Frequency Converter SFU-0302-SSE

Contents

1. 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 U/s * 60 = 3000 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 **SFU-0302** -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.

2. Description and Features

- Operation of **a.c. and d.c.** motors/spindles

- The frequency converter SFU-0302 allows **speed frequencies** up to **180,000Upm** with 2-pole a.c. motors and **60,000Upm** with d.c. motors.

- **High output power (3,6kVA@230V / 2kVA@115V)** from a **compact design**

- The Kernel of the SFU-0302 **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.

- **Highly-accurate sinusoidal** output signals with low harmonic distortion, facilitate the smooth running of a.c. and d.c. motors/spindles under all operational conditions.

- The **highest efficiency** of motors at **both low and high frequencies** is made possible.

- 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.

- **Integrated braking resistor** for reduced external wiring.

- **Transparency**: The user is continuously informed of the status of the frequency converter and the motor / spindle by means of a 4-column plain-text display on the front panel.

- **Control:** The frequency converter can be manually controlled and calibrated as required using 6 keys on the front panel.

- **Individual adaptation** to the application in hand and the spindle in use. Up to 16 different spindle characteristics can be created and stored in the memory of the frequency converter, or existing characteristics can be modified and adapted to the application.

- **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: 2 analogue, 6 digital
  Control outputs: 2 analogue, 6 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

- **Automatic spindle detection**, if supported by the spindle

3. Block Diagram

3. Block Diagram
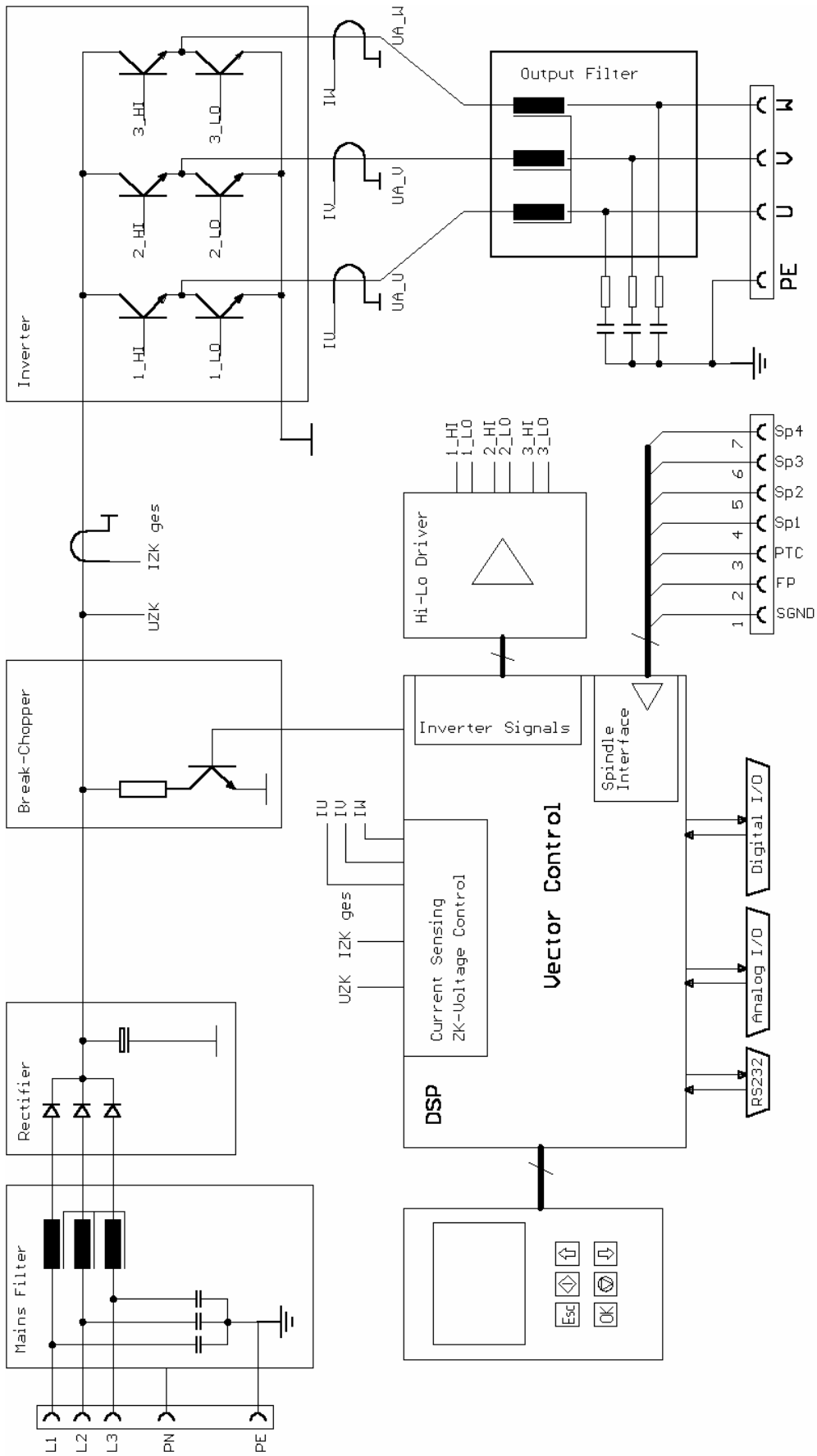
4. Technical Data

Supply connection	115V, 60Hz, 1PH	230V, 50Hz, 1PH
Output power	Max 2 kVA	Max 3,6 kVA
Motor connection	7-pole: U, V, W, PE, 2*PTC, SGND Type: Amphenol C16-1 (fem. 6+PE) / Binder 693 (fem. 6+PE) 8-pole: U, V, W, 2*PE, PTC, FP, SGND screw terminals 4mm^2	
Output voltage	3* 115V	3* 230V
Output current	Electronically limited	
Over-current	max. 10s	
Output frequency	AC: 3kHz / 180.000 rpm DC: 60.000 rpm	
Spindle characteristics	max 16, stored internally, freely definable	
Spindle sensor inputs	PTC, magneto-resistor, logic (D-Sub 15-pin fem.)	
Control inputs	2 analogue: 0-10V, galvanically separated : (D-Sub 25-pin fem.)	
Control inputs	6 digital: 0-24V, galvanically separated: (D-Sub 25-pin fem.)	
Control outputs	2 analogue: 0-10V, galvanically separated (D-Sub 25-pin fem.)	
Control outputs	6 digital: relay outputs, (D-Sub 25-pin fem.) 24VDC/1000mA, 125VAC/500mA	
Interface	RS232 galvanically separated, 9600Bd (D-Sub 9-pin male)	
Housing dimensions	width 130mm, height: 320mm (with mounting straps: 380mm), depth: 262mm	
Weight	7 kg	
Protection	IP20	
Operating conditions	max. ambient temperature 40°C, no humidity	

⚠ **CAUTION: To avoid severe motor / spindle damage, select correct
                motor / spindle characteristic !**

5. 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 id 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 personal 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.

6. Connections, Interfaces and Pinouts

Operational parameters and outputs:
The **SFU-0302** 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:
6 digital inputs (24V) and 2 analogue inputs (0-10V) are available for remote control of the **SFU-0302**.

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.

6.1 Digital and Analog I/Os (D-Sub 25pin fem.)

| Pin	Description	Direction	Function / User Message
1	Relay Common		
14	Relay Common		
2	Relay 1	Output	
15	Relay 2	Output	
3	Relay 3	Output	
16	Relay 4	Output	
4	Relay 5	Output	
17	Relay 6	Output	
5	Relay 1 NO contact	Output	
18	+24V/50mA	Output	auxiliary power supply
6	+24V/50mA	Output	auxiliary power supply
19	GND		
7	GND		
20	Relay 2 NO contact	Output	
8	Hall Sensor	Output	RPM-Signal from DSP
21	Digital In 6	Input	
9	Digital In 5	Input	
22	Digital In 4	Input	
10	Digital In 3	Input	
23	Digital In 2	Input	
11	Digital In 1	Input	
24	Analogue In 1	Input	
12	Analogue In 2	Input	
25	Analogue Out 1	Output	
13	Analogue Out 2	Output	

- The digital outputs (relays 1...6) are galvanically separated contacts ($500V_{Isolation}$).
  D.C.: 24V / 1000mA   A.C.: 125V / 500mA

- Digital input switching level: "0" 0...7V   "1" 18...24V

- The digital inputs require a high level of 24 V for correct function (PLC standard level).

- Hall sensor output level: 0-24V (24V level.)

- Analogue input voltage range: 0...10V

- The +24V output can be used as a power supply for this type of electronic spindle interface.

6.2 Spindle Interface for Control Signals (D-Sub 15pin fem.)

Pin	Name	Direction	Function
1	NC		
9	+5V/50mA	Output	for auxiliary power supply
2	GND		
10	GND		
3	Bit 0	Input	automatic spindle detection
11	Bit 0	Input	automatic spindle detection
4	Bit 1	Input	automatic spindle detection
12	Bit 1	Input	automatic spindle detection
5	Bit 2	Input	automatic spindle detection
13	Bit 2	Input	automatic spindle detection
6	Bit 3	Input	automatic spindle detection
14	Bit 3	Input	automatic spindle detection
7	PTC	Input	Temperature Signal from Spindle
15	PTC	Input	Temperature Signal from Spindle
8	Hall sensor	Input	RPM-Signal from Spindle to DSP

- The spindle interface is completely isolated by optocouplers. It can be used for automatic spindle detection, if enabled.. To set a high level to one bit, a simple connection to the spindle GND is made. An open contact equals low level. The direction of high/low active can be changed in the form '**digital inputs**'.

- The PTC input detects over-temperature of the spindle. A high resistor value at this pin of >600 Ohms causes the switching of digital output overtemp spindle and safety cut-out following the programmed delay .

- The Hall sensor input operates from input signal levels of +/- 1V within the common mode range of 0..10V.

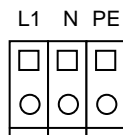- The 5V output can be used as a power suppl.

6.3 Spindle connection at screw terminals

-	-	1	2	3	4	5	6

PE PE U V W PTC FP SGND
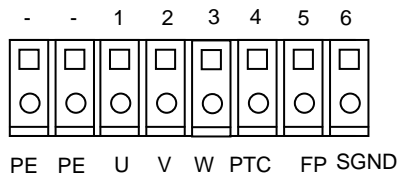
PE	Earth Protection GND
PE	Earth Protection GND
U	Spindle Phase 1
V	Spindle Phase 2
W	Spindle Phase 3
SGND	Signal-GND for FP- and PTC-Signals
FP	Hall-Sensor-Signal (Spindle speed)
PTC	PTC-Signal (Spindle Temperature)

6.4 Mains

L1 N PE

L1	Mains L1
N	Neutral N
PE	Earth Protection GND

> **Control cables, supply cables and motor cables must be isolated from each other. Shielded cables are to be preferred !**

6.3 RS232 (D-Sub 9pin male)

Pin	Description	Function
2	RxD	receive-data (data to converter)
3	TxD	send-data (data from converter)
5	GND	Ground

use a standard zero-modem-cable for connection to PC
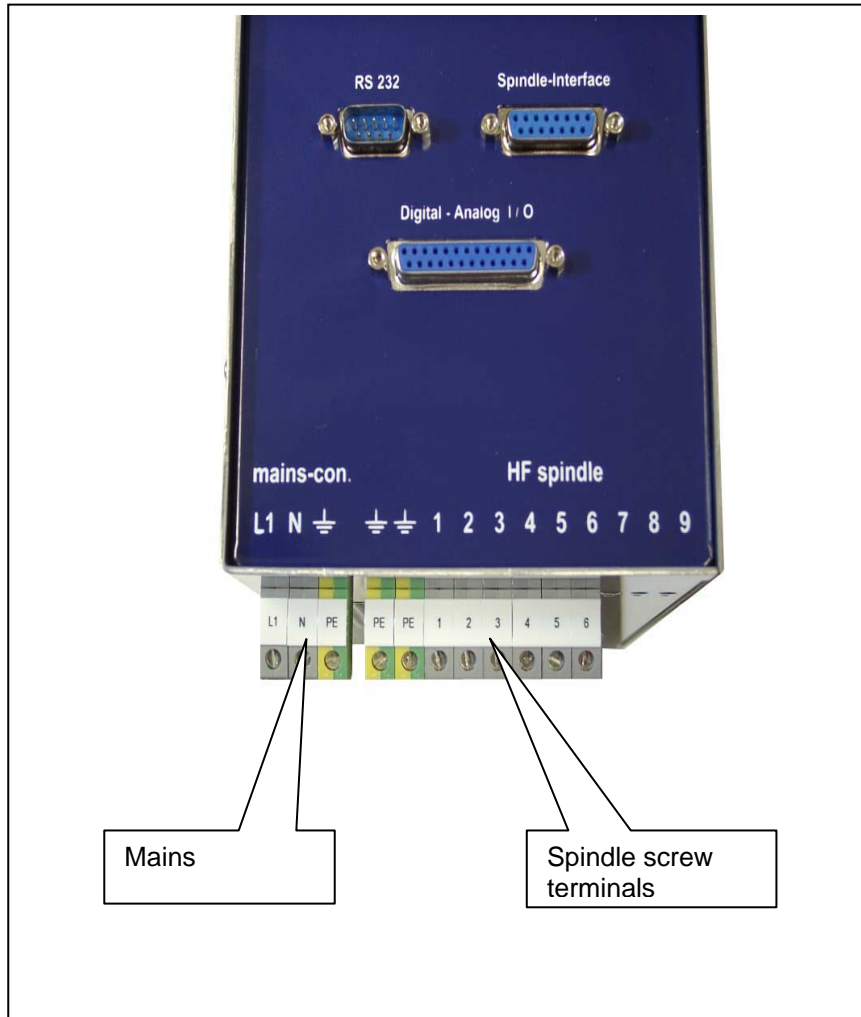
6.5 Screw Terminals

figure 1

7. 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)
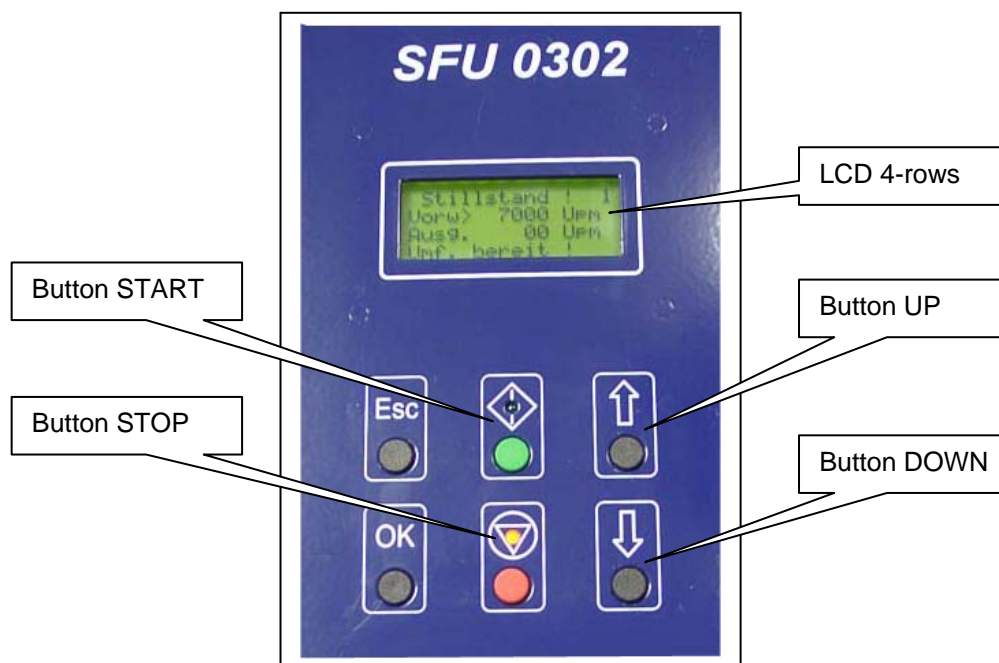
7.1 Front Panel

figure 2

The front keys allow access to following functions:

- Start / Stop manually
- RPM-control via UP / DOWN keys
- Spindle characteristic selection

7.2 LCD-Display

All system data and parameter such as RPM, load or errors will be displayed on the LCD-display.
The actual load output is displayed by bargraph and absolute in % in the bottom line of the display.
The pre-selected duty RPM and spindle characteristic and the actual RPM of the spindle is displayed

converter is running spindle characteristic 3
converter is in Stop State > spindle standstill

```
 S t o p  s t a t e  !      3
 F o r w >  2 5 0 0 0   R p m
 O u t p .   2 5 0 0 0   R p m
 C o n v   r e a d y   !
```

converter is accelerating
power output 67%

```
                             3
 F o r w >  2 5 0 0 0   R p m
 O u t p .    7 8 3 0   R p m
 ● ● ● ● ● ● ● _
```

converter is accelerating
power output 34%

```
                             3
 F o r w >  2 5 0 0 0   R p m
 O u t p .   1 9 2 4 0   R p m
 ● ● ● ● _ _ _ _ _ _ _ _ _
```

spindle is rotating at duty RPM
power output 20%

```
 d u t y R P M r e a c h e d  3
 F o r w >  2 5 0 0 0   R p m
 O u t p .   2 5 0 0 0   R p m
 ● ● _ _ _ _ _ _ _ _ _ 2 0
```

Errors are displayed in the top line by text.

```
  O v e r l o a d          3
 F o r w >  2 5 0 0 0   R p m
 O u t p .   2 5 0 0 0   R p m
 c o n v .  n o t  r e a d y  !
```

If an error is detected, this is indicated by the message   c o n v . n o t r e a d y !
and with an error-message in the first line.
list of possible error-messages

• Error overload	O v e r l o a d S t o p
• Error overload of converter	O v e r t e m p e r a t u r e !
• Error overtemperture of the spindle	O v e r t e m p S p i n d l e
• Error overtemperature of converter and spindle	O v e r t e m p c n v + s p !
• Error overvoltage	O v e r v o l t a g e s t o p
• Error undervoltage	U n d e r v o l t . o u t
• Error undervoltage Stop	U n d e r v o l t . s t o p !
• Error powerstage disabled	P W R s t a . d i s a b l e d
• Error shutdown enabled	S t o p s t a t e !
• Error no spindle or spindle-line break	n o S p i n d l e - c a b l e ?
• Error timeout ser. interface	R S 2 3 2 E r r o r !
• Error spindle characteristic not valid	D a t a E r r o r : !
• Error encoder/hall sensor	E n c o d e r e r r o r : !

7.3 Configuration via the Front Keys

Menu settings can only be adjusted when the device has come to a complete standstill.
By simultaneously pressing the keys **STOP** and **OK**, the Menu **Spindle Characteristic Setting** will appear**:**

Select the number of the spindle characteristic using the **UP** and **DOWN** keys.
Accept and activate desired characteristic by pressing **OK.**
The display will indicate whether the spindle characteristic is valid or not (check sum...., data)
Exit with **ESC** without selection

Spindle Characteristic :
- Standard: A number of spindle characteristics are already implemented. Existing characteristics can be loaded and displayed using the PC software *"SFU-Terminal"*.
- Variants for HPT motors: all spindle characteristics for HPT-Motors are implemented ex-works.

⚠ **CAUTION: To avoid severe motor / spindle damage, select correct motor / spindle characteristic !**

⚠ **Where several spindles are in use within one system, the user must ensure use of the correct spindle characteristic number to prevent spindle damage (different spindle types may have different line voltages !)**

The LCD shows all relevant system messages for speed, load or errors.
In the event of an error, the error type is displayed in plain text.

7.4 RPM configuration
(all references to menues relate to setup software SFU-Terminal)

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

- **Preset manually via panel keys**
  In form 'Analogue Inputs'option button **0V** has to be enabled in the line of duty RPM . (no analogue input is assigned to this function)
  The duty RPM is displayed on the LCD and can be changed with **UP** / **DOWN** (holding a key down increases the count rate). RPM can be changed during operation

- **Preset via analogue input** duty RPM
  In menue 'Analogue Inputs' option button **0V** has to be disabled and the function duty RPM . has to be assigned to an analogue input. Additionally a scaling has to be selected from the list box duty RPM (e.g.: 1V/10.000RPM)
  The value of the duty RPM is displayed on the LCD according to the scaling and the voltage at the input. A voltage of 0V leads to a standstill and a voltage higher than 0V leads to a startup upto the desired revolution. An input voltage of 4V and a scaling as above mentioned lead to a revolution of 40.000RPM.

  The settings must be downloaded into the converter with the button write data.

7.5 Starting and Stopping the Frequency Converter
(all references to menues relate to setup software SFU-Terminal)

There are different methods of starting and stopping **SFU-0302** frequency converters, due to many different requirements, as follows below:

- manually via panel keys
- Remote control via digital input
- Remote control via analogue input
- Remote control via serial interface

Before starting the converter is possible, a preset of the RPM (> 7.4) has to be done. This is necessary for all options of starting with the exception of analogue starting.

- 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. To change this, click on themenue '**digital inputs**' .The correct spindle characteristic can be preset here also.

  Depending on your safety regulations, you can program this individually and set high or low active signals. In general, when using SPS control, it is best to set safety cut-outs at low-active, so that the machine will stop should a cable or connector defect occurs.

- Remotely via the analogue input
  Analogue starting will be enabled where at least one of the analogue inputs in the menue '**analogue inputs**' is selected and a valid signal at the digital input Start/Stop is present. Additionally a scaling has to be selected from list-box duty RPM of analogue value to RPM.

- Remotely via the RS232 serial interface from a PC or PLC .
  The speed pre-selected from the panel is taken as the required speed in this instance. Speed can be altered via commands from the RS232 interface.

  The RS232 interface offers complete control of the **SFU-0302** converter via the optional full-version Windows platform. The level of control this provides is almost at machine-level, so that this option is more appropriate for error evaluation and special control features via PC. If you need to control the **SFU-0302** remotely, please contact BMR or your local distributor for assistance and the RS232 command-set.

> 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.

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

Via digital input RPM direction . Setup is carried out in menue '**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.

7.7 Safety stop functions

As shown above, all these safety and start-up features are programmable and a digital input pin or logical behaviour of this pin (high-, low-active) can be selected.

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 In form 'Spindle' this function can be enabled with the check button Temp. sense and in form '**delays**' the delay time can be specified.

- Safety stop by converter over-temperature and delay-time exceeded, specified in the form '**delays**' (accessed by delays button)

- Safety stop by overload and time delay exceeded (determined by maximum current and voltage in the spindle diagram and the form '**delays**', accessed by delays button)

- Immediate safety stop by over-current of the converter.

- Safety stop by emergency stop through digital input shutdown in form '**digital inputs**'

The following stopping methods shut off the power stage and the spindle will slow down only though its own load. This process can take up to ten minutes until the spindle has fully stopped:

- Safety stop via short-circuit protection on digital input PDP Interrupt determined by internal converter current limit.

- Safety stop by digital input PWR stage off in the form '**digital inputs**'.

After an error flag has occurred, it must be cleared by a Start/Stop sequence or a digital error reset with a digital input (in form '**digital inputs**' Error reset). 4 seconds after error reset, the device is ready for operation again.

8. Connection to Profibus

As option for communication with CNC a Profibus DP Interface is available. The physical connection is realized by a standard RS485 Interface. With the help of a USB-RS485 converter (e.g. from Meilhouse) communication to SFU-Terminal software(see 9.) is possible as usual. After having installed a specific windows hardware driver for USB-RS485 converter on the PC which emulates a virtual com port, SFU-Terminal Software V2.0 and higher will detect RS485 and establish communication automatically.

The relevant files plus command interpreter for integration for example into Siemens S7, are available under Support/Download/BMR-GSD.

The setup of address of station is carried out either Online with the help of SFU-Terminal and the listbox Profibus Address, or Offline: Pressing Start and Stop key simultaneously during PowerOn will show a selection menu. The address can be changed in the range of 0..126 with the Up-Down keys. Storing and returning to operating mode with ESC-key

Special Features of Profibus Version:

For controlling is carried out completely digitally, some features are eliminated. Analogue input function for rotational speed and the output of analogue values aren't available no longer. Analogue input and output can be done via Profibus. With the help of a pointer any value can be addressed. Please see the documentation of command interpreter Profibus in folder BMR-GSD.

9. Configuration with Windows-Software

The software "**SFU-Terminal**" is an optional tool used to configure all frequency converters 0102...0601 and also provides the possibility of user-friendly data display and calibration, implemented as follows:
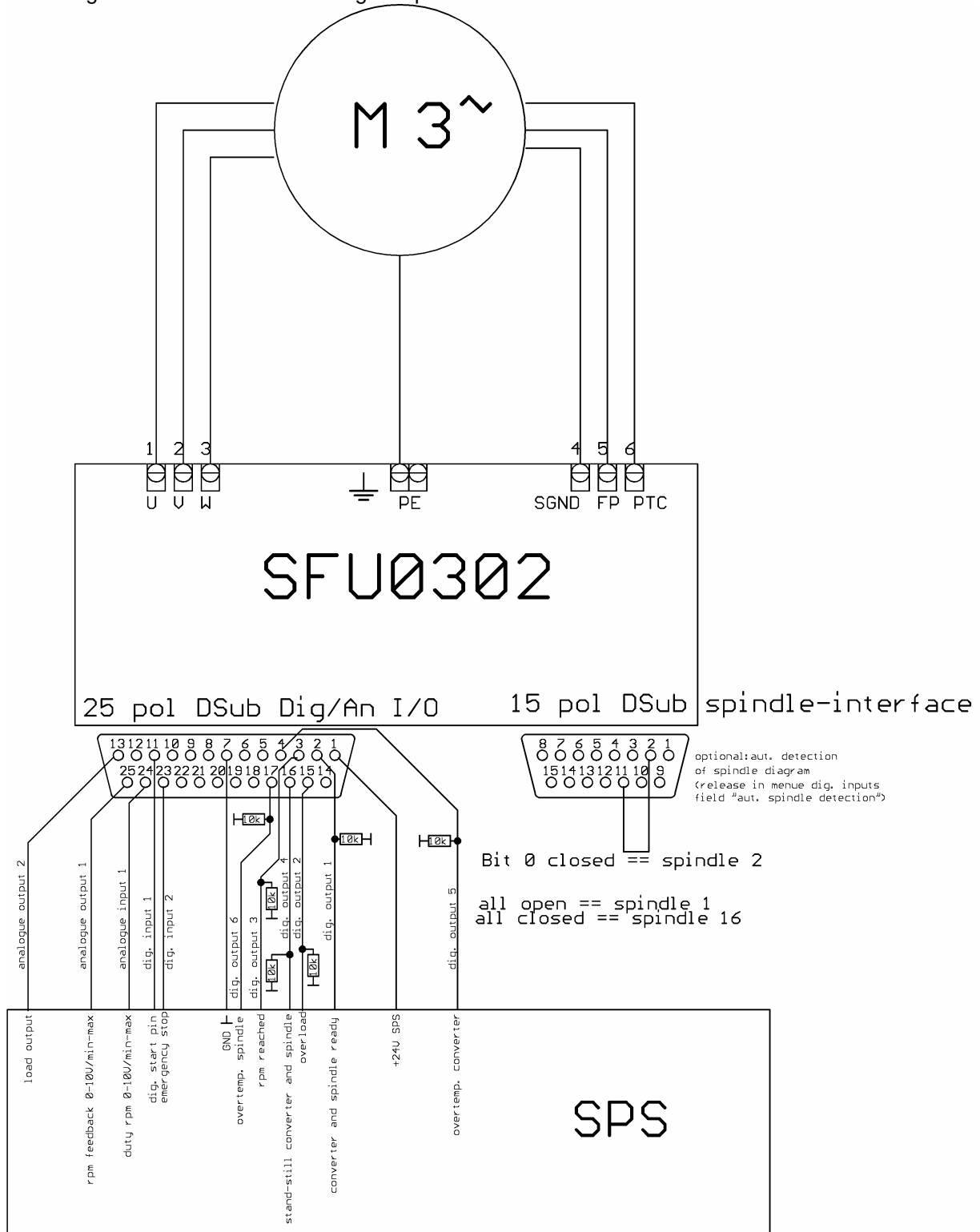
1. Start-up frequency converter and connect via RS232 interface.

2. Start-up program *SFUTerminal.exe*
   The interface is then configured automatically. A connected frequency converter is detected and all data transfer parameters are synchronised.
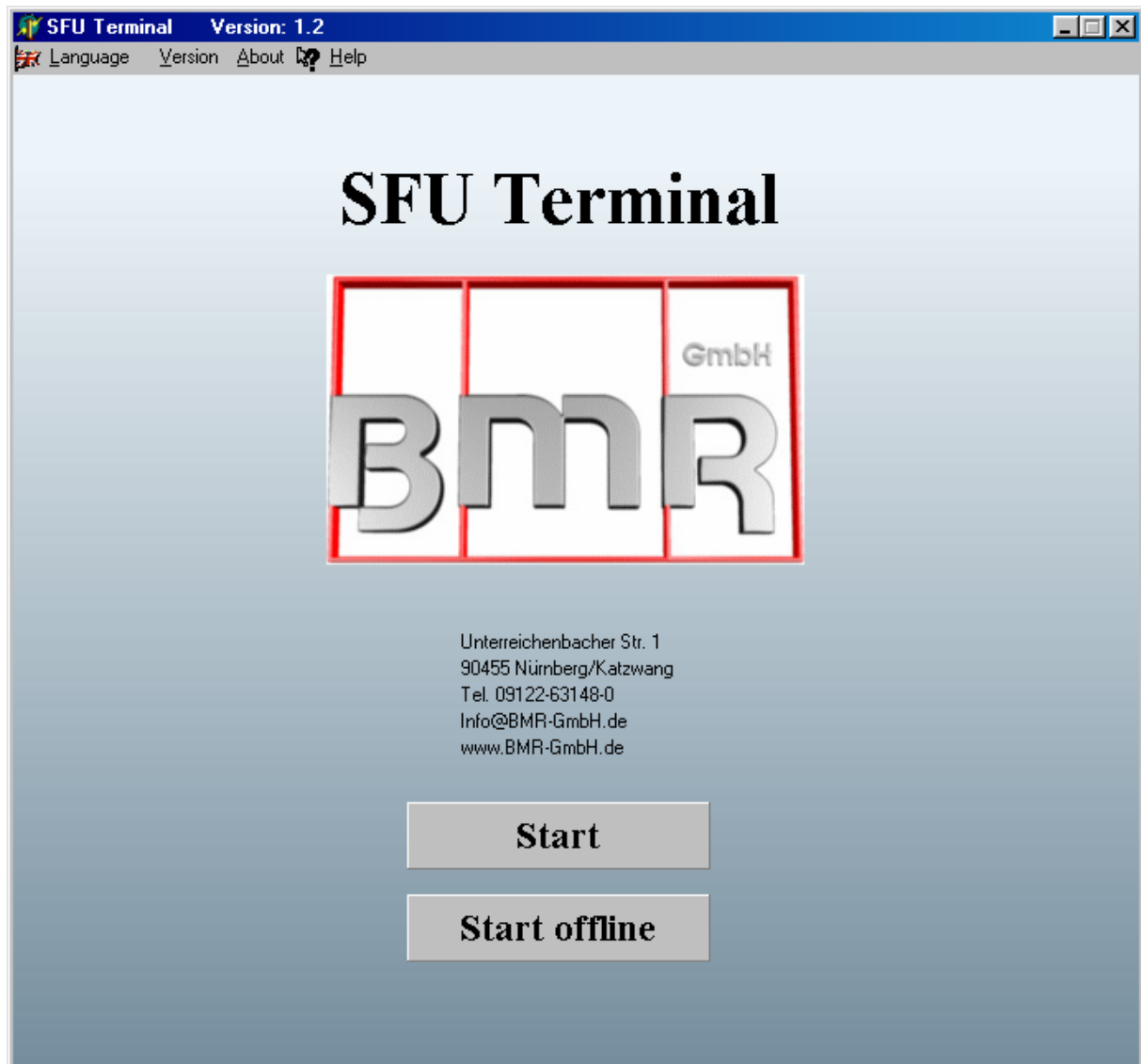
The description can be found in the help menu and manual of "SFU-Terminal".

10. Connection examples

91 Configuration with SPS and analogue Input

M 3~

SFU0302

1 2 3   4 5 6
U V W   PE   SGND FP PTC

25 pol DSub Dig/An I/O   15 pol DSub spindle-interface

13 12 11 10 9 8 7 6 5 4 3 2 1
25 24 23 22 21 20 19 18 17 16 15 14

8 7 6 5 4 3 2 1
15 14 13 12 11 10 9

optional: aut. detection
of spindle diagram
(release in menue dig. inputs
field "aut. spindle detection")

10k

10k

10k

10k

10k

10k

Bit 0 closed == spindle 2

all open == spindle 1
all closed == spindle 16

analogue output 2

analogue output 1

analogue input 1

dig. input 1

dig. input 2

dig. output 6

dig. output 3

dig. output 4

dig. output 2

dig. output 1

dig. output 5

load output

rpm feedback 0-10V/min-max

duty rpm 0-10V/min-max

dig. start pin
emergency stop

GND
overtemp. spindle

rpm reached

stand-still converter and spindle

overload

converter and spindle ready

+24V SPS

overtemp. converter

SPS

Starting behaviour with released analogue input:
The motor will start, when dig start is high and the input voltage of the duty rpm is higher than the min rpm (given in the field „min rpm" in the according spindle diagram). It will stop, when either the dig. start pin wents low or the voltage at the analogue pin is lower than the given

min. rpm. Eg. When 10V are applied at the analogue input 1 and the dig. start is high, the motor will start and accelerate up to ist max rpm.

11. Errors. Trouble-Shooting

Error Description	Cause	Fixing
After power on the converter indicates **Not Ready** and **Error**	Input "Emergency Stop" is not properly or not wired at all.	+24V Signal at this input
	The converter is at excess temperature	> Let the converter cool down > Check, if the fan is working properly or maintain that air flow around the heatsink is sufficient > Slow down the tooling process
	Pulse inhibitor circuit is engaged, at devices with such a circuit (SFU0303)	> For disengaging wire +24V to the appropriate Pin > Wire a bridge between X2.1 - X2.10 (SFU0303)
	A spindle diagram which is not valid is selected	Change spindle characteristic with the help of the front panel keys or with *SFU-Terminal*
	Short circuit detection of the out put has tripped	> Check, if the spindle is blocked > Check, if there is a short circuit within the spindle > Check, if there is a Ground fault (at least one prong of the spindle cable is connected with PE) > Check, if there is a short circuit within the spindle cable
Error Description	**Cause**	**Fixing**
After power on the converter indicates **Not Ready** and **Error** and the evaluation of the temperature sensor is activated in the spindle characteristic	No spindle connected	Connect spindle
	No temperature sensor present within the spindle	Disable in spindle characteristic menu in *SFU-Terminal* the Temperature Sensor button
	Temperature sensor of the spindle defective	> Change spindle > Disable in spindle characteristic menu in *SFU-Terminal* the Temperature Sensor button

Error Description	Cause	Fixing
In case of connecting the converter with a PC or after launching the SW *SFU-Terminal* the **Converter is not detected and not recognized**	Incorrect connection cable or wiring fault	> Check cable for proper Pinout. > Verify at USB cables that it's length is not longer than 2m > Try to use original BMR cables, only.
	In case of using RS232	> Use the USB-Interface at the PC together with a USB-RS232 converter. > For use with SFU 0303 a specific RS232 cable is required
	In case of using a USB-RS232 converter the USB-driver is not installed correctly.	install driver
	unsure	Restart *SFU-Terminal*
Start with push **buttons** not possible	Start button deactivated	Enable Start button by un-checking the checkbox "Block Start Button"
Spindle does not start, in spite of a valid signal for Start	An input is assigned with the function **Emergency Stop** and configured as "Low Active". > This is default state on delivery	> For unlocking, a signal of "HI" / +24V is required at this input > Deactivate this function or setup as "High Active"
	The evaluation of the temperature sensor is activated in the spindle characteristic, but it is not connected or a sensor isn't implemented within the spindle -> in this case **Error** is indicated, additionally	> Connect the temp sensor wires with the SFU . > un-check the button "Temp Sensor" in the spindle characteristic in *SFU-Terminal*
	The spindle test is engaged	> Check cable and connections for proper wiring or short circuit > Check spindle

| Error Description	Cause	Fixing
Spindle does not start, in spite of a valid signal for Start	Spindle cable and spindle are OK, and the spindle test is activated > Spindle cable is too long With activated spindle test, a test current is send via spindle cable to the spindle by applying a voltage at output lines. In case that this current is too low, or a wrong spindle characteristic selected, it does not match to the reference values and the spindle test fails.	> Select correct spindle characteristic > In the spindle characteristic the value of the start voltage has to be increased. -> contact BMR
The error message **Spindle not ready** is indicated.	Spindle is at excess temperature	Let it cool down > Check, if the characteristic matches with the spindle
	PTC in the spindle is defective	change spindle
	The PTC-wires within the spindle cable are defective	exchange cable or fix the connection
Start via Digital Input is not possible	Start via Analogue input is activated.	Deactivate Start via analogue input. -> Manual: "Analogue Inputs" and activate Digital Start
	Set value for duty speed is too low	Increase Analogue value for duty value. > A spindle start is carried out after reaching the required minimum voltage according to the scaling, only
It is displayed **Error Char xx** or **E xx**	The selected spindle characteristic at memory place xx is wrong, invalid or corrupted.	> Select matching characteristic with the help of the buttons at the front panel or with *SFU-Terminal* > Contact BMR

Error Description	Cause	Fixing
With activated speed sensor: The spindle runs properly, but sometimes there appears the message **Encoder Error**.	Loose connection in spindle, spindle cable or at the connectors	> Check spindle cable and exchange potentially > Check connectors
	Disturbances on the signal or the signal amplitude is too low > sensor wires in spindle cable are not shielded	> Exchange spindle cable > for verification test exchange spindle
Error **Without Spindle, Cable** is displayed	Spindle cable is defective	> Check the 3 spindle phase wires
	Spindle cable too long With activated spindle test, a test current is send via spindle cable to the spindle by applying a voltage at output lines. In case that this current is too low, or a wrong spindle characteristic selected, it does not match to the reference values and the spindle test fails.	> Check, if the proper characteristic is selected. > Increase value for start voltage in the spindle characteristic -> contact BMR > Deactivate function "Spindle test"

12. 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.

13. Mechanics, Views + Dimensions

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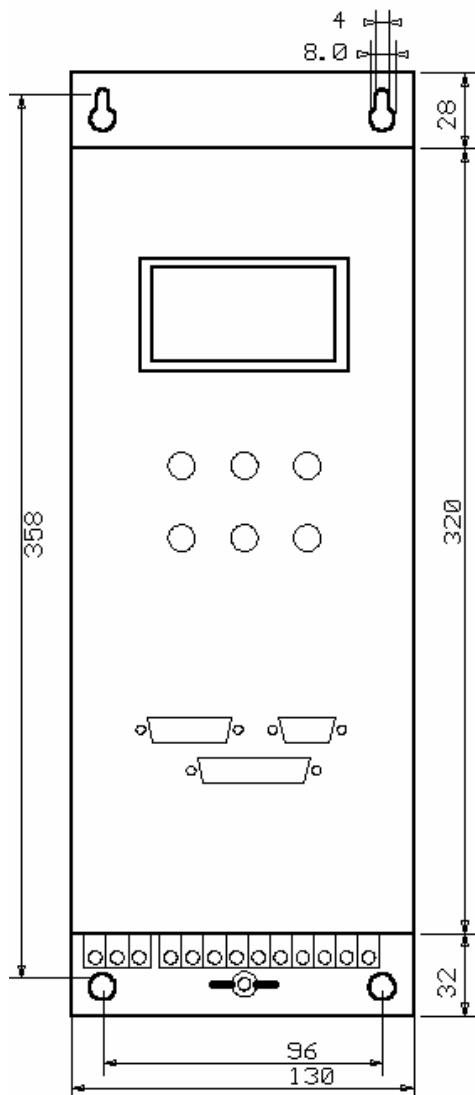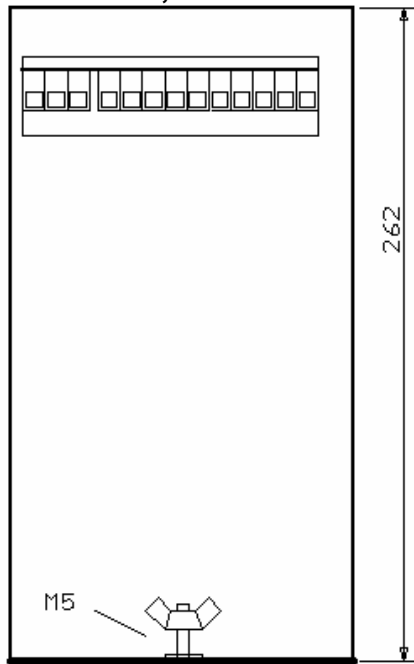
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Walpersdorfer Straße 38
D 91126 Schwabach
Germany
Tel.:   +49 (0)9122 63148-0
Fax.:   +49 (0)9122 63148-29
e-mail: Info@bmr-gmbh.de
Internet: www.bmr-gmbh.de

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