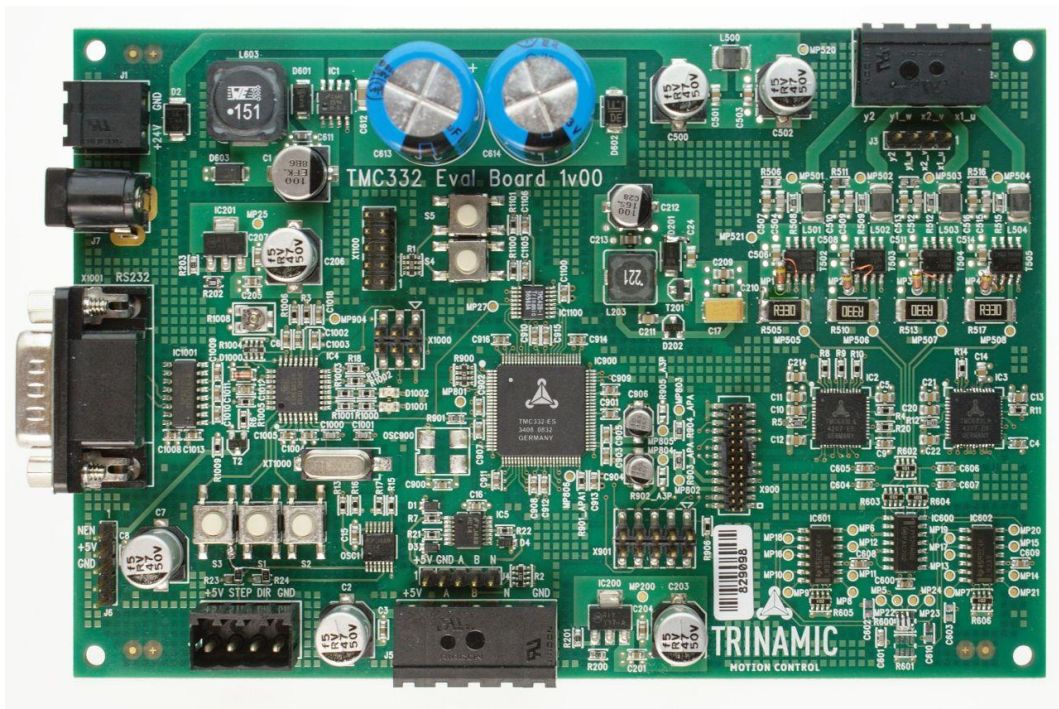


TMC332 Evaluation Board Manual



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1 Introduction

The TRINAMIC TMC332 evaluation board is a stepper motor driver module that is capable of driving either one two-phase bipolar stepping motor or one three-phase stepping motor with a maximum coil current of 2A.

The board is compatible with the TMC428 evaluation software and a modified version to access the TMC332 registers. Additionally, the board is equipped with three control keys and a potentiometer for stand-alone motor control and inputs for a step-direction interface and an ABN-Encoder.

The TMC332 is controlled by a TMC428. For the TMC428, the TMC332 is simply another SPI driver.

The TMC332 includes an SPI interface for the TMC428 SPI driver chain, an SPI interface for configuration, a high resolution micro step sequencer, three high resolution PWM units to control either four half bridges for two-phase stepper motors or three half bridges for three phase stepper motors.

The half bridges are driven by two (one in three phase stepping mode) TMC603.

This board is shipped with a preliminary version of the TMC332 in a TQFP100 package. The final version of the TMC332 is only available in a FBGA144 package.

The dimensions of the evaluation board are 153mm x 100mm. Four mounting holes with a diameter of 3.2mm are located at the corners of the board, with the centers located 3.5mm from the edges.

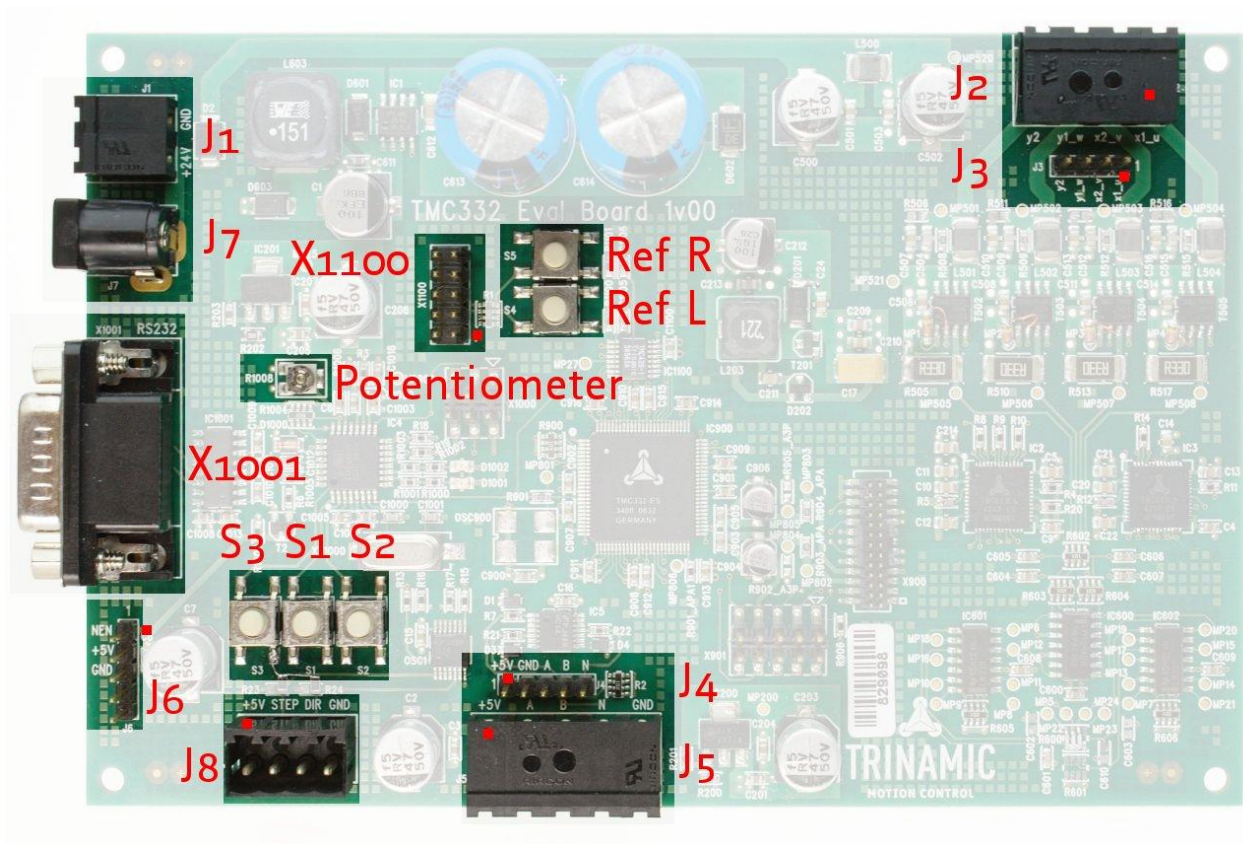


Figure 1: TMC332 Evaluation Board – connectors and control elements

2 Connectors

See Figure 1 for the positions of the connectors. The red squares denote Pin 1 of the connectors.

2.1 Power connectors (J1, J7)

The TMC332 Evaluation Board has two connectors for Power supply. One RIACON connector with 5.08mm spacing and one connector that is compatible with notebook AC adapter (e.g. ThinkPad™ AC adapter, GND on the outside, supply voltage on the inside).

The nominal supply voltage is 24V.

2.2 Motor connectors (J2, J3)

To connect the motor, one can either use the header with 2.54mm spacing or the 4-pin RIACON connector. A two phase stepper motor needs all four pins, a three phase motor is connected to pin 1-3 (x1_u, x2_v, x3_w).

Pin	Two phase stepper	Three phase stepper
1	x1	U
2	x2	V
3	y1	W
4	y2	n.c.

2.3 RS232 connector (X1001)

To use the eval software to change parameters on the board, the board has to be connected to a PC with a standard nullmodem cable, plugged into this connector.

Pin	Signal
2	RxD (data to the board)
3	TxD (data from the board)
5	GND

2.4 Encoder input connectors (J4, J5)

A default ABN incremental encoder with TTL or open collector output can be connected to this input. A 5-pin header or a 5-pin RIACON 5.08mm connector are available. These two connectors have different pin assignments:

Pin	Header	RIACON
1	+5V	+5V
2	GND	A
3	A	B
4	B	N
5	N	GND

2.5 Step/Direction input connector (J8)

With this input, Step/Direction signals (TTL level) can be applied to the TMC332. The connector is a 4 pin RIACON 3.5mm connector.

Pin	Signal
1	+5V
2	Step
3	Dir
4	GND

2.6 Reference switch connector (X1100)

This 10-pin header connector has inputs for two reference switches that can be used additionally to those on the board (S4, S5).

Pin	Signal
1	GND
2	GND
3	Ref L (S4)
4	+3.3V
5	Ref R (S5)
6	+3.3V
7	n.c.
8	+3.3V
9	GND
10	GND

2.7 General purpose output connector (J6)

On this connector one general purpose output is available. The output is an open collector output with a 10k pull up resistor (R1009) to +5V.

Pin	Signal
1	Output
2	+5V
3	GND
4	n.c.
5	n.c.

3 Control Elements

3.1 Two Phase Stepper & Three Phase Stepper

The TMC332 evaluation board can control both, types of stepper motors. Three phase stepper motors have to be connected to X1_U (red), X2_V (blue) and Y1_W (yellow). Two phase stepper motors have to be connected to X1_U, X2_V, Y1_W and Y2; phase X to X1_U and X2_V and phase Y to Y1_W and Y2.

The two phase stepper mode is the default.

3.2 Potentiometer

Depending on the selected mode, the potentiometer is used to define either a position or a speed. The mode is selected with the control key S2 (3.3, p. 6).

3.3 Control Keys S1 & S2 & S3

S1: Switch different functions depending on operating mode. When the motor is stopped, this button toggles the enable signal for the two TMC603 (enabled on power on). When the board is in velocity mode, this button toggles the direction of rotation of the motor by negating the velocity value. In positioning mode this button toggles between two positioning velocities.

S2: Switch between the operating modes. The active operating mode is shown via the green LED.

- Positioning mode (potentiometer controls the position, the green LED flashes with ~5Hz).
- Velocity mode (potentiometer controls the velocity, the green LED flashes with ~1Hz)
- Stop mode (power on default, the green LED flashes with ~0.5Hz)

S3: Switch between two phase and three phase motor mode (the red LED is on when the two phase mode is active)

3.4 Reference Switches RefL & RefR (S4 & S5)

The reference switches are processed by the TMC428 depending on its configuration. The default configuration is that both switches are used as stop switches.

4 Recommended Motors

The recommendations are the default settings of the evaluation board. The recommended supply voltage for these settings is 24V. For other voltages and other motors these settings might have to be adjusted.

4.1 Three Phase Stepper Motor

JapanServo, Type KT42JM06-551

Recommended settings:

PHI_INT = 1

PHI_FRAC = 0

PWM_AMPL = 31

Modulation = ON

4.2 Two Phase Stepper Motor

QMot, QSH-4218-41-10-035

Recommended settings:

PHI_INT = 0

PHI_FRAC = 8388608 (2²³)

PWM_AMPL = 31

Modulation = ON

4.3 Changing the connected Motor

To change the motor, the board does not have to be switched off when following this procedure:

- Change into Stop Mode (Key **S2**)
- Disable the TMC603 drivers (Key **S1**)
- Change the Motor
- If necessary, switch the motor type (Key **S3**)
- Enable the TMC603 (Key **S1**)
- Switch to the other operating modes (Key **S2**)

When changing the motor without disabling the TMC603, the bridge transistors might be destroyed.

5 TMC428 Eval Board Software V 1.44 for TMC332 Eval Board

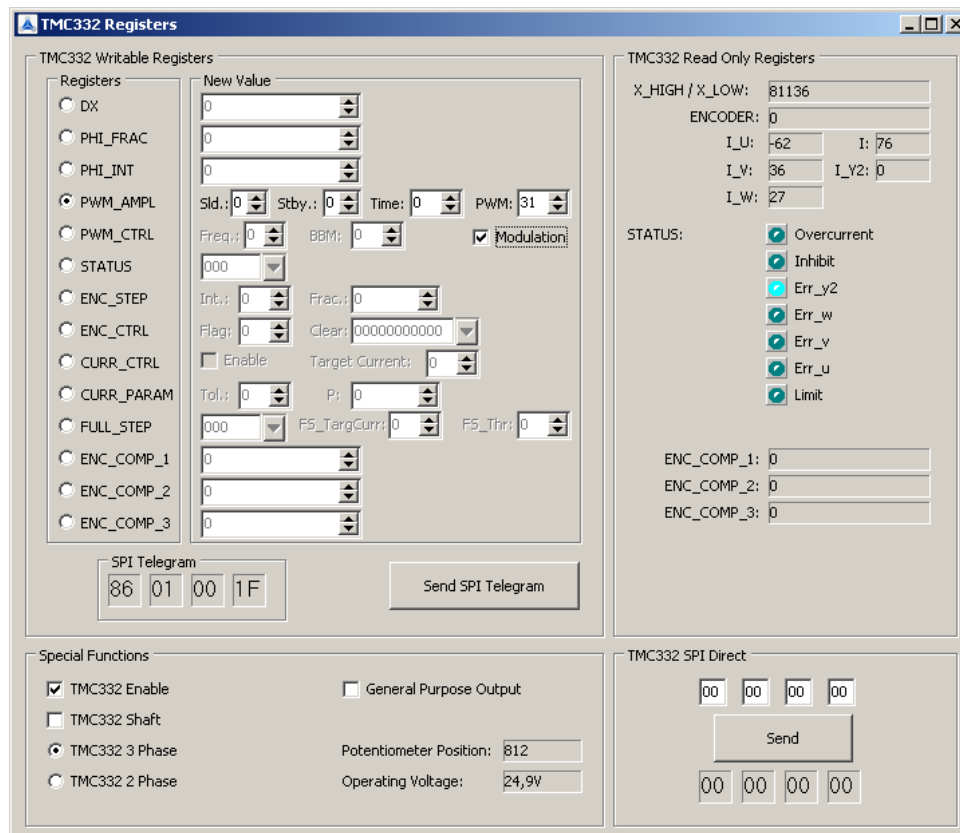


Figure 2: Screenshot of the evaluation software

The evaluation software gives access to every register of the TMC332. The registers for the standby current and the encoder compare registers are not available in the preliminary version of the TMC332, changing these has no effect. For the detailed description of the registers, see the TMC332 datasheet.

Important Hints: Be careful with the PWM_AMPL setting. Doubling the value of the PWM_AMPL register (default is 0x1F = 31) at a given motor supply voltage (e.g. 24V) doubles the coil current. When using the current regulator, the PWM_AMPL setting may be set to a higher value as it is used as the upper limit for the current regulator. Remember to decrease it again before switching off the current regulator.

6 References

TMC332 datasheet (see <http://www.trinamic.com>)

7 **Version history**

Version	Comment	Author	Description
1.0	04-Nov-2008	SL	Initial Version

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