

Hardware Documentation

*PicoCore™ BBSP
for HW Revision 1.10*

Preliminary

Version 001
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About This Document

This document describes how to use the [PicoCore™BBSP](#) start interface board with mechanical and electrical information. The latest version of this document can be found at:

<http://www.fs-net.de>.

ESD Requirements



All F&S hardware products are ESD (electrostatic sensitive devices). All products are handled and packaged according to ESD guidelines. Please do not handle or store ESD-sensitive material in ESD-unsafe environments. Negligent handling will harm the product and warranty claims become void.

History

Date	V	Platform	A,M,R	Chapter	Description	Au
25.10.2019	001	All		-	Initial Version	GI

V Version
A, M, R Added, Modified, Removed
Au Author

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1 Main Features

The PicoCoreBBSP is a baseboard for 6V - 45V stepper motors.

The following table shows the maximum possible number of each interface. Not all interfaces are available at the same time and depends on the appropriate assembly variant.

Features	Description
Main Board	PicoCore™MX6SX or PicoCore™MX6UL
DC-Input	+6V...45V; +5V ±10%
GPIO	max. 8
Interfaces	1 x USB OTG (Device) 2 x USB Host 1 x UART (with line flow control) 1 x JTAG 4 x Adjustable Power Driver 2 x Buttons 1 x Led connector 1 x I2C 1 x SPI

Table 1: Main Features

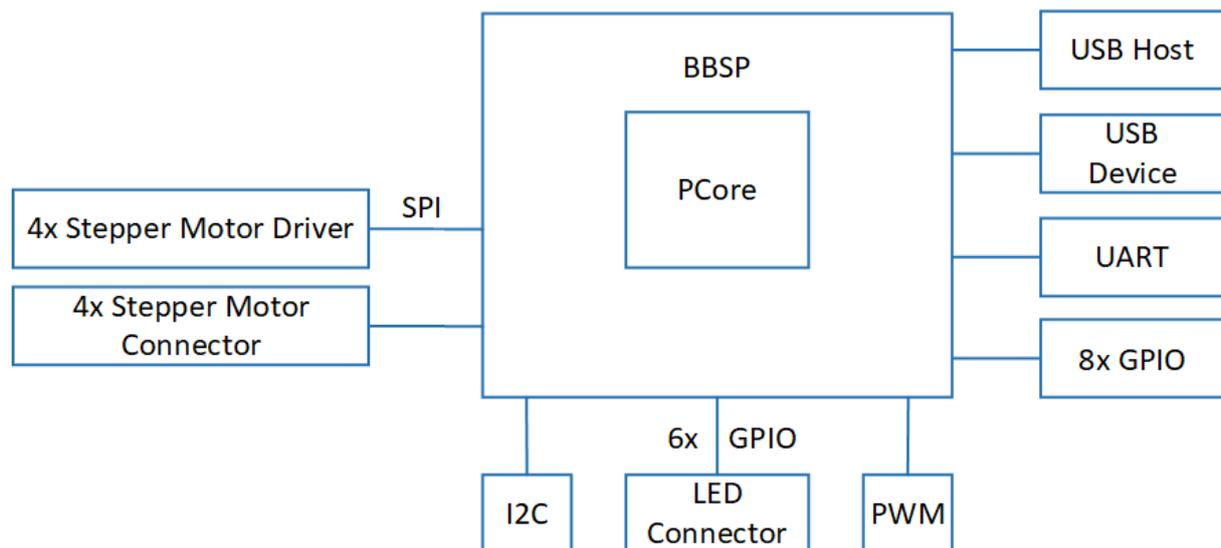


Figure 1: Block diagramm

2 Mechanical Dimensions

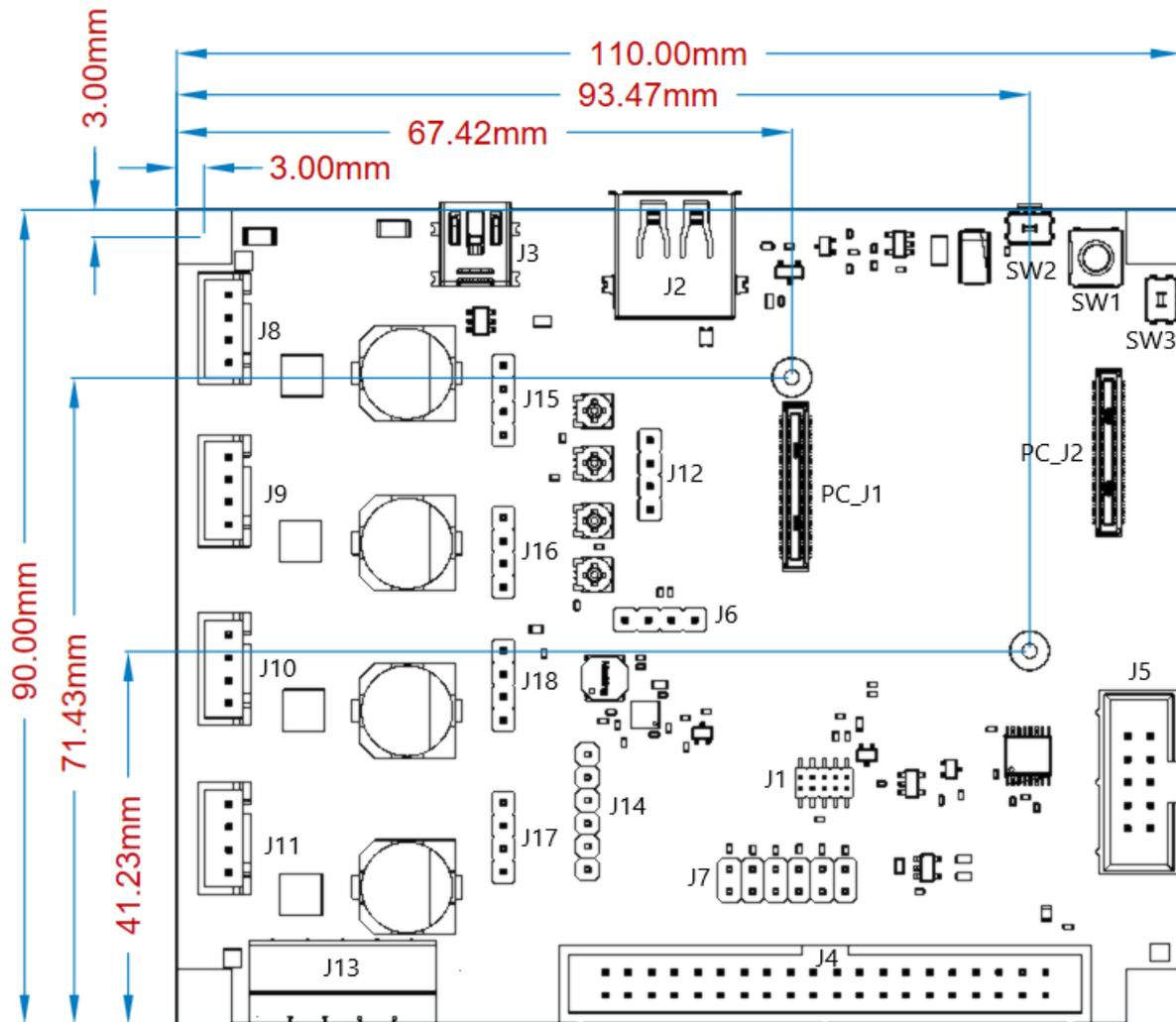


Figure 2: Mechanical Dimensions Top Side

Dimensions	Description
Size	110mm x 90mm
PCB Thickness	1.5mm ± 0.1mm
Height of the parts on the top side	124mm
Height of the parts on the bottom side	3mm

Table 2: Mechanical Dimensions

Des.	Description	Remarks
J1	JTAG connector	Top Side, 10-pins
PC_J1	PicoCore Board to Board connector	Top Side, 80-pins
PC_J2	PicoCore Board to Board connector	Top Side, 80-pins
J2,J3	USB connector	Top Side, Host & Device
J4	IO connector	Top Side, 40-pins
J5	UART, RS232 with RXD, TXD, RTS and CTS	Top Side, 10-pins
J6	PWM connector	Top Side, 4-pins
J7	LED connector	Top Side, 12-pins
J8–J11	Two-phase bipolar stepper motor power connector	Top Side, 4-pins
J12	Current scaling connector	Top Side, 4-pins
J13	Power Connector for stepper motor	Top Side, 5-pins
J14	SPI interface	Top Side, 6-pins
J15-J18	Stepper driver control interface	Top Side, 4-pins
SW1	Boot Select Button	Top Side, Tact Switch
SW2	Reset switch	Top Side, Side Tact Switch

Table 3: Connectors & Switches List

3 Interface and signal description

3.1 B2B connectors (J2 and J3)

Type: DF40C-80DS-0.4V (51) [or another pin compatible connector with different height]

Manufacturer: Hirose

Please refer the PicoCore module datasheet for pin-out assignments.

3.2 Power Supply

The PicoCore™ baseboard has a 5 way connector with 3,81mm pitch for the two-phase bipolar stepper motor.

The PicoCore™ CPU board needs to be powered with 5V on J4 (+V5_SB)

Connector Base Board: Würth WR-TBL Series 322 – 5- pins

Matching Connector: WR-TBL Series 361 – 5-pins

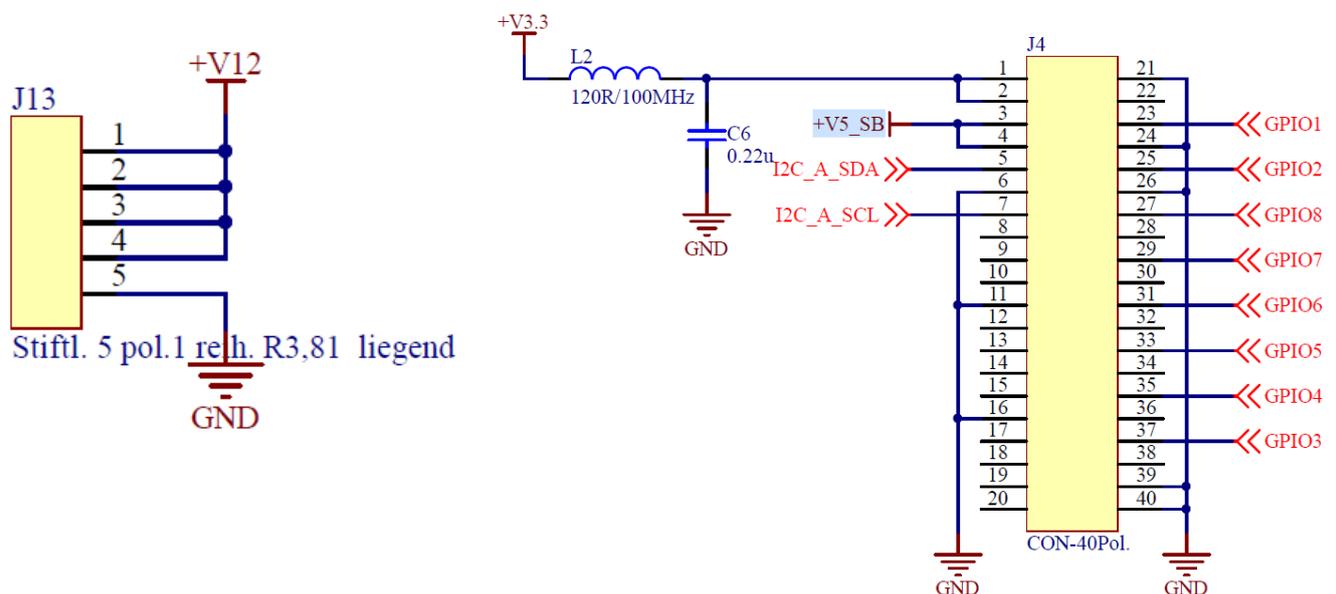


Figure 3: Power Supply Connector

J13 Pin	Signal Name	I/O	Voltage	Remarks
1	+V12	I	6V – 45V	Voltage depends on Stepper Motor
2	+V12	I	6V – 45V	Voltage depends on Stepper Motor
3	+V12	I	6V – 45V	Voltage depends on Stepper Motor
4	+V12	I	6V – 45V	Voltage depends on Stepper Motor
5	GND	GND	GND	Ground

J4 Pin	Signal Name	I/O	Voltage	Remarks
1,2	+V3.3	PWR	3,3V	x
3,4	+V5_SB	I	5V	Power for PicoCore™MX6-UL/SX
5	I2C_A_SDA	I	I2C	I2C Data connector
7	I2C_A_SCL	I	I2C	I2C Clock connector
6,11,16,21,24,26,39,40	GND	GND	GND	Ground
23,25,27,29,31,33,35,37	GPIO1...8	I/O	5V	Free configurable IO Pins

Table 4: Power Connector Pin Layout

The PicoCore™ baseboard has 2 voltage regulator.

They are converting the +V5_SB (5V) to +V3.3 and +V3.3_CPU (VDD_SNVS)

VDD_SNVS is needed for the CPU Board on the PicoCore™ baseboard.

+V3.3 is needed for the baseboard itself.

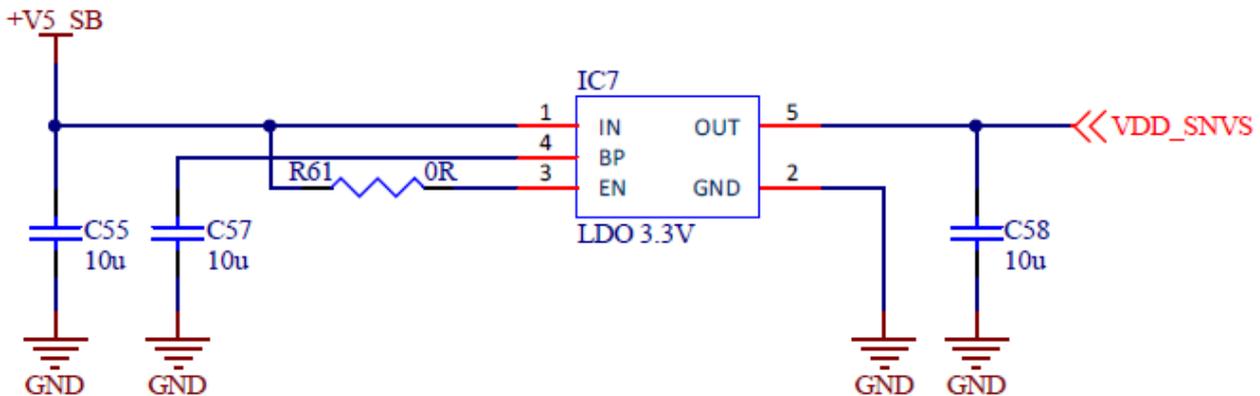
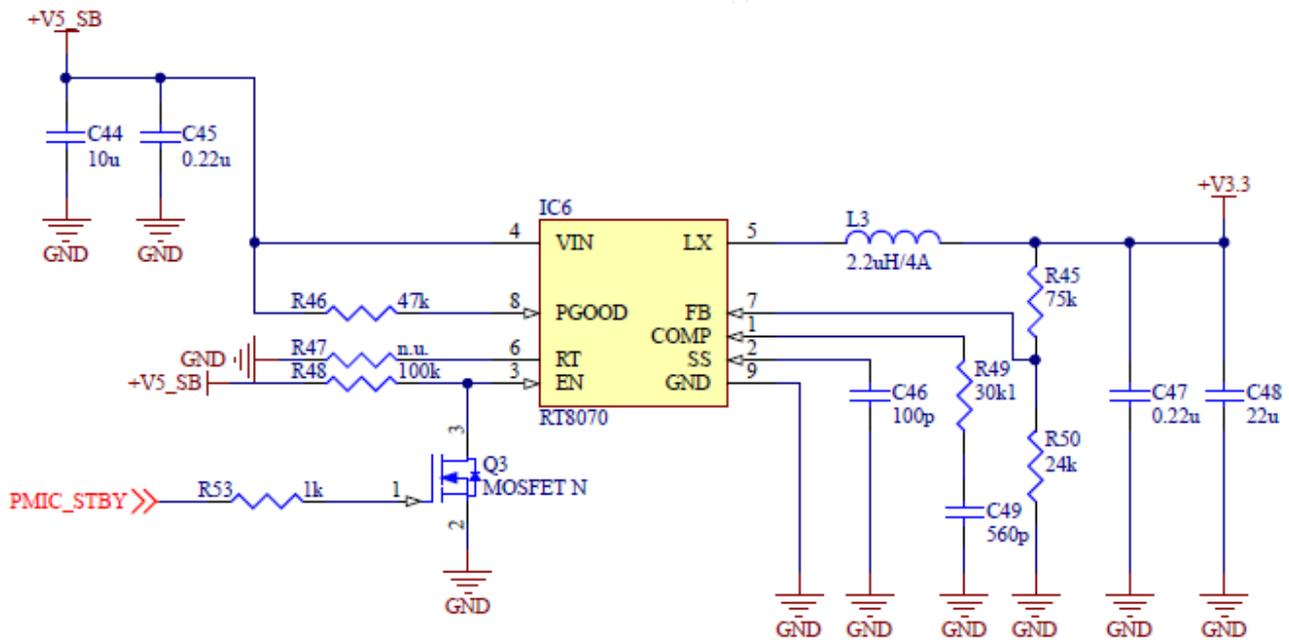


Figure 4: Power Regulator

3.3 USB OTG

The USB OTG port can operate as device or as a host port. The USB differential signals are routed with an impedance of 90Ω.

The USB TypeA Hub is fused with a 1.1A Fuse

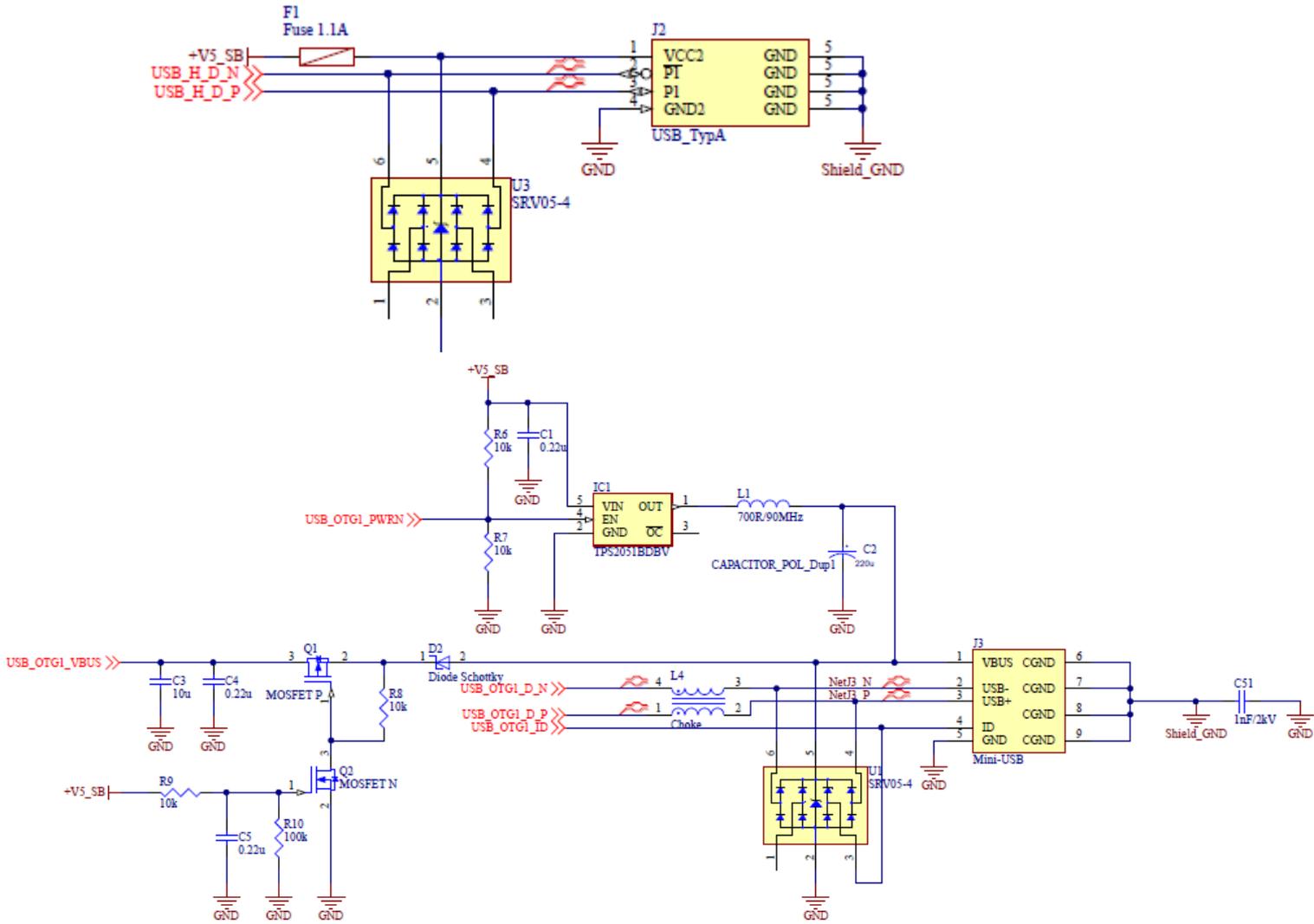


Figure 5: USB Host Full Feature Example

J3 Pin	Signal Name	I/O	Voltage	Remarks
1	USB_OTG1_VBUS	PWR	5V	USB OTG Supply Voltage
2	USB_OTG1_D_N	I/O diff	0,15V	Differential data line (-) routed with 90Ω
3	USB_OTG1_D_P	I/O diff	3,3V	Differential data line (+) routed with 90Ω
4	USB_OTG1_ID	O	5V	USB OTG ID
5	GND	PWR	GND	Ground

J2 Pin	Signal Name	I/O	Voltage	Remarks
1	V5_SB	O	5V	Fused 1.1A
2	USB_H_D_N	I/O diff	0,15V	Differential data line routed with 90Ω
3	USB_D_P	I/O diff	3,3V	Differential data line routed with 90Ω
4	GND	PWR	GND	Ground
5	Shield_GND	PWR	GND	Shield Ground

Table 5: USB OTG Interface Pin Layout

3.4 UART

The PicoCore base board provides a UART Interface (with line flow control) for RS232.

Connector type: FCI 75869-501 10-pins/3.81mm

SP3232ECT (U2) is needed for converting the CPU TTL logic level to RS232 logic level.

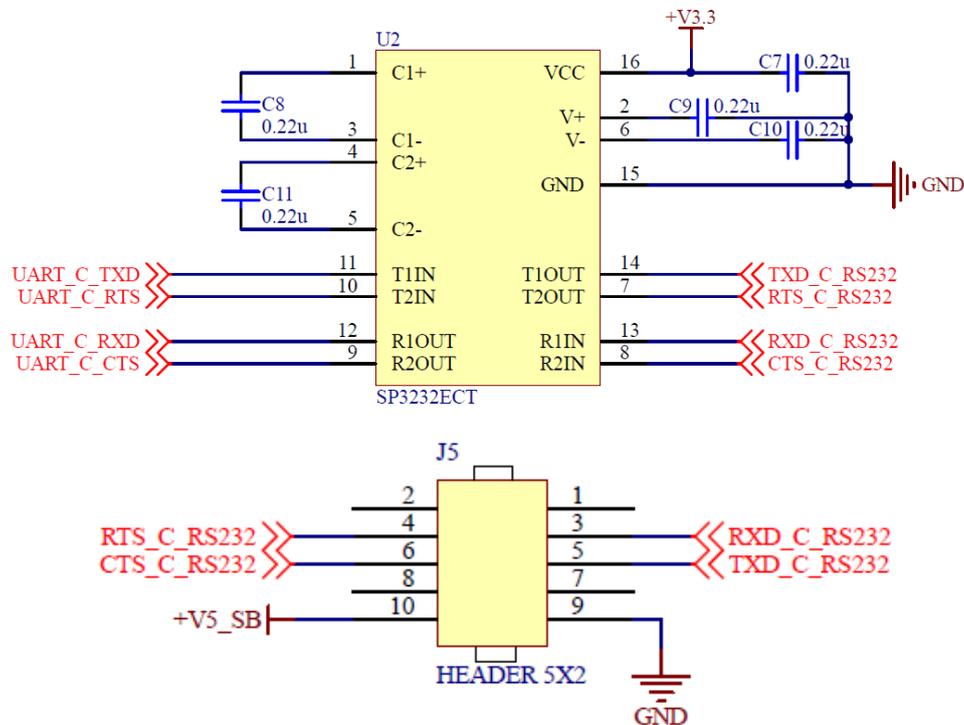


Figure 6: UART Pin Layout + Schematic

J5 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	NC	X	X	X	X
2	NC	X	X	X	X
3	RXD_C_RS232	PC_J1/13	I	RS232	UART_C Receive data
4	RTS_C_RS232	PC_J1/11	O	RS232	UART_C Request to send
5	TXD_C_RS232	PC_J1/15	O	RS232	UART_C Transmit data
6	CTS_C_RS232	PC_J1/9	I	RS232	UART_C Clear to send
7	NC	X	X	X	X
8	NC	X	X	X	X
9	GND	PC_J1/45...	GND	GND	Ground
10	+V5_SB	PC_J2/2,4,6	PWR	5V	X

Table 6: UART Pin Layout

3.5 JTAG

The PicoCore base board provides a 10-pin connector for JTAG

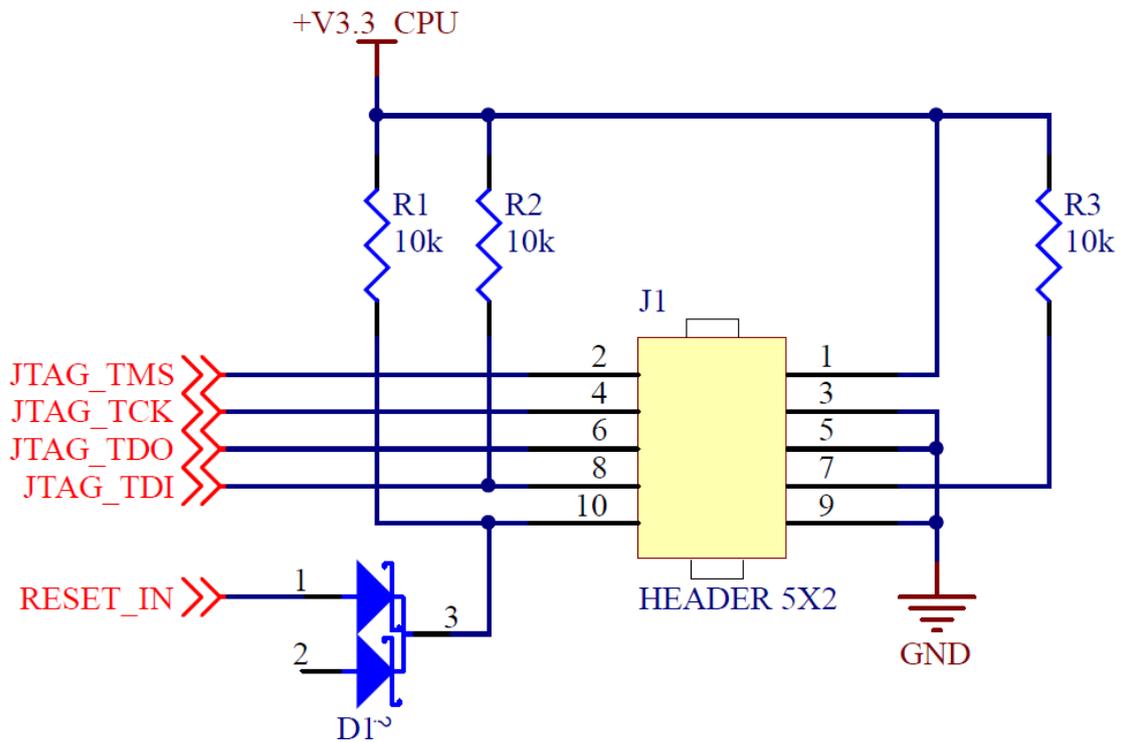


Figure 7: JTAG Connector

J4 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	+V3.3 CPU	PC_J2/ 52	PWR	3,3V	X
2	JTAG_TMS	PC_J2/ 20	I/O	JTAG	JTAG Test Mode Select
3	GND	PCJ_2/8,10,12...	GND	GND	Ground
4	JTAG_TCK	PC_J2/ 18	O	JTAG	JTAG Test Clock
5	GND	PCJ_2/8,10,12...	GND	GND	Ground
6	JTAG_TDO	PC_J2/ 24	O	JTAG	JTAG Test Data Out
7	+V3.3 CPU	PC_J2/ 52	PWR	3,3V	X
8	JTAG_TDI/ +V3.3 CPU	PC_J2/ 22	I	3,3V	JTAG Test Data In
9	GND	PCJ_2/8,10,12...	GND	GND	Ground
10	RESET_IN/ +V3.3 CPU	PC_J2/ 52	PWR	3,3V	Reset In

Table 7: JTAG Pin Layout

3.6 Adjustable power driver

The PicoCore Mainboard has 4 adjustable power driver (IC2) for the stepper motors.

The drivers can be replaced with help of the connectors J14-J18.

Connector type: W+P 943-11-004-00

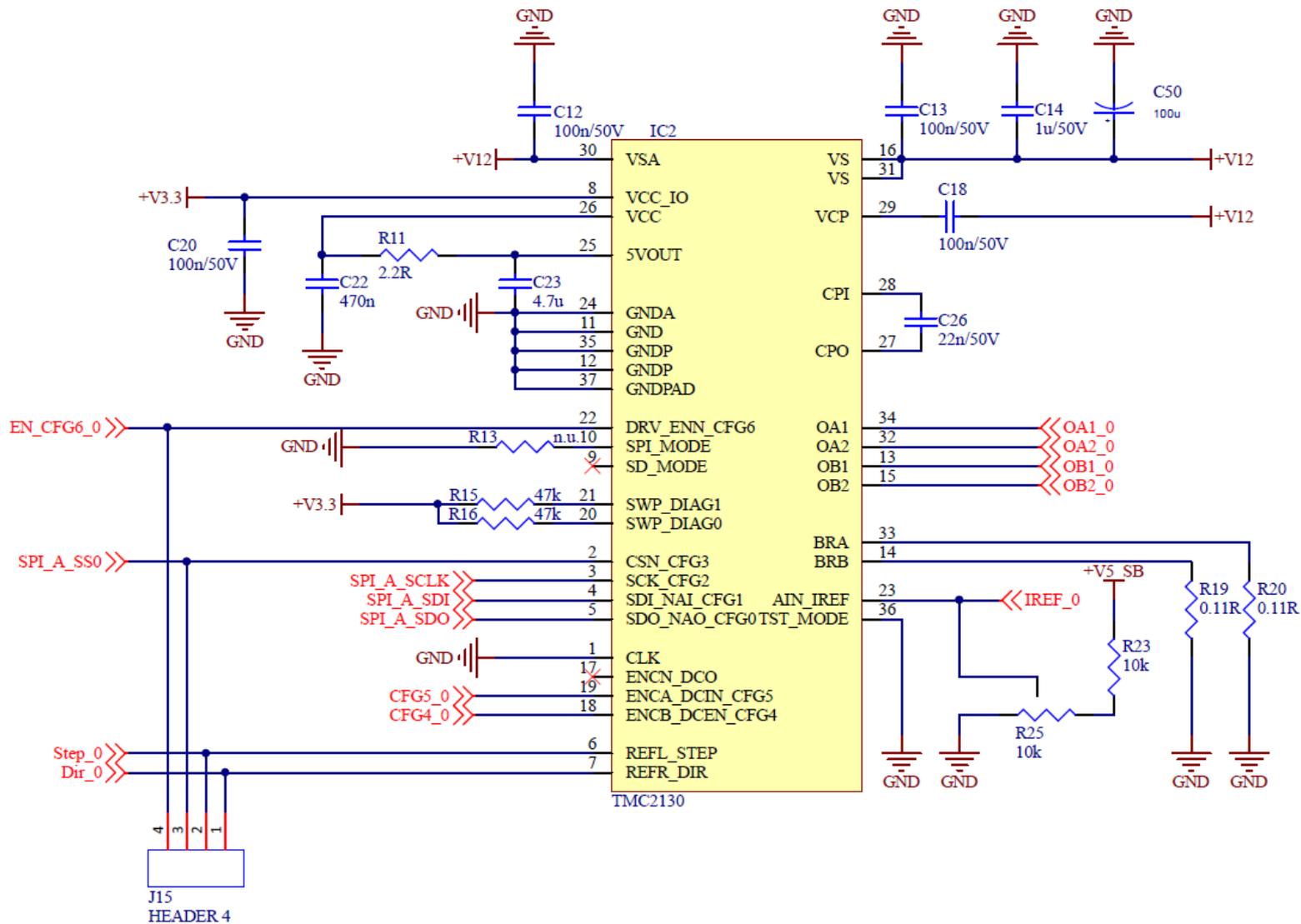


Figure 8: Power Driver Pin Schematic + Connector

J14 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	SPI_A_SDI	PC_J1/18	I	+3.3V	SPI_A Serial Data In (Master In Slave Out)
2	SPI_A_SDO	PC_J1/16	O	+3.3V	SPI_A Serial Data Out (Master Out Slave In)
3	SPI_A_SCLK	PC_J1/20	O	+3.3V	SPI_A Serial Clock
4	SPI_A_SS3	PC_J1/53	I	+3.3V	SPI_A Slave Select
5	CFG4_3	PC_J1/54	I	+3.3V	DCStep Enable input
6	CFG5_3	PC_J1/56	I	+3.3V	DCStep Gating input
7	EN_CFG6_3	PC_J1/78	I/O	+3.3V	Enable Input

J15 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	Dir_0	PC_J1/69	I/O	+3.3V	Free configurable pin
2	Step_0	PC_J1/55	I/O	+3.3V	Free configurable pin
3	SPI_A_SS0	PC_J1/14	I	+3.3V	SPI_A Slave Select
4	EN_CFG6_0	PC_J1/22	I/O	+3.3V	Free configurable pin

J16 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	Dir_1	PC_J1/71	I/O	+3.3V	Free configurable pin
2	Step_1	PC_J1/57	I/O	+3.3V	Free configurable pin
3	SPI_A_SS1	PC_J1/24	I	+3.3V	SPI_A Slave Select
4	EN_CFG6_1	PC_J1/77	I/O	+3.3V	Free configurable pin

J17 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	Dir_3	PC_J1/75	I/O	+3.3V	Free configurable pin
2	Step_3	PC_J1/61	I/O	+3.3V	Free configurable pin
3	SPI_A_SS3	PC_J1/53	I	+3.3V	SPI_A Slave Select
4	EN_CFG6_3	PC_J1/78	I/O	+3.3V	Free configurable pin

J18 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	Dir_2	PC_J1/73	I/O	+3.3V	Free configurable pin
2	Step_2	PC_J1/59	I/O	+3.3V	Free configurable pin
3	SPI_A_SS2	PC_J1/29	I	+3.3V	SPI_A Slave Select
4	EN_CFG6_2	PC_J1/79	I/O	+3.3V	Free configurable pin

Table 8: Power driver connector pin layout

3.7 LED connector

External LEDs can be connected to J7.

The LED pins are connected to the GPIO pins of the CPU board.

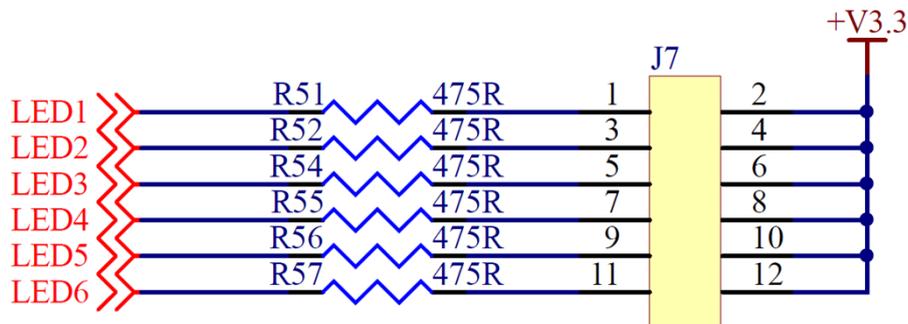


Figure 9: LED Connector Schematic

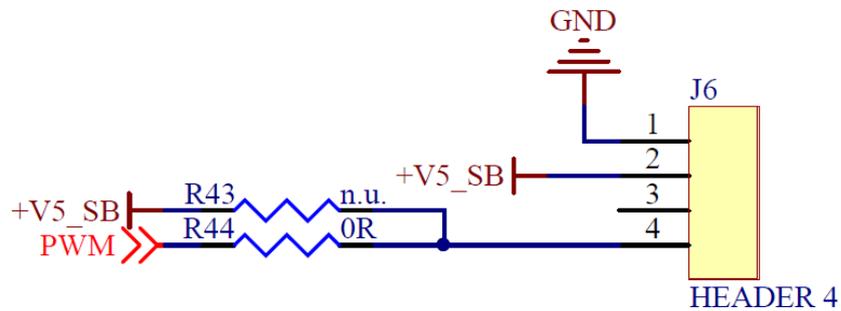
J7 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage
1	LED1	PC_J2/46	O	3.3V
2	+V3.3	J4/1,2	PWR	3.3V
3	LED2	PC_J2/44	O	3.3V
4	+V3.3	J4/1,2	PWR	3.3V
5	LED3	PC_J2/42	O	3.3V
6	+V3.3	J4/1,2	PWR	3.3V
7	LED4	PC_J2/38	O	3.3V
8	+V3.3	J4/1,2	PWR	3.3V
9	LED5	PC_J2/34	O	3.3V
10	+V3.3	J4/1,2	PWR	3.3V
11	LED6	PC_J2/32	O	3.3V
12	+V3.3	J4/1,2	PWR	3.3V

Table 9: LED Connector Pin Layout

The resistors (R51 – R57) are for the LEDs

3.8 PWM Connector

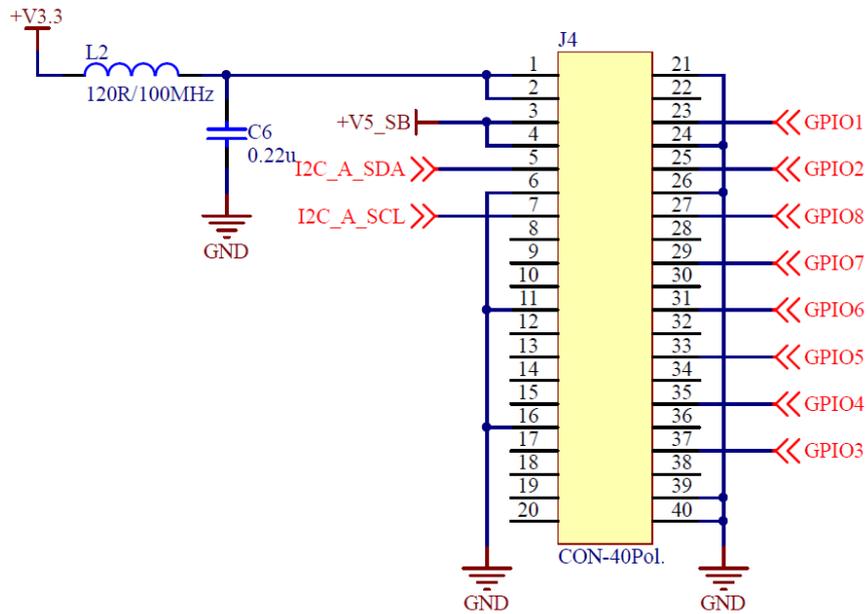
The connector J6 offers the possibility to connect an optional fan as a cooling option.



J6 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	GND	PC_J1/45	GND	GND	X
2	+V5_SB	PC_J2/2,4,6	O	5V	For constant 5V → R43 needs to be soldered
3	NC	X	X	X	X
4	PWM	PC_J2/70	O	PWM	For constant 5V → R43 needs to be soldered

3.9 Feature Connectors

The PicoCore baseboard provides one feature connector (J4)



J4 Pin	Signal Name	PicoCore Pin Number	I/O	Voltage	Remarks
1	+V3.3	X	O	+3.3V	X
2	+V3.3	X	O	+3.3V	X
3	+V5_SB	PC_J2/2,4,6	I	+5V	Needed for PicoCore™ CPU Board
4	+V5_SB	PC_J2/2,4,6	I	+5V	Needed for PicoCore™ CPU Board
5	I2C_A_SDA	PC_J1/23	I/O	+3.3V	I2C Serial Data Line
6	GND	PC_J1/45	GND	GND	Ground
7	I2C_A_SCL	PC_J1/21	O	+3.3V	I2C Serial Clock Line
8	NC	X	X	X	X
9	NC	X	X	X	X
10	NC	X	X	X	X
11	GND	PC_J1/63	GND	GND	Ground
12	NC	X	X	X	X
13	NC	X	X	X	X
14	NC	X	X	X	X
15	NC	X	X	X	X
16	GND	PC_J1/46	GND	GND	Ground
17	NC	X	X	X	X
18	NC	X	X	X	X
19	NC	X	X	X	X

20	NC	X	X	X	X
21	GND	PC_J1/52	GND	GND	Ground
22	NC	X	X	X	X
23	GPIO1	PC_J1/6	I/O	+3V3	Free configurable pin
24	GND	PC_J1/62	GND	GND	Ground
25	GPIO2	PC_J1/8	I/O	+3V3	Free configurable pin
26	GND	PC_J1/80	GND	GND	Ground
27	GPIO8	PC_J1/33	I/O	+3V3	Free configurable pin
28	NC	X	X	X	X
29	GPIO7	PC_J1/27	I/O	+3V3	Free configurable pin
30	NC	X	X	X	X
31	GPIO6	PC_J1/19	I/O	+3V3	Free configurable pin
32	NC	x	X	X	X
33	GPIO5	PC_J1/17	I/O	+3V3	Free configurable pin
34	NC	X	X	X	X
35	GPIO4	PC_J1/12	I/O	+3V3	Free configurable pin
36	NC	X	X	X	X
37	GPIO3	PC_J1/10	I/O	+3V3	Free configurable pin
38	NC	X	X	X	X
39	GND	PC_J2/17	PWR	GND	Ground
40	GND	PC_J2/35	PWR	GND	Ground

Table 10: 40-pin Feature Connector Pin Layout

3.10 Buttons and Switches

On PicoCore™BBSP baseboard there are 2 buttons to operate general preset functions.

Ref.	Signal Name	PicoCore Pin Number	Function	Usage
SW1	BOOTSEL	PC_J2/72	Boot selection	Normal push
SW2	RESET_IN	PC_J2/54	Hardreset	Normal push

Table 11: Buttons + Functions

4 Electrical Characteristic

4.1 Power Inputs

Signal Name	Connector	Remarks
+V12	J13-pin1...4	For Stepper Motor (6V-45V)
+V5_SB	J4-pin3,4	For baseboard / CPU Board
USB_OTG1_VBUS	PC_J2-pin37	Shielded
USB_H_D_N USB_H_D_P	J2	Shielded

Table 12: Power Inputs

4.2 Recommended Operation Conditions

Parameter	Description	Min.	Typ.	Max.	Unit
+V12	Power Supply Voltage	6	12	45	V
+V5_SB	Power Supply Voltage	4.5	5	5.5	V
USB_OTG1_VBUS	USB Device Power Supply	4.5	5	5.5	V
USB_H_D_N USB_H_D_P	USB Host Power Supply	4.5	5	5.5	V

Table 13: Recommended Operation Conditions

5 Review service

F&S provide a schematic review service for your baseboard implementation. Please send your schematic as searchable PDF to support@fs-net.de.

6 ESD and EMI Implementation

On the PicoCoreBBSP base board there are ESD protection diodes for Mini-USB and Audio Jack connectors. The other connectors do not have any protection, because of their immunity to ESD. To reduce EMI the PicoCoreRT1 supports Spread spectrum. This will normally reduce EMI between 9 and 12 dB and so this decrease your shielding requirements. We strictly recommend having your baseboard with controlled impedance and wires as short as possible.

A helpful guide is available from TI; just search for slva680 at ti.com.

7 Second source rules

F&S qualifies their second sources for parts autonomously, as long as this does not touch the technical characteristics of the product. This is necessary to guarantee delivery times and product life. A setup of release samples with released second sources is not possible.

F&S does not use broker components without the consent of the customer.

8 ROHS and REACH statement

All F&S designs are created from lead-free components and are completely ROHS compliant.

The products we supply do not contain any substance on the latest candidate list published by the European Chemicals Agency according to Article 59(1,10) of Regulation (EC) 1907/2006 (REACH) in a concentration above 0.1 mass %.

Consequently, the obligations in No. 1 and 2 paragraphs in Annex are not relevant here.

Please understand that F&S is not performing any chemical analysis on its products to testify REACH compliance and is therefore not able to fill out any detailed inquiry forms.

9 Matrix Code Sticker

All F&S hardware will ship with a matrix code sticker including the serial number. Enter your serial number here <https://www.fs-net.de/en/support/serial-number-info-and-rma/> to get information on shipping date and type of board.



Figure 8: Matrix Code Sticker

10 Appendix

Important Notice

The information in this publication has been carefully checked and is believed to be entirely accurate at the time of publication. F&S Elektronik Systeme (“F&S”) assumes no responsibility, however, for possible errors or omissions, or for any consequences resulting from the use of the information contained in this documentation.

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