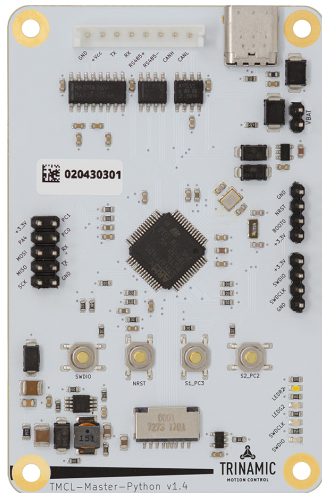


TMCM-0960-MotionPy

Document Revision V1.00 • 2020-10-23

The **TMCM-0960-MotionPy board** is a single board computer running MicroPython. It comes with several communication interface options like CAN, RS485, UART, and separate GPIO headers. With a wide supply voltage range of +6...+50V and industrial Fieldbus interfaces it is the engineers' swiss-army-knife for small automation applications.



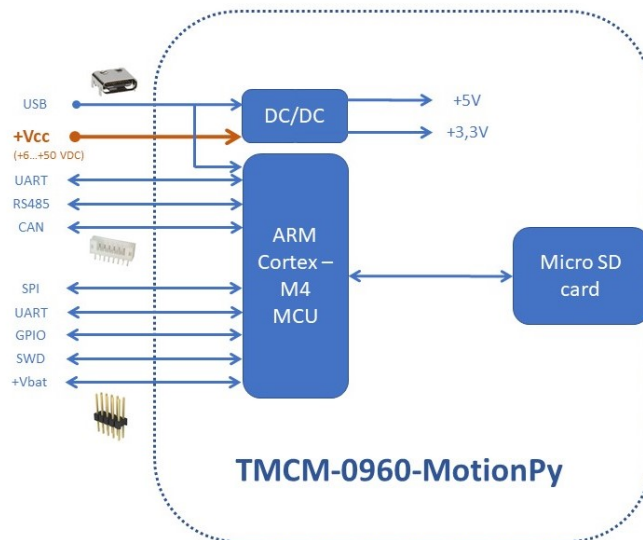
Features

- Board supply voltage: +6V to +50V
- Screw terminals and standard connectors
- CAN, RS485, UART Interfaces
- Connectors and headers for GPIOs
- CAD design files available for download on www.trinamic.com
- Software projects available on Github: www.github.com

Applications

- Laboratory Automation
- Semiconductor Handling
- Factory Automation
- Drives
- Robotics

Simplified Block Diagram



©2020 TRINAMIC Motion Control GmbH & Co. KG, Hamburg, Germany
 Terms of delivery and rights to technical change reserved.
 Download newest version at: www.trinamic.com



Read entire documentation.

Contents

| | |
|--|-----------|
| 1 Getting Started | 3 |
| 2 Connectors and LEDs | 4 |
| 2.1 Power supply and Communication Interface Connector | 5 |
| 2.2 GPIO Connectors | 6 |
| 2.3 Evaluation Board LEDs and Switches | 8 |
| 2.4 Safe Mode | 9 |
| 2.5 Reset to Factory Default | 9 |
| 3 Evaluation Board Design Files | 10 |
| 4 Software and Firmware Information | 10 |
| 5 Revision History | 11 |
| 5.1 Document Revision | 11 |



1 Getting Started

You need

- TMCM-0960-MotionPy
- Regulated Power Supply for nominal +24 VDC
- Latest [TMCL-IDE](#)
- For TMCL and CAN firmware versions: USB-2-RS485 adapter or CAN adapters

Precautions

- Do not mix up signals or short-circuit pins.
- Do not exceed the maximum rated supply supply voltage!
- **Start with power supply off!**

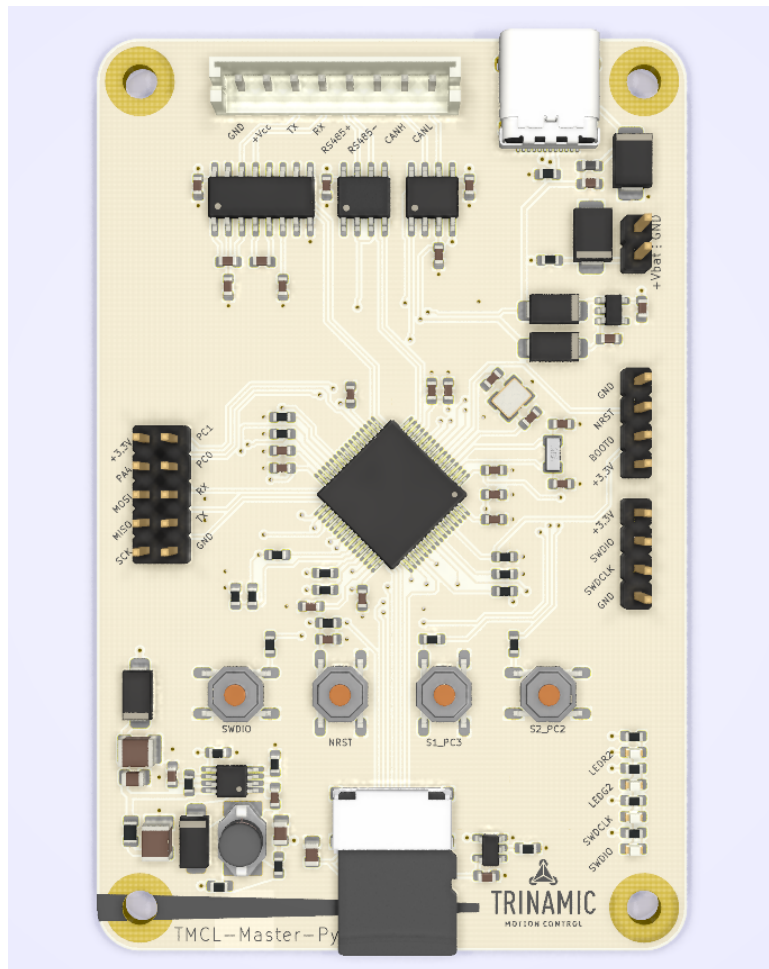


Figure 1: TMCM-0960-MotionPy Evaluation board

NOTICE

Both supplies (motor supply and logic supply) must be connected. They can be driven by the same source.



2 Connectors and LEDs

Figure 5 top view of the TMCM-0960-MotionPy shows the main connector JST-PH with Power input (+Vcc) and UART, RS485, CAN communication interfaces (marked light blue), GPIO signal pin headers (marked green, red, pink) and Realtime Clock power source (+Vbat) 2pin header (marked gray).

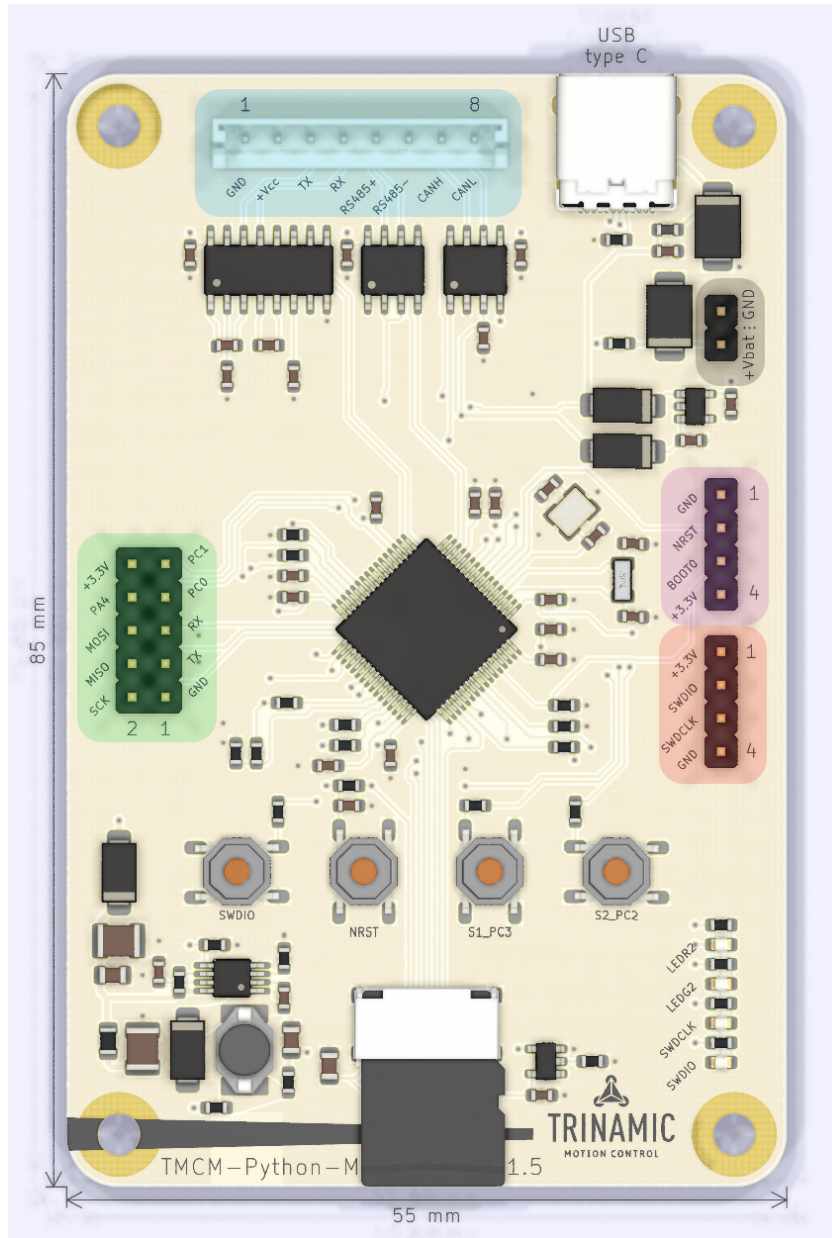


Figure 2: Top view of TMCM-0960-MotionPy

Each connector has a small individual signal name marked in the silkscreen of the board , right next to the respective connectors' pin.



2.1 Power supply and Communication Interface Connector

| Connector Types and Mating Connectors | | |
|---------------------------------------|--|--|
| Connector | Connector type on-board | Mating connector type |
| Power/Comms | JST B8B-PH-K-S (JST PH series, 8pins, 2mm pitch) | Connector housing: JST PHR-8 Contacts: JST SPH-002T-P0.5S Wire: 0.22mm ² , AWG 24 |
| USB-C | USB-C female connector | USB-C male connector |

Table 1: Connector Types and Mating Connectors of the TMCM-0960-MotionPy

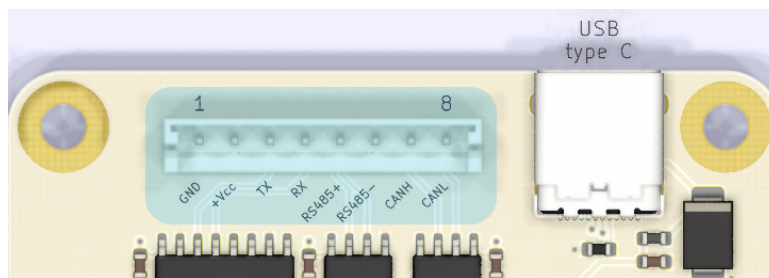


Figure 3: Power/Communication and USB-C connectors of TMCM-0960-MotionPy

| Power/Communication Connector Pin Assignment | | | |
|--|----------|-------------|--|
| Pin no. | Pin name | Level | Description |
| 1 | GND | Power (GND) | Supply and signal ground connection |
| 2 | +Vcc | Supply | Supply voltage input (+6V to +50 VDC) |
| 3 | UART TX | +3.3 VDC | Serial comm. transmitting signal |
| 4 | UART RX | +3.3 VDC | Serial comm. receiving signal |
| 5 | RS485+ | +3.3 VDC | Bidirectional diff. RS485 bus signal (non-inverting) |
| 6 | RS485- | +3.3 VDC | Bidirectional diff. RS485 bus signal (inverting) |
| 7 | CAN_H | +3.3 VDC | Bidirectional diff. CAN bus signal (non-inverting) |
| 8 | CAN_L | +3.3 VDC | Bidirectional diff. CAN bus signal (inverting) |

Table 2: TMCM-0960-MotionPy Power supply and Communication Interface connector pin assignment

NOTICE

Always keep the power supply voltage below the upper limit of 50V! Otherwise the driver electronics will be seriously damaged. Especially, when the selected operating voltage is near the upper limit a regulated power supply is highly recommended.



2.2 GPIO Connectors

The TMCM-0960-MotionPy offers three separated input/output headers, directly connected to the MCU (STM32F405RGT6). On the left side of the board, from 2x5pin header (green) - direct SPI and serial interfaces, plus three GPIO options. On the right side of the board, from two 1x4pin headers (pink / red) - MCU direct reset and boot, plus software-set digital input/output and clock signals. In addition, from the 1x2pin header - Supply for the MCU Real-Time Clock.

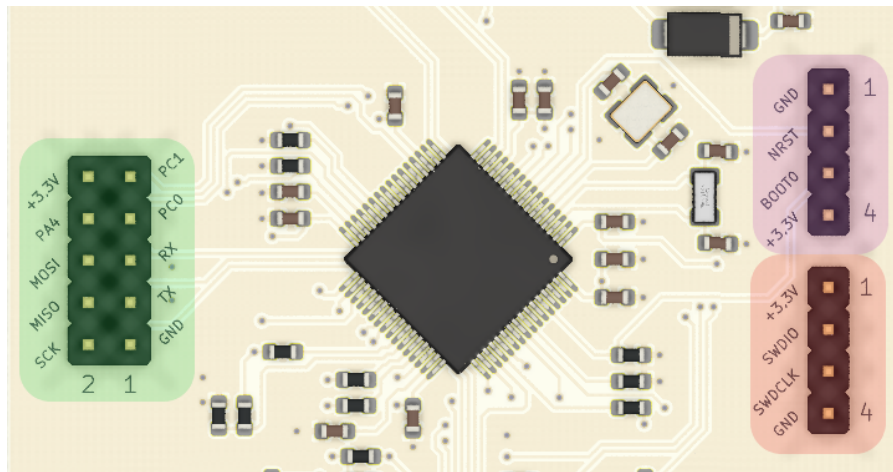


Figure 4: GPIO connectors of TMCM-0960-MotionPy

Please check the online available design files and schematic data for additional information on the connectors' signal connections and pinning.

| 2x5pin GPIO Header (Green) Pin Assignment | | | |
|---|------------|-------------|--|
| Pin no. | Pin name | Level | Description |
| 1 | GND | Power (GND) | Common system supply and signal ground |
| 2 | SPI SCK | +3.3 VDC | SPI Interface Serial Clock |
| 3 | UART TX | +3.3 VDC | UART General Serial Output |
| 4 | SPI MISO | +3.3 VDC | SPI Interface Master In Slave Out |
| 5 | UART RX | +3.3 VDC | UART General Serial Input (Pull-down) |
| 6 | SPI MOSI | +3.3 VDC | SPI Interface Master Out Slave In |
| 7 | GPIO (PC0) | +3.3 VDC | MCU GPIO PC0 pin |
| 8 | GPIO (PA4) | +3.3 VDC | MCU GPIO PA4 pin |
| 9 | GPIO (PC1) | +3.3 VDC | MCU GPIO PC1 pin |
| 10 | +3.3V | +3.3 VDC | Common on-board +3.3V supply level |

Table 3: 2x5pin GPIO Header (Green) Pin Assignment



| 1x4pin Header (Pink) Pin Assignment | | | |
|-------------------------------------|----------|-------------|---|
| Pin no. | Pin name | Level | Description |
| 1 | GND | Power (GND) | Common system supply and signal ground |
| 2 | NRST | +3.3 VDC | MCU NRST pin7 - MCU Reset signal (Activated through button SW101) |
| 3 | BOOT0 | +3.3 VDC | MCU BOOT0 pin60 - MCU Boot signal (Pull-down) |
| 4 | +3.3V | +3.3 VDC | Common on-board +3.3V supply level |

Table 4: 1x4pin Header (Pink) Pin Assignment

| 1x4pin Header (Red) Pin Assignment | | | |
|------------------------------------|----------|-------------|--|
| Pin no. | Pin name | Level | Description |
| 1 | +3.3V | +3.3 VDC | Common on-board +3.3V supply level |
| 2 | SWDIO | +3.3 VDC | Software programmable GPIO (Green LED) |
| 3 | SWDCLK | +3.3 VDC | Software programmable CLK (Red LED) |
| 4 | GND | Power (GND) | Common system supply and signal ground |

Table 5: 1x4pin Header (Red) Pin Assignment

| 1x2pin RTC Header (Gray) Pin Assignment | | | |
|---|----------|------------------|---|
| Pin no. | Pin name | Level | Description |
| 1 | GND | Power (GND) | Common system supply and signal ground |
| 2 | +Vbat | +1.65...+3.3 VDC | MCU VBAT pin1 Supply for Real-Time Clock (RTC) |

Table 6: 1x2pin RTC Header (Gray) Pin Assignment



2.3 Evaluation Board LEDs and Switches

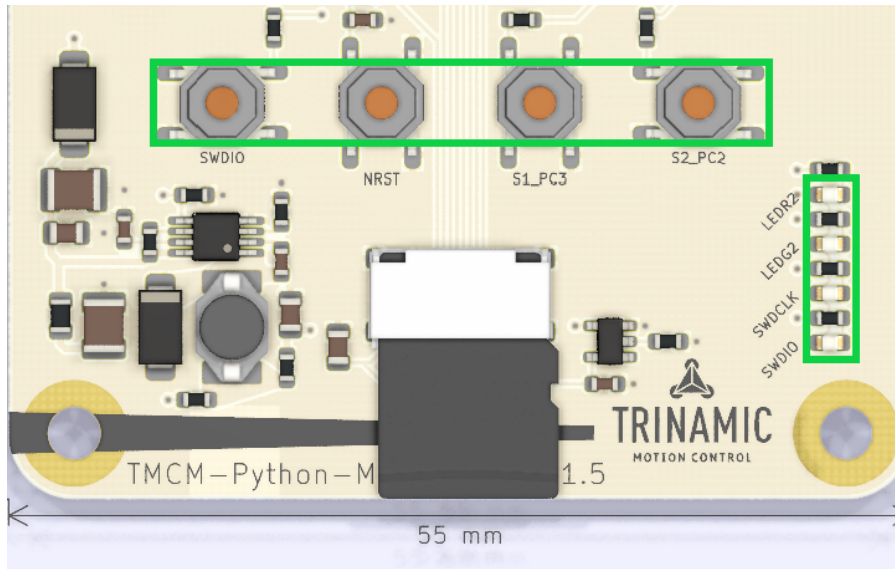


Figure 5: Switches and LEDs of TTCM-0960-MotionPy

| Switches | |
|----------|---|
| Switch | Description |
| SWDIO | Software defined; special function - USR Switch (chapter 2.4) |
| NRST | Board reset |
| S1PC3 | Software defined; connected to MCU |
| S2PC2 | Software defined; connected to MCU |

Table 7: TTCM-0960-MotionPy Switches

| LED | Description |
|--------|--|
| LEDR2 | White LED - Software defined; connected to MCU |
| LEDG2 | Blue LED - Software defined; connected to MCU |
| SWDCLK | Green LED - Software defined; connected to 1x4pin Header (Red) pin 3 and MCU |
| SWDIO | Red LED - Software defined; connected to 1x4pin Header (Red) pin 2 and MCU |

Table 8: TTCM-0960-MotionPy LEDs



2.4 Safe Mode

To enter safe mode, do the following steps:

1. Connect the board with USB, so it powers up.
2. Hold down the USR switch (SWDIO switch).
3. While still holding down USR, press and release the NRST switch.
4. The LEDs will then cycle red to blue to red+blue and back again.
5. Keep holding down USR until only the red LED is lit, and then let go of the USR switch.
6. The red LED should flash quickly 4 times, and then turn off.
7. You are now in safe mode.

In safe mode, the `boot.py` and `main.py` files are not executed, and so the MotionPy board boots up with default settings. This means you now have access to the filesystem (the USB drive should appear), and you can edit `boot.py` and `main.py` to fix any problems. Entering safe mode is temporary, and does not make any changes to the files on the pyboard.

2.5 Reset to Factory Default

The SWD connector can also be used to reset the Evaluation board to factory default settings. This is useful for example when the RS485 and/or CAN bit rate and ID settings of the board are not known. Do the following things to perform a reset to factory default settings:

1. Switch off the supply power.
2. Link together the pins CLK and DIO of the 1x4pin Header (Red) (using a jumper).
3. Switch on the supply power.
4. Wait until the MCU status and error LED flash alternating.
5. Switch off the supply power.
6. Remove the link between the CLK and the DIO pin.
7. Switch on again. The module now runs with factory default settings.



3 Evaluation Board Design Files

All design files for the base board are available for free. We offer the original ECAD files, Gerber data, the BOM, and PDF copies.

- For the TMCM-0960-MotionPy the ECAD files are in KiCAD format.

The files are available on Trinamic's website at <https://www.trinamic.com/>.

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

4 Software and Firmware Information

Example firmware projects are available on Github: <https://github.com/trinamic/PyTrinamicMicro>.



5 Revision History

5.1 Document Revision

| Version | Date | Author | Description |
|---------|------------|------------|--------------------------|
| 1.00 | 2020-10-29 | HH, LK, SK | Initial release version. |

Table 9: Document Revision

