# TMCM-1290-EVAL Evaluation Board

Hardware Version V1.00 | 19-101844, Rev 0, 01/24

The TMCM-1290-EVAL evaluates the TMCM-1290 as a standalone board with TMCL-IDE evaluation capabilities. It uses the standard schematic and offers several options to test different modes of operation. The TMCM-1290 is a module for two-phase bipolar stepper motors up to 2.1A$_{RMS}$ (3A$_{PEAK}$). It can be configured through an SPI/RS485/UART interface option.

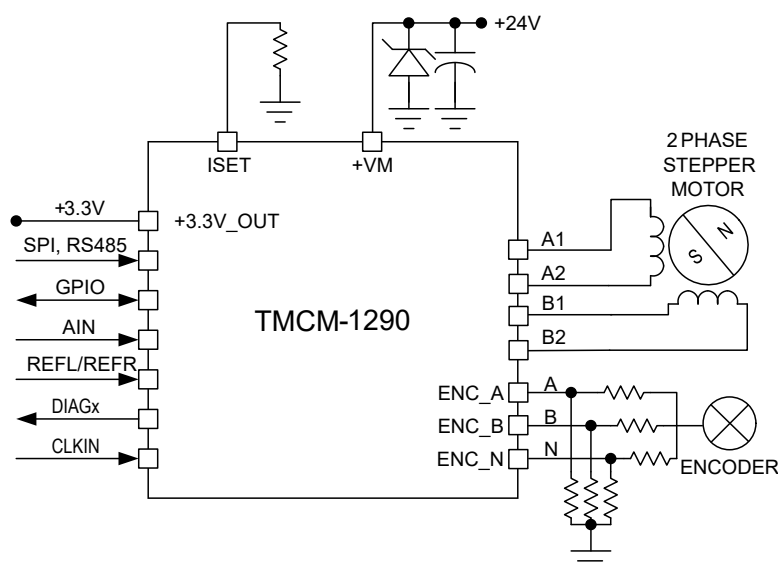| ⚠ WARNING	DO NOT CONNECT/DISCONNECT MOTOR WHILE POWER IS CONNECTED.
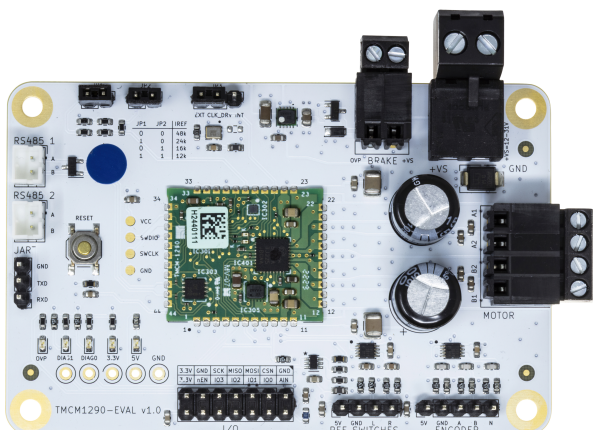
Features

- **2-phase** stepper motor up to 2.1A$_{RMS}$ coil current (3A$_{PEAK}$)
- **Supply Voltage:** 12V to 31V DC
- SPI, RS485, and UART (optional) interface
- TMCL™ and Modbus protocol stack
- Integrated stepper motor driver
- Integrated 8-point motion controller
- Encoder interface and reference switch input
- StealthChop2 , CoolStep , StallGuard2 , SpreadCycle Support
- Analog and Digital IO

Applications

- Broad Market
- System Integrators
- Lab Automation
- Textile
- Packaging
- Life Sciences
- Semiconductor Handling
- Pumps and Motor Drives
- Multi-Axis Applications

Simplified Block Diagram

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Read entire documentation.

Contents

1 Order Codes

Order Code	Description	Size
TMCM-1290-EVAL	Evaluation board for the TMCM-1290-TMCL and TMCM-1290-Modbus Motion Cookies with RS485 and UART interface and a dual H-bridge 24V/2A power stage for stepper motors	85mm x 55mm

Table 1: TMCM-1290-EVAL Order Codes

2   Getting Started

Required Equipment

- TMCM-1290-EVAL evaluation board
- Stepper motor (example, QMot line)
- RS485 to USB adapter
- Power supply
- Latest TMCL-IDE V3.9.0 (or higher)
- Cables for interface, motor, and power

Precautions

- Do not mix up connections or short-circuit pins.
- Avoid bundling I/O wires with motor wires.
- Do not exceed the maximum rated supply voltage!
- Do not connect or disconnect the motor while powered!
- START WITH POWER SUPPLY OFF!

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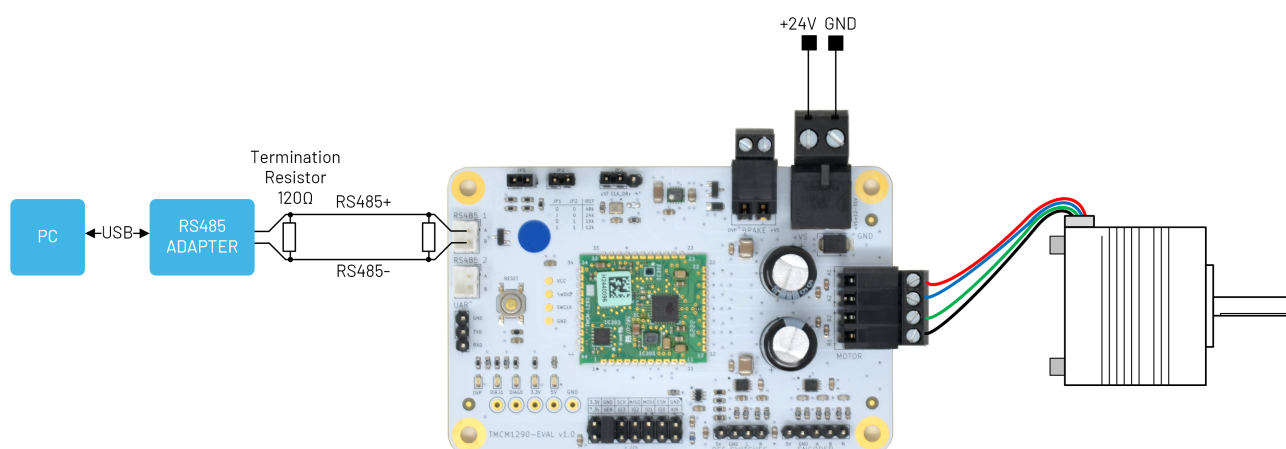
2.1   First Start-Up

Figure 1: Getting Started

1. Make sure that the latest version of the TMCL-IDE V3.X is installed. Download the TMCL-IDE V3.X from https://www.analog.com/en/design-center/evaluation-hardware-and-software/motor-motion-control-software/tmcl-ide.html.

2. Set the IREF jumper JP1 and JP2 according to the stepper motor rated current.

3. Set jumper JP3 to external clock (EXT).

4. Connect the stepper motor phases to the TMCM-1290-EVAL motor connector.

5. Connect TMCM-1290-EVAL RS485 connector to the PC using a RS485 adapter. The bus should be poperly terminated using a termination resistor at both ends, especially for longer buses.

NOTE   Some RS485 adapters include the termination resistor. Refer to the manufacturer RS485 data sheet.

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6. Power the module through the power supply connector. The TMCM-1290 on-board green LED blinks after power up.

7. Open TMCL-IDE V3.X and connect the TMCM-1290-EVAL through RS485 to the computer. The default baud rate is 115200 and default ID 1.

   For Windows® 8 and higher, no driver is needed. On Windows 7 machines, the TMCL-IDE V3.X installs the driver automatically.

   Windows is a registered trademark of Microsoft, Corp.

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Figure 2: TMCL-IDE R485 Connection Tool
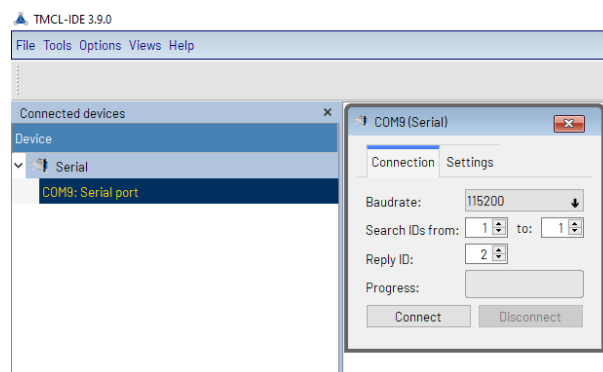
8. Verify that the evaluation board is using the latest firmware version. The connected device tree shows the firmware version. Download the newest firmware from the product page.
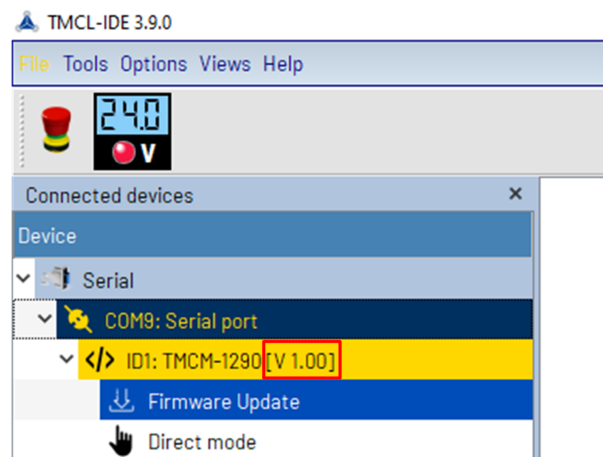

Figure 3: Firmware Version

9. Set the run and hold current using the Settings tool.

10. Enable the motor and pull ENN pin low.

11. Run the motor using the Velocity mode or the Position mode tool.

3   Hardware Information

All design files for TRINAMIC evaluation boards are available for free. The original ECAD files, Gerber data, the BOM, and PDF copies are available. Typically, the ECAD files are in KiCAD format. Check the schematics for jumper settings and input/output connector descriptions.

Download the files from the TRINAMIC evaluation boards home page.

| Note | To locate files or for other concerns, contact Customer Service. |

3.1   Connectors

The TMCM-1290-EVAL has six on-board connectors. The following table contains information on the connector type and mating connectors.
The connector pinning and signal names can be derived from the board design and schematic files available here: TRINAMIC TMCM-1290-EVAL homepage

#	Connects to...	Connector Type	Description
1	Power Supply	METZ CONNECT 31330102	Power supply to the evaluation board. Mating connector: METZ CONNECT 31349102
2	Motor	METZ CONNECT 31330103	Connects the motor to the TMCM-1290 output. Mating connector: METZ CONNECT 31349103
3	Encoder	Standard 5x 2.54mm header	Use to connect ABN encoder to board.
4	Ref Switches	Standard 4x 2.54mm header	Use to connect reference switches to board.
5	I/O	Multipin connector, 14x 2.54mm header	Use to connect I/O to board.
6	RS485,	JST_PH_B2B-PH-K_1x02_P2.00mm_Vertical	CAN interface. Mating connector: JST PHR-2 Crimp contacts: BPH-002T-P0.5S (0.5mm to 0.22mm)
7	UART	3x 2.54mm header	Use to connect UART to board.
6	Brake	METZ CONNECT 31182102	Use to connect a brake resistor or a motor brake to the TMCM-1290. Mating connector: METZ CONNECT 31169102

Table 3: TMCM-1290-EVAL Connectors
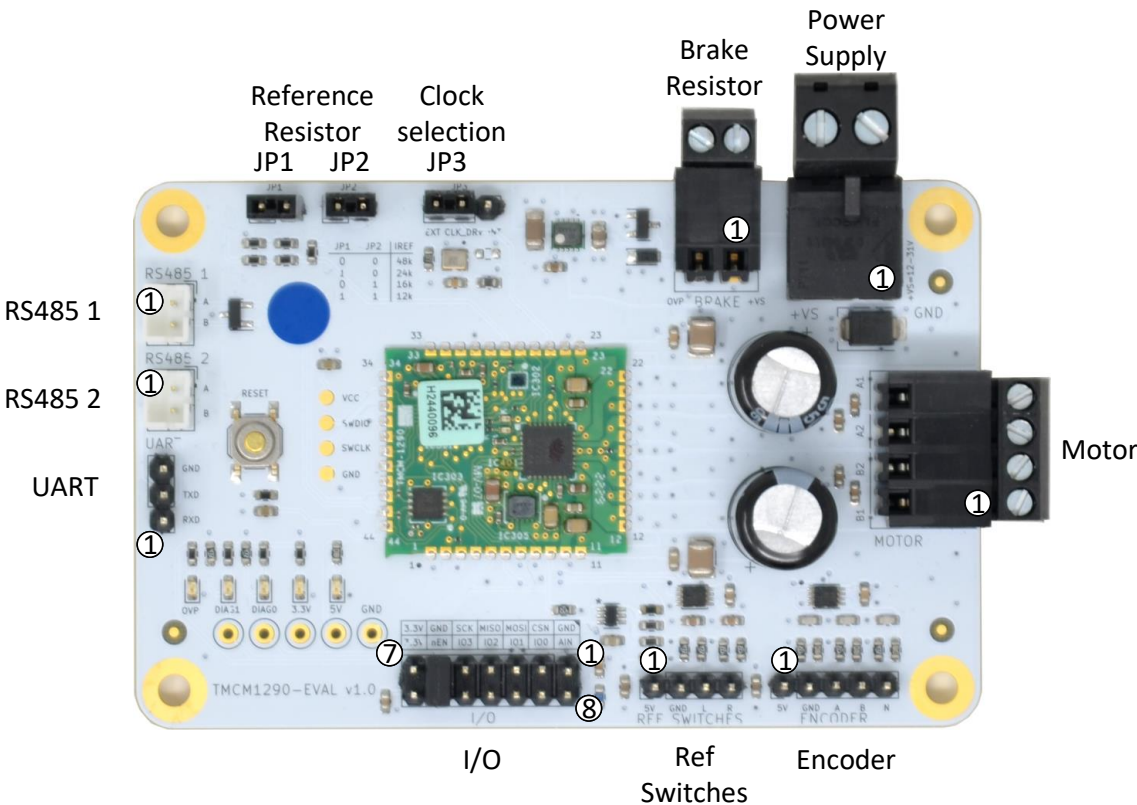
Figure 4: TMCM-1290-EVAL Connectors

3.1.1 Power Connector

The power supply connector to power the TMCM-1290-EVAL-KIT. Required for operation and communication.

Pin	Label	Description
1	GND	Signal and supply ground
2	+VS	Motor supply voltage (12V to 31V)

Table 4: Power Supply Pin Assignment

3.1.2 Motor Connector

Pin	Label	Description
1	B1	Motor coil phase B1
2	B2	Motor coil phase B2
3	A2	Motor coil phase A2

Pin	Label	Description
4	A1	Motor coil phase A1

Table 5: Motor Pin Assignment

3.1.3   Encoder Connector

Pin	Label	Description
1	+5V	+5V output for encoder sensor supply
2	GND	Encoder sensor supply and signal ground
3	A	Encoder channel A
4	B	Encoder channel B
5	N	Encoder index/null channel

Table 6: Encoder Pin Assignment

3.1.4   Reference Switches Connector

Pin	Label	Description
1	+5V	+5V output for SPI encoder sensor supply
2	GND	SPI encoder sensor supply and signal ground
3	L	Left reference switch input, +5V level
4	R	Right reference switch input, +5V level

Table 7: Reference Switches Pin Assignment

3.1.5   I/O Connector

Pin	Label	Description
1	GND	Supply and signal ground
2	CSN	SPI chip select signal, +3.3V level
3	MOSI	SPI MOSI signal, +3.3V level
4	MISO	SPI MISO signal, +3.3V level
5	SCK	SPI clock signal, +3.3V level
6	GND	Supply and signal ground
7	+3.3V	+3.3V output rail
8	AIN	Analog input (0V to 1.25V)
9	GPIO0	General purpose input/output, FW default: input, +3.3V level
10	GPIO1	General purpose input/output, FW default: input, +3.3V level

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Pin	Label	Description
11	GPIO2	General purpose input/output, FW default: input, +3.3V level
12	GPIO3	General purpose input/output, FW default: input, +3.3V level
11	Enable	Motor driver enable, GND: low power mode, 3.3V: driver enabled
14	+3.3V	+3.3V output rail

Table 8: I/O Pin Assignment

3.1.6 RS485 Connector

The RS485 connector is an interface for the TMCM1290-CAN-EVAL. The second RS485 connector can be used to connect a second RS485 node.

Pin	Label	Description
1	RS485 A	RS485+, differential RS485 bus signal (non-inverting)
2	RS485 B	RS485-, differential RS485 bus signal (inverting)

Table 9: RS485 Pin Assignment

3.1.7 UART

The UART interface connects directly to the TMCM-1290 .

Pin	Label	Description
1	RXD	UART RxD, receive data in (+3.3V level)
2	TXD	UART TxD, transmit data out (+3.3V level)
3	GND	Supply and signal ground

Table 10: UART Pin Assignment

The UART is an interface option and not supported by default on the TMCM-1290. In case UART is required, contact Customer Service.

3.1.8 Brake Connector

A brake resistor can be connected to the brake connector to dissipate energy from voltage overshoot. For configuration of the BRAKE pin function, refer to the TMCM-1290 firmware data sheet .

Pin	Label	Description
1	+VS	Power Supply Output
2	OVP	Open collector brake output

Table 11: Brake Pin Assignment

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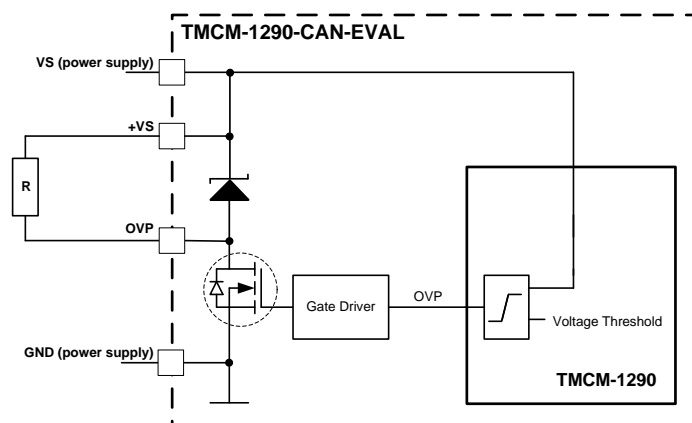DEVICES**

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Figure 5: Example Brake: Shunt Resistor

3.2 Jumper and Button

3.2.1 Current Scaling IREF Jumper JP1 and JP2

The IREF pin of TMCM-1290 is connected to a resistance network on the evalboard. This feature is targeted for a quick change of the reference resistor and defines the maximum motor phase current.

IREF_R2	IREF_R3 [Ω]	R_REF [Ω]	Max. FS current [A]	Max. rms current [A]
LOW	LOW	48k	0.75	0.5
HIGH	LOW	24k	1.5	1.1
LOW	HIGH	16k	2.25	1.6
HIGH	HIGH	12k	3	2.1

Table 13: IREF Selection and Resulting Maximum Current Setting, AP179 = 3 (Default)

NOTE	The jumper configuration must be set in the Settings tool for correct display of the current values in the TMCL-IDE V3.X.

3.2.2 Clock Selection Jumper JP3

The TMCM-1290 clock is selected by jumper JP3.

Pin	Description
INT	Internal clock 12.5Mhz
EXT	External clock 16Mhz

Table 14: Motor Driver Enable JP2

3.2.3   Reset Button

The reset button pulls the TMCM-1290 nRST pin low when pressed, which resets the TMCM-1290.

Pin	Description
Open	Pin nRST = 3.3V, normal operation
Pressed	Pin nRST = GND, TMCM-1290 reset

Table 15: Reset button

3.3   Light-Emitting Diode (LED)

| LED Description		
Status	**Label**	**Description**
5V	5V	This yellow LED lights up upon +5V supply being available.
3.3V	3.3V	This yellow LED lights up upon +3.3V from the TMCM-1290 being available. This LED is connected to +3.3V (pin 37) of the TMCM-1290.
Position compare	DIAG0	This red LED turns off when moving over a programmable position (configuration required). This LED is connected to DIAG0 (pin 4) of the TMCM-1290.
Step output	DIAG1	This red LED turns off at every microstep. This LED is connected to DIAG1 (pin 5) of the TMCM-1290.
Brake active	OVP	This red LED lights up upon an active brake condition (configuration required). This LED is connected to OVP (pin 9) of the TMCM-1290.

Table 16: LED Description
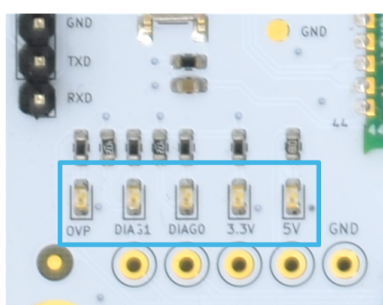
Figure 6: TMCM-1290-EVAL LEDs

Beside the LED on the TMCM-1290-EVAL, the TMCM-1290 integrates an green on-board LED. This LED indicates the current firmware version:

- 1Hz: TMCL
- 2Hz: Modbus

4　TMCL-IDE Evaluation Features

This chapter gives tips on using the TMCL-IDE. For example, how to use the velocity mode or some feature-based tools.
Each setting corresponds to one axis parameter in TMCL. The correponding parameter numbers are shown when hovering over a setting with the mouse pointer.

For further information on the TMCL-IDE usage, refer to the TMCL IDE user manual.

NOTE	The *Direct Mode* tool of the TMCL-IDE provides helpful information about any axis parameter. For a description of available axis parameters and to achieve optimal settings, refer to the descriptions and flow charts in the TMCM-1290 firmware data sheet. Beyond that, the data sheet explains concepts and ideas essential for understanding how the axis parameters are linked together and which settings are suitable for the application. At first, to get more familiar with the evaluation board, drive the motor using velocity or position mode first.

4.1　Board Information

The TMCM-1290-EVAL board information tool is available from the tree view, when clicking on the board. It provides information on the analog inputs and digitial inputs status of the board. The digital output states can be changed using the checkboxes.
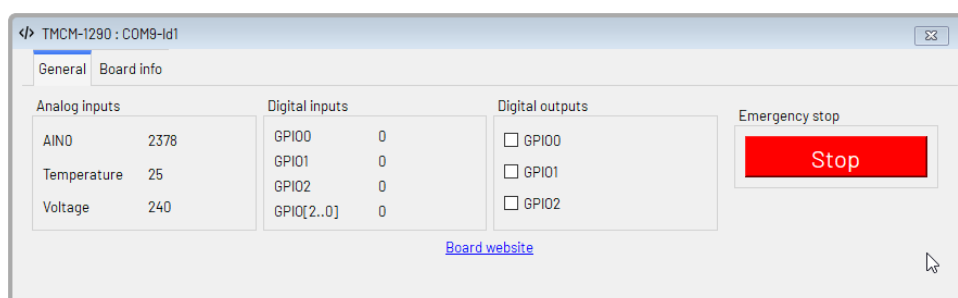

Figure 7: Board Information Tool

The *Emergency Stop* stops the motor by sending the following commands to the module:

- Stop the application/stop TMCL program execution (128).

- Stop the motor (MST).

4.2 Settings

The *Settings* tool allows to change basic axis-specific settings. The main settings here are the motor run current and standby current. The current settings should be adapted to the used motor.

Furthermore, the limit switches and the microstep resolution are configured here.
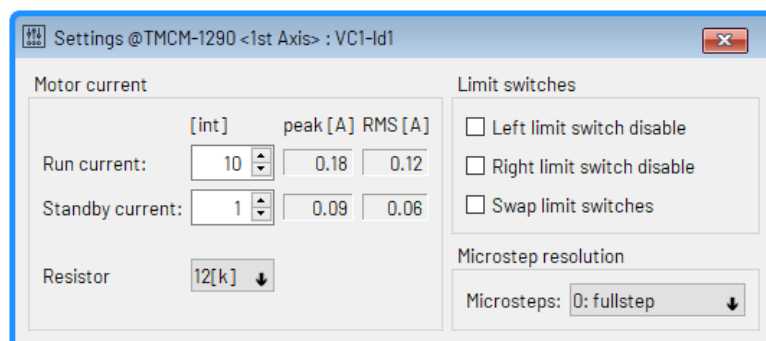

Figure 8: Settings Tool

4.3   Velocity Mode

To move the motor in velocity mode, open the velocity mode tool by clicking the appropriate entry in the tool tree. In the velocity mode tool, enter the desired velocity and acceleration, and then move the motor using the arrow buttons. Stop the motor at any time by clicking the stop button. Open the velocity graph tool to get a graphical view of the actual velocity. Check the desired run and hold currents in the *Current settings* tool before.
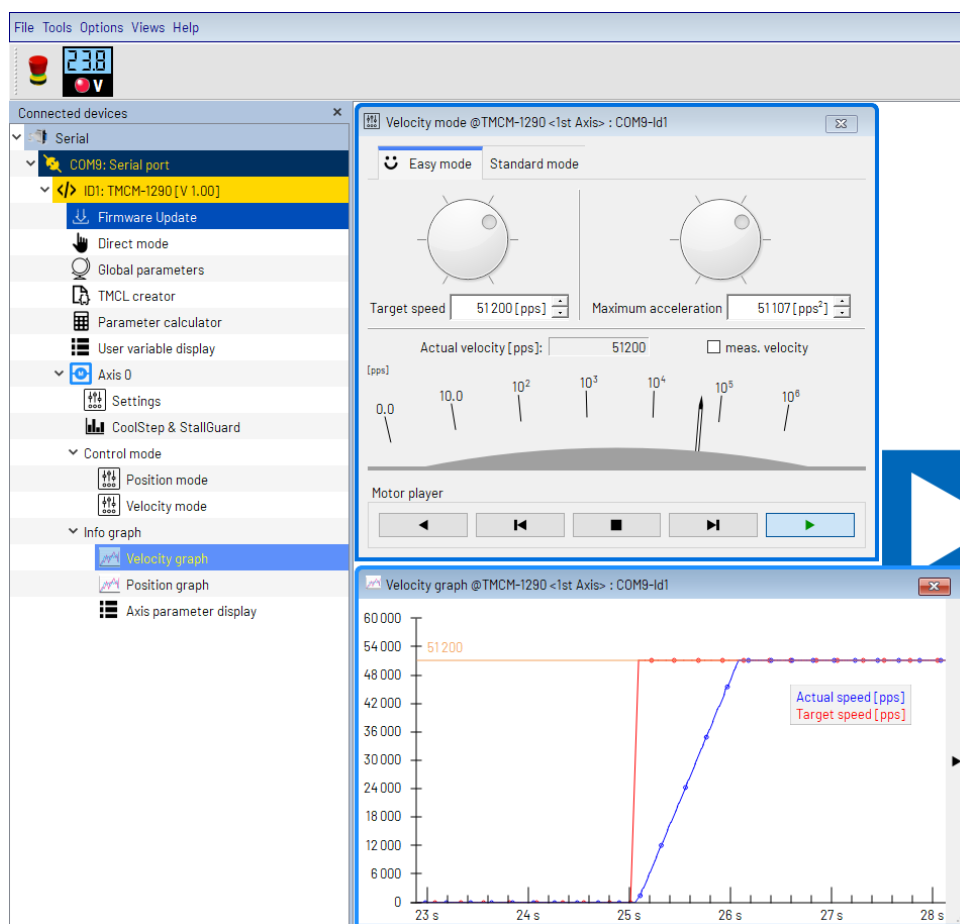

Figure 9: Driving the Motor in Velocity Mode

4.4   Position Mode

To move the motor in position mode, open the position mode tool by clicking the appropriate entry in the tool tree. In the position mode tool, enter a target position and then start positioning by clicking the *Absolute* or *Relative* move button. The speed and acceleration used for positioning can also be adjusted here.
Open the position graph tool to get a graphical view of the actual position.
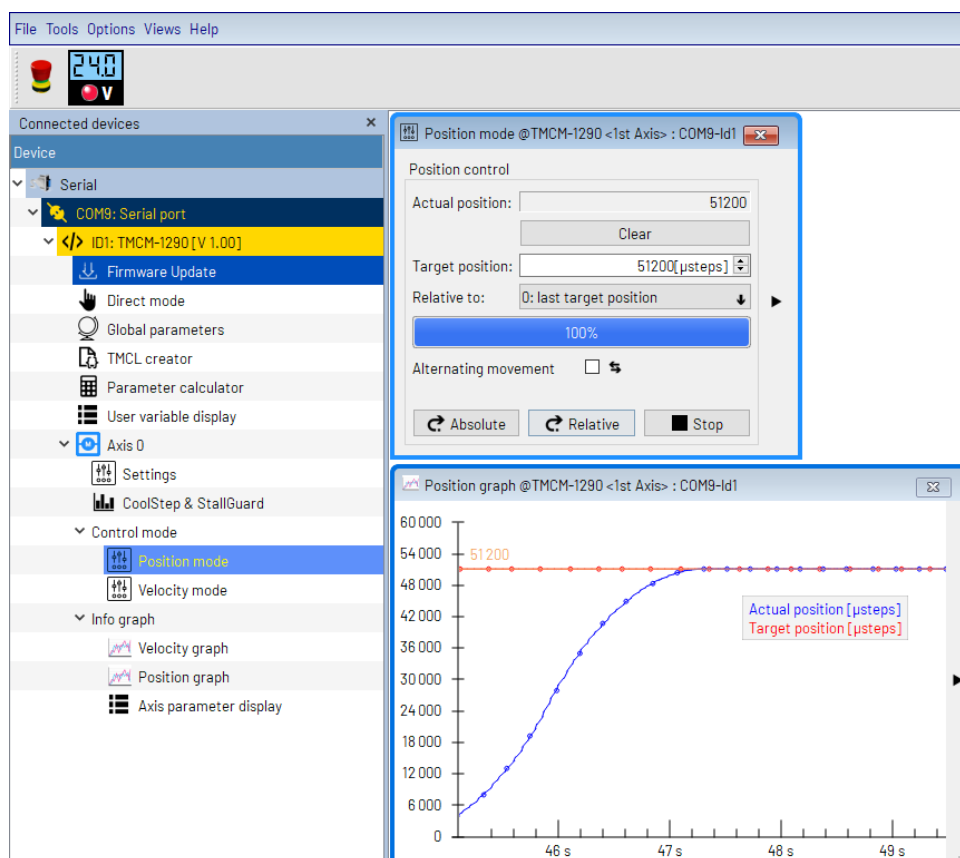Change the desired run and hold currents in *Current settings* tool before.

Figure 10: Driving the Motor in Position Mode

4.5 TMCL Creator

The *TMCL Creator* can be used to develop standalone TMCL programs on the TMCM-1290. These TMCL programs can be downloaded to the TMCM-1290 and then run standalone after power up. The central part of the TMCL Creator is its main window with its own menu bar and the TMCL program editor. The TMCL program editor mainly provides the functionality of a standard text editor with built-in syntax highlighting for TMCL. Here, TMCL programs can be entered and modified. After a program is entered, it can be assembled, downloaded to the module, and run on the module.
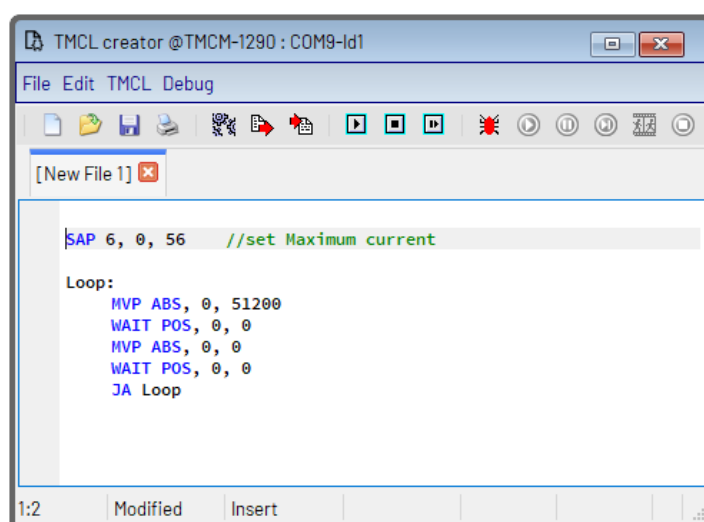

Figure 11: TMCL Creator Example

For further information on the syntax of the TMCL programming language and the *TMCL Creator* tool, refer to the TMCL-IDE user manual manual. Refer to the TMCM-1290 TMCL firmware manual to learn more about using TMCL as a programming language.

5   Revision History

5.1   Hardware Revision

Version	Date	Description
V1.0	2022-DEC-12	Initial version

Table 17: Hardware Revision

5.2   Document Revision

Version	Date	Description
Rev 0	01/24	Initial release

Table 18: Document Revision

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