# TMCM-Eval
# Manual

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# Version

| Version | Date | Author | Comment |
|---|---|---|---|
| 1.00 | 15-Apr-03 | OK | Describes version 1.1 of the board |
| 1.01 | 1-Oct-04 | OK | Minor error corrections |

# Contents





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# 1 Introduction

The TMCL-Eval board is an evaluation board for testing and evaluating the TMCM-301, TMCM-302, TMCM-303 and the TMCM-100 module. It is equipped with clamps where every relevant pin of the module is connected, so that cables can be connected easily to every important pin of the module that is to be tested. The board is also equipped with standard RS232 and CAN connectors and an RS232 level shifter and an RS485 line driver, so that all interfaces of a module can be used. There is also one TMC236 motor driver for use with the TMCM-301 and the TMCM-100 module, and a 5V voltage regulator so that the module always gets the right supply voltage.

# 2 Using TMCM-Eval

## 2.1 Overview

Please have a look at Fig. 2.1 or the board itself for an overview of the board.

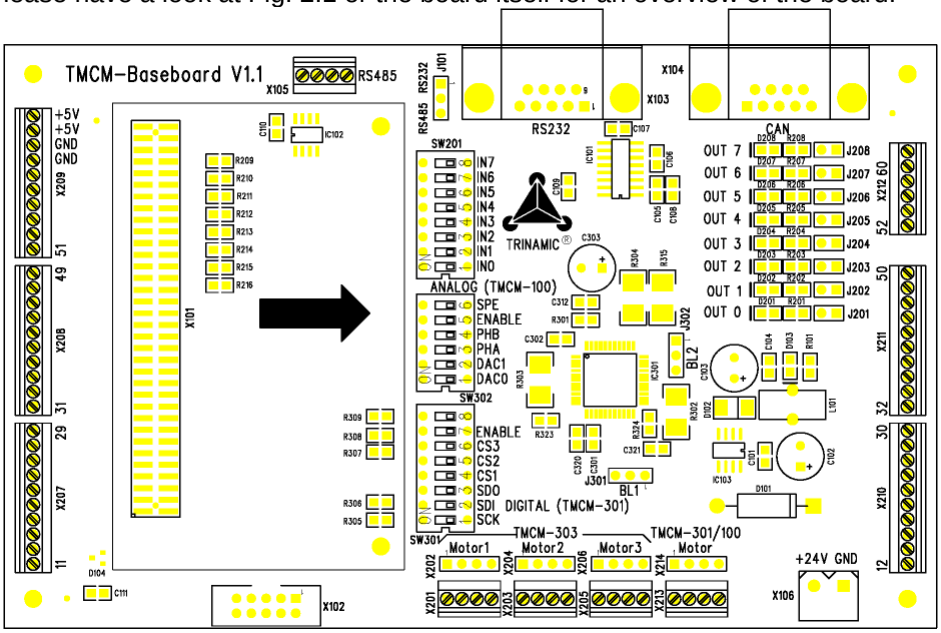


**Fig. 2.1: TMCM-Eval overview**

## 2.2 Mounting the module

Plug in your module so that the side of the module where the LED (and most of the chips) is located points in the direction marked by the big arrow printed on the TMCM-Eval board. **Never use the wrong mounting direction.** Always double check the mounting direction, as a wrong mounting direction will cause severe damage to the module!

## 2.3 DIP switches

Before connecting the power supply, make sure that the DIP switches are set up correctly. The positions of the switches SW301 (marked “DIGITAL (TMCM-301)”) and SW302 (marked “ANALOG (TMCM-100)”) depend on the module you are using:

- If you are using a TMCM-100 module, all switches of SW301 (“DIGITAL (TMCM-301”) must be in their OFF positions. All switches of SW302 (“ANALOG (TMCM-100)”) must be in their ON positions, so that the TMC236 motor driver can be used in analog mode with the TMCM-100 module.
- If you are using a TMCM-301 module, switches #1, #2, #3, #7 and **one of** the switches #4, #5 or #6 must be in their ON positions. Then, the TMC236 motor driver on the TMCM-Eval board can be used in digital (SPI) mode with the TMCM301 module.
- If you are using a TMCM-302 or a TMCM-303 module, all switches of SW301 and SW302 must be in their OFF positions, as the TMC236 chip on the TMCM-Eval board can not be used (and is not needed) with these modules.

The following subsections explain the functionality of the DIP switches in detail.

### 2.3.1 DIP switch SW301 (DIGITAL / TMCM-301)

These switches connect the digital (SPI) pins of the TMC236 motor driver on the TMCM-Eval board to the appropriate pins of a TMCM-301 module.

| Switch | Function |
|---|---|
| #1 (SCK) | Connects the SCK (SPI Clock) pin of module (pin 30). |
| #2 (SDI) | Connects the SDI (SPI Data Input) pin of the module (pin 26). |
| #3 (SDO) | Connects the SDO (SPI Data Output) pin of the module (pin 28). |
| #4 (CS1) | Connects the CS_M0 (Chip Select) pin of the module (pin 20). |
| #5 (CS2) | Connects the CS_M1 (Chip Select) pin of the module (pin 22). |
| #6 (CS3) | Connects the CS_M2 (Chip Select) pin of the module (pin 24). |
| #7 (ENABLE) | Pulls the EN (Driver Enable) pin of the TMC236 low so that the motor driver will be enabled if this switch is in its ON position. |
| #8 | not used |

The switches #4, #5 and #6 must never be switched on simultaneously. Only one of these switches should be switched on at a time. They select if the TMCM236 is used as a driver for axis #0, #1 or #2 of the module.

### 2.3.2 DIP switch SW302 (ANALOG / TMCM-100)

These switches connect the analog pins of the TMC236 motor driver chip to the appropriate pins of a TMCM-100 module.

| Switch | Function |
|---|---|
| #1 (DAC0) | Connects the analog signal for Phase A (module pin 39). |
| #2 (DAC1) | Connects the analog signal for Phase B (module pin 41). |
| #3 (PHA) | Connects the polarity signal for Phase A (module pin 25). |
| #3 (PHB) | Connects the polarity signal for Phase B (module pin 29). |
| #5 (ENABLE) | Pulls the EN (Driver Enable) pin of the TMC236 low so that the motor driver will be enabled if this switch is in its ON position. |
| #6 (SPE) | Puts the TMC236 chip into the analog mode (by pulling the its SPE pin low). |

All these switches must be in their ON positions to make the TMC236 motor driver work with a TMCM-100 module plugged on the TMCM-Eval board.

### 2.3.3 DIP switch SW201 (IN0..IN7)

These switches can be used with all TMCM modules. They pull the input lines of the module (pins 45/47/49/51/53/55/57/59) low when switched on. The input lines are pulled high by pull-up resistors (10k, R209..R216) on the TMCM-Eval board when the DIP switches are switched off.

## 2.4 LEDs on the board

The green LED D103 is the power control LED which lights up when a power supply is connected to the board and switched on.
The red LEDs D201..D208 (OUT0..OUT7) are connected to the digital output pins of the TMCM-301/302/303 modules. They can be disconnected by pulling the jumpers beside the LEDs. The output pin assignment of the TMCM-100 module is different, so when using a TMCM-100 module, only the LEDs D201..D203 (OUT0..OUT3) can be used and they show the states of OUT2..OUT5 of the module, all the other LED jumpers should be pulled.

# 2.5 The power connector

Connect your power supply to the power connector (X106). The polarity is printed on the board beneath the connector. The voltage must be between 7 and 28.5 VDC. The TMCM-Eval board is protected against wrong polarity by a diode which shorts the power supply if the polarity is wrong.

# 2.6 The motor connectors

## 2.6.1 TMCM-303

When using a TMCM-303 module, use the three motor connectors marked “TMCM-303 Motor 1 / Motor 2 / Motor 3”. For every motor you can either use the header or the clamp connector. Every motor must be connected as shown in Fig. 2.2. **Do not connect or disconnect a motor while the power is switched on.**

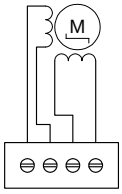


**Fig. 2.2: How to connect a motor**

## 2.6.2 TMCM-301 or TMCM-100

When using a TMCM-301 or a TMCM-100 module, connect your motor to the connector marked “TMCM-301/100 Motor”. This connects to the TMC236 motor driver chip the TMCM-Eval board is equipped with. Connect the motor as shown in Fig. 2.2. **Do not connect or disconnect a motor while the power is switched on.**

# 2.7 The interface connectors

The TMCM-Eval board provides connectors for CAN, RS232 and RS485 interface. It is also equipped with level shifters / line drivers so that every interface can be connected directly to a PC. Before using the RS232 or RS485 interface you have to select which one you are using by setting the jumper JP101.

## 2.7.1 RS232

The Sub-D connector marked “RS232” (X103) provides the RS232 interface. To use it, set jumper J101 into its appropriate position (connecting pins 1+2, printed on the board). Use a null modem cable to connect the board to the RS232 interface (COM1, COM2, or the like) of a PC. The pin assignments of the RS232 connector are as follows:

| Pin | Signal |
|---|---|
| 2 | RxD |
| 3 | TxD |
| 5 | GND |

All the other pins of this connector are not connected.

### 2.7.2 RS485

The clamp marked “RS485” (X105) provides the RS485 signals. To use it, set jumper J101 to its appropriate position (connecting pins 2+3, printed on the board). The pin assignments of the RS485 clamp are as follows:

| Pin | Signal |
|---|---|
| 1 (rightmost pin) | GND |
| 2 | GND |
| 3 | RS485 + |
| 4 | RS485 - |

### 2.7.3 CAN

The Sub-D connector marked “CAN” (X104) provides the CAN interface. In contrast to the other interfaces, the module itself is equipped with the line driver for this interface. The pin assignments of the CAN connector are as follows:

| Pin | Signal |
|---|---|
| 2 | CAN Low |
| 7 | CAN High |
| 3 | GND |
| 6 | GND |

All the other pins of this connector are not connected.

## 2.8 Other connectors

All pins of the module which are not connected to any connector mentioned above are connected to the clamps located at the left and the right side of the TMCM-Eval board. Pins with odd numbers are on the left, and pins with even numbers are on the right side of the module. The pin numbers are printed on the board. Please consult the module-specific hardware manual for the pin assignments.