# TMC4671-EVAL Evaluation Board

Document Revision V1.0 • 2018-MAY-03

The TMC4671-EVAL is designed for evaluating all features of the TMC4671-ES. The evaluation board is part of TRINAMICs user-friendly plug-in system for chip evaluation. Just connect the TMC4671-EVAL with Landungsbruecke, the associated base board and a separate Power Stage (e.g. TMC-UPS-10A/70V) for easy configuration of PI controllers and feedback systems as well as driving a motor in standard modes like position, velocity or torque mode.



## Applications

- Laboratory Automation
- Robotics
- Manufacturing
- Semiconductor Handling
- Factory Automation
- Test & Measurement

### Features

- Servo Controller for DC, BLDC and stepper motors
- Control of torque (FOC), velocity and position by cascade control
- Integrated Delta Sigma ADCs
- 5V Supply Voltage (onboard buck converter for VCCIO 3.3V)
- SPI and UART for communication with Microcontroller
- Realtime Monitoring Interface
- ABN Encoder Interface, Digital Hall Interface, Analog Hall Interface, Sine/-Cosine Encoder and Ref.-Switch Input
  - Life Science
  - Biotechnology
  - Liquid Handling





## Contents

1	Getting Started         1.1       First Start-Up	<b>3</b> 4			
2	Hardware Information	5			
3 Evaluation Features in the TMCL-IDE					
4	Revision History         4.1 Document Revision	<b>8</b> 8			



### **1 Getting Started**

### You need

- TMC4671-EVAL
- Landungsbruecke or Startrampe with latest firmware (We recommend the Landungsbruecke as it offers faster USB communication.)
- 2 x Eselsbruecke
- TMC-UPS-2/24-EVAL or TMC-UPS-10A/70V-EVAL
- BLDC or Stepper motor with supported feedback system
- USB interface
- Power Supply
- Latest TMCL-IDE V3.0 and PC
- · Cables for interface, motors and power

### Precautions

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



Figure 1: Getting started

#### NOTICE

The Landungsbruecke operates on USB Power Supply. All other voltages are generated from V\_M. Kit works only, when V\_M is applied.



#### **1.1 First Start-Up**

- 1. Make sure that the latest version of the TMCL-IDE is installed. The TMCL-IDE can be downloaded from www.trinamic.com/support/software/tmcl-ide/.
- Open the TMCL-IDE and connect the Landungsbruecke or Startrampe via USB to the computer. For Windows 8 and higher is no driver needed, on Windows 7 machines the TMCL-IDE is installing the driver automatically.
- 3. Verify that the Landungsbruecke or Startrampe is using the latest firmware version. The firmware version is shown in the connected device tree.

🚴 TMCL-IDE 3.0					
<u>File</u> <u>T</u> ools <u>O</u> ptions Views <u>H</u> elp					
Connected devices ×					
Device					
✓ 🛶 USB					
🗸 🏹 COM6: USB port					
🗸 🌰 ID1: Landungsbruecke [V 3.01]					
🕛 Direct mode					

Figure 2: Firmware Version

- 4. The TMCL-IDE 3.0 needs room to show all important information and to provide a good overview. Therefore, arrange the main window related to your needs. We recommend using full screen. For evaluation boards it is essential to have access to the registers. Therefore open up the Register Browser (left side). For a better view click top right on the normal icon to get a maximized register browser window.
- 5. The TMCL-IDE includes a dialogue for diagnostic tasks. Further, the dialogue provides an overview of the connected motion controller and driver chips. Thus, a window pops up immediately after connecting the evaluation kit the first time. The window shows the actual status of the connections. The second tab of the dialogue offers the possibility to choose basic settings or to reset the module to factory 1defaults.

Board Assignment Settings	Board Assignment Settings
Automated board detection	Reset
Push scan for automated detection of connected boards. Please keep the evaluation board firmware up to date.	You can reset the board settings to defaults here. Form most Trinamic chips it's a matter of firmware to restore defaults.
Scan	Please note that the default settings are not neccessarily the chip reset settings. The default
Scanning.	O Motion controller board only
Manual board assignment	O Power driver board only Reset boards to defaults
Select connected boards manually. This is only recommended if automated detection fails somehow. Please keep the evaluation	<ul> <li>Both</li> </ul>
board firmware up to date. Choosing a wrong combination	Driver Enable
Motion controller Driver	Please disable drivers before plug/unplug a motor to a driver board. Otherwhise the driver may be damaged!
Diagnostics	Diagnostics
Everything seems to be fine. Have Fun!	Everything seems to be fine. Have Fun!
Information	Information
Motor Supply: 0.0V	Motor Supply: 0.0V
	Board at ch1(Motion Controller): none
Board at ch1(Motion Controller): none	Board at ch2(Power Driver): pone
Board at ch1(Motion Controller): none Board at ch2(Power Driver): none	

Figure 3: Landungsbruecke Dialogue



6. In the upper area of the Evaluation board you find pin headers for connecting Digital Encoders, Digital Hall Signals and Reference Switches. These input pins are 5V tolerant and have extra protection and conditioning circuitry. Analog Hall Sensor Signals or Sine/Cosine Encoder can be processed as single ended analog signals at the respective pin headers in the lower area of the PCB. Power Supply and GND pins allow easy connection. Please check board schematics for proper connection of your feedback system.



Figure 4: Pin Headers on TMC4671-EVAL

## 2 Hardware Information

All design files for our evaluation boards are available for free. We offer the original ECAD files (Eagle, Altium, or PADS), Gerber data, the BOM, and PDF copies.



The files can be downloaded from the evaluation boards' website directly at <a href="https://www.trinamic.com/support/eval-kits/">https://www.trinamic.com/support/eval-kits/</a>.

Note

If files are missing on the website or something is wrong please send us a note.

### **3** Evaluation Features in the TMCL-IDE

This chapter gives some hints and tips on using the functionality of the TMCL-IDE, e.g. how to use the velocity mode or using the wizards. The register browser can be used to access every register of the TMC4671.

Start first parametrization of the TMC4671-EVALwith the Wizard, providing guided dialogues to configure and calibrate your setup. Use configuration dialogues to setup PWM, Openloop generator, ADC calibration, and feedback configuration. You can start the Wizard by clicking the marked icon (see fig. 5).



Figure 5: Wizard Icon in TMCL-IDE

The TMCL-IDE also offers special dialogues for selectors, limits and PI controller configuration accessible from the left control pane.

	NE TRANSPORT		
Adr	Name	Value	
0x52	PHI_E_SELECTION	reserved	
0x50	0 VELOCITY_SELECTION phi_e selected via PHI_E_S		
0x51	POSITION_SELECTION	phi_e selected via PHI_E_SELECTION	
	MODE_MOTION	stopped_mode	
0x63	MODE_RAMP	no velocity ramping	
	ADC_10_SELECT	ADC_I0_RAW (analog input ADC_I_U)	
	ADC_I1_SELECT	ADC_10_RAW (analog input ADC_1_U)	
0x0A	ADC_I_UX_SELECT	UX = ADC_I0 (default)	
	ADC_I_V_SELECT	V = ADC_10	
	ADC_I_WY_SELECT	WY = ADC_10	
Limit	s @TMC4670 [Aα] <1st motor of 1> (Landun;	gsbruecke) : COM9-Id 1	
imits			
imits Adr	4	lame Value	
imits Adr 0x5C	PID_TORQUE_FLUX_TARGET_DDT_LIMITS	lame Value	
Adr 0x5C 0x5D	PID_TORQUE_FLUX_TARGET_DDT_LIMITS PIDOUT_UQ_UD_LIMITS	Name Value 1 (1/µ3) 0	
imits Adr 0x5C 0x5D 0x5E	PID_TORQUE_FLUX_TARGET_DDT_LIMITS PIDOUT_UQ_UD_LIMITS PID_TORQUE_FLUX_LIMITS	Name Value 1 [1/µs] 0	
imits Adr 0x5C 0x5D 0x5E 0x5F	PID_TORQUE_FLUX_TARGET_DDT_LIMITS PIDOUT_UQ_UD_LIMITS PID_TORQUE_FLUX_LIMITS PID_ACCELERATION_LIMIT	Name Value 1 [1/µs] 0 0	
imits Adr 0x5C 0x5D 0x5E 0x5F 0x60	PID_TORQUE_FLUX_TARGET_DDT_LIMITS PIDOUT_UQ_UD_LIMITS PID_TORQUE_FLUX_LIMITS PID_ACCELERATION_LIMIT PID_VELOCITY_LIMIT	Name Value 1 [1/µs] 0 0 0 0 0 0	

Figure 6: Selectors and Limits dialogues in TMCL-IDE



The TMCL-IDE also provides ease-of-use dialogues for using drive modes (Torque Mode, Velocity Mode and Position Mode, see fig. 7).

Torque mode @TMC4670 . 😒	Welocity mode @TMC4670 [Aa] . 🖂
Torque control	Velocity control
Actual cur. [mA]	Actual vel. [rpm] 0
Target cur. [mA] 0 🗘	Target vel. [rpm] 0 🔹 🕨
Position mode Position control Actual pos.	TMC4670 [Aα] <1
Target pos.	0 🔄 🕨
Relative to	actual position 🔹
C? absolute C?	relative stop

Figure 7: Control Mode Dialogues



## 4 Revision History

### 4.1 Document Revision

Version	Date	Author	Description
1.0	2018-MAY-03	ОМ	Initial creation.

Table 1: Document Revision



# **Mouser Electronics**

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Trinamic: TMC4671-EVAL