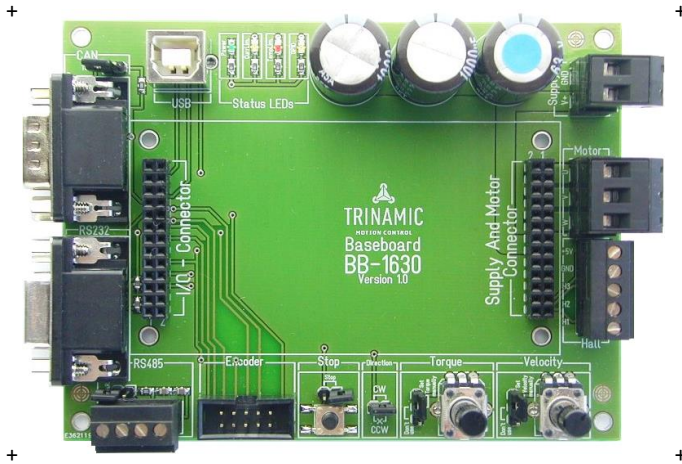**V 1.00**

HARDWARE MANUAL

BB-163x

**Baseboard
for TMCM-1630 and TMCM-1633
10A / 48V DC
RS232, CAN, RS485, and USB
Encoder interface**

TRINAMIC Motion Control GmbH & Co. KG
Hamburg, Germany

www.trinamic.com

TRINAMIC
MOTION CONTROL
Now part of Maxim Integrated

Table of contents

1 Life support policy

TRINAMIC Motion Control GmbH & Co. KG does not authorize or warrant any of its products for use in life support systems, without the specific written consent of TRINAMIC Motion Control GmbH & Co. KG.

Life support systems are equipment intended to support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided, can be reasonably expected to result in personal injury or death.

2   Features

The BB-163x is the baseboard for the TMCM-163x plug-in modules. The baseboard has been primarily designed for evaluation of the plug-in boards.

Applications
- Baseboard / Evaluation board for TMCM-1630 and TMCM-1633

Electrical data
- Supply voltage: +24V DC or +48V DC nominal (+12… +55V DC max.)
- Motor current: up to 10A RMS peak

Interfaces
- The interface connectors refer to the assembly options of the TMCM-163x:
  - RS232
  - CAN (2.0B up to 1Mbit/s)
  - RS485
  - USB (High-speed 12Mbit/s)

  The baseboard integrates all communication connectors. There are no assembly options.

  Please note: Functionality of communication interfaces depends on assembly options of TMCM-163x

Other
- Separate connectors for interfaces, encoder, power supply, motor, and hall sensors
- Potentiometers for analog inputs plus push-button for digital input (function depending on firmware)
- ROHS compliant
- Size: 120x90mm²

3   Order codes

Order code	Description	Dimensions [mm]
BB-163x	Baseboard for TMCM-1630 and TMCM-1633	120 x 90 x 38

Table 3.1: Order codes

4 Mechanical and electrical interfacing

4.1 Dimensions of the module

The module has a size of 120mm x 90mm. Maximum overall height of the module including connectors and screws: approx. 38mm.
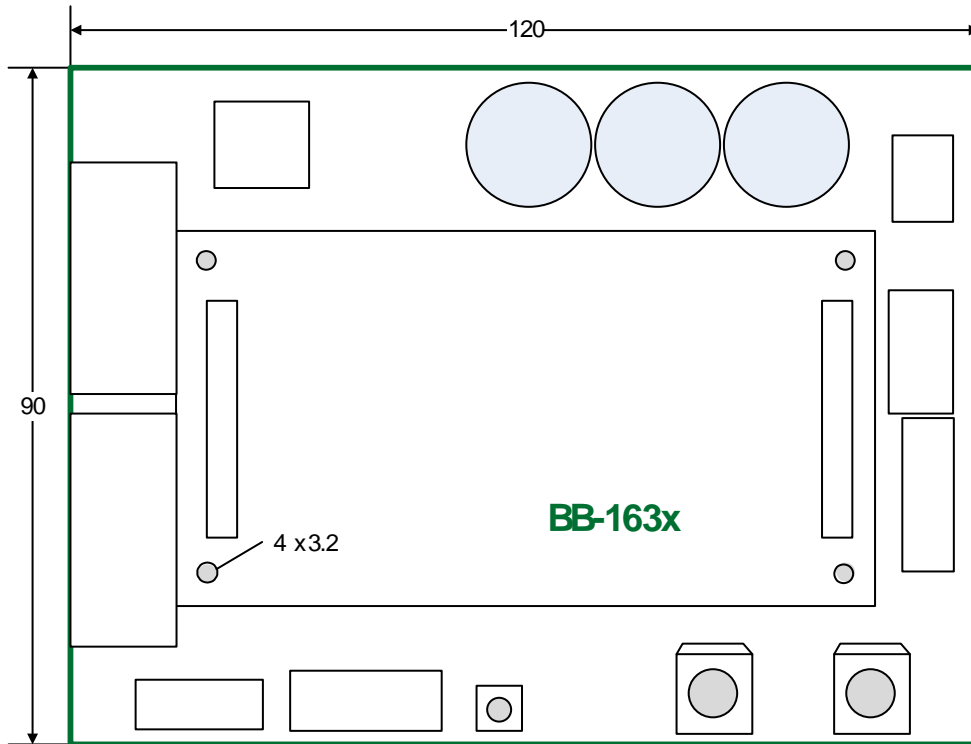

Figure 4.1: Size of module

5   Connectors

The baseboard offers two double row 2.54mm pitch standard connectors (female) for connecting the TMCM-163x (I/O-connector and supply / motor connector)
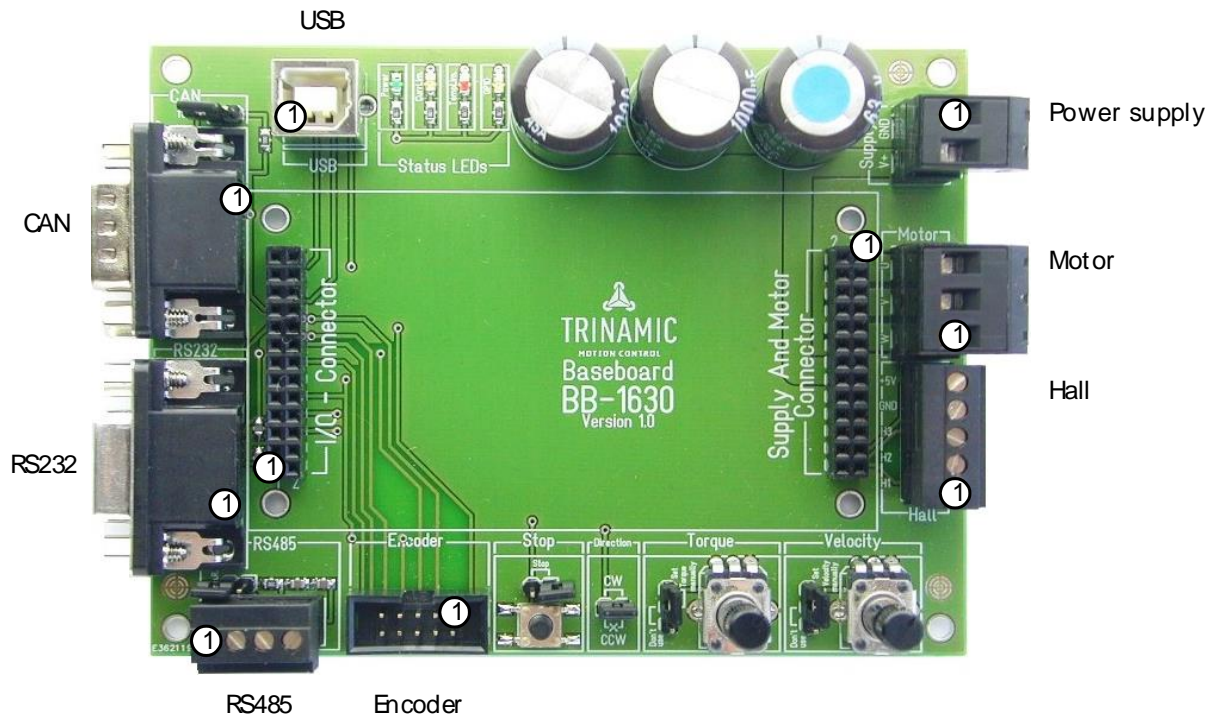

Figure 5.1: Connectors of BB-163x

Domain	Connector type	Mating connector
I/O connector	SSW series, socket strip, 2x13 poles, double row, 2.54mm pitch, Samtec	TSM-113-03-L-DV-K-A, 2x13 poles, double row, 2.54mm pitch, SMD vertical, Samtec
Power / motor connector	SSW series, socket strip, 2x13 poles, double row, 2.54mm pitch, Samtec	TSM-113-03-L-DV-K-A, 2x13 poles, double row, 2.54mm pitch, SMD vertical, Samtec
USB	USB, type B, 4 pol., vertical, female	USB, type B, 4 poles, male
RS232	D-sub, 9 poles, female VS-09-BU-D-SUB/10-MPT-0,5	D-sub, 9 poles, male
CAN	D-sub, 9 poles, male VS-09-ST-DSUB/10-MPT-0,5	D-sub, 9 poles, male
RS485	RIA Connect 31383104, 4 poles, grid dimension 3.81mm	RIA Connect 31114104, 4 poles, grid dimension 3.81mm
Motor	RIA Connect 31220103, 3 poles, grid dimension 5.08mm	RIA Connect 31249103, 3 poles grid dimension 5.08mm
Encoder	low profile box header without locking bar, 2.54mm pitch	Female connector, 10 poles, 2.54mm pitch
Power supply	RIA Connect 31220102, 2 poles, grid dimension 5.08mm	RIA Connect 31249102, 2 poles, grid dimension 5.08mm
Hall	RIA Connect 31383105, 5 poles, grid dimension 3.81mm	RIA Connect 31114105, 5 poles, grid dimension 3.81mm

Table 5.1: Connectors of the BB-163x

> *Since the two connectors of the TMCM-1633 are similar be careful not to plug-in the module the other way round. Also, be sure to place the connectors exactly to their mating opponents. Not following these guidelines might cause permanent damage to the module when turning power supply on.*

5.1 Power / motor connector

A double row 26 pin socket strip with 2.54mm pitch is used for connecting all motor related signals and module power supply.

Pin	Label	Description	Pin	Label	Description
1	W	Motor coil W	2	W	Motor coil W
3	W	Motor coil W	4	W	Motor coil W
5	V	Motor coil V	6	V	Motor coil V
7	V	Motor coil V	8	V	Motor coil V
9	U	Motor coil U	10	U	Motor coil U
11	U	Motor coil U	12	U	Motor coil U
13	VM	Module driver supply voltage	14	VM	Module driver supply voltage
15	VM	Module driver supply voltage	16	VM	Module driver supply voltage
17	GND	Module ground (power supply and signal ground)	18	GND	Module ground (power supply and signal ground)
19	GND	Module ground (power supply and signal ground)	20	GND	Module ground (power supply and signal ground)
21	GND	Module ground (power supply and signal ground)	22	GND	Module ground (power supply and signal ground)
23	+5V	+5V output (100mA max.) for encoder and/or hall sensor supply	24	HALL3	Hall sensor 3 signal input
25	HALL1	Hall sensor 1 signal input	26	HALL2	Hall sensor 2 signal input

Table 5.2: Connector for motor related signals and power supply

5.1.1.1 Power supply requirements

The power supply should be designed in a way, that it supplies the nominal motor voltage at the desired maximum motor current. In no case shall the supply voltage exceed the upper or lower voltage limits. To be able to cope with high voltage spikes which might be caused by energy fed back from the motor during deceleration, a sufficient power supply capacitor should be added on the baseboard closed to the module. Depending on the motor and expected motor current please use a 4700µF or larger capacitor with suitable voltage rating. Additionally, a suitable suppressor (zener-) diode might be useful.

5.2 I/O connector

A double row 26 pin socket strip with 2.54mm pitch is used for connecting all communication and GPIO signals.

Pin	Label	Description	Pin	Label	Description
1	+5V	5V analog reference as used by the internal DAC. Max. load 0.5mA	2	Velocity	Used for velocity control in standalone operation by supplying external 0 - 10V signal
3	Torque	Used for max. motor current / torque control in standalone operation by supplying external 0-10V signal	4	GND	Module ground (power supply and signal ground)
5	Dir_IN	5V TTL input. Tie to GND to inverse motor direction, leave open or tie to 5V otherwise.	6	Tacho	This pin outputs a tacho impulse, i.e. toggles on each hall sensor change
7	Stop_IN	Emergency stop. Tie this pin to GND to stop the motor (same as the *Motor Off* switch on PCB). The motor can be restarted via the interface, or by cycling the power supply	8	LED-Temp	5V TTL output: Toggling with 3Hz when temperature pre-warning threshold is exceeded, high when module shut down due to overtemperature
9	LED-Curlim	High, when module goes into current limiting mode	10	+5V	5V output as reference for external purpose

Pin	Label	Description	Pin	Label	Description
11	GND	GND reference	12	GND	GND reference
13	Enc_A+	Encoder A+ channel	14	Enc_A-	Encoder A- channel
15	Enc_B+	Encoder B+ channel	16	Enc_B-	Encoder B- channel
17	Enc_N+	Encoder N+ channel	18	Enc_N-	Encoder N- channel
19	CANL/USBD-	CAN low / USB D- bus line	20	RXD/ 485-	RXD signal for RS232 / inverting signal for RS485
21	CANH/USBD+	CAN high / USB D+ bus line	22	TXD/ 485+	TXD signal for RS232 / non inverting signal for RS485
23	USB_+VB	Use to detect availability of attached host system (e.g. PC)	24	n.c.	
25	GND	GND reference	26	GND	GND reference

Table 5.3: Connector for communication and GPIOs

5.3 Power connector

Pin	Label	Description
1	GND	Module ground (power supply and signal ground)
2	VDD	Power supply input

Table 5.4: Power connector

5.4 Motor connector

Pin	Label	Description
1	U	Motor coil U
2	V	Motor coil V
3	W	Motor coil W

Table 5.5: Motor connector

5.5 Hall connector

Pin	Label	Description
1	Hall1	Hall sensor 1 signal input
2	Hall2	Hall sensor 2 signal input
3	Hall3	Hall sensor 3 signal input
4	GND	Signal and module ground
5	+5V_Hall	+5V output (100mA max.) for encoder and/or hall sensor supply

Table 5.6: Hall connector

5.6 Encoder connector

Pin	Label	Description
1, 2	GND	Module and signal ground
3	Encoder_N+	Encoder channel N+
4	Encoder_N-	Encoder channel N-
5	Encoder_A+	Encoder channel A+
6	Encoder_A-	Encoder channel A-
7, 8	+5V_output	+5V output
9	Encoder_B+	Encoder channel B+
10	Encoder_B-	Encoder channel B-

Table 5.7: Encoder connector

5.7 Interface connectors of BB-163x

5.7.1 USB interface

Pin	Label	Description
1	USB_+VB	Board is self-powered – just use to detect availability of attached host system (e.g. PC)
2	USB-	Differential USB bus
3	USB+	Differential USB bus
4	GND	System / module ground

Table 5.8: USB connector

Note: the USB interface can only be used if the RS485 termination jumper is not set.

5.7.2 CAN interface

Pin	Label	Description
2	CAN_L	CAN differential bus
7	CAN_H	CAN differential bus
3	GND	System / board ground
1, 4, 5, 6, 8, 9	n.c.	Pins not used / not connected

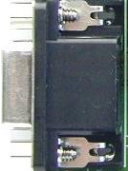**Table 5.9: CAN connector**

5.7.3 RS232 interface

Pin	Label	Description
2	RS232_TxD	RS232 transmit serial data
3	RS232_RxD	RS232 receive serial data
5	GND	System / board ground
1, 4, 6, 7, 8, 9	n.c.	Pins not used / not connected

Table 5.10: RS232 connector

5.7.4 RS485 interface

Pin	Label	Description
1	RS485-	RS485 differential bus (connected to pin 3)
2	RS485+	RS485 differential bus (connected to pin 4)
3	RS485-	RS485 differential bus (connected to pin 1)
4	RS485+	RS485 differential bus (connected to pin 2)

Table 5.11: RS485 connector

6 Jumpers

There are six jumpers on the Baseboard BB-163x for activating/deactivating special functions.
Further, it is possible to access signals via the jumper strips.

Note: Pin1 is always a square solder pad.

SIGNALS

Section	Pin 1	Pin 2	Pin 3
CAN	CANH	CANL	N/A
RS485	485-	485+	N/A
Stop	Stop	GND	N/A
Direction	Direction	GND	N/A
Torque	GND	Torque	+5V to GND[1]

Table 6.1: Signals on jumper strips

[1]) Actual voltage depends on potentiometer position.

FUNCTIONS WITH/WITHOUT JUMPERS

Section	Jumper set/unset	Description
CAN	Jumper set	Termination resistor 120Ω applied
	Jumper unset	Resistor not applied
RS485	Jumper set	Termination resistor 120Ω applied
	Jumper unset	Resistor not applied
Stop	Jumper set	Permanent stop signal
	Jumper unset	No stop signal
Direction	Jumper set	Direction signal is GND
	Jumper unset	Direction signal is set by potentiometer
Torque	Jumper set pin1 - pin2	Torque signal is GND
	Jumper set pin2 - pin3	Torque signal is set by potentiometer
	Jumper not set	No external signal applied
Velocity	Jumper set pin1 - pin2	Velocity signal is GND
	Jumper set pin2 - Pin3	Velocity signal is set by potentiometer
	Jumper not set	No external signal applied

Table 6.2: Jumper setting

It is necessary to remove the RS485 termination jumper before using the USB interface!

7   LEDs

The BB-163x module has 4 on-board LEDs:

- Power
- Current overload
- temperature warning
- GPIOs

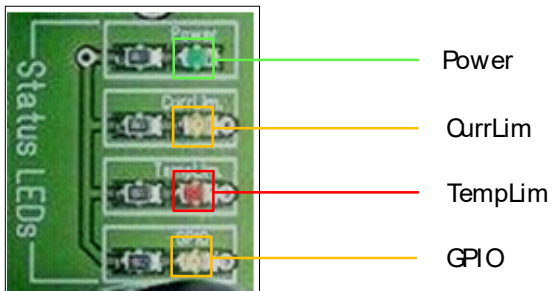*Please note: function of LEDs might depend on firmware version*

Table 7.1: Status LEDs of BB-163x

8   Operational ratings

The operational ratings show the intended/the characteristic range for the values and should be used as design values. An operation within the limiting values is possible, but shall not be used for extended periods, because the unit life time may be shortened. In no case shall the limiting values be exceeded.

Symbol	Parameter	Min	Typ	Max	Unit
V_S	Power supply voltage for operation	12	24, 48	55	V
I_S	Power supply current			10	A

Table 8.1: Operational ratings

9   Revision history

9.1   Document revision

Version	Date	Author	Description
1.00	2019-AUG-08	SK	Initial version for BB-163x

Table 9.1: Document revision

9.2   Hardware revision

Version	Date	Description
1.00	2018-MAY-28	First version of adapted BB-1630 for TMCM-1633

Table 9.2: Hardware revision

10 References

[TMCM-1630]   TMCM-1630 Hardware Manual
[TMCM-1630]   TMCM-1630 TMCL™ Firmware Manual
[TMCM-1633]   TMCM-1633 Hardware Manual
[TMCM-1633]   TMCM-1633 TMCL™ Firmware Manual
[TMCL-IDE]   TMCL-IDE User Manual

Please refer to www.trinamic.com.