Frequency Converter SFU 0156

Quality

Made in Germany

We thank you for choosing a BMR-Product !
This product was carefully developed and manufactured in Germany at BMR-GmbH

⇨ **Please read this manual carefully before first operation!**

Content

1. Description and Features

- Operation of **AC spindles** and **BLDC spindles**
- The frequency converter **SFU 0156** allows **speed frequencies** up to **100.000Upm** with 2-pole spindles.
- The core of SFU-0156 is a **digital signal processor** (DSP) which produces all output parameters and collects signals.
- **High-precision sinusoidal** output signals with a low distortion factor and low deformation allow for optimal rotation qualities in AC motors of all operating conditions
- All parameters like power, voltage and frequency are collected in **real time** and are regulated by the implemented vector control depending on the load.
- High **operating safety:** All operating conditions like acceleration, operation with nominal rotation speed, braking are controlled and critical conditions are intercepted.
- **Short circuit protected**
- **on board chopper resistor**
- **Protection against excess temperature.**

2. Technical Data

Power Supply SL4	Logic Supply: 24V / 0,25A DC (max. 30V) Spindle Supply: max. 80V / 6A DC pluggable screw terminals 4mm^2
Fuses	FS1:T250mA recommended Littelfuse 0477.500XP FS2:T6,3A recomm. Littelfuse 0477 06.3XP / SIBA 179200 6.3
Power	400VA
Spindle Connection SL3	4-pin: U, V, W, PE pluggable screw terminals 4mm^2
Output Voltage	depending on the spindle characteristic: max. 3 x 60V
Output Current	electronically limited and matched to the corresponding spindle
Output Frequency	AC: 1.667Hz / max 100.000 rpm
Control Inputs SL2	Pin1 / **DI -** digital in: Start / Stop (0 / 24V) "0": 0..7V, "1": 18..24V Pin3 / **AI -** analogue in: Set Value Rotational Speed (0..10V)
Control Outputs SL2	Pin9 / **DO1** - digital out: free configuration: open collector 45V/0,5A Pin7 / DO2 - digital out: free configuration: open collector 45V/0,5A Pin10 / DO3 – digital out: free configuration: open collector 45V/0,5A PIN6 / AO - analogue out: Output Load (0..10V)
Operating Status Indicators	Converter Ready: LED green Converter Overload: LED red
Interface SL5	- RS232: 115.200Bd, 8Data 1Stop Bit, No Parity - USB Interface (USB-Mini)
Dimensions	Approx..132 x 111 x 43 L x B x H (mm) open frame style
Chopper Resistor	47Ohms / 10W
Operating Conditions	10°C bis 40°C / Rel. Humidity max. 80% - Maximum Surrounding Temperature: 40°C. - The inverter shall be installed in a pollution degree 2 environment.

3. Safety-Precautions and Warnings

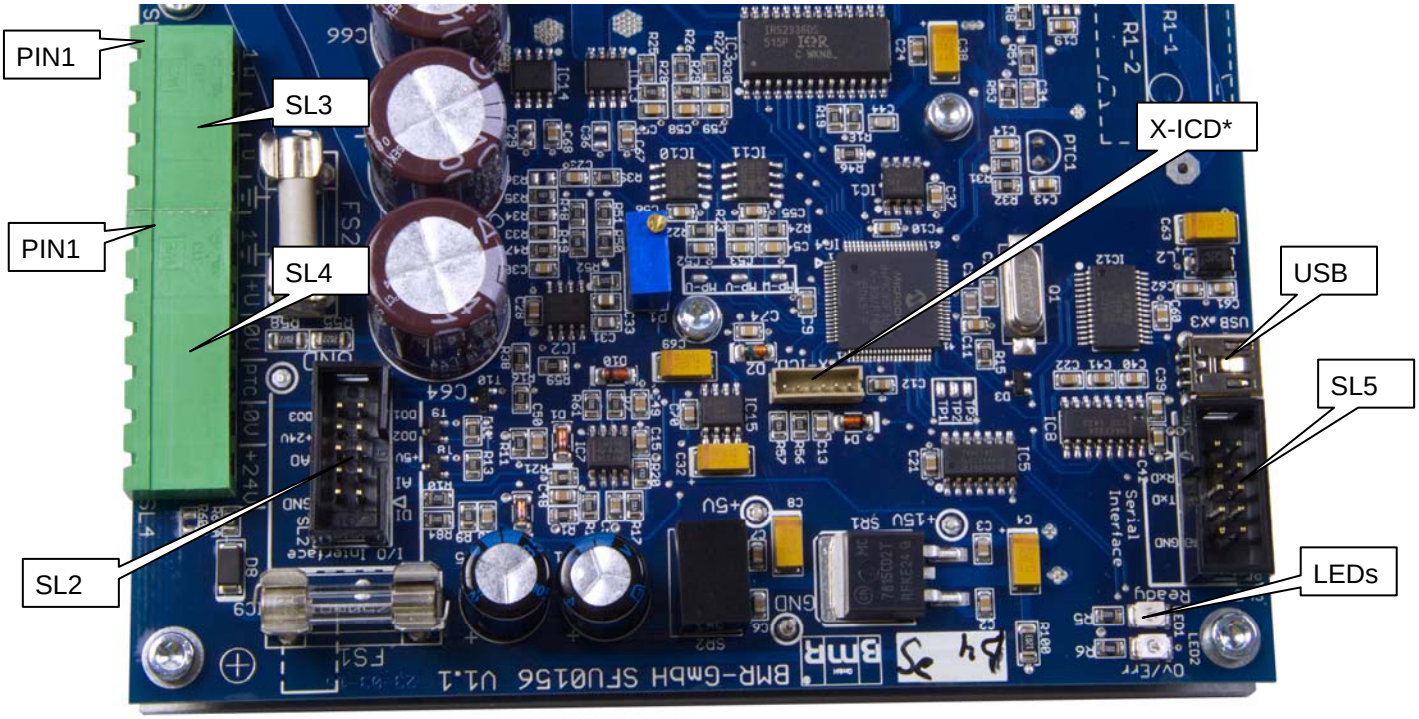
- This device produces dangerous electrical voltages and is used for the operation of fast spinning tools. Because of their high rotational speed, it may be dangerous in case of improper handling. For this reason, only professionally trained and qualified personnel should be allowed to work with and setup this device!
- Any maintenance to the device must be carried out after the supply voltage has been disconnected, only!
- Before the first commissioning can be carried out, it should be ensured that the spindle and the tool are fixed properly, to eliminate all dangers because of uncontrolled movement of the spindle.
- Safety regulations being valid for the country where the device is used, have to be adhered to where any work is carried out on the device.
- 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 (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.
- For the reasons listed above, installation and connection of the device should be carried out by qualified personnel, only.

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!

Attention:
In case of replacing the fuses, please ensure to use types only, which are mentioned in 'Technical Data'!

4. Connections, Plugs and Pin Assignments



* X-ICD for internal use only

4.1 Power Supply Connection SL4 (pluggable screw terminals)

Pin	Function	Description
1	PE	Protective Earth, is internally connected to mounting bracket
2	+80V_{DC}	+ Supply Voltage for spindle -> Fuse FS2 6,3AT ➔ Attention, not protected against voltage reversal
3	0V (80V)	Voltage Return for spindle supply
4	PTC / KTY	Temp sensor Spindle ➔ available at HW V1.1 and to be configured with SFU-Terminal > V6.25
5	0V (24V)	return for controller supply (internally connected with PIN3)
6	+24V (max 30V)	+ Supply voltage for control logic -> Fuse FS1 250mAT protected against voltage reversal with Diode D8
	NC	Version SFU0156 with onboard +24V logic supply In this version the logic supply voltage is directly generated from the spindle supply voltage (➔ 9.)

4.2 Spindle Connection SL3 (pluggable screw terminals)

Pin	Function	Description
1	W	Spindle Phase W
2	V	Spindle Phase V
3	U	Spindle Phase U
4	PE	Protective Earth of spindle and cable shield

4.3 Inputs and Outputs – I/O Interface SL2 (2.54mm Header)

Pin	Function	Description / default function
1	DI Digital Input	**Start/Stop**
3	AI Analog Input	Set value for **rotational speed**
2,4	Ground	Ground Ref for Pin 1,3,5,7,8,9,10 (internally connected with SL4.3/5)
5	+5V /10mA $_{max}$	auxiliary supply (1)
6	AO Analog Out	Output 0…10V (free configuration) default setting: **Load Percent**
7	DO2 Open Collector 2	Output (for free configuration) default setting: **Overload**
8	+24V /10mA $_{max}$	auxiliary supply (1) (internally connected with SL4.6)
9	DO1 Open Collector 1	Output (for free configuration) default setting: **Converter Ready**
10	DO3 Open Collector 3	Output (for free configuration) default setting: **Duty Speed Reached**

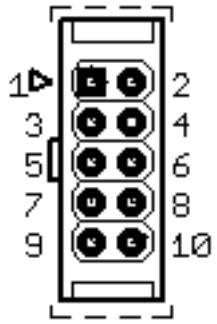
The scaling of the analog input can be modified, as well as the function of the open collector outputs can be defined freely. The noted functions are the factory default setup.

On option a remote controller is available which can be connected directly with the I/O interface at SL2. (→10.

4.4 USB Interface (alternative with RS232 →4.6**)**

The SFU 0156 has an USB Mini connector for easy access to "SFU-Terminal" configuration program. You have the options to setup and configure the converter. The USB interface is using the same interface channel as the RS232 interface (4.5) so that either one of both can be used, only.

4.5 Serial Interface RS232 SL5 (2.54mm Header) (alternative with USB →4.5)



Pin	Function
1,2,4,6,7,8	NC
3	RxD
5	TxD
9	GND
10	NC

4.6 Adapter Cable for SL2 and SL5

For easy connection to SL2 and SL5 a standard(2) ribbon cable connector with Dsub9 fem is available as option.

DSub-Pin	SL2-Pin	Funktion an SL2
1	1	Digital Input1
2	3	Analog Input1
3	5	+5Vdig (1)
4	7	Open Collector 2
5	9	Open Collector 1
6	2	GND
7	10	GND
8	6	Analogue Out
9	8	+24V (1)
7	10(2)	Open Collector 3

DSub-Pin	SL5-Pin	Funktion an SL5
1	1	
2	3	RxD
3	5	TxD
4	7	
5	9	GND
6	2	
7	4	
8	6	
9	8	

(1) Attention, with using and wiring these auxiliary voltages particular care is required and lies under the responsibility of the user! These voltages may be used as auxiliary voltage but are not especially fused. +24V is directly connected to FS1 and +5Vdig is directly connected with the DSP and all other ICs. So, potential errors at the wiring may harm the board severely!

(2) Attention, On request a non standard cable is available with a special wiring which makes OC3 accessible at PIN7 of the 9Pin D-Sub

5. Functions, Setup, Operation

5.1 Start / Stop

There are two possibilities to start the spindle:

digitally with a digital control signal at digital input1 **Start/Stop** at SL2.1.
The switching levels for "OFF=0" are 0...7V and for "ON=1" 18...24V,
voltages between 7V and 18V are undefined.

➔ As soon as this is initiated, the spindle will be accelerated to the set value of the rotational speed which is pre-selected as voltage at analogue input1 **Set Value of Rotational Speed** at SL2.2.

analogue with a voltage at analogue input1
Precondition is a valid "ON" signal at digital input1 **Start/Stop**

➔ An input voltage of 0V makes the spindle stop, and a voltage higher than 0,29V starts the spindle up to a rotational speed according to the scaling.

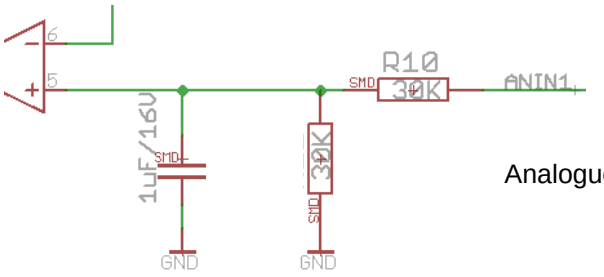
5.2 Set Value of Rotational Speed

There are two possibilities for scaling the rotational speed

- **0-10V / Min-Max**: The default scaling for the analogue value is according the Min/Max values of the rotational speed from the spindle characteristic
  e.g.: set values are Min: 5.000rpm, Max: 60.000

This results in a formula for the control voltage u: u = set value * 10V/60.000rpm
A voltage of u<0,8V realizes standstill, a voltage of 0,8V sets the minimum speed of 5.000rpm and 10V sets the maximum rotational speed of 60.000rpm.

- Another option of the input scaling is **1V/10.000rpm**.



Analogue input circuit

5.3 Outputs

Digital Outputs:

As feedback signals to a PLC or another control there are 3 open collector outputs available. They indicate the current operational status of the converter. (→ 6.)
The functions can be setup freely, factory default is listed below

DO1 / SL2.9 default **Converter Ready** . In this case, the PIN is drawn to ground
DO2 / SL2.7 default **Overload**. In this case, the PIN is drawn to ground
DO3 / SL2.10 default **Duty speed reached**. In this case, the PIN is drawn to ground

Analogue Output:

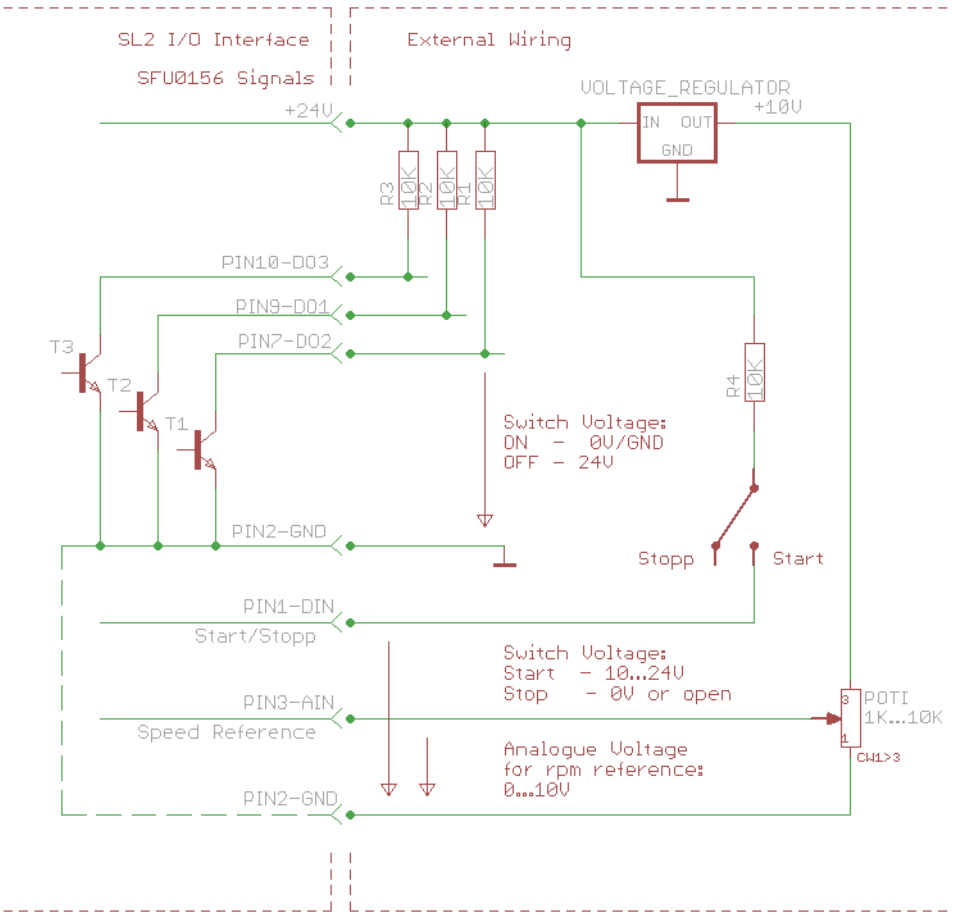
As a default function the output load condition is output as a voltage between 0..10V at the analogue output AO / SL2.6. with a scaling of 1V/10% . Other function values are available and can be setup with SFU-Terminal.

5.4 LEDs

Likewise the open collector outputs, there are LEDs indicating the current operational status of the converter.

GREEN	RED	Function
Off	Off	Converter Not Ready
On	Off	Converter Ready
On	On	Overload or Error Warning
Off	On	Converter not Ready, Switch Off because of Error
Off	blinking	internal Error

6. Example for I/O Wiring



example for wiring the I/O Interface

A successful start of the spindle the analogue voltage at PIN3 as reference for the duty speed hast be higher than the minimum voltage (→ 5.2) **.**
With using a potentiometer for dialing the rotational speed it should be wired to 10V, so that the required range from 0…10V can be covered, representing the speed range.

7. Safety Functions

The following safety functions bring about controlled stop of the spindle according predefined deceleration times:

- Safety stop because of converter excess temperature after delay-time of 10s is exceeded
- Safety stop by overload and time delay exceeded (default 10sec)
- Safety stop will occur immediately by exceeding the maximum admissible spindle current.

8. EMC

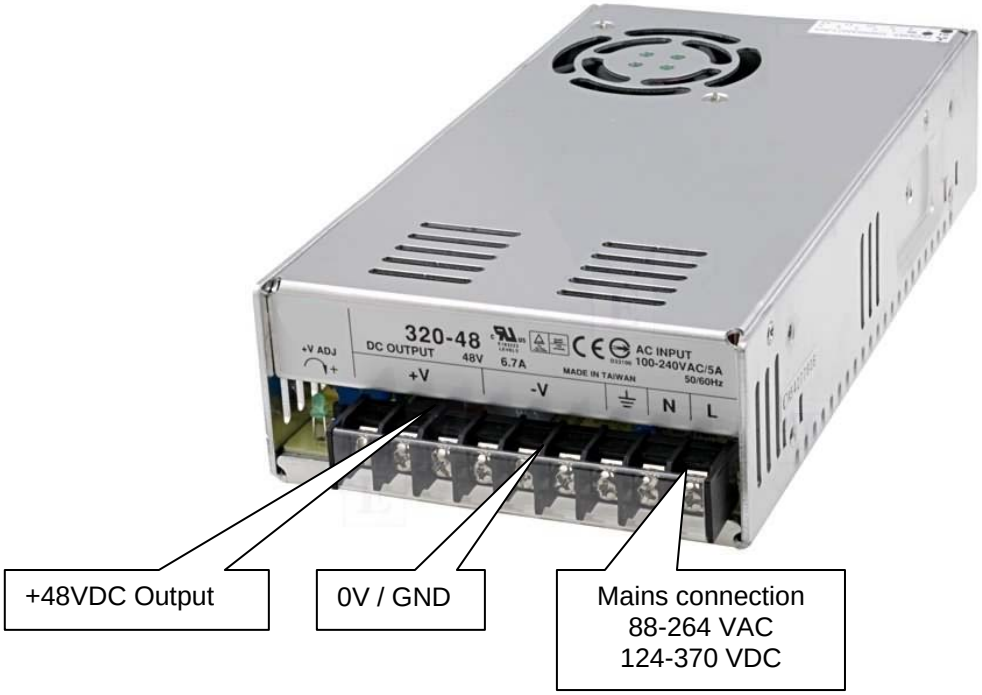
This device was developed for use in industrial environments. For trouble-free operation and to reduce emitted interference, the following should be observed during wiring of the equipment:

- 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.
- 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.

9. Power Supply Set (as Option)

As option a power supply set is available, consisting of a switched mode power supply for the 48V and a DCDC voltage converter for the 24V supply. With the help of this set it is possible, to generate the required DC-supply voltages for the SFU0156.

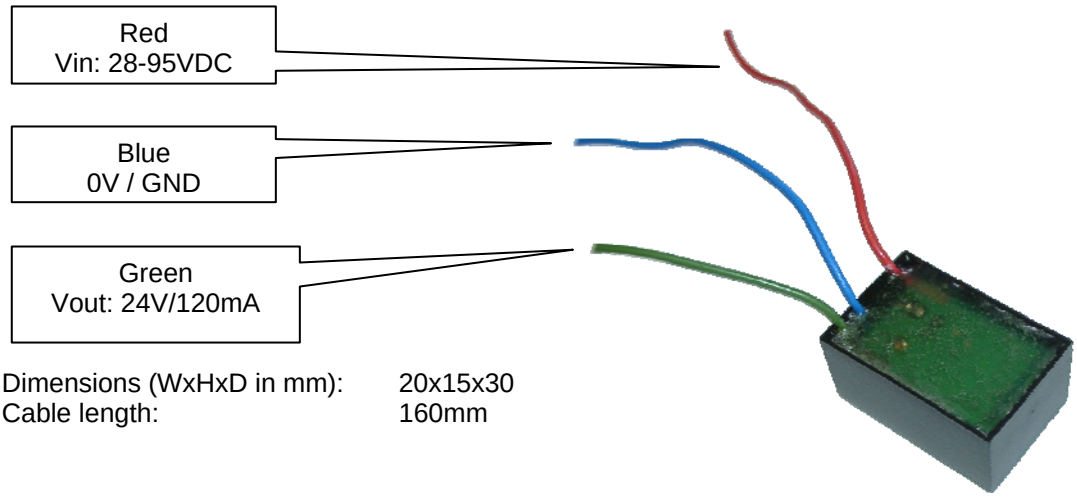
- **48V Power Supply for Spindle Voltage Supply**



Dimensions (WxHxD in mm): 115x50x216

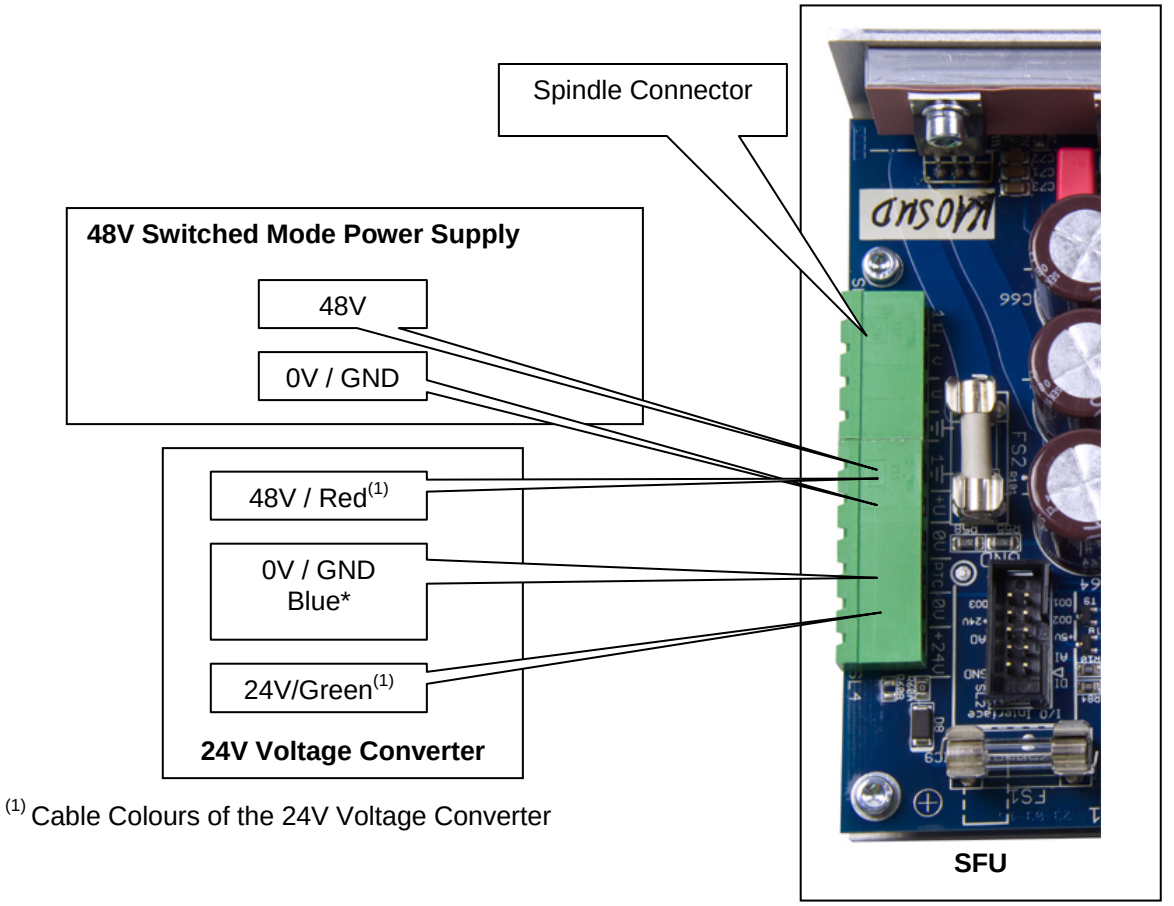
- **24V DC-DC Voltage Converter as separate solution**

This DC-DC voltage converter generates the voltage for the 24V logic supply directly from the spindle voltage. It has a wide band input range and a regulated 24V output.



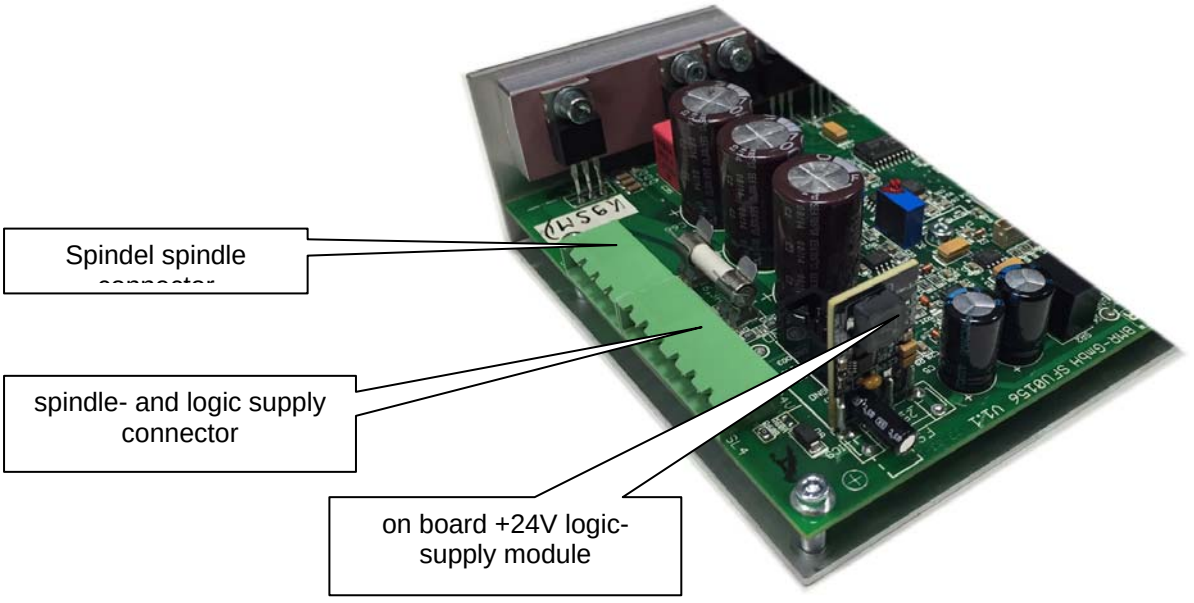
Dimensions (WxHxD in mm): 20x15x30
Cable length: 160mm

- **Connection Diagramm of Power Supply**



(1) Cable Colours of the 24V Voltage Converter

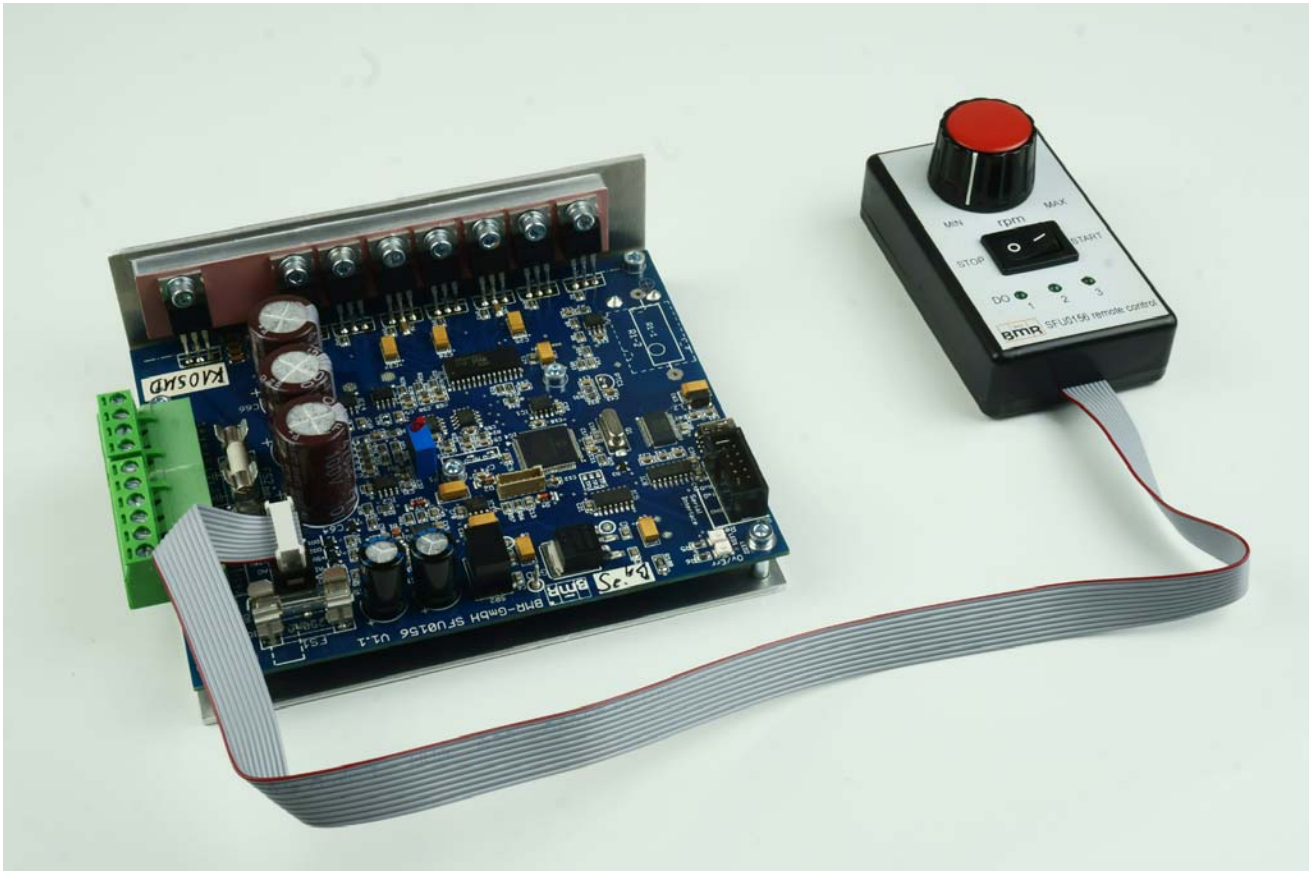
- **Version with onboard +24V logic supply**



Attention: All these works handle with dangerous voltages and have to be carried out by skilled persons only.

Please verify before connecting that the mains voltage is switched off!

10. SFU0156 with Remote Controller

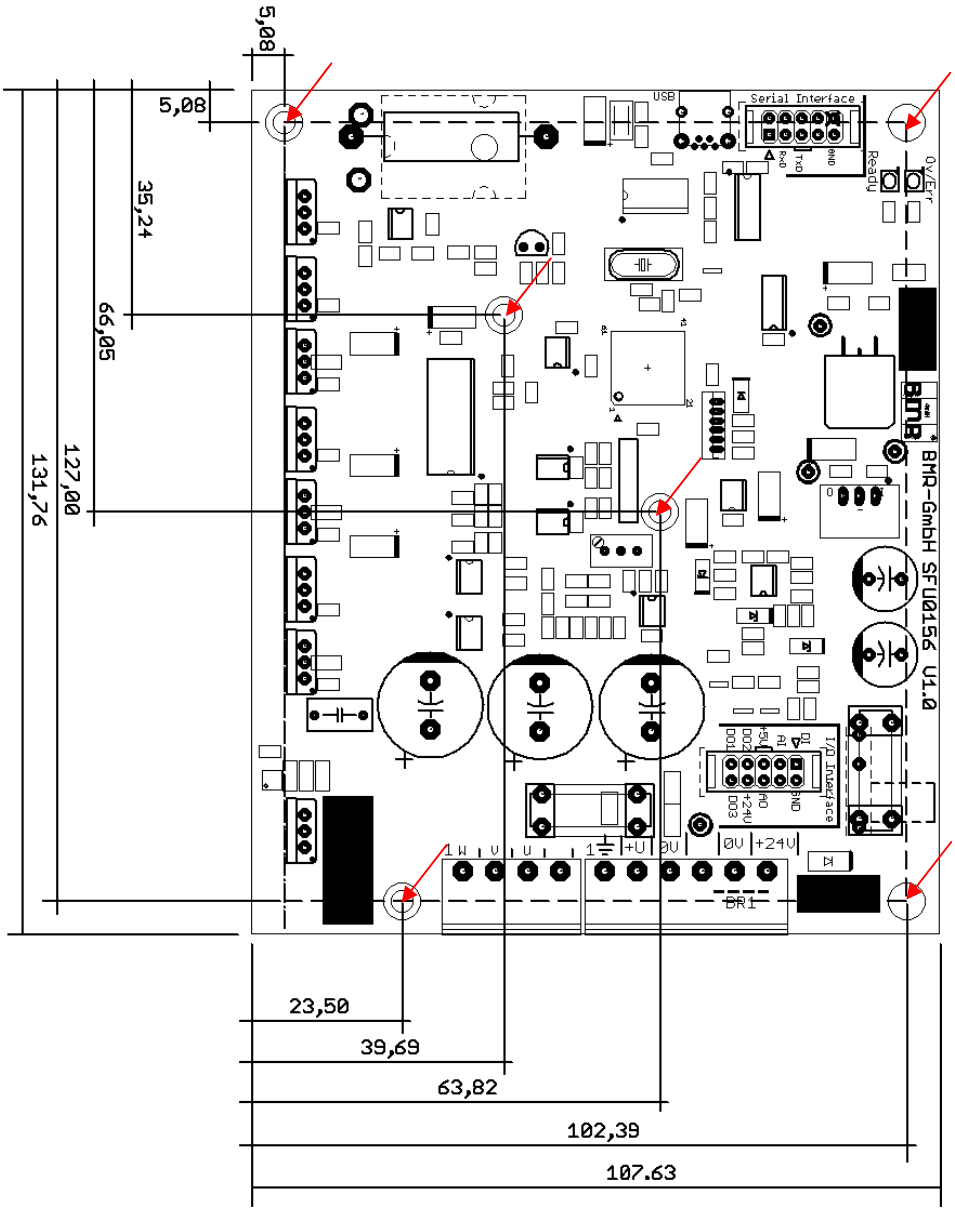


On option a remote controller is available which can directly be connected with the I/O interface at SL2.
By this, the required duty speed can be adjusted with a potentiometer and the converter can be started and stopped with a rocker switch.
The status of the digital outputs is indicated on LEDs

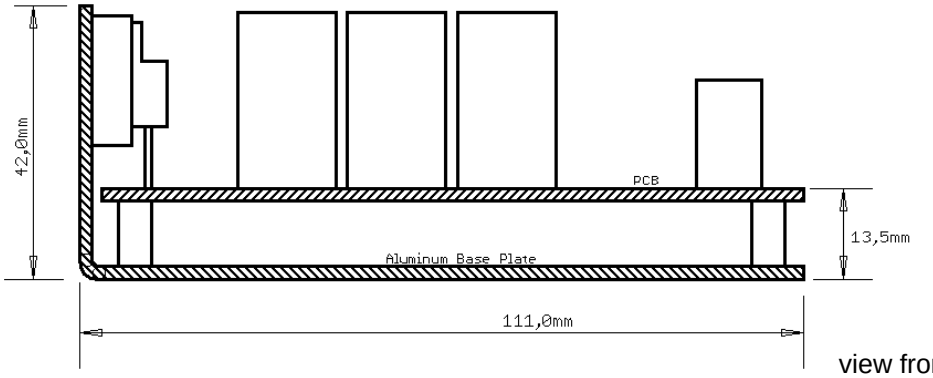
All required voltages are generated within this adapter, so the converter can be controlled and tested very easily.
A quick test and setting into action of the converter becomes possible even without external control signals.

11. Drawing and Mounting

For mounting purpose there are 6 nuts with a 3mm thread provided, being pressed into the at the bottom side of mounting bracket.



view from top



view from side

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