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# SFU 0200X

## Schnellfrequenzumrichter
## High Frequency Converters

# CONTENT SFU0200X-SSE

**Stand Januar 2026** **Rev. 1.3**

# 1 Model Variants SFU 0200X

| Typ | Name | Housing |
|---|---|---|
| Typ 1 / 325VA | SFU200X / 1 | Standard in Desktop Housing with LCD |
| | SFU200X / 1 SSE | in SSE cabinet housing with LED |
| Typ 2 / 520VA | | |
| | SFU200X / 2 LCD | Standard in Desktop Housing with LCD |
| | SFU200X / 2 SSE | in SSE cabinet housing with LED |
| Typ 3 / 620VA | *in planning* | |
| | SFU200X / 3 LCD | Standard in Desktop Housing with LCD |
| | SFU200X / 3 SSE | in SSE cabinet housing with LED |
| Typ 4 / 550VA | *in planning* | |
| | SFU200X / 4 LCD | Standard in Desktop Housing with LCD |
| | SFU200X / 4 SSE | in SSE cabinet housing with LED |

# 2 Description and Features

- ✓ Operation of **Asynchronous-AC und Synchronous-BLDC** Motors**.**
- ✓ Very compact size for various mounting types such as control cabinet mounting and more
- ✓ The high frequency converter **SFU 0200X** makes possible **output frequencies 4000Hz/240.000 rpm** with 2pole AC-Motors and with BLDC-Motors up to **1667Hz/100.000 rpm.**
- ✓ **Output Power 325VA / 520VA / 620VA / 550VA** with compact design
- ✓ Hohe Effizienz und geringe Verlustleistung durch **Synchron-Gleichrichter**
- ✓ The core of **SFU200X** is a **Digital Signal Processor** (DSP) which produces all output signals and collects all input signals.
- ✓ **High precision sinusoidal** output signals with low distortion factor realize very high accuracy and running behavior with AC-motors.
- ✓ All parameters like current, voltage and frequency are captured in **real time** and are regulated by the implemented vector control depending on the load condition.
- ✓ Allows highest **efficiency** of the spindles at **low and high frequencies**
- ✓ High **operational safety**: All operating conditions like acceleration, operation with nominal rotational speed, deceleration are monitored and critical conditions are intercepted.
- ✓ **Short Circuit Proof** by DSP-supervision
- ✓ **Integrated Brake Chopper Resistor**
- ✓ **Simple and flexible integration** into existing systems thanks to free I/O configuration
  Control inputs: 1 Analog, 4 Digital
  Control outputs: 1 Analog, 2 Digital, 2 Relay
- ✓ **Galvanic Separation** of the interfaces from Mains potential
- ✓ **Overload control** selectable either by time control or by **$I^2T$**
- ✓ **Overtemperature** protection by DSP-supervision
- ✓ **STO Function** for highest safety at standstill and protection against unintended starting

# 3 Technical Data

| Output Power | 200X/1: 325VA S1-100% | 200X/2: 520VA S1-100% | 200X/3: 620VA S1-100% in planning | 200X/4: 550VA S1-100% in planning |
|---|---|---|---|---|
| Power Supply | 230V, 50 Hz / 115V, 60Hz rotary switch and change of fuse | | | selectable with |
| Fusing | 230V: 2AT<br>115V: 4,0AT | 230V: 2,5AT?<br>115V: 5,0AT | 230V: 4,0AT<br>115V: 8,0AT | 230V: 5,0AT<br>115V: 5,0AT |
| Spindle Connection | Desktop Housing: | Customizable according to requirements:<br>Circular Jacks 3-pin or 7-pin<br>or pluggable Screw Clamps 2,5mm² 6-pin | | |
| | SSE, 19"-Rack: | pluggable Screw Clamps 2,5mm² 4-pin<br>2*PE, U, V, W, Temperatur Sensor, Speedsensor/FP, SGND | | |
| Output Voltage | max. 36V | max. 60V | max. 48V | max. 60V |
| Continuous Phase Current<br>Phase Peak Current | 7,5A<br>9,0A | 7,5A<br>9,0A | 9,8A 11,0A | 9,5A 11,5A |
| Over Current | Duration to be setup max. 20s / or by $I^2T$ | | | |
| Output Frequency | AC: 4.000Hz / 240.000 rpm | | | DC: 1.667Hz / 100.000 rpm |
| Spindle Characteristics | max. 16, internally stored | | | |
| Sensor Inputs | Speed Sensor: Field Plate, Temperatur Sensor: PTC, KTY, PT1000 | | | |
| Control Inputs | 2 Analog: 0-10V<br>4 Digital: 0-24V | | | |
| Control Outputs | 1 Analog: 0-10V<br>2 Digital: 0-24V,<br>2 Relay Changer Contacts: 30VDC/1000mA, 125VAC/300mA | | | |
| Interface | USB, RS232 | | | |
| Dimensions<br>B x H x T (mm) | Desktop: 243 x 94 x 220<br>SSE: 82 x 245 x 205 | | Desktop: 268 x 94 x 220<br>SSE: 82 x 245 x 205 | |
| Weight | Desktop approx. 5kg SSE approx. 5,5kg | | Desktop approx. 8kg | Desktop approx. 8kg |
| Protection | IP20 | | | |
| Operating Conditions | 5 - 40°C /<br>rel.Humidity max. 85 % | | | |

# 4 Intended Use / Safety Instructions and Warnings

- ✓ This unit is designed **for operation in industrial environments only**. When used in residential and commercial areas, additional measures may be required to limit the emitted interference
- ✓ Applicable safety regulations must be observed during installation.
- ✓ Before switching on the inverter for the first time, make sure that it is fixed and that the connected spindle is also securely fixed and cannot make any uncontrolled movements.
- ✓ Compliance with EMC (Electro Magnetic Compatibility) limits is the responsibility of the manufacturer of the machine or device. The inputs and outputs of this unit are equipped with filters to increase immunity to interference and reduce emitted interference. This means that operation in an industrial environment is generally possible.
- ✓ The EMC of a machine or appliance is influenced by all connected components (motor, cables, wiring, ...). Under certain conditions, the connection of external filters may be necessary to ensure compliance with the applicable EMC standards.
- ✓ This unit generates dangerous electrical voltages and is used to operate dangerous rotating mechanical tools. For this reason, only professionally qualified, trained personnel may work on this appliance and make the connection!
- ✓ Before putting the unit into operation, make sure that it is in perfect condition. If it has been damaged during transport, it must not be connected under any circumstances.
- ✓ The inverter must not be operated in the vicinity of heat sources, strong magnets or devices generating strong magnetic fields.
- ✓ Sufficient air circulation at the inverter must be ensured.
- ✓ Do not allow any liquid to enter the unit. If this appears to be the case, the appliance must be switched off and disconnected from the mains.
- ✓ The ambient air must not contain any aggressive, highly flammable or electrically conductive substances and should be as free of dust as possible.
- ✓ All work on the inverter and the corresponding accessories may only be carried out when it is switched off and disconnected from the mains. The national accident prevention regulations as well as the general and regional assembly and safety regulations (e.g. VDE) must be observed.
- ✓ All work in connection with one of our inverters may only be carried out by persons who are professionally qualified and have been instructed accordingly.

**ATTENTION**
**Please verify that all power supply voltages are correct in polarity and value.**

**ATTENTION**
**Please ensure to have the proper characteristic selected, always!**
**The operation of a spindle with a wrong characteristic may harm the spindle severely!**

# 5 Connections, Interfaces and Pinouts

Operating parameters and outputs:
The **SFU 0200X_SSE** records all current important operating parameters and data.
Four of these can be output as messages at the digital outputs and one analogue value (0-10V) at the analogue output.

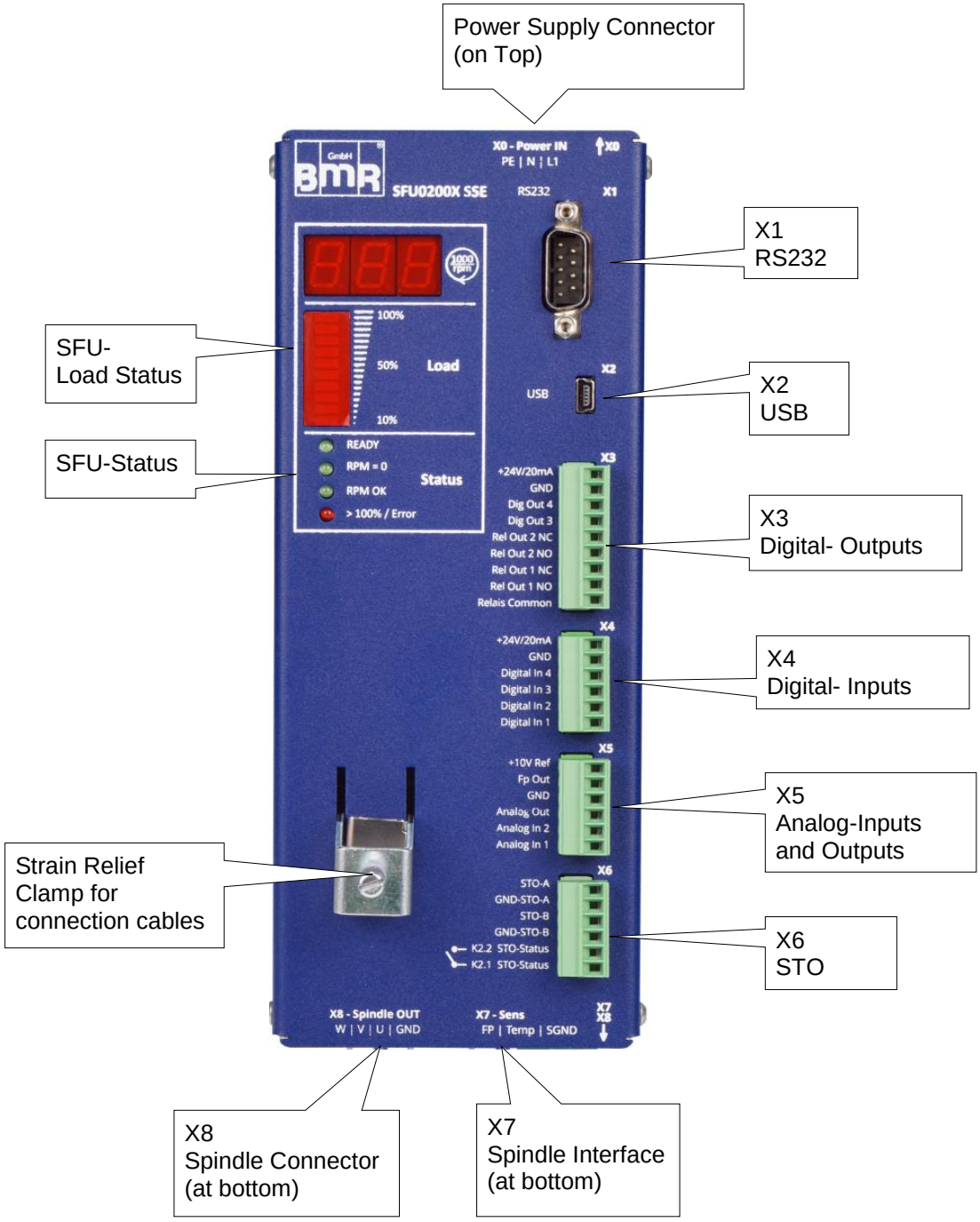
Remote control and inputs:
For remote control of the **SFU 0200X-SSE** there are available 4 digital inputs (24V) and up to 2 analog inputs (0-10V).

These assignments are freely configurable. With the optional Windows PC software ***SFU-Terminal***, the above assignments can be made conveniently. This enables extremely flexible adjustment to the respective application.
Each operating parameter can be assigned as a message and each control signal can be assigned to any I/O pin. In addition, the respective logic level (high or low active) can also be defined individually.
For analog measurement and control data, corresponding assignments to analog I/O pins can also be made.

The standard assignments of operating parameters and associated outputs and control signals and inputs are listed in the tables below in the section 'Inputs and Outputs'.

**ATTENTION**
**Please verify that all power supply voltages are correct in polarity and value.**

## 5.1 Connections SSE-Version



## 5.2 Serial Interface

- ✓ With the help of the PC program **SFU-Terminal**, the SFU0200X can be configured and controlled very easily via the serial interface.
- ✓ The program is freely available on the BMR homepage, and is very helpful in configuring and commissioning the inverter.
- ✓ A manual for it is available on the website as a PDF.
- ✓ The command set for the control commands is freely available as a download on the BMR homepage.
- ✓ **Attention**: Since the serial interface RS232 shares the internal connection with the USB interface, the connections can only be used alternatively.

### 5.2.1 **RS232** (D-Sub9-Male)

| Pin | Function |
|---|---|
| 1, 4, 6, 7, 8 | NC |
| 2 | RxD |
| 3 | TxD |
| 5 | GND |

- ✓ For communication via the RS232 interface with a PC, a null modem cable with crossed RxD and TxD lines can be used.
- ✓ **Attention**: Since the serial interface RS232 shares the internal connection with the USB interface, the connections can only be used alternatively.

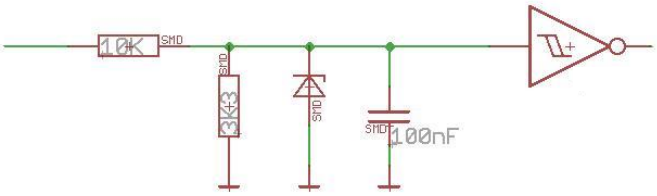
### 5.2.2 **USB-Connection** (USB Mini)

- ✓ The SFU 0200X is equipped with an USB-Interface via a USB-Mini connector.
- ✓ **Attention**: Since the serial interface RS232 shares the internal connection with the USB interface, the connections can only be used alternatively.

## 5.3 I/O Description and Specification

### 5.3.1 Digital-Inputs

- ✓ Switching level of digital inputs: Log"0" = 0…7V / Log"1" = 13….24V according PLC standard level
- ✓ All GND potentials are connected together, unless otherwise stated
- ✓ Special care is required when using and wiring the auxiliary voltage and is on the responsibility of the user! The voltages are not fused. Possible connection errors can lead to damage to the device



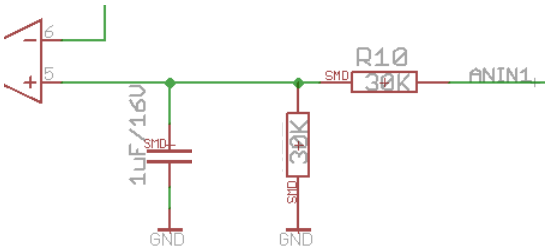

Shown here as an example, the input stage of a digital input

### 5.3.2 Digital-Outputs

- ✓ The output level for Digital Out 3,4 is 0 and +24V and can supply up to 10mA each .

### 5.3.3 Analog-Inputs and Outputs

- ✓ Analog Voltage Range: 0…10V
- ✓ All GND potentials are connected together, unless otherwise stated
- ✓ With a connection of a potentiometer between pin6 and pin5, a speed setting can be tapped directly at the wiper.




Shown here as an example, the input stage of an analog input

## 5.4 Inputs and Outputs Version SSE

Both the scaling of the analogue value and the assignment of the functions to the inputs and outputs can be done freely. The functions in **bold** are the default delivery settings

### 5.4.1 X3 Digital Outputs Version SSE
(pluggable Screw Clamps RM3,5 mm / up to 1,5mm2)

| Pin | Function | Default Setting / Description |
|---|---|---|
| 9 | +24V UH | Auxillary Supply Output (10mA max.) |
| 8 | GND | Reference-GND for Pin 6,7 and Pin1 UH. |
| 7 | Digital Out 4 | **"Overload"**, Funct. free programmable |
| 6 | Digital Out 3 | **"Duty Speed Reached"**, Funct. free programmable |
| 5 | Relay Contact 2 NC | **Rel-Out 2(normally closed contact): "Standstill"**, Funct. free programmable |
| 4 | Relay Contact 2 NO | **Rel-Out 2(normally open contact): "Standstill"**, Funct. free programmable |
| 3 | Relay Contact 1 NC | **Rel-Out 1(normally closed contact): "Ready",** Funct. free programmable |
| 2 | Relay Contact 1 NO | **Rel-Out 1(normally open contact): "Ready",** Funct. free programmable |
| 1 | Relay Contact Com | Relais-Common |

### 5.4.2 X4 Digital-Inputs Version SSE
(pluggable Screw Clamps RM3,5 mm / up to 1,5mm2)

| Pin | Function | Default Setting / Description |
|---|---|---|
| 6 | +24V UH | Auxillary Supply Output (10mA max.) |
| 5 | GND | Reference-GND for Pin 1,2,3,4 and Pin6 $U_H$. |
| 4 | Digital Input 4 | Funct. free programmable |
| 3 | Digital Input 3 | Funct. free programmable |
| 2 | Digital Input 2 | Funct. free programmable |
| 1 | Digital Input 1 | **"Start / Stop"**, Funct. free programmable |

### 5.4.3 X5 Analog-Inputs and Outputs Version SSE
(pluggable Screw Clamps RM3,5 mm / up to 1,5mm2)

| Pin | Function | Default Setting / Description |
|---|---|---|
| 6 | +10V URef | +10V Reference-Supply for Pin 1,2 ( 100mA max.) |
| 5 | Fp Out | Converted Digital Signal from Speed Sensor |
| 4 | GND | Reference-GND for Pin 1, 2, 3, 5, 6 |
| 3 | Analog Output | "**Load Percent**", Funct. free programmable |
| 2 | Analog Input 2 | Funct. free programmable |
| 1 | Analog Input 1 | "**Reference Value Duty Speed**", Funct. free programmable |

### 5.4.4 X6 STO-Function

(pluggable Screw Clamps RM3,5 mm / up to 1,5mm2)

| Pin | Funktion | Beschreibung |
|---|---|---|
| 6 | STO-A | STO-Kanal A |
| 5 | GND-STO-A | Ground STO-Channel A |
| 4 | STO-B | STO-Kanal B |
| 3 | GND-STO-B | Ground STO-Channel B |
| 2 | Relay contakt K2.2 | Status STO: |
| 1 | Relay contact K2.1 | Status STO: |

The ground potentials are separated from each other and from the spindle and logic ground.
Relay contact K2 is only used to check the STO status, but must not be used for safety-related functions.
Relay contact K2 is closed when a +24V signal is applied to channel A and B, thus unlocking the STO function. The power stage of the inverter is now ready for operation. (→ 8.3)

## 5.5 Mains Connection and Spindle Connection Version SSE

### 5.5.1 Mains Connection– 3pol terminal block Version SSE

(pluggable Screw Clamps RM5,08 mm / up to 2,5mm²)

| Pin | Function | Description |
|---|---|---|
| 1 | L | Phase |
| 2 | N | Neutral |
| 3 | PE | PE Protection Earth !Safety! |

### 5.5.2 Spindle-Connection Version SSE

### 5.5.3 X7 Spindle Interface

(pluggable Screw Clamps RM3,5 mm / up to 1,5mm2)

| Pin | Function | Description |
|---|---|---|
| 1 | Speed Sensor | For Connection of Speed Sensor |
| 2 | Temp Sensor | For Connection of Temp Sensor<br>PTC, KTY, PT1000 |
| 3 | Spindle GND | Reference-GND for Pin 1, 2 |

### 5.5.4 X8 Spindle Connection

(pluggable Screw Clamps RM5,08mm / up to 2,5mm2)

| Pin | c | Description |
|---|---|---|
| 4 | PE | Spindle Protective Earth |
| 3 | U | Spindle Phase U |
| 2 | V | Spindle Phase V |
| 1 | W | Spindle Phase W |

With the configuration program **SFU-Terminal**, it is very easy to activate and deactivate the speed sensor and the temperature sensor. Equally the type of temperature sensor type can easily be selected.

**ATTENTION**
**After the first test, please check whether the direction of rotation is correct!**
**If necessary, adjust the direction of rotation by exchanging the motor phases or by configuring the direction of rotation using the SFU terminal!**

# 6 Functional description, commissioning, operation

## 6.1 Spindle Characteristics or Spindle Diagrams

All converters of BMR need an information about the basic data of the spindle, such as maximum voltage, current, rotational speed, and many more. These are stored in so called "**Spindle Characteristic**" or "**Spindle Diagram**".
A BMR spindle characteristic has 16 setpoints within the range of the rotational speed. At every point data of voltage, current, load scaling, acceleration and deceleration ramp and many more data can be defined and this for idle load as well as for full load.
And there are in total 16 places for different characteristics.

The spindle characteristics are the **key for any spindle** and give a possibility to control the running behavior at every load condition.

In advance of starting a spindle first, it has to be ensured, that the proper characteristic is selected and activated.
This is generally the case, if the converter is delivered together with a spindle/motor and the required setup is already done.

If the converter and spindle are delivered separately, the proper spindle characteristic has to be loaded into the converter first. This can be achieved with the free setup software SFU-Terminal, easily. In case of being unsure, characteristics for most common spindles are available at BMR.

The spindle characteristics can be selected in the project file ( * .ps5 ) .

Spindle characteristics are created by BMR and can be loaded and managed using the program **SFU - Terminal**.

**ATTENTION**
**Please ensure to have the proper characteristic selected, always!**
**The operation of a spindle with a wrong characteristic may harm the spindle severely!**

## 6.2 Start / Stopp

The spindle can be started in three ways:

✓ **digitally** with a control signal at the digital input with the start/stop function.
The switching thresholds are 0...7V for "OFF=0" and 18...24V for "ON=1",
Voltage levels between 7V and 18V are not defined.

➔ As soon as the start has been triggered, the spindle is accelerated to the setpoint value which is set at the analogue input with the function **Reference Value Duty Speed** by a corresponding voltage.

➔ The scaling for this is adjustable:

- 1V/1.000Upm for fine resolution in the lower speed range
- 1V/10.000Upm as standard setting
- 0-10V/Min-Max for using the full resolution of the control range

✓ **analog** with a voltage at the analog input
For this purpose, a valid "ON" level must be applied to the input with the **Start/Stop** function.

➔ a voltage greater than 0.29V starts the spindle from the min speed up to the speed according to the scaling

➔ An input voltage of 0V leads to a standstill of the spindle

✓ **Serially** via **interface** and **control commands**
The command set for the control commands is freely available as a download on the BMR homepage. Since the serial interface RS232 shares the internal connection with the USB interface, the connections can only be used alternatively.

In the simplest case, a connected and appropriately set up spindle can be started by pressing the Start-Button. The desired speed can be adjusted by dialing with the rotary knob either as preset value during standstill or in Run mode. The preconditions for a correct Start can be looked up under 8.1.

Any error or malfunction is displayed as plain text

All relevant system messages on rotational speed, load or problems are displayed on the LCD display

The current power output is displayed in the lower part as analogue load bar as % and absolute.
An overload condition will be displayed as well.

The pre-selected and current speed, the selected characteristic are displayed.

**ATTENTION:**
**The operation of a spindle with an incorrect spindle characteristic may harm the spindle severely!**
**Please ensure that the correct characteristic is selected**

**If several spindles are operated simultaneously, in parallel mode it has to be ensured that they are of the same type and that a specific characteristic is selected.**
**Otherwise this may harm one or more spindles or the converter severely!**

## 6.3 Setup of Rotational Speed

Die Drehzahlvorwahl kann auf zwei Arten erfolgen:
The preset of the rotational speed can be achieved by two ways:

- ✓ **manually preset with menu keys**
  For this, the Option-Button 0 in the line Duty speed in the grey field in the menu "**Analogue-Inputs**" of SFU Terminal Software has to be activated. By this all analogue inputs were switched to inactive and no analogue signal is selected for Start.
  The set value for rotational speed is displayed at the LCD-Display and can be adjusted with the rotary encoder. The speed of change is dependent on the speed of dialing. The rotational speed can altered during operation, also.

- ✓ **preselection with a voltage applied to the analogue input SetValue Rotational speed**
  For this, an analogue input has to be assigned to this function, which can be done in SFU Terminal Software in the menu "**Analogue-Inputs**". Additionally it has to be selected a scaling for the analogue voltage in the listbox field at left. 3 scalings are possible: **1V**/10.000rpm or 1V/1.000rpm or 0-10V min/max).
  The value of the rotational speed according the scaling is displayed on the LCD-display and can be altered as wanted.
  An input voltage of 0V leads to Standstill and a voltage > min voltage will make the spindle start up to the speed according to the current scaling.
  A scaling 1V/10.000 and a voltage of 4V will cause a speed of 40.000 rpm.

  All settings made in SFU-Terminal have to downloaded into the SFU before they are valid with the button Write only I/O (F6).

There are three possibilities for scaling the speed:

- ✓ **1V/1.000Upm**:
  here, the control voltage directly maps the speed. In this scaling, fine adjustment is possible in the lower speed range. This is not suitable for higher speeds.
  At a minimum speed of 5,000 rpm, the minimum start voltage is > 5 V.

- ✓ **1V/10.000Upm**:
  here, the control voltage maps the speed directly and is thus very easy to scale.
  However, the resolution of the speed in the voltage value is reduced for speed ranges up to 100,000.
  At a minimum speed of 5,000 rpm, the minimum start voltage is > 0.5 V.

- ✓ **0-10V / Min-Max**:
  The scaling for the analogue value corresponds to the min. and max. values of the speed from the spindle characteristic curve. This means, that the full range of the resolution can always be used.
  Basic values e.g.: Min: 5,000 rpm, Max: 60,000 rpm.
  This results in the control voltage U= target speed * 10V/60000Upm
  A voltage of U < 0.8V is standstill, a voltage of 0.8V sets the minimum speed of 5,000 rpm.
  of 5,000 rpm, and 10V sets a speed of 60,000 rpm.

## 6.4 Inputs

### 6.4.1 Digital Inputs

4 digital inputs are available for controlling the inverter.
These can be freely configured for 4 functions. Further functions are in preparation

- **Converter Start/Stop**
- **Emergency Stop / Locking**
- **Reversing direction of Rotation**
- **Error Reset**

The switching thresholds are 0...7V for "OFF=0" and 18...24V for "ON=1",
Voltage levels between 7V and 18V are not defined.

### 6.4.2 Safe Torque Off (STO) Function

While being unwired, the STO function is activated and the output stage is deactivated. To enable the output stage, both control inputs STO-A and STO-B must be connected to +24V. (→ 8.2)

### 6.4.3 Analog Inputs/ Varioload

analog inputs (0...10V) are available for controlling the inverter and specifying setpoint and reference values.

- In the SSE version, there are 2 inputs and 2 functions:
- **Reference Value Duty Speed**
- **Reference Value Varioload**
- In the Desktop version, only one input is available for the **Reference Value Duty Speed** function.

**Reference Value Duty Speed**
Is explained in Chapter 6.3

**Varioload**
is a freely definable switching threshold in the range of 0-100% for the load current.
The scaling for this is fixed at 1V/10%.
Thus, the range 0-100% covers the voltage range 0 to 10V.

This threshold can be set up as a fix value in the SFU terminal or variably set via an analogue input.

When this threshold is reached, the **Varioload** parameter is set to "1".
A digital output can be assigned to this parameter for feedback to the controller. The StatusFlags can be checked in the debug tool of the SFU terminal.

The following examples can be seen as an application for this:

✓ For example, **monitoring the cutting power** of the tool.
Since the load current of the spindle typically maps the machining process directly, an increasing current can be seen as an indicator for the degree of wear of a tool. Above a certain value, it can be determined when the tool is worn and needs to be changed.
With this, the quality and surface finish of the machining can be kept constant and unplanned tool breakage can also be prevented.

✓ Or **tool breakage detection**.
A certain machining process always requires a certain load current. If this is suddenly undershot and no longer reached, a tool breakage can be assumed and the control can trigger a warning message for this.

## 6.5 Outputs

### 6.5.1 Digital Outputs/ Relay Output

3 digital outputs and a potential-free relay with changeover contact are available as feedback to the PLC or another control system.
They are freely configurable and can be assigned to different inverter messages.
The most important are listed here:

- **Converter Ready**
- **Overload Spindle**
- **Duty Speed Converter Reached**
- **Duty Speed Spindle Reached**
- **Standstill Converter**
- **Standstill Spindle**
- **Overtemperature Spindle**

And many more (all functions are mapped in the SFU terminal)

The switching thresholds are 0V for "OFF=0" and +24V for "ON=1",
They can each be loaded up to 10mA.

Potential-free to inverter ground (GND) and (PE) with dielectric strength of 1500V AC.
The contacts can be loaded with the following values: 30V DC / 1A or 125V AC / 0.3A.

### 6.5.2 STO- Feedback Contact

Is open, when STO is active → the inverter is disabled (→8.2)

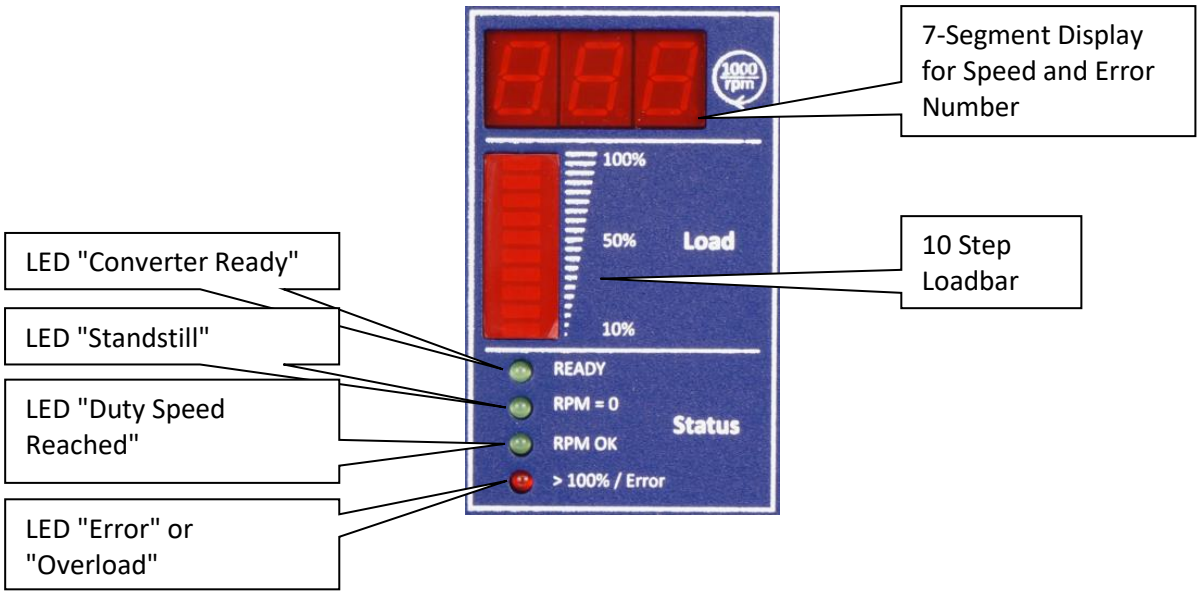
### 6.5.3 Analog Output

An analogue output is available for feedback to the PLC or another control system.
This is freely configurable and can be assigned to different inverter parameters.
In the default setting, the **current active load%** is output as a voltage between 0...10V at the analogue output X5.3 in a scaling of 1V/10%.
Other configurations are possible.

### 6.5.4 Auxillary Reference Voltage Output +10V URef

A +10V reference voltage is available here. This can be used to set a preset speed value with the help of a potentiometer.
The +10V output is short-circuit proof and rated for a maximum current of 100mA.
A continuous short circuit is not permissible and will damage the inverter. It is the user's responsibility to prevent this.

## 6.6 Frontpanel




## 6.7 Error Messages

With the SSE version, any errors that occur and cause the converter to stop are shown as error numbers on the display. If there are several faults, these fault numbers are displayed cyclically one after the other. Errors are coded as follows:

E30: Overload switch-off after the delay time has elapsed
E31: Overtemperature converter (switch-off after the delay time has elapsed)
E32: Spindle overtemperature (switch-off after the delay time has elapsed)
E33: Overtemperature converter or spindle (switch-off after the delay time has elapsed)
E34: Overvoltage DC link voltage
E35: Undervoltage OFF DC link voltage
E36: Undervoltage STOP DC link voltage
E37: Overcurrent shutdown -> power stage shutdown
E38: Emergency stop input locked
E39: Without spindle or spindle cable defective (with activated spindle test)
E40: TimeOut serial interface
E41: Spindle characteristic curve invalid or damaged
E42: Switch-off due to excessive baking energy (AC) or spindle stall (DC)
E43: reserved
E44: reserved
E45: Encoder error

## 6.8 Overload Function: I2T

**Activation I2T-Funktion:**

This setting can be made in the SFU terminal in the spindle characteristic curve:

✓ The $I^2T$-function is switched on automatically as soon as **both values** are entered in the SKL. Activation when applies:

- Threshold > 0 and
- Time > 0

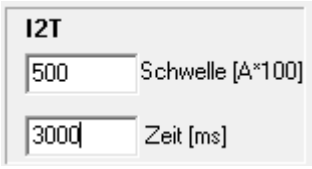
✓ If no parameters or only one parameter is stored in the SKL, the $I^2T$ module is deactivated and the classic overload function via pure switch-off takes place according to the overcurrent parameters stored in the SKL..

**Description $I^2T$ -Function:**

For the setup of the $I^2T$ timer, the spindle manufacturer's specifications are required, e.g. max. permissible current for a certain time:

→ $I_{max}$ = 5A / 3sec

These spindle-specific parameters are to be stored in the spindle characteristic curve (SKL) and transferred to the SFU. Please enter here:




Pay attention to the scaling: Threshold: 5A = 500 / Duration: 3s = 3000ms

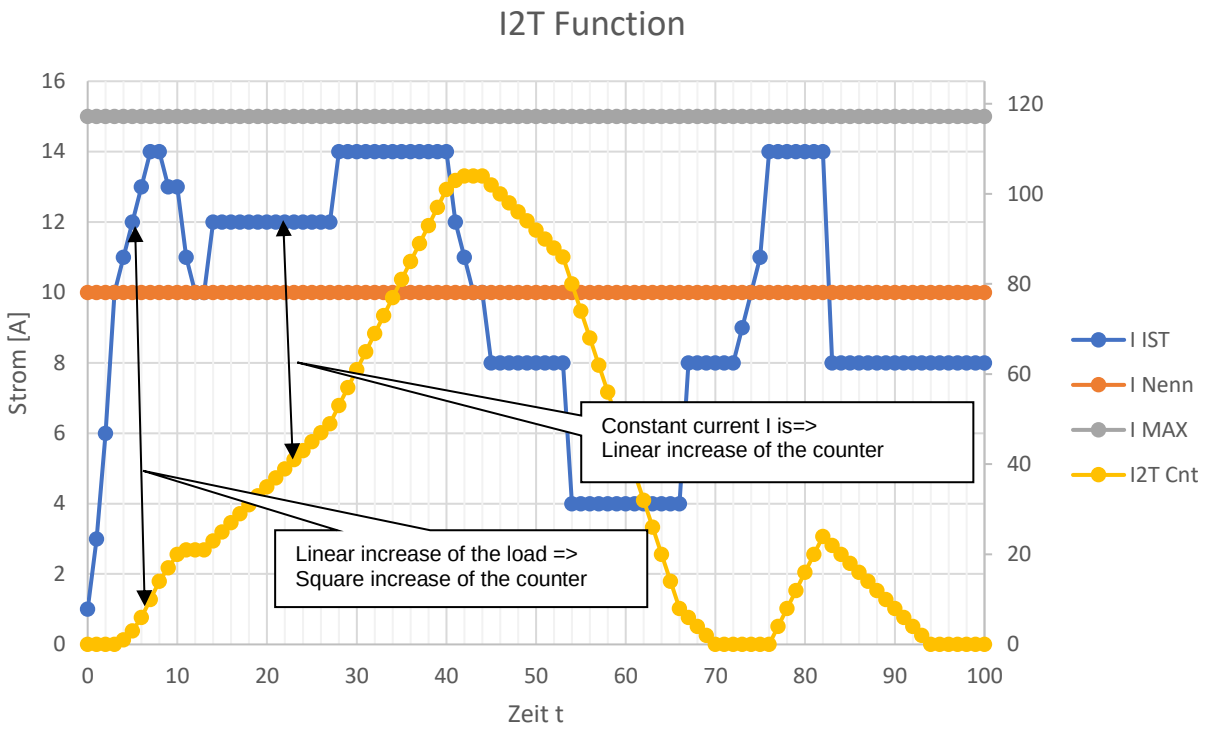
The $I^2T$ product is calculated internally from the values entered above and stored as the switch-off threshold. The current load current is recorded with a certain sampling rate and evaluated quadratically. If the current value measured is above Imax, the internal I2T counter is incremented, otherwise decremented..

**SFU-Switch-Off due to I2T-Function has triggered**

If the $I^2T$ counter exceeds the internal $I^2T$ product, a power stage switch-off occurs immediately as in the "overload case“.

**LED-display $I^2T$ -Function:**

As long as the $I^2T$ counter is > 0, the red LED remains on. The green LED continues to signal operational readiness.
After switching off by $I^2T$, the red LED remains permanently on..

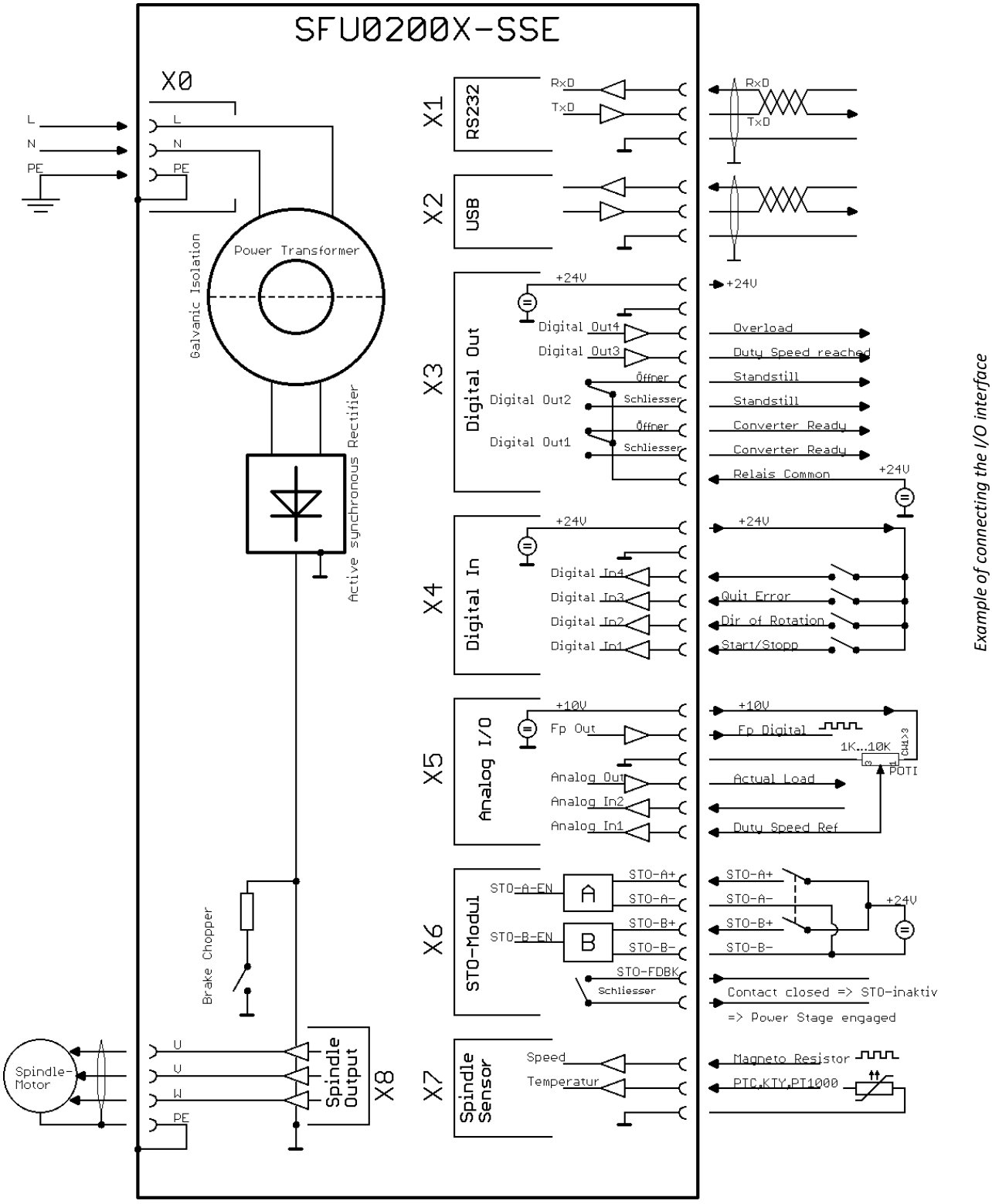



Graphical display of the I2T-Function

# 7 Example for I/O Connection

For the spindle to start, the analog voltage at the **Reference Value Duty Speed** input must be greater than the stop voltage. ( →6.3).
With a potentiometer between +10V and GND and with the slider at the **Reference Value Duty Speed** input, the speed range in the voltage range of 0..10V can be covered accordingly. For this, it is best to choose a set speed setting of 0-10V/Min-Max or the setting 1V/10.000Upm.

**Example for I/O Connection SSE version**




*Example of connecting the I/O interface*

# 8 Safety Functions

## 8.1 Automatic Stop and Cut Off

The menus described in the following refer to the SFU-Terminal software.

- The following events initiate a **controlled deceleration to standstill** according to the specified acceleration data of the spindle as given in the spindle characteristic curve for this spindle.

  ✓ **Emergency-Stopp due to Signal** at digital input E-Stop / Locking
  To be set in the menu "**Digital Inputs**"

  ✓ **Stop due to overtemperature at the spindle**, if this function is activated and the associated delay time has elapsed.
  In the "**Spindle-characteristic**" this function can be activated with the check Button Temp. Sense and the delay time can be set in the menu "**Delays – Excess temperature spindle**"

  ✓ **Stop due to overtemperature of the converter**, if this function is activated and the associated delay time has elapsed. To be set in the menu "**Delays – Excess temperature converter**".

  ✓ **Stop due to overload** , if this function is activated and the associated delay time has elapsed. The parameters for the overload criteria are set in the characteristic curve. Normally, the current value 100% is taken for S1 operation. For overload criteria about 10% more and for S6 operation about 30% more and as delay overload about 20sec.

- The following events make the **output stage to switch off with an uncontrolled run out of the spindle until standstill**. The spindle is only slowed down by its own load. Depending on the flywheel mass, it can take a very long time until standstill is reached. With AC-spindles a rotary encoder in the spindle is recommended for reliable standstill detection. In the "**Spindle-characteristic**" this function can be activated with the check Button Standstill Detection

  ✓ **Immediate-Stopp** due to exceeding the internal max current of the converter

  ✓ **Stop by short-circuit at the spindle** connection triggers a switch-off of the output stage. Determined by internal limit values for the maximum current of the converter.

  ✓ **Stop because of signal** at digital input Power Stage Off setup in menu "digital inputs"
  A restart can only be achieved with a systematic Stop/Start-Sequence or with a valid signal at the input "Error Reset". This can be setup in the menu "digital inputs" the power stage will be activated again after 4 sec.

## 8.2 Safe Standstill and protection against unintentional startup

✓ The SSE version has an STO module installed.

- As soon as this is activated during standstill, the output stage of the inverter is immediately deactivated and an unintentional restart of the spindle is reliably prevented.
- If the STO function is activated during spindle operation, the output stage of the converter is immediately switched off. As a result, the spindle may continue to run for a long time until it comes to a standstill.
- A **controlled braking to a standstill is therefore not possible** and for this, it is not recommended to use this function during operation.
- To implement an unscheduled stop, it is better to stop the converter using the “Emergency stop” function and brake it to a standstill before activating the STO function to prevent restarting.

✓ For this, the condition must be met that a circuit branch independent of the central processor is available and ensures that the output stage of the converter can only be activated with external signals. This is the case with the SFU 0200X-SSE.

✓ A two-channel pulse inhibit according to the Safe Torque Off Standard STO in accordance with stop category 0 as specified in IEC 61800-5-2 (? Section 8.3) is possible.

**Attention:**
**To enable the output stage of the inverter, these must be wired accordingly. The device cannot be commissioned without these settings**

## 8.3 Safe Torque Off (STO)

Safe Torque Off (STO) is a safety function to prevent unexpected start-up in accordance with EN 60204-1.
The STO function prevents the motor from generating torque and therefore corresponds to stop category 0 as specified in IEC 61800-5-2.

For this, the condition must be met that a circuit branch independent of the central processor is available and ensures that the output stage of the converter can only be activated with external signals. This is the case with SFU 0200X.

**Achtung:**
Zum Freischalten der Endstufe des Umrichters müssen die Eingänge STO-A und STO-B entsprechend beschaltet werden. Ohne diese Einstellungen kann das Gerät nicht in Betrieb genommen werden.

To enable the output stage of the inverter, the STO-A and STO-B inputs must be wired accordingly. The device cannot be put into operation without these settings.

In this case, the output stage of the inverter can only be enabled by synchronously applying a +24V level to the STO-A and STO-B inputs.
Feedback on the status of the STO is provided via the display (Chap.→ 6.6.2.3) and via the STO feedback contact K2.1/K2.2 on the STO connector X7 (→ Kap 5.4.4).

**STO Safety hints**

→ The STO state does not guarantee protection against electric shock

→ If the STO is triggered during operation, the output stage is deactivated immediately. A rotating spindle **can no longer be braked and will slowly coast and run out to a stop**.
This means, that a certain amount of time passes until the drive no longer performs a dangerous movement and the safe state is reached.

→ Monitoring whether or when the drive reaches the safe state is not integrated.

**On two independent channels function and application**
- Function "Safe Torque Off“ (STO)
- Potential-free feedback contact for operating status

### 8.3.1 Description of the safety function STO

By using the "Safe Torque Off" function (STO Safe Torque Off), the pulse control to the motor can be interrupted in the application so that it can no longer execute torque or rotary motion.
The STO safety circuit is implemented in the SFU0303 as follows:
The control signals to the output stage are routed via optocouplers. When the STO function is triggered, the power supply to the optocouplers is interrupted twice. This interrupts the isolating point to the output circuit and no output pulses can be generated.
The drive can therefore no longer execute any dangerous movements.

The two control inputs STO-A and STO-B (Chap. → 5.4.4) are used to request the STO safety function on two channels.
The two channels are potential-free to the inverter and also to each other and protected against polarity reversal.

### 8.3.2 Functional description STO

**- STO is activated**:
If both control inputs STO-A and STO-B are not connected or are at 0 volts or the supply voltage of the STO logic is missing, the STO function is activated and the output stage is switched off.
**power stage is switched off** → Display: **STO Pulse Blocking** →Relay K1/Feedback Contact = open

**- STO is deactivated**
If both control inputs STO-A and STO-B are connected with +24V, the STO function is deactivated and the output stage is enabled. → Display: **Ready** → Relay K1/Feedback Contact = geschlossen

**- STO Error**
In both cases, it must be noted that both inputs must be connected synchronously, within a certain discrepancy time with the same levels. If the levels of the two channels are not equal, this is interpreted as an error and leads to an error message and shutdown of the inverter. The STO function is permanently activated and the inverter is set to the blocking state and the power stage is switched off.
**power stage is switched off** → with a message on the display → Relay K1/Feedback Contact = offen.
**The inverter can only be unlocked by switching the mains voltage off and on again.**

**Control inputs STO-A and STO-B**
STO channels 1 and 2 and the feedback contact are galvanically isolated from each other and from all other inputs and outputs
The STO inputs tolerate voltages with levels of ±60-V and have reverse polarity protection that meets the characteristics of IEC 61131-2 types 1, 2 and 3.

| **Level STO-A/B** | 0…5V = low | 5,1V…..14,9V | 15…30V (max. 60V) =high |
|---|---|---|---|
| **State STO** | STO active | not defined | STO inactive |
| | Converter is locked = Not Ready | not defined | Converter is unlocked = Ready for operation |
| **Relay Contact K1** | open | not defined | closed |

**Discrepancy time $t_{Dis}$**
According to the specification of the safety function STO, both levels must always be identical, otherwise the inverter is set to the disabled state and can only be unlocked by switching the mains voltage off and on again.
At the same time, an error message is output on the display ("STO Error" ) and the LEDs.
The microcontroller of the inverter monitors the evaluation of the two inputs STO-A and STO-B for synchronicity and equality.
The software tolerates a certain discrepancy time in which the inputs can be different, this can be caused e.g. by bouncing of contacts.

→ Discrepancy time: 100 msec.

**Test pulses**
Test pulses from safety devices are tolerated within a certain range, but are not evaluated and do not lead to STO being switched off

→ OSSD signals with a test pulse length of max. 3.5 ms are tolerated at 24 volts.

**STO-Feedback Contact at STO Relay Contacts K2.1, K2.2**

✓ is **open, if STO is active** → the power stage of the converter is **locked**

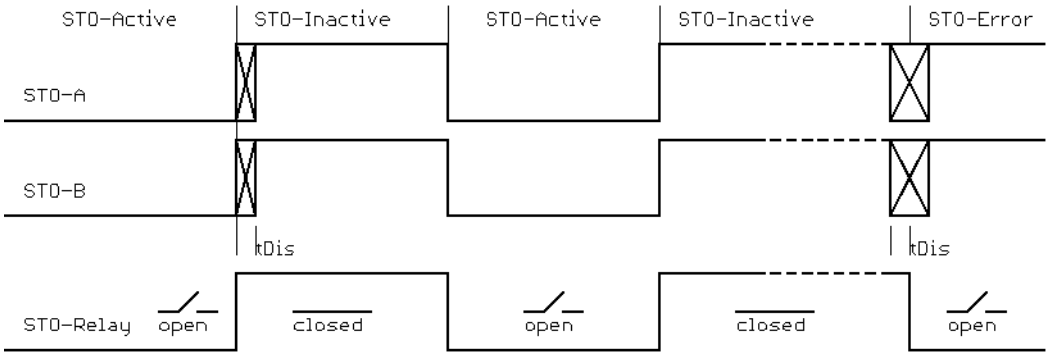
- in case there is no signal or 0V applied at the control inputs STO-A und STO-B.
- in case only one control input carries a signal of +24V → STO-Error
- if the power supply of the STO-module is missing or defective.

✓ Is **closed, if STO is inactive** → the power stage of the converter is **unlocked**

**Attention:**

**The feedback contact K1 is only designed as a single-channel contact and may therefore only be used for monitoring, but may not be used in the safety circuit.**

### 8.3.3 Timing STO




✓ STO channels 1 and 2 and the feedback contact are galvanically isolated from each other and from all other inputs and outputs

✓ The relay normally open contact between pins 1 and 2 is potential-free and is used to provide feedback on the status of the STO:

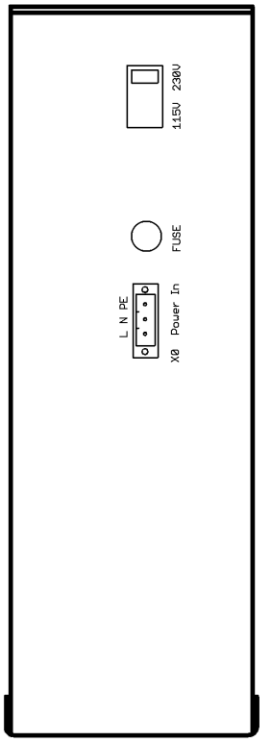
# 9 EMC

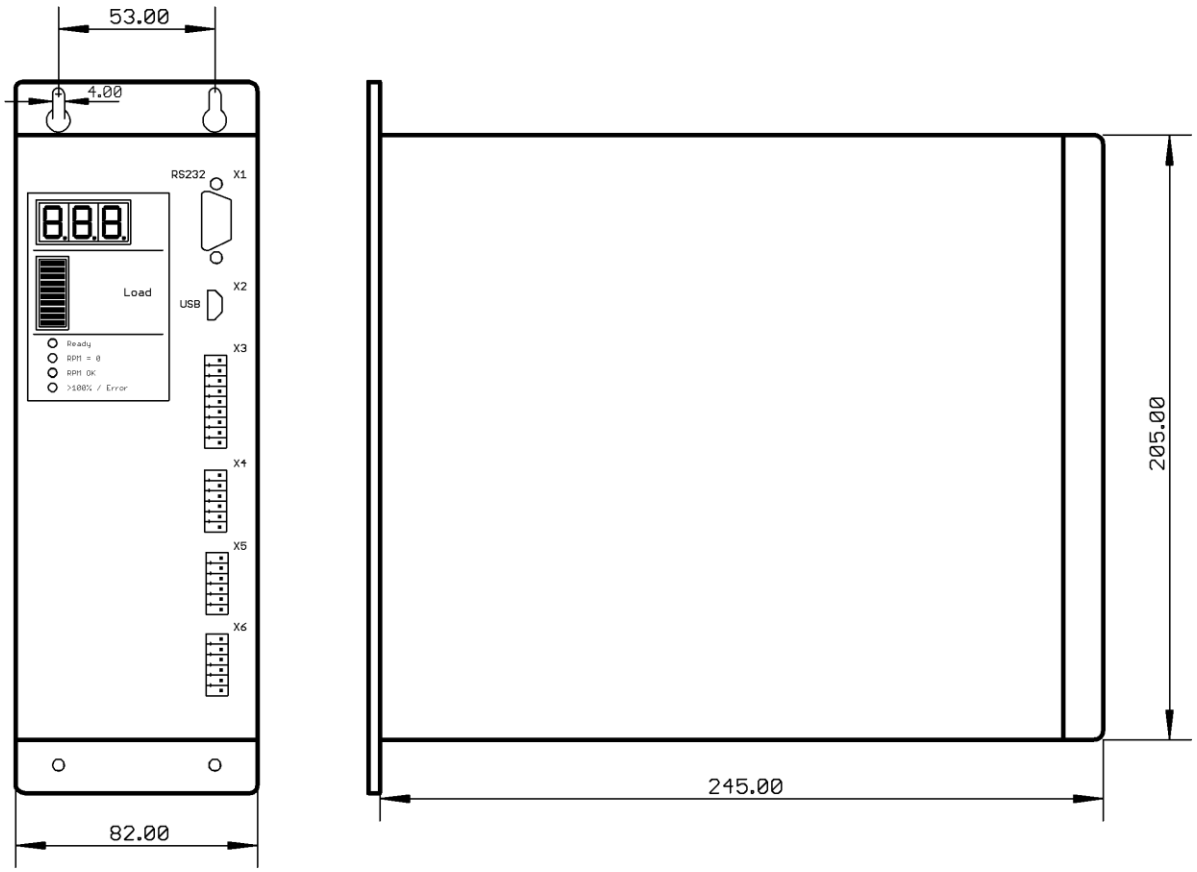
- ✓ This unit is designed **for operation in industrial environments only**. When used in residential and commercial areas, additional measures may be required to limit the emitted interference.
- ✓ The compliance with the limit values of EMC is the responsibility of the manufacturer of the machine or device.
- ✓ This device was developed for use in industrial environments. For trouble-free operation and to reduce emitted interference, the following should be observed during wiring of the equipment:
- ✓ The EMC of a machine or device is affected by all connected components (motor spindle, length and type of cables, wiring, etc..). Under certain conditions the use of additional filters can be necessary to maintain the current laws.
- ✓ The earth and shield connections of all those devices used in conjunction with the frequency converter should be as short as possible and have as large a cross-section as possible.
- ✓ Control devices used with the frequency converter (PLC, CNC, IPC, ...) should be connected to a common earth/earth terminal bar
- ✓ All connections both to and from the frequency converter should be via shielded cable.
- ✓ Supply cables, motor cables and control cables must be completely isolated from each other. Where crossing cannot be avoided, cables should be laid at 90° to each other.
- ✓ the control cable should be laid as far away as possible from the load cable.

# 10 Power Supply

- ✓ The SFU 0200X is designed for operation on mains voltage.
- ✓ The Converter can be set up for 115V and 230V networks using a changeover switch. The correct setting and the matching fuse value must be checked carefully before switching on!
- ✓ A mains transformer fulfils the highest demands on insulation resistance.
- ✓ The intermediate circuit voltage for the inverter stage is generated from the secondary voltage of the transformer via a highly efficient active synchronous rectifier.

# 11 Dimensions and Mounting



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Beschreibungen