

Frequency Converter SFU 0300

SSE and Desktop



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1. Type Numbers SFU0300

SFU0300	Standard in desktop housing
SFU0300 SSE	cabinet housing

2. Introduction

Depending on its construction, the speed of a three-phase a.c. motor is directly dependent on the number of poles and the frequency of the network. In a 3ph 380V/50Hz network, with a 2-pole motor, the rated speed would be $50 \text{ U/s} * 60 = 3000 \text{ Upm}$.

With d.c. motors (brushless d.c.), the speed is dependent on the voltage applied.

Three-phase a.c. motors provide numerous benefits in industry, such as brushless operation, freedom from wear and tear, favourable capacity/weight ratio, high-speed capability, and much more. These motors can be used many different application areas, such as milling and grinding spindles, or with drilling machinery, for example.

D.C. motors have the advantage of a high power efficiency (approx. 85%) when compared with a.c. motors, but the disadvantage of not quite reaching the torque of an a.c. motor at low speeds (when starting), nor reaching the high speeds of an a.c. motor. However, the higher efficiency also means cooling requirements are lower and dimensions can be smaller.

In the aforementioned applications, three-phase a.c. motors are operated using special control gear – frequency converters. These frequency converters convert the fixed 50 Hz network into a 3-phase network with variable frequency and voltage. This greatly reduces the start-up problems and the high starting currents that are inevitable when high-capacity three-phase a.c. motors are connected to a fixed network. The motor is controlled according to a special characteristic curve until its rated speed has increased, or it has been braked to a standstill.

The frequency converter **SFU0300** -series has been specially designed for use in these high frequency applications, offering excellent safety, performance and reliability, the result of years of experience in the design and construction of frequency converters, together with the use of the latest materials and the most reliable components. It can be used in many different applications and is as equally suitable for use as a replacement device in existing systems with older type series as it is in pre-planned applications as a cost-effective solution, helping to prolong the useful life of tools. In addition, both a.c. and d.c. motors can be operated by this high frequency converter.

3. Description and Features

- Operation of **a.c.** motors/spindles
- The fast frequency converter SFU-0300 allows **speed frequencies** up to **100.000Upm** with 2-pole a.c. motors
- **High output power 1500VA** from a **compact design**
- The kernel of the SFU-0300 is a **Digital Signal Processor (DSP)**, which generates all output variables and captures signals.
- All parameters, such as current, voltage and frequency, are captured in **real time**, and adjusted by implementing via the **Vector Control** according to loading.
- High level of **operational safety**. All operating states such as acceleration, operation at rated speed, and deceleration, are monitored and critical statuses are intercepted and brought under control. This also includes the **controlled deceleration** of the motor / spindle in the event of power failure or Emergency Stop.
- **Diverse control and communication possibilities**. 3 types of connection are available to facilitate communication using peripheral devices - PC , PLC (Programmable Logic Control), CNC (Computer Numeric Control).
- **Straight-forward and flexible integration** into existing systems by means of open configuration of I/O signals for control and configuration:
Control inputs: 1 analogue, 3 digital
Control outputs: 1 analogue, 2 digital (relay)
- **Galvanic separation** of all interfaces from each other and from the network / motor potential
- **Short-circuit-protected**
- **User-friendly configuration** and control using optional Windows Software for the PC

4. Block Diagram

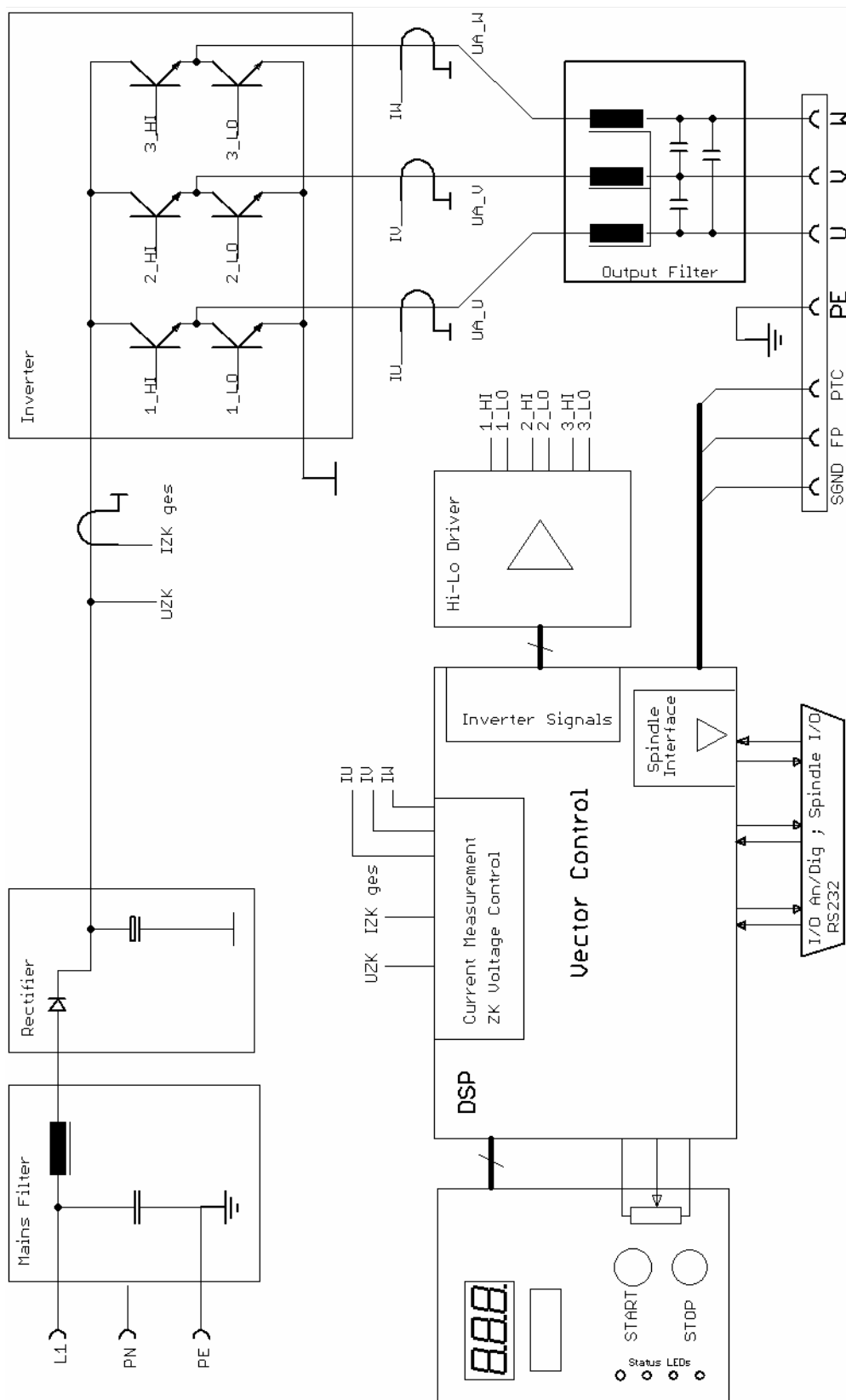


figure 1

5. Technical Data

Supply connection	230V, 50Hz, 1PH / 115V, 60Hz, 1PH	
Output power	1.500VA for 1.000W spindle shaft power	
Motor connection	Desktop-Housing: 3-polig: U, V, W, SSE Housing: 8-polig: U, V, W, 2*PE, PTC, FP, SGND Screw Terminals 4mm ²	
Output voltage	3*230V	
Output current	3,8A limited electronically	
Over-current	max. 10s	
Output frequency	1.000Hz / max 60.000 rpm as option 100.000	
Spindle characteristics	max 16, stored internally, freely definable	
Control inputs	1 analogue: 0-10V, galvanically separated : (located on D-Sub 15-female)	
Control inputs	3 digital: 0-24V, galvanically separated: (located on D-Sub 15-female)	
Control outputs	1 analogue: 0-10V, galvanically separated (located on D-Sub 15-female)	
Control outputs	2 digital: relay outputs, (located on D-Sub 15-female) 24VDC/1000mA, 125VAC/500mA	
Interface	RS232 galvanically separated, 9600Bd (located on D-Sub 15-female)	
Housing dimensions w x h x d	(desktop) 240 x 90 x 266	(SSE) 85 x 314 x 250
Weight	(desktop) about 4kg	(SSE) about 3,5kg
Protection	IP20	
Operating conditions	max. ambient temperature 40°C, no humidity	

On Option switchable 115V/230V



ATTENTION:

The operation of a spindle with a wrong characteristic may harm the spindle severely!

Please ensure to have the proper characteristic selected always!

6. Safety-Precautions and Warnings

- This device produces dangerous electrical voltages and is used for the operation of dangerous moving mechanical parts. For this reason, only professionally trained and qualified personnel should be allowed to install and repair this device!
- Before first activation of the device, verify, if it is in a faultless condition. If it was damaged during shipping and transportation it must not be switched on.
- During installation the safety regulations have to be observed.
- Before the device is turned on for the first time, it should be verified, that the connected parts cannot carry out uncontrolled movements.
- The frequency converter must not be operated close to heating devices or magnets or devices generating strong magnetic fields.
- The maximum permissible ambient temperature of this device is from +41 °F till +104 °F.
- Sufficient air circulation around the converter should be ensured
- Fluids should be prevented from intruding into the housing. If it seems to be happened, the converter has to be switched off immediately.
- The relative humidity must not exceed 90% (not condensed).
- The ambient air must not use aggressive, flammable or electrically conductive substances and should be as free of dust as possible.
- All repairs and maintenance on the converter and the relating accessories must be carried out by skilled personnel and with powered off, only. To ensure this, the mains plug should be pulled out. In doing this, both the terms of regulations for preventing accidents and the general and national rules for mounting and safety have to be applied.
- The device must not be operated without properly connected PE connection and it has to be verified that the mains connector is fixed with screws, if detachable.
- Maintaining EMC (electromagnetic compatibility) limits is the responsibility of the manufacturer of the machine or device. The inputs and outputs on this device are fitted with filters, to increase the interference immunity and reduce emitted interference, making it possible to use this device in an industrial environment. The EMC of a machine or device is affected by all connected components (cables, wiring, etc..) and for this reason, installation and connection of the device should only be carried out by qualified personnel.

7. Connections, Interfaces and Pinouts

Operational parameters and outputs:

The **SFU-0300** covers all current important operational parameters and operating data.

Up to 6 digital outputs can be used for signalling and up to 2 analogue values can be output to the analogue outputs (0-10V) .

Remote Control and Outputs:

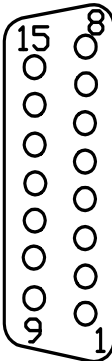
3 digital inputs (24V) and 1 analogue input (0-10V) are available for remote control of the **SFU-0300**.

These assignments can be freely configured. Using the optional Windows PC software **SFU-Terminal** the above assignments can be easily achieved, providing exceptional flexibility with each application .

Each operating parameter can be assigned as a signal and each control signal can be allocated the required I/O pin. In addition, the logic level (high or low active) can be individually defined. The same assignment is also possible for the analogue measured data and control data at the analogue I/O pin.

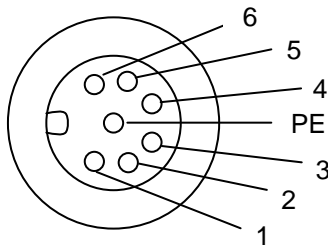
The standard allocations of operational parameters, their outputs, control signals and inputs, are listed in the following table.

7.1 Digital and Analog I/Os (D-Sub 15pin fem.)

		factory default function
	Pin 1 = Common Relay	
	Pin 2 = Relay 1 (normally closed)	"Set Value Rotational Speed Reached"
	Pin 3 = Relay 1 (normally open)	
	Pin 9 = Relay 2 (normally closed)	"Overload Spindle"
	Pin 10 = Relay 2 (normally open)	
	Pin 6 = not used	
	Pin 4 = Analogue Output,	Effektive Load Condition 1V = 10%
	Pin 11 = Analogue Input	Set Value Rotational Speed
	Pin 12 = Digital Input 1	Start/Stop
	Pin 8 = Ground	
	Pin 7 = Speed Sensor Output	
	Pin 5 = Digital Input 3	Direction of Rotation
	Pin 13 = RxD	(RS 232)
	Pin 14 = TxD	(RS 232)
	Pin 15 = Digital Input.2	Locking (Emergency Stop)

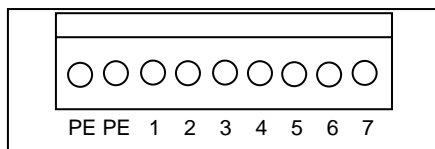
7.2 Spindle Connector:

7 pin circular connector Amphenol C16-1 / Binder 693



Pin 1 = U	Spindle Phase 1
Pin 2 = PTC	PTC-Signal (Spindle temperature)
Pin 3 = V	Spindle Phase 2
Pin 4 = NC	
Pin 5 = W	Spindle Phase 3
Pin 6 = SGND	Signal-Ground for PTC
Pin 7 = PE	Schutzerde

7.3 Spindle Connection with Screw and Plug Terminals used in Model SSE



PE	Protective Earth
PE	Protective Earth
1	U Spindle Phase 1
2	V Spindle Phase 2
3	W Spindle Phase 3
4	PTC-Signal (Spindle temperature)
5	Hall-Sensor-Signal (Spindle speed sensor)
6	SGND GND für FP- and PTC Signals
7	UH +15V for active hall sensor supply

7.4 Mains Connector

Desktop: 3 pol. Mains Jack
SSE: 3 pol. ScREW and Plug Terminals

8. Functions, Commissioning, Operation

3 operational possibilities:

- Control and configuration manually via front keys
- Automatic control and configuration via PLC / IPC
- Automatic control and configuration via PC (RS232 interface)

8.1 Front Panel (view LED Version A)

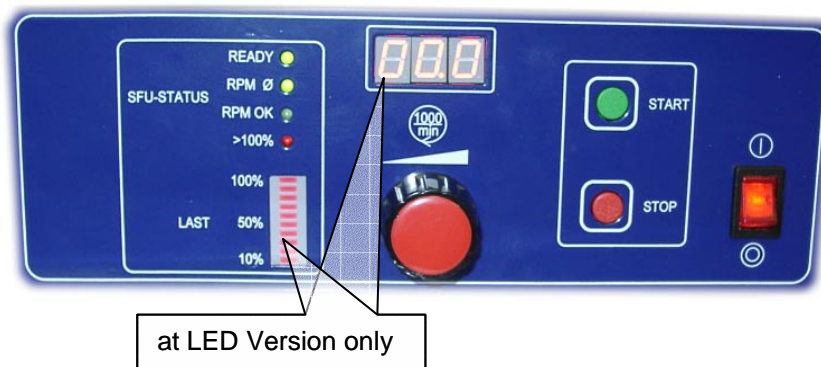


figure 2

With the **START** **STOP** -key the spindle is started and stopped. The rotational speed is adjusted with the radio knob. The actual rotational speed is displayed on a 3digit LED.

The Status LEDs **READY**, **RPM 0**, **RPM OK**, **>100%** give information on the actual spindle status: The red LED **>100%** indicates generally an error or as an indicator for an overload condition.

Additionally these states were signalized on the relay out outputs:

At overload relay 2 **Rotational Speed Reached** is deenergized and will be opened.

At an general error relay 3 **Ready** is deenergized and will be opened.

In case of need of more detailed information about an error, the errors can be evaluated with the help of the as option available windows software *SFU-Terminal*. The documentation of this software shows how evaluation of these errors is possible.



ATTENTION:

Where several spindles are in use within one system, the user must ensure that these are of the same type and that the correct spindle characteristic is used. Otherwise this could cause severe damages of one or more spindles, because the driving voltage may be different!

8.2 Configuration of the rotational speed

The preset of revolutions per minute of the spindle can be achieved by three ways:

- **Preset manually with the radio knob on the front panel**
- **Preset via analogue input** Set Value Rotational Speed
The default scaling for this input is set up to 1V/10.000rpm
- **Preset via RS232 interface**
refer to help in the menu bar of windows software *SFU-Terminal*.

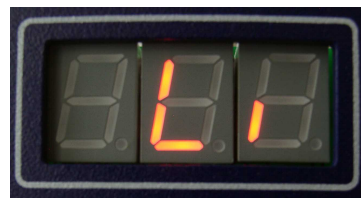
8.3 Configuration of the direction of rotation

The direction of rotation can be set up before start. For this the key **STOP** has to be pressed approx. 4sec. In the setup mode it can be switched with the **START STOP** -keys alternating between Right and Left. Right means clockwise rotation with view to the back side of the spindle and Left means counter clockwise respectively. This is stored within the converter, so that this selection is maintained even after power off.

It will be returned to the operating mode if the keys are not pressed for a while.



clockwise figure 4a



counter clockwise figure 4b

8.4 Selection of the Spindle Characteristics

For selecting an other characteristic the **STOP START** – key has to be pressed together for about 4 sec. In the selection mode, the next higher characteristic can be selected with the **START** – key and the next lower with the **STOP** – key.

Up to 16 different characteristics can be stored. In case of selecting a characteristic place where no data have been stored it will be displayed for example **E 03** "for missing characteristic No.3". The display stays in this state, unless a used place is selected. If a characteristic is available it will be the respective place number using **01** or **02** and so on.

It will be returned to the operating mode if the keys are not pressed for a while.

The configuration of the characteristic places can be carried out with the PC-software *SFUTerminal*.

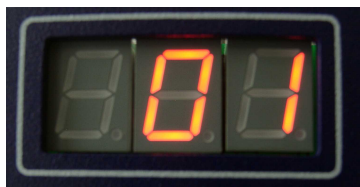


figure 5a



figure 5b



ATTENTION:

The operation of a spindle with a wrong characteristic may harm the spindle severely!

Please ensure to have the proper characteristic selected always!

8.5 Starting and Stopping the Frequency Converter

Due to many different requirements, there are several possibilities for starting and stopping the **SFU-0200** frequency converter.

- Manually with the panel keys
- controlled remotely via a digital input
- controlled remotely via an analogue input
- controlled remotely via serial interface

In every case, with the exception of analogue start, the start of the converter is only possible, if a preset of the rotational speed is set up.

- Manually via panel keys
Activation of spindle start via the green **START** key.
Spindle-stop is activated by the red **STOP** key on the operator panel.
- Remote control via digital input **Start/Stop** by external PLC or CNC
Digital Input 1 is the default. If necessary, this can be changed to another input with the help of *SFU-Terminal* software in the menu "Digital Inputs".

According to safety requirements all signals can be set up individually for ACTIVE-LO or ACTIVE-HI. In combination with a plc the configuration ACTIVE-LO is to be preferred, because in case of spindle cable defect or plc fault an automatic stop can be carried out.

- Remotely via the analogue input **Rotational Speed Duty** .
This is possible, if the start-function is assigned to an analogue input and valid signal at the digital input **Start/Stop** is present.
This setup can made with the *SFU-Terminal* software in the menu "Analogue Inputs":

In the according edit-field for the preset of **Rotational Speed Duty** a selection of the scaling can be selected (for example: 1V/10.000UpM or 0-10V min/max).

An input voltage of 0V makes the converter stop, and a voltage higher than 0V starts the converter to a rotational speed according to the scaling.

The above mentioned scaling makes the converter run 40.000rpm at 4V.

- Remotely via the RS232 serial interface from a PC or PLC
The rotational speed can be changed with commands via interface. (refer to help in the menu bar of windows software *SFU-Terminal* (as option).

If necessary, a documentation of the serial interface commands can be ordered at BMR-GmbH or the responsible representation.



Where one of the above options has been selected to operate the converter, only that pre-selected option can then be used to stop the converter!
Only one of the safety functions can override the operation

8.6 Remote-Controlled Configuration of Direction of Rotation via Digital Inputs

this can be achieved via the digital input **Direction of Rotation** . This setup can made with the *SFU-Terminal* software in the menu "Digital Inputs":

This is necessary, if the direction of rotation has to be controlled , for example, via a PLC.

Reversal can only take place once the spindle / motor has come to a complete stop. If the direction pre-selection setting is changed whilst the spindle / motor is running, the spindle / motor will not turn in the new direction until it has been brought to a complete standstill and then restarted.

8.7 Safety Functions

The following safety functions bring about controlled stopping of the machine, pre-defined by the deceleration times selected within the spindle characteristics,

- Safety stop by spindle overtemperature, if this function is activated and it's delay-time exceeded.
- Safety stop by converter overtemperature and delay-time exceeded
- Safety stop by overload and time delay exceeded
- Safety stop by exceeding the maximum admissible spindle current.
- Emergency stop via digital input locking

9. Calibration and Configuration using Windows-Software

The setup of this device can be done in a very flexible and comfortable way with the help of our Windows PC-Software software **SFU-Terminal**. It is available on CD or on our website www.bmr-gmbh.de/html/british/dokumente/bediensoftware.htm for free. It is possible to administrate spindle characteristics or to configure the functions of inputs and outputs. Moreover there are further functions and useful tools available

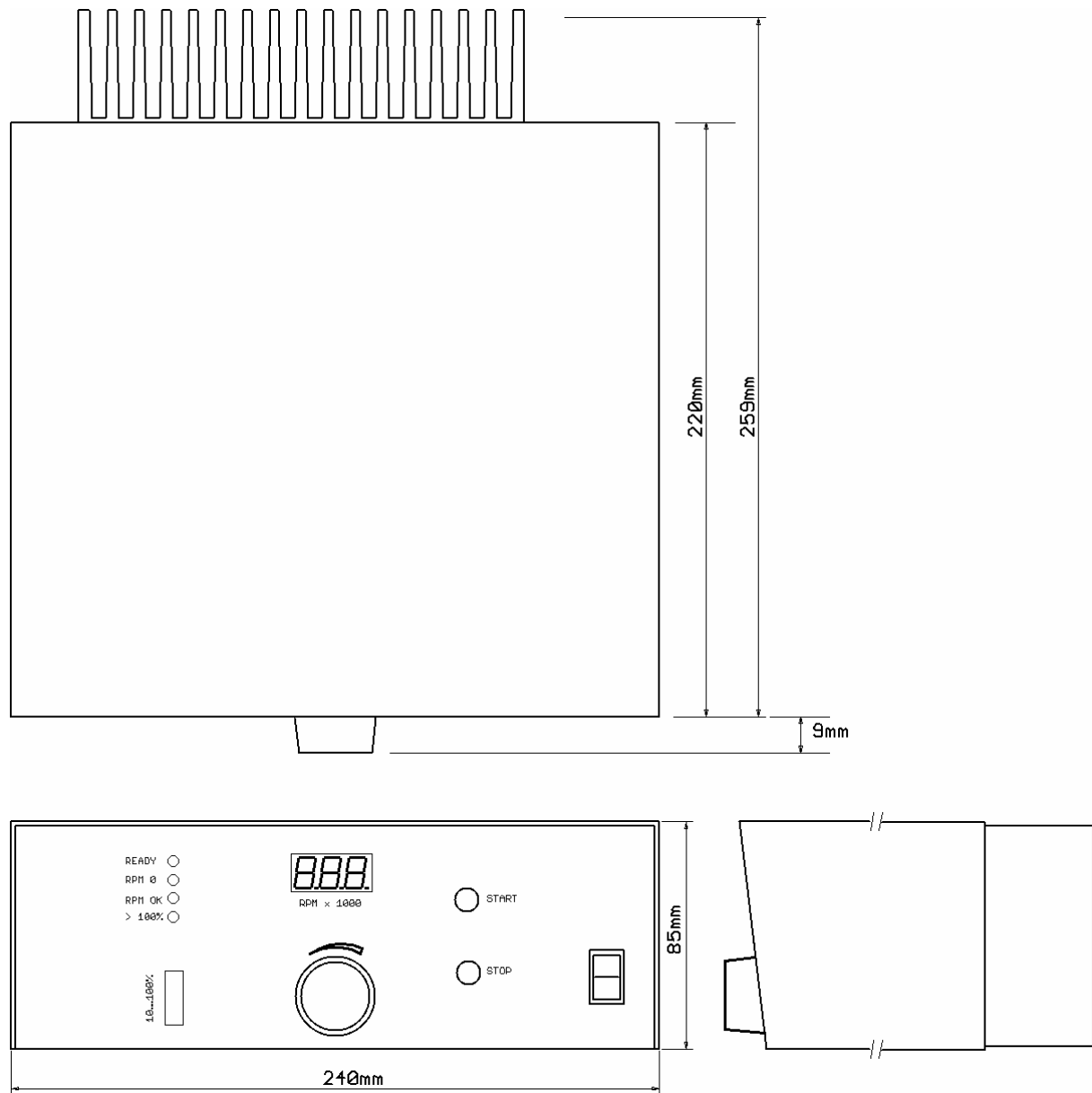
10. EMC

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:

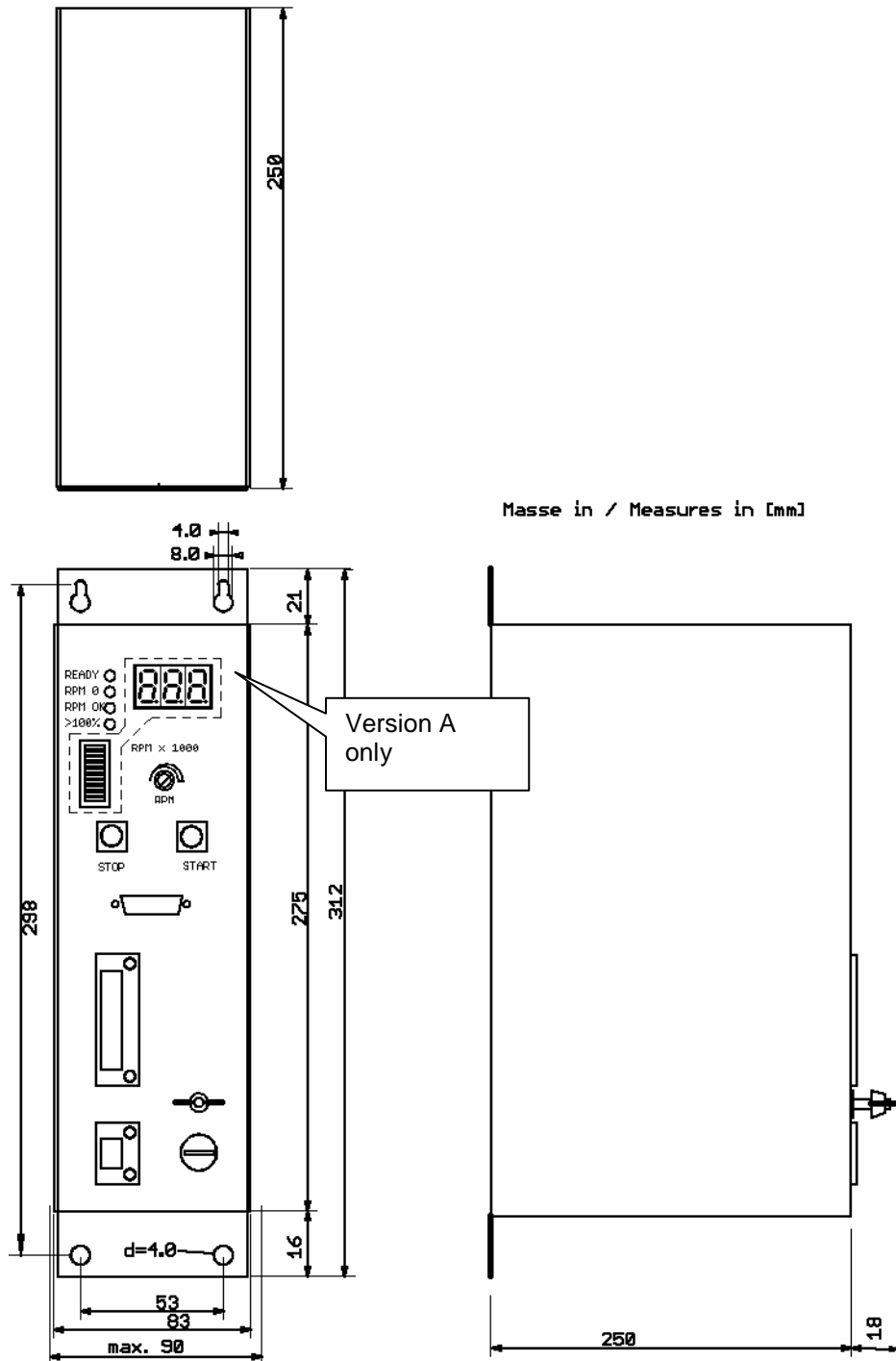
- The EMC of a machine or device is affected by all connected components (motor spindle, length and type of cables, wiring, etc.). Under certain conditions the use of additional filters can be necessary to maintain the current laws.
- The earth and shield connections of all those devices used in conjunction 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.
- For mechanical installation, use serrated lock washers to guarantee good electrical contact with the housing.
- All connections both to and from the frequency converter should be via shielded cable.
- The shield must be completely connected to PE (protective earth).
- 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.

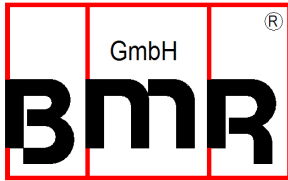
11. Views and Dimensions

11.1 SFU 0300 in desktop housing with LED-Display



11.2 SFU 0300 in SSE Housing





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