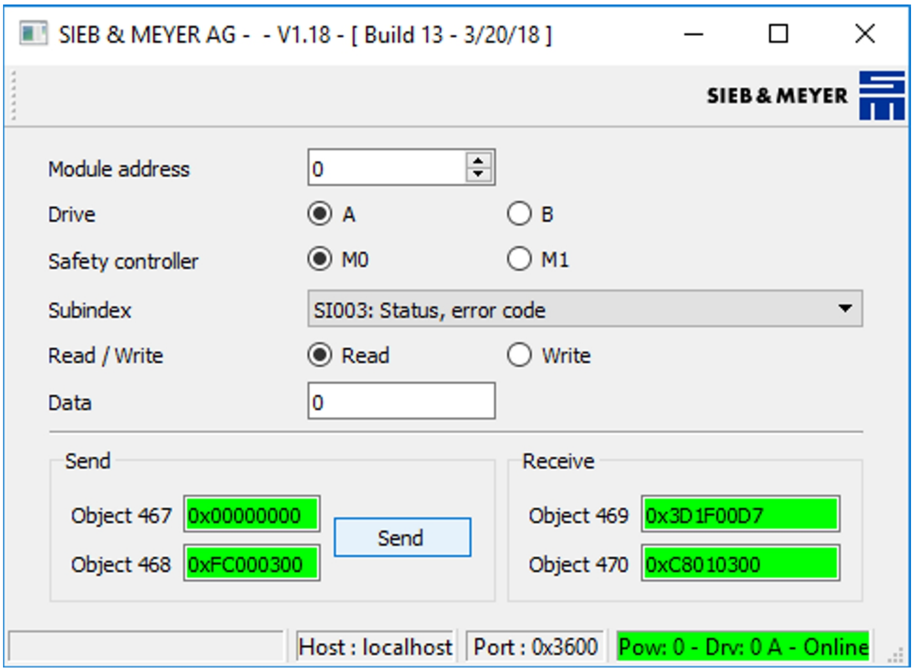



*Fig. 12: safety object converter: data were sent*

Sent data have a green background. The answer of the controller is displayed in the objects 469 and 470.

# 8 OSSD Signals

With the aid of OSSD signals malfunction and errors can be detected. For this purpose dynamic signals are used instead of static output and input signals. The following errors can be determined:

- short circuits
- cross circuits
- open signals

The PLC pulses its OSSD output signal at regular intervals and reads it back, i.e. the PLC expects the regular pulses at its input line. Only then, the PLC assumes error-free operation. If an error is detected, the PLC automatically switches to the safe status and the error is reported.

The time period, the point in time and the repetition frequency of the pulses should vary for different signals, so the PLC can detect a crossover of different OSSD signals.

For a HIGH level the signal is pulsed to LOW and for a LOW level the signal is pulsed to HIGH.

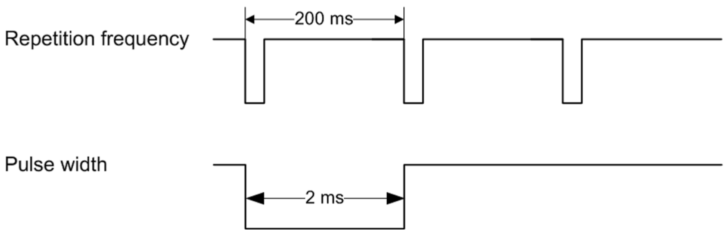



*Fig. 13: Example for OSSD pulse*

### OSSD test signals

The OSSD test signals OSSD1 (X66 / pin 10) and OSSD2 (X67 / pin 10) supply pulsed signals that are shifted to each other by 2 ms.

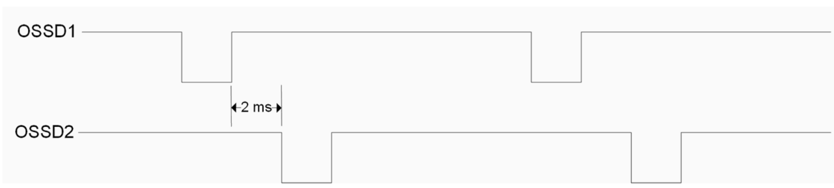



*Fig. 14: OSSD test signals*

The test signals are sent every 200 ms. They have a pulse width of 2 ms.

**Note**

These signals are to be used for test purposes. The OSSD test outputs are neither certified nor safety-related.

**Note**

The pulses in between are generated by the self tests of the drives. They have a typical pulse width of 1 ms. These test pulses of the drives must be filtered out by the PLC.

## 8.1 OSSD Channels and Signal Chains

The drive controller SD2 provides 8 OSSD signal channels. There are 2 channels for SFM and 2 channels for SLOF for each drive A and B.

Each channel includes 2 relays connected in series and a measuring device to monitor the self tests. This internal measuring device is made up of a 3-fold RC-combination. In combination with the internal resistance of the relays the measuring device affects the current consumption and the voltage drop. The RC-combinations are located at the input, at the internal intermediate tap and at the output.

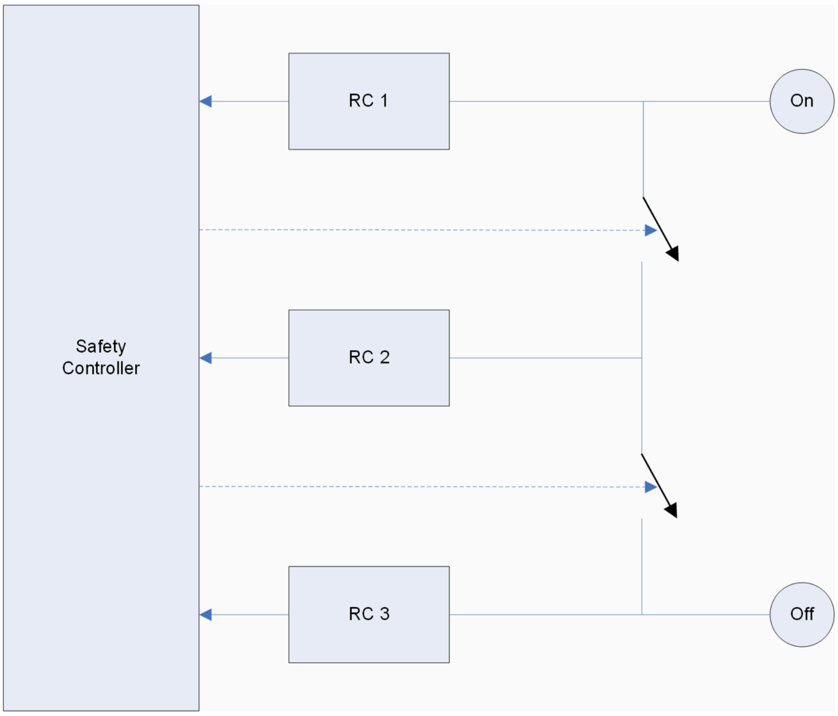



*Fig. 15: Circuit concept of an OSSD channel*

### 8.1.1 OSSD Self Test

Every 100 ms a self test of the OSSD relays is executed. The relays are tested one after the other. That means, each relay is tested every 1600 ms.

Order of the relay tests:

| Drive | Function | Channel | Relay | Connector/Pin |
|---|---|---|---|---|
| B | SLOF | 1 | K3-1 | X67 / pin 1, 2 |
| | | | K4-1 | |
| | | 2 | K7-1 | X67 / pin 5, 6 |
| | | | K8-2 | |
| | SFM | 1 | K1-1 | X66 / pin 1, 2 |
| | | | K2-2 | |
| | | 2 | K5-1 | X66 / pin 5, 6 |
| | | | K6-1 | |

| Drive | Function | Channel | Relay | Connector/Pin |
|---|---|---|---|---|
| A | SLOF | 1 | K3-2 | X67 / pin 3, 4 |
| | | | K4-2 | |
| | | 2 | K7-2 | X67 / pin 7, 8 |
| | | | K8-1 | |
| | SFM | 1 | K1-2 | X66 / pin 3, 4 |
| | | | K2-1 | |
| | | 2 | K5-2 | X66 / pin 7, 8 |
| | | | K6-2 | |

**Test procedure**

To execute the self test the respective relay must be switched. In addition, the input contact of the relay must be connected to 24 V.

The test is started by opening the respective relay and starting a time monitor. Thus, a falling edge occurs at the output contact of the relay. The GPIO port pin of the processor detects the falling edge and triggers an interrupt. Due to the interrupt the time monitor is stopped and the relay is closed. The signal chain is reclosed after approximately 1 ms.

If the falling edge is not detected, the time monitor quits the test after 250 µs. The relay is closed and an error counter for the respective channel is incremented. After 3 successive timeouts the drive triggers the corresponding error code.

Typical switching times of the relay according to the data sheet:

- $t_{on}$ = 800 µs
- $t_{off}$ = 100 µs

***Note***

If the self test coincides with the OSSD pulse of the PLC, an accidental timeout is caused. For this case the timeout counter is implemented.

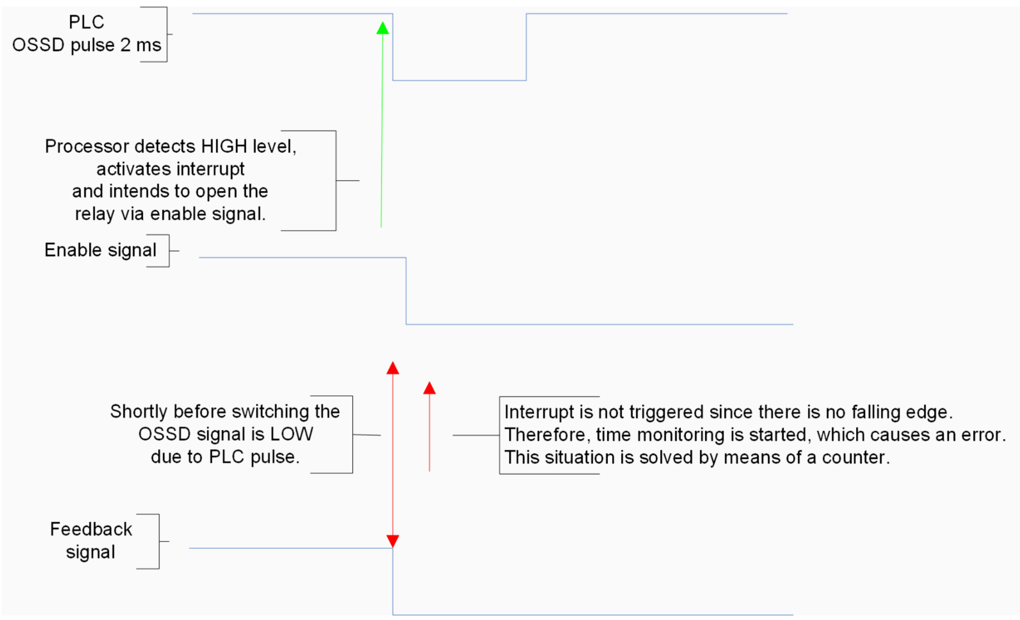



*Fig. 16: Signal overlap: OSSD pulse of PLC and self test*

# 8.2 OSSD Monitoring by PLC

The PLC sends a pulsed OSSD signal.

If the requirements for Safe Frequency Monitor (SFM) or Safe Limited Output Frequency (SLOF) are fulfilled, the safety functions close the respective relays and the pulsed OSSD signals are forwarded.

If the requirements are not fulfilled, an error occurs. The respective relays are opened and the pulsed input signal cannot be forwarded. The output signal is permanently LOW. By the missing pulsing the PLC determines that the requirements for the respective function are not fulfilled.

Examples:

- Broken cable: Safety is ensured because the output signal is permanently LOW. The PLC cannot detect pulsing anymore.
- Short circuit against GND or VCC: Safety is ensured because the output signal is permanent. The PLC cannot detect pulsing anymore.

## 8.2.1 OSSD Monitoring: Speed zero

The signal for “Speed zero” is a status signal. The PLC makes the signal active HIGH. By closing the relay the signal chain is closed and the PLC receives its signal. If a drive fails to send the “Speed zero” signal, the relay remains open and the signal chain is interrupted.

The PLC sends OSSD signals to both drives A and B. The OSSD signals are 2-channel signals. Each signal for each drive is passed through 2 electronic relays before it is fed back to the PLC. Each safety controller controls one of the two relays of each OSSD channel. When the safety controllers detect “Speed zero” at the drives, they switch the corresponding relays.

Internal requirements for switching the relays and for testing:

- No SYNC signals are counted at the motor control.
- The comparators must have detected “Speed zero”.
- The other safety controller must signal “Speed zero” for the respective drive.

## 8.2.2 OSSD Monitoring: Frequency Limitation

The PLC sends OSSD signals to both drives A and B. The OSSD signals are 2-channel signals. Each signal for each drive is passed through 2 electronic relays before it is fed back to the PLC. Each safety controller controls one of the two relays of each OSSD channel. When the safety controllers detect “Safe Limited Output Frequency” at the drives, they switch the corresponding relays.

### 8.2.2.1 With Frequency Limitation

Internal requirements for closing the relays and for testing:

- At the motor control the signal “Safe Limited Output Frequency” must be detected.
- The comparators must have detected “Safe Limited Output Frequency” (currently not used).
- The other safety controller must signal “Safe Limited Output Frequency” for the respective drive.
- An error must not be present.

### 8.2.2.2 Without Frequency Limitation

Internal requirements for closing the relays:

- An error must not be present.

OSSD self tests of the relays are not executed.

## 8.3 Conducted Measurements

### 8.3.1 Measurements at SFM/SLOF Connectors

The measurements described in the following were conducted at the SFM/SLOF connectors (X66/X67) of an SD2 drive controller.

Notes on the measurements:

- The internal measuring device, that is made up of a 3-fold RC-combination, monitors the test pulses of the drive and also affects the current consumption and the voltage drop. The RC-combinations are located at the input, at the internal intermediate tap and at the output.
- The data sheet specifies for each G3VM relay a nominal, internal resistance of 1 Ω and max. 2 Ω.
- For the measurements, an additional 24 V logic voltage was connected to input X66 / pin 1.

#### 8.3.1.1 Measurement at the Output without Load

Measured input voltage = 23.9 V

At first switch-on (3 s) a current of approx. 2.19 mA was measured using a digital voltmeter.

Throughout the next 4 s (closed G3VM relays) the measured current was 6.59 mA. A voltage drop could not be measured.

Then, the measured current was permanently 4.39 mA (open G3VM relays). This current flows through the 3-fold RC-combination.

#### 8.3.1.2 Measurement at the Output with a Load of 300 Ω

A load of 300 Ω was connected to X66 / pin 2.

A voltage of 23.7 V was fed into the input and at the output the measured voltage was 23.3 V.

Thereby, a voltage drop of 0.3 V between input and output was determined. The measured current was 86 mA.

#### 8.3.1.3 Measurement at the input with 18 V power supply

A load of 300 Ω was connected to X66 / pin 2.

A voltage of 18 V was connected to the input. The measured voltage at the output was 17.7 V.

Thereby, a voltage drop of 0.3 V between input and output was determined. The measured current was 69 mA.

**Note**

Lower input voltages can cause misinterpretation by the relay monitoring.

## 8.3.2 Chain of OSSD Channels

### 8.3.2.1 Test Setup

The test setup is made up of 4 single-axis drives and 4 double-axis drives of the device type SD2 with the integrated safety functions SFM and SLOF.

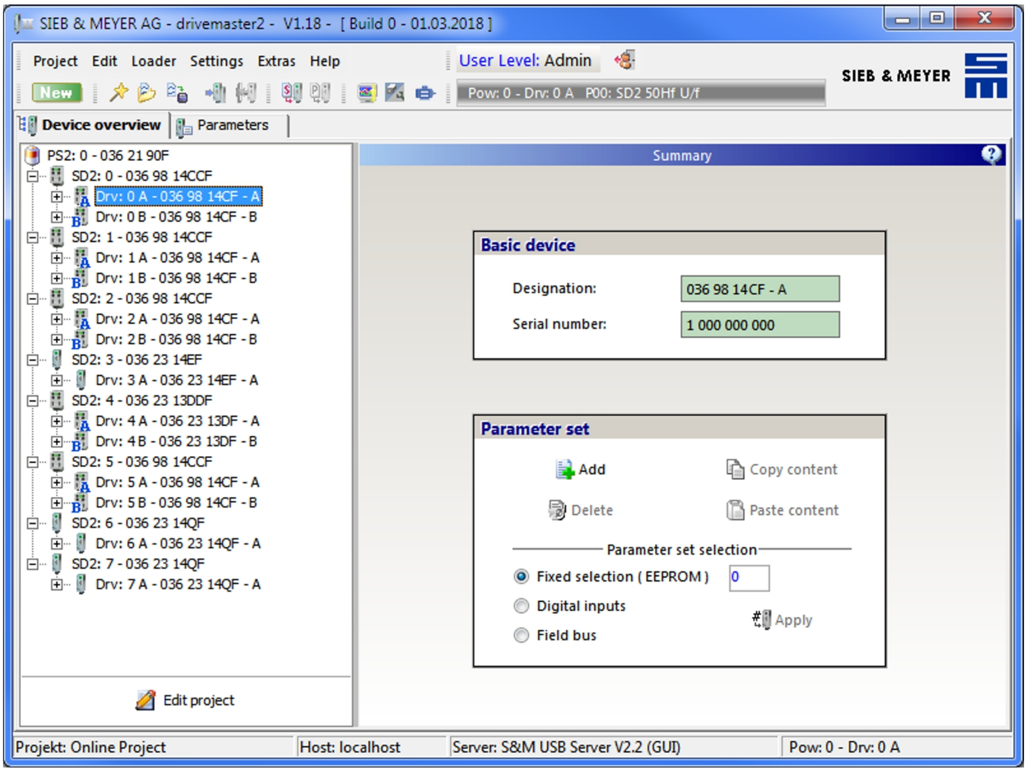



*Fig. 17: Device overview of the test setup in drivemaster2*

### 8.3.2.2 Oscilloscope Plots

The test signals at the connector X66 / pin 10 (OSSD1) and the connector X67 / pin 10 (OSSD2) are used as OSSD signals.

Input signals at the oscilloscope:

- input 1 (yellow): test signal OSSD1 at X66 / pin 10
- input 2 (blue): signal SFM_OUT_1 at the end of the signal chain
- input 3 (pink): test signal OSSD2 at X67 / pin 10
- input 4 (green): signal SFM_OUT_2 at the end of the signal chain

The following plot shows the offset between the test signals OSSD1 and OSSD2:

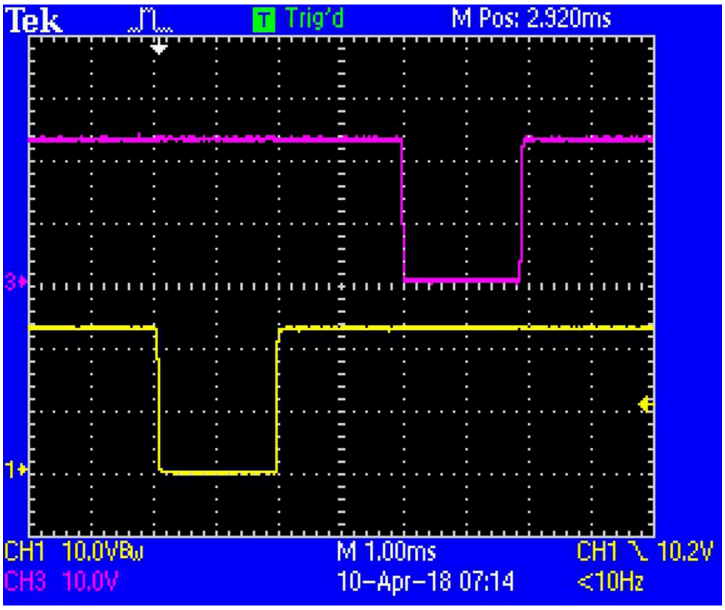



*Fig. 18: Offset of OSSD test signals*

The following plot shows the incoming OSSD signals that are passed to the end of the signal chain (OSSD1: yellow / blue and OSSD2: pink / green). The test pulses in-between are generated asynchronously by the drives, when they switch the relays (blue and green):

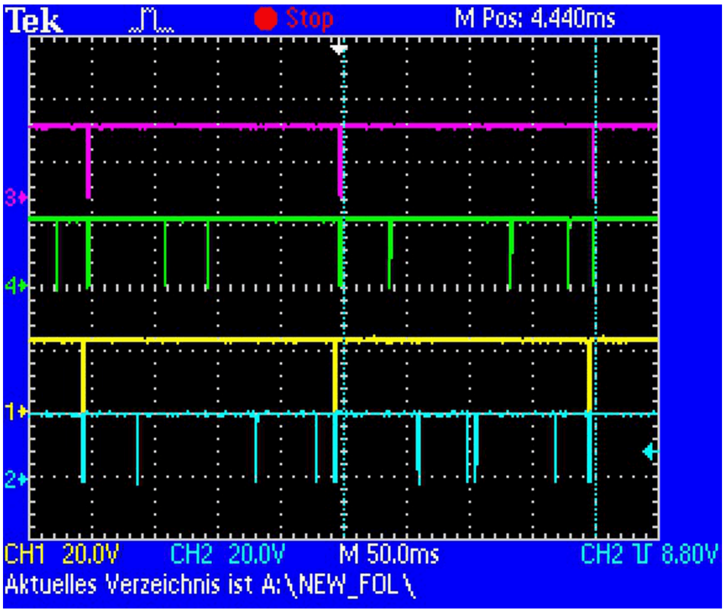



*Fig. 19: Signal chain OSSD1 and OSSD2*

The following plot shows a self test pulse of the drive followed by an OSSD pulse:

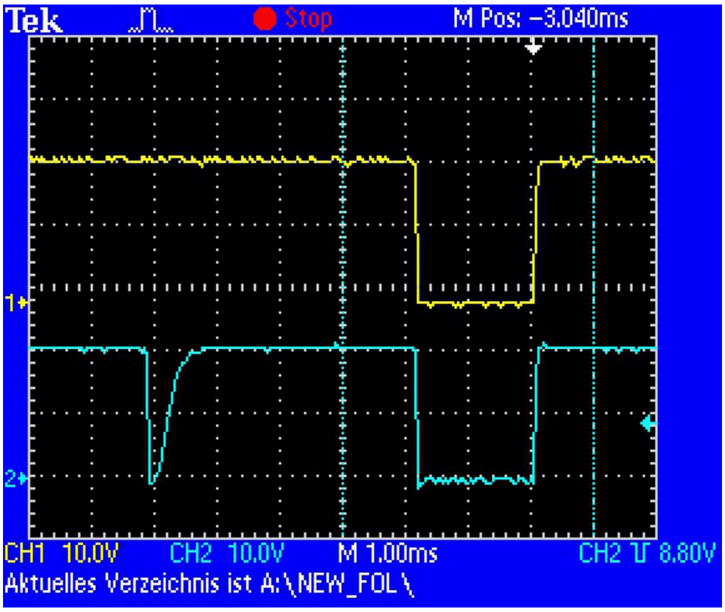



*Fig. 20: Drive pulse and OSSD pulse*

The following plot shows 2 successive self test pulses of the drive:

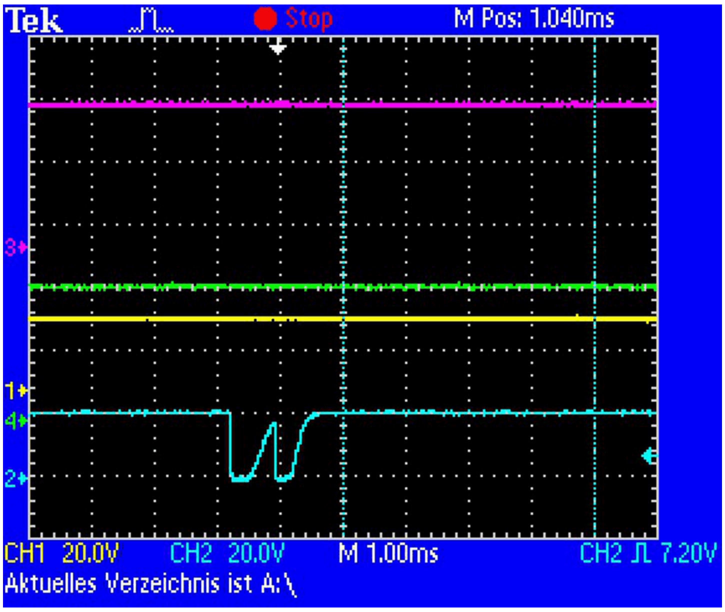



*Fig. 21: 2 drive pulse*

The following plot shows an OSSD pulse followed by 2 self test pulses of the drive:

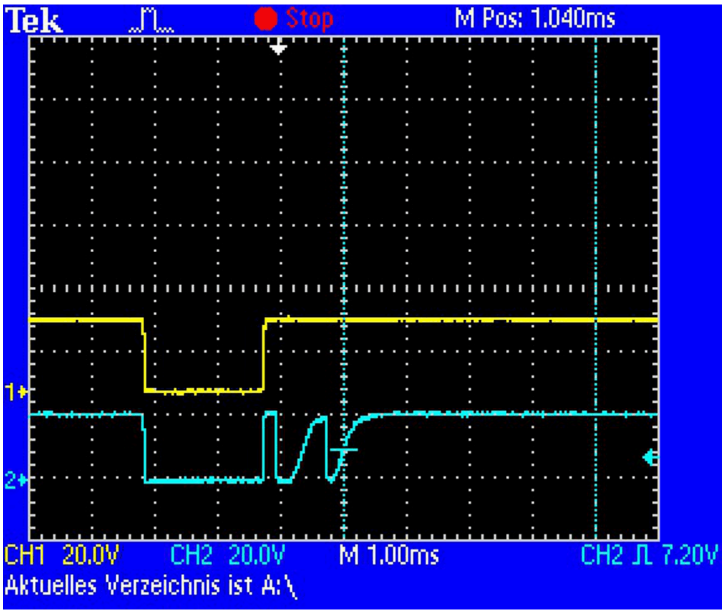



*Fig. 22: OSSD pulse an 2 drive pulses*

## 8.3.2.3 Summary

- The measuring device, that monitors the self test, causes a voltage drop of approx. 0.3 V per drive in the chain. This limits the maximum number of drives in the chain.
- The user must ensure that the drives can execute their self tests.
- The user must ensure that the PLC filters the self test pulses and evaluates only the safety-related OSSD pulses.

***Note***

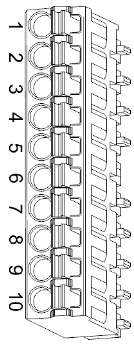
You can connect up to 16 drives (or 8 double-axis drives) in one chain to meet the requirements mentioned above.

# 9 Connector Pin Assignment

## 9.1 X66 – Safe Frequency Monitor (SFM)

Connection of the safety function SFM via 2-channel OSSD signal

10-pole Mini-Combicon connector, suitable for mating connector MC 1,5/ 10-ST-3,5 (Phoenix)

| Mating connector X66 | Function | Name | Meaning | Pin | I/O |
|---|---|---|---|---|---|
|  | Drive A | SFM_IN_1 | OSSD input signal (1st channel) | 3 | I |
| | | SFM_OUT_1 | OSSD output signal (1st channel) | 4 | O |
| | | SFM_IN_2 | OSSD input signal (2nd channel) | 7 | I |
| | | SFM_OUT_2 | OSSD output signal (2nd channel) | 8 | O |
| | Drive B | SFM_IN_1 | OSSD input signal (1st channel) | 1 | I |
| | | SFM_OUT_1 | OSSD output signal (1st channel) | 2 | O |
| | | SFM_IN_2 | OSSD input signal (2nd channel) | 5 (coded) | I |
| | | SFM_OUT_2 | OSSD output signal (2nd channel) | 6 | O |
| | Ground | GND | Reference ground | 9 | I/O |
| | Source | OSSD1 | OSSD test signal 1 (1) | 10 | O |

(1) The OSSD test signal is used for test purposes. This OSSD output is neither certified nor safety-related.

Specification of terminal connections

- Conductor cross-section solid/stranded: 0.2 to 1.5 mm²
- Connection method: spring-cage connection (handling: see page 49)

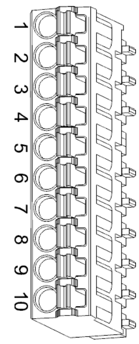
### Related topics

Transmission of the Status Message, page 9

# 9.2 X67 – Safe Limited Output Frequency (SLOF)

Connection of the safety function SLOF via 2-channel OSSD signal

10-pole Mini-Combicon connector, suitable for mating connector MC 1,5/ 10-ST-3,5 (Phoenix)

| Mating connector X67 | Function | Name | Meaning | Pin | I/O |
|---|---|---|---|---|---|
|   | Drive A | SLOF_IN_1 | OSSD input signal (1st channel) | 3 | I |
| | | SLOF_OUT_1 | OSSD output signal (1st channel) | 4 (coded) | O |
| | | SLOF_IN_2 | OSSD input signal (2nd channel) | 7 | I |
| | | SLOF_OUT_2 | OSSD output signal (2nd channel) | 8 | O |
| | Drive B | SLOF_IN_1 | OSSD input signal (1st channel) | 1 | I |
| | | SLOF_OUT_1 | OSSD output signal (1st channel) | 2 | O |
| | | SLOF_IN_2 | OSSD input signal (2nd channel) | 5 | I |
| | | SLOF_OUT_2 | OSSD output signal (2nd channel) | 6 | O |
| | Ground | GND | Reference ground | 9 | I/O |
| | Source | OSSD2 | OSSD test signal 2(1) | 10 | O |

(1) The OSSD test signal is used for test purposes. This OSSD output is neither certified nor safety-related.

Specification of terminal connections

- Conductor cross-section solid/stranded: 0.2 to 1.5 mm²
- Connection method: spring-cage connection (handling: see page 49)

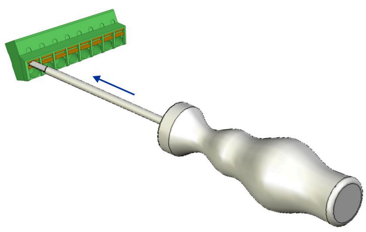
**Related topics**

Transmission of the Status Message, page 14

# 9.3 Spring-cage Connection

The individual conductors are fixed in the terminal by means of spring-cage connection. In order to plug and unplug a conductor proceed as follows:

- Push a screwdriver into the designated groove above the chamber to operate the spring-cage connection as shown in the figure.
- Put the conductor into the chamber / remove the conductor from the chamber.
- Release the screwdriver.



***Note***

Solid wires or conductors with ferrules can be put directly into the chamber without the help of a screwdriver.

# 10 Error Messages

The error messages for the safety functions SFM and SLOF are combined in error E46.

The error messages are described in this chapter and in the hardware documentation of your drive.

## 10.1 List of the Operating States

| Code | Description |
|---|---|
| 0 | Ready to switch on |
| 1 | Controller active |
| 1. | Controller active, controller is limited / PI limit |
| 2 | Mains 'Ready for operation' not present yet |
| L | Boot loader active (during boot / software load) |

## 10.2 List of Drive Error Messages

***Note***

The following messages apply to the entire SD2x drive series. According to the device type or operating mode, certain messages may not appear.

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E03<br>(0x103)<br>(259*d*) | Interpolation error (interpolated position control)<br>1 Acceleration limit exceeded<br>2 Speed limit exceeded<br>3 Index error | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Faulty motion profile of the higher-ranking control |
| E05<br>(0x105)<br>(261*d*) | Error caused by warning | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Parameter-driven monitoring stopped the drive. |
| E06<br>(0x106)<br>(262*d*) | Digital Input 'External Hardware'<br>0 Digital input<br>1 Analog input 0: broken cable<br>2 Analog input 1: broken cable<br>3 Analog input 0 and 1: broken cable | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | Monitoring of external hardware:<br>0 Digital input “External Hardware OK” is not connected to 24 V.<br>1 Minimum current monitoring of analog input 0 has triggered.<br>2 Minimum current monitoring of analog input 1 has triggered.<br>3 Minimum current monitorings of analog inputs 0 and 1 have triggered. |
| E07<br>(0x107)<br>(263*d*) | Error in internal hardware | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ Overload in digital outputs |
| E09<br>(0x109)<br>(265*d*) | Hiperface / EnDat OEM data incorrect | No "Ready" for startup | ▸ Number of motor pole pairs in EnDat/Hiperface encoder does not match the parameter set. |
| E10<br>(0x10A)<br>(266*d*) | drive-setup-tool heartbeat | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ▸ *drive-setup-tool* was not able to communicate with the drive in the parameterized monitoring time. |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E11<br>(0x10B)<br>(267*d*) | Communication / bus system error<br>‣ [1] SERVOLINK 4<br>‣ [2] DNC 8 Byte<br>‣ [3] CAN bus<br>‣ [4] EtherCAT | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | Monitoring of bus communication led to switch-off: |
| | 1 Faulty telegram ID [1] | | 1 Faulty reference value telegram |
| | 2 Zero data telegram[1] | | 2 Higher-ranking control not active |
| | 3 CRC error [1] | | 3 Check sum error, interferences during transmission |
| | 4 Synchronization error [1, 4] | | 4 Drive telegram not synchronized |
| | 5 Configuration error [4] | | 5 Faulty configuration of mailbox, PDO, watchdog or synchronization |
| | 6 NMT error [2, 3, 4] | | 6 Control channel of bus system was not active during switch-on (pre-operational) |
| | 7 Addressing error [4] | | 7 Faulty drive address |
| | 8 Node Guarding [3] | | 8 Communication node monitoring: monitoring time expired (configurable) |
| | 9 EEPROM error [4] | | 9 Error in EtherCAT EEPROM |
| | 10 Heartbeat / Watchdog [2, 3, 4] | | 10 Heartbeat monitoring: monitoring time expired (configurable) |
| E12<br>(0x10C)<br>(268*d*) | Mains 'Ready for operation' is missing | Motor is stopped by parameter-driven ramp and drive is disabled (controlled standstill). | ‣ Power output stage was switched on, when mains supply was disconnected/interrupted. |
| E15<br>(0x10F)<br>(271*d*) | Endat / Hiperface communication faulty | Motor is stopped by quick stop ramp and drive is disabled (controlled standstill). | ‣ Communication of EnDat/Hiperface is faulty. |
| E17<br>(0x311)<br>(785*d*) | FPGA power output stage shutdown | Motor is stopped immediately. | ‣ Overload in power supply unit |
| E17<br>(0x311)<br>(785*d*) | Zero voltage control DC link (only SD2M) | Motor is stopped immediately. Mains thyristors are no longer controlled. | ‣ Window range of the zero voltage control has been exceeded.<br>‣ Unbalanced load<br>Please contact SIEB & MEYER. |
| E18<br>(0x312)<br>(786*d*) | Error in spindle selection | Motor is stopped immediately. | ‣ Spindle selection was not valid at "Switch on" |
| E25<br>(0x319)<br>(793*d*) | Power supply load too high | Drive is stopped by limitation of motor torque. | ‣ Output power of drive is greater than rated power of power supply unit, since the dimensioning of drive and motor are not compatible. |
| E26<br>(0x31A)<br>(794*d*) | Motor temperature too high | Motor is stopped by error ramp and current limitation. | ‣ Wrong parameters entered for the motor or wrong dimensioning of the motor |
| E27<br>(0x31B)<br>(795*d*) | Ambient temperature too high | Motor is stopped by error ramp and current limitation. | ‣ Insufficient device cooling |
| E28<br>(0x31C)<br>(796*d*) | Power output stage temperature too high | Motor is stopped by error ramp and current limitation. | ‣ Insufficient cooling of power output stage (heat sink) |
| E29<br>(0x31D)<br>(797*d*) | Motor load too high (Motor I²t) | Motor is stopped by error ramp and current limitation.[(1)] | ‣ Average motor load is too high due to mechanical problems<br>‣ Wrong dimensioning of the motor |
| E30<br>(0x31E)<br>(798*d*) | Power output stage load too high (I²t) | Motor is stopped by error ramp and current limitation.[(1)] | ‣ Average load of output stage is too high due to mechanical problems<br>‣ Wrong dimensioning of the drive |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E31<br>(0x31F)<br>(799*d*) | Speed error or slip too high | SERVO / VECTOR: Drive is limited by current monitoring due to short-circuit of the motor phases.[1]<br>HSPWM: Drive is stopped by error ramp and current limitation. | ▸ Motor is not able to comply with the set speed (e.g. defective motor, mechanical problems, wrong parameters), failure of the measuring system |
| E33<br>(0x521)<br>(1313*d*) | Power supply load monitoring -> mains voltage too high | Power supply unit will be disconnected from mains. | ▸ Parameterized mains voltage does not match the connected voltage<br>▸ Device connected incorrectly<br>▸ Heavy fluctuation of the power supply towards overvoltage |
| E34<br>(0x522)<br>(1314*d*) | Power supply charge monitoring -> mains voltage too low<br>1 Undervoltage | Power supply unit will be disconnected from mains. | E34/E34-1: DC link was not precharged to the minimum voltage level in the set time period. Mains voltage is connected to the short-circuited DC link. |
| E35<br>(0x523)<br>(1315*d*) | Error in external power supply unit | Drive is immediately disabled, motor coasts to standstill. | ▸ Error message from external power supply unit; power supply is switched off.<br>See . |
| E36<br>(0x524)<br>(1316*d*) | Encoder 0 monitoring | Motor is stopped by current monitoring via short-circuit of the motor phases. | ▸ Connection of encoder 0 is faulty<br>▸ Broken cable |
| E37<br>(0x525)<br>(1317*d*) | Ballast circuit load (I²t ballast resistor) | Drive is immediately disabled, motor coasts to standstill. | Ballast circuit load due to: |
| | 1 I²t | | 1 Wrong dimensioning, too much energy supplied to $R_{Ballast}$, broken cable, no bridge at $R_{Ballast}$ (int./ext.) |
| | 2 (VCE) desaturation detection or: DC/DC converter overload *(only 0362144xx)* | | 2 Bridge at $R_{Ballast}$ is not correct, short circuit of insulation etc.<br>or: internal hardware fault *(only 0362144xx)* |
| E37<br>(0x525)<br>(1317*d*) | DC converter overload *(only 0362161xx)* | Power supply unit will be disconnected from mains. | ▸ Overload at voltage converter of DC link |
| E38<br>(0x526)<br>(1318*d*) | Actual speed value greater than overspeed threshold | Motor is stopped by current monitoring via short-circuit of the motor phases.[1] | ▸ Wrong parameters<br>▸ Motor connected incorrectly |
| E39<br>(0x527)<br>(1319*d*) | Tracking error monitoring and motor slowdown | Motor is stopped by current monitoring via short-circuit of the motor phases.[1] | ▸ Wrong parameters<br>▸ Motor connected incorrectly<br>▸ Mechanical problems |
| E40<br>(0x528)<br>(1320*d*) | Motor feedback | Motor is stopped by current monitoring via short-circuit of the motor phases.[1] | ▸ Connection of motor feedback faulty<br>▸ Broken cable |
| E41<br>(0x529)<br>(1321*d*) | Motor phase lost | Motor is stopped by current monitoring via short-circuit of the motor phases.[1] | Motor connection/configuration is faulty: |
| | 1 No motor connected | | 1 No motor connected / incorrect wiring, broken cable |
| | 2 Wrong motor connected | | 2 Wrong parameters |
| E42<br>(0x52A)<br>(1322*d*) | Overvoltage in DC link | Drive is immediately disabled, motor coasts to standstill. | Braking process feeds too much energy back to the DC link:<br>▸ deceleration ramp time too short<br>▸ devices with braking circuit:<br>– internal resistor: wiring of the bridge is faulty<br>– external resistor: wiring is faulty<br>– external resistor: resistance too high |
| E43<br>(0x52B)<br>(1323*d*) | Undervoltage in DC link | Drive is immediately disabled, motor coasts to standstill. | ▸ DC link not connected |

| Code | No. | Error message | Error reaction | No. | Possible reason |
|---|---|---|---|---|---|
| E44 (0x52C) (1324*d*) | | Commutation lost<br>The following list of error messages includes a note for which drive function the error might appear.<br>▸ [1] HSBLOCK<br>▸ [2] FPAM<br>▸ [3] SVC<br>▸ [4] HSPWM<br>▸ [5] VF | Drive is immediately disabled, motor coasts to standstill. | | ▸ The error E44 is triggered in case of wrong current feed of the motor during operation without sensor.<br>▸ Faulty parameters entered for the motor or faulty dimensioning of the motor. The error depends on the drive function. For details refer to the corresponding setup instructions. |
| | 1 | EMF monitoring[1, 2, 3 4] | | | |
| | 2 | Flux monitoring[4] | | | |
| | 3 | Overload current monitoring[4] | | | |
| | 4 | Under flux monitoring[4] | | | |
| | 5 | Minimum speed monitoring[1, 2, 3] | | | |
| | 6 | Error during alignment[1, 2] | | | |
| | 7 | Current limitation V/f oscillates[5] | | | |
| E45 (0x52D) (1325*d*) | | Short circuit in power output stage | Drive is immediately disabled, motor coasts to standstill. | | Short circuit of the power output stage due to: |
| | 1 | Internal short circuit | | 1 | Faulty drive control |
| | 2 | (VCE) desaturation detection | | 2 | Wrong parameters, output stage defective, broken cable, short circuit etc. |
| | 3 | Short to ground | | 3 | Short to ground of a motor phase |
| | 4 | Current measuring range | | 4 | Wrong parameters, output stage defective, broken cable, short circuit etc. |
| | 5 | Overload motor | | 5 | Drive function V/f: incorrect parameter setting of “Flying restart” |
| E46 (0x52E) (1326*d*) | 1 | Safety circuit (Safety X10) | Drive is immediately disabled, motor coasts to standstill without control. | 1 | Safety circuit STO is activated when the output stage is active; input SAFE A and/or input SAFE B were triggered. |
| | 2 | Initialization error: internal hardware of safety controller | | 2 | Safety function SFM/SLOF: error in according hardware components of the safety controller |
| | 3 | Incorrect data/parameters in process sequence | | 3 | Safety function SFM/SLOF: faulty PLC telegrams |
| | 4 | Error in function parameters for a functional part | | 4 | Safety function SFM/SLOF: parameter is out of limits |
| | 5 | Timeout of monitoring functions | | 5 | Safety function SFM/SLOF: error in according hardware components |
| | 6 | Monitoring of OSSD signals and output stage enable | | 6 | Safety function SFM/SLOF:<br>▸ wrong OSSD signals<br>▸ defective OSSD relay<br>▸ defective multiplexer |
| | 7 | Monitoring of motor phases | | 7 | Safety function SFM/SLOF: defective motor cable (broken cable) |
| | 8 | Frequency exceeded | | 8 | Safety function SFM/SLOF:<br>▸ set reference speed value is too high<br>▸ limit value for Safe Limited Output Frequency is parameterized incorrectly<br>▸ OSSD signals are set incorrectly |
| | 9 | Communication error between DSP and safety controller | | 9 | Safety function SFM/SLOF: communication between DSP and safety controller is disturbed |

| Code | Error message | Error reaction | Possible reason |
|---|---|---|---|
| E47 (0x52F) (1327*d*) | Drive parameters not activated | Power output stage can not be activated. | ▸ Drive start is not acknowledged by master yet (configurable by parameters in software). |
| E55 (0x737) (1847*d*) | Firmware stopped by ESC | Device stops in BIOS. | ▸ During boot-up, the device received an ESC sequence at the serial interface. |
| E56 (0x738) (1848*d*) | Device configuration | Device stops in BIOS. | ▸ During boot-up the device detected that hardware, firmware parameters and logic are not consistent;. A detailed error description is received by a parameter download. |
| E57 (0x739) (1849*d*) | Faulty or no firmware | Device stops in BIOS. | ▸ During boot-up the device detected no firmware or a faulty firmware. |
| E58 (0x73A) (1850*d*) | FPGA watchdog triggered | Device stops in BIOS. | ▸ FPGA process monitoring has been triggered;. Please contact SIEB & MEYER. |
| E59 (0x73B) (1851*d*) | No drive parameters loaded | Device stops in BIOS. | ▸ Device is not parameterized (status of delivery). |
| E60 (0x73C) (1852*d*) | Drive parameters incorrect | Device stops in BIOS. | ▸ Parameter set of the device is not valid (CRC error). |
| E61 (0x73D) (1853*d*) | Logic coding missing or incorrect | Device stops in BIOS. | ▸ Logic programming of the device is not valid. |
| E62 (0x73E) (1854*d*) | Error in electronic type plate | Device stops in BIOS. | ▸ Type plate is not programmed or faulty. Please contact SIEB & MEYER. |

(1) For servo motors with commutation via an incremental motor measuring system, the warning W17 “Unknown commutation angle” is signaled. After a restart of the device, the phasing of the motor measuring system starts automatically (magnetic alignment).

# 10.3 List of the Warning Messages

Warning messages are not displayed on the device display. They can only be seen in the software *drivemaster2* via “Diagnosis → Errors and warnings”.

| Code | Description |
|---|---|
| W00 | Digital input 'Quick stop' active |
| W01 | Digital input 'Positive limit switch' active |
| W02 | Digital input 'Negative limit switch' active |
| W03 | Voltage of mains supply not OK |
| W04 | Power output stage load greater than parameterized warning threshold W04 (power output stage $I^2t$) |
| W05 | Motor load greater than parameterized warning threshold W05 (motor $I^2t$) |
| W06 | Power output stage temperature greater than parameterized warning threshold W06 |
| W07 | Motor temperature greater than parameterized warning threshold W07 |
| W08 | DC link voltage greater than parameterized warning threshold W08 |
| W09 | DC link voltage less than parameterized warning threshold W09 |
| W10 | Speed controller in current limitation / PI limit |
| W11 | Position/tracking error greater than parameterized warning threshold W11 |
| W12 | Speed error greater than parameterized warning threshold W12 |
| W13 | Tracking error of the current too great |
| W14 | Ambient temperature greater than parameterized warning threshold W14 |
| W15 | Ballast resistor load greater than parameterized warning threshold W15 (ballast resistor $I^2t$) |
| W16 | Safety circuit is active |
| W17 | Unknown commutation angle |

| Code | Description |
|---|---|
| W18 | Hiperface / EnDat OEM data not valid |
| W19 | Dirt signal encoder input 0 |
| W20 | Dirt signal encoder input 1 |
| W21 | Dirt signal encoder input 2 |
| W22 | Power supply unit load greater than 90% of the rated power |
| W23 | Reserved |
| W24 | Current or current rise greater than warning threshold W24 (warning current) |
| W25 | Reference speed less than minimum motor speed |
| W26 | Current greater than warning threshold W26 (warning overload current) |
| W27 | Reserved |
| W28 | Reserved |
| W29 | Reserved |
| W30 | Reserved |
| W31 | Reserved |

## 10.4 Messages of the Quick Stop Functions

| Code | Description |
|---|---|
| H01 | Digital input "Switch on" waits for positive edge to switch the drive on (This function is only active when the input is set as "Switch on type 2 (with positive edge)".) |
| H03 | Software function "Quick stop" |
| H04 | Digital input "Quick stop" |
| H07 | Software positioning error "Negative limit" |
| H08 | Software positioning error "Positive limit" |
| H09 | Bus system "Quick stop" (The quick stop bit is set to 0) |
| H11 | Digital input "Negative limit switch" |
| H12 | Digital input "Positive limit switch" |
| H13 | Digital input "Speed Enable" |
| H14 | Magnetic bearing calibration active |

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