

Installation and Service Instructions

Machine Control Unit

Model Type : V2.0



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1 PREFACE

1.1 Explanation of Safety Warnings

DANGER! Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury

WARNING! Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

CAUTION! Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

1.2 Conventions Used in This Manual

The following style conventions are used in this document:

- **Bold** : Important words or clauses.
- [hyperlink](#) : a link to further information on the internet

1.3 Obtaining Documentation and Information

The latest version of the documentation is available at the following address:

<https://www.toolsquare.io/manuals/>

Documentation Feedback

If you are reading ToolSquare product documentation on the internet, any comments can be sent to team@toolsquare.io.

We appreciate your feedback.

2 Description of the product

2.1 Description of the User

This manual describes how to install and deploy the ToolSquare **Machine Control Unit** (MCU).

WARNING! Installation, service and de-installation of the ToolSquare MCU are to be done by ToolSquare Technical Support Engineer or Toolsquare certified technicians only.

2.2 Purpose of the Product

The ToolSquare **Machine Control Unit** (MCU) is a device to facilitate the management of machines in a lab or workshop. The device controls the **access** to the machines and **reports** the actual use of them towards the lab or workshop managers.

Please consult the '[End User Manual](#)' for a detailed description of the different use scenarios.

3 Installation

3.1 Mounting the Unit

CAUTION! Unit must always be mounted. Not properly mounting the unit may cause danger as the unit or its cables may interfere with a running machine.

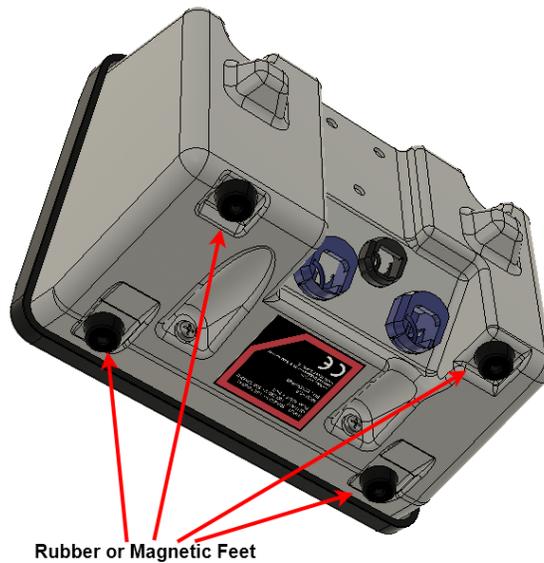
CAUTION! The unit is intended for indoor use only. Do not install the unit outdoors or in a wet location.

CAUTION! When installing the unit, ensure at all times an unrestricted access to the power-plug for disconnecting the unit from the mains power.

Horizontal surface

The unit can be mounted on a sheet-metal¹, horizontal surface using the magnetic feet.

1. replace the rubber feet with magnetic feet, using the plastic bolt and nuts supplied.
2. place the unit on the metal surface.



¹ Mounting with magnetic feet requires a magnetical metal surface such as iron or steel. Magnetic mounting is not supported on stainless steel or aluminium.

In case the unit is mounted on a non-magnetic horizontal surface, fix the power and digital input/output cables with a tie-wrap to secure the unit in its location.

Vertical surface

The unit can be mounted on a wall, pole or other vertical surface using the bracket :

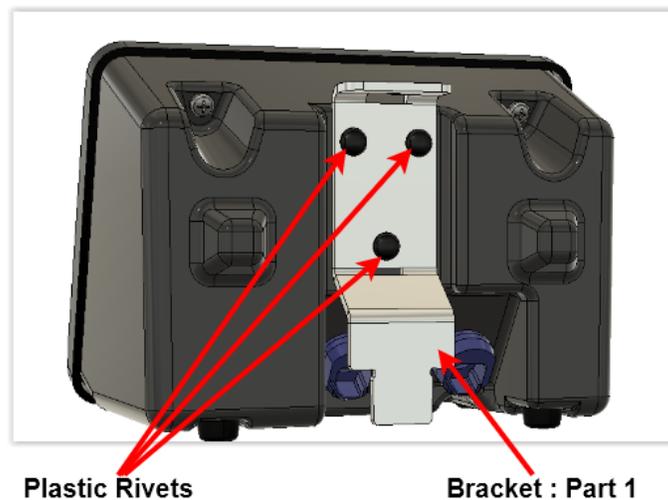
NOTE : For a safe operation, the unit must be installed at **maximum 1.5m** above the floor.

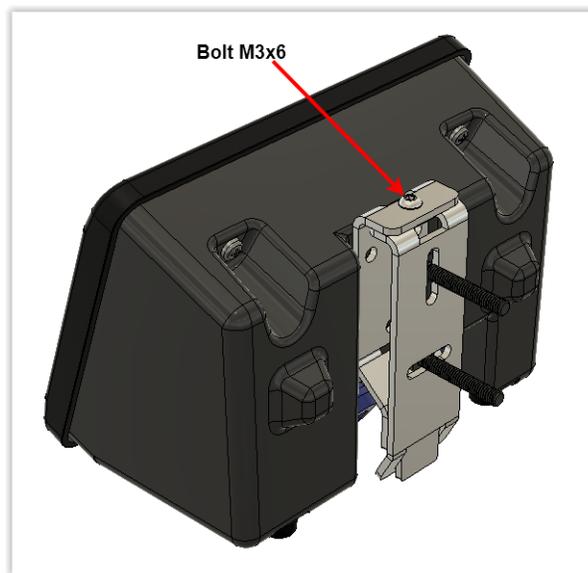
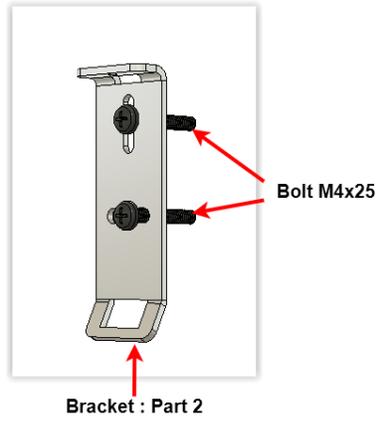
For units being operated while standing, we recommend installing them 1.5m above the floor.
For units being operated while seated, we recommend installing them 0.85m above the floor.

1. Drill out the 3 holes for the plastic rivets with a 3.5mm drill.
2. Mount the bracket part 1 to the MCU using the supplied ABS rivets. (see image below)
3. Mount the bracket part 2 to the wall or pole. Use the supplied bolts and nuts or other 4mm screws, depending on the material you are mounting to. (see image below)
4. Hook the MCU onto the wall part and fix it using the M3x6 bolt at the top of the bracket. (see image below)

NOTE : When installing the unit to a vertical wall, make sure the marking plate, located on the bottom of the product, remains **visible** at all times.

NOTE : In order to keep the MCU as sealed as possible from dirt and dust, only drill the holes for wall mount when it will actually be installed.





3.2 Wiring the Unit - Introduction

WARNING ! All cable installation must be performed with **both** the MCU and the machine being controlled, **disconnected from power**.

Power supply to the MCU

- Electrical power is supplied to the MCU via a fixed power-cord.
- To disconnect the device from the power, remove the plug from the outlet.
- The cable must be H 03 RN F 3G1.0 or H 03 VV F 3G1.0 and conform to
 - IEC 60227 or IEC 60245
 - EN50525
 - maximum length : 3m
- The plug must be type 2P+E, 16A, 250V certified according to local regulations.
- The unit must be connected to an outlet with protective earth, IEC Class I.
- The plug must remain easily accessible after installation.

Output Power

- Electrical power to the machine being controlled, is done via a fixed power cable.
- Machine being controlled must be IEC Class I
- The cable must be H 03 RN F 3G1.0 or H 03 VV F 3G1.0 and conform to
 - IEC 60227 or IEC 60245
 - EN50525
 - maximum length : 3m

Digital Inputs and Outputs

- The cable must be minimum H 03 RN F 4X0.5 or H 03 VV F 4X0.5
- Digital inputs and outputs are intended to be connected to SELV circuits only

USB

- In some scenarios, the MCU will be powered through USB. The USB Cable is a standard USB-C cable

3.3 Wiring the Unit – Different Connection-Style Options

For the MCU to **control** a lab or workshop machine means two things :

1. A way to **lock / unlock** the machine :
 - Locked : the machine cannot be used

- Unlocked : the machine can be used
2. A way to **monitor** if the machine is **idle** or is **running**
 - Idle : machine is **not** actively working, eg. printing, milling, cutting, etc, but rather **waiting** before or after such activity
 - Running : machine is active, eg. printing, milling, cutting, etc.

3.4 Wiring the Unit – Locking / Unlocking

For the MCU to lock / unlock a machine, select one of the three following options :

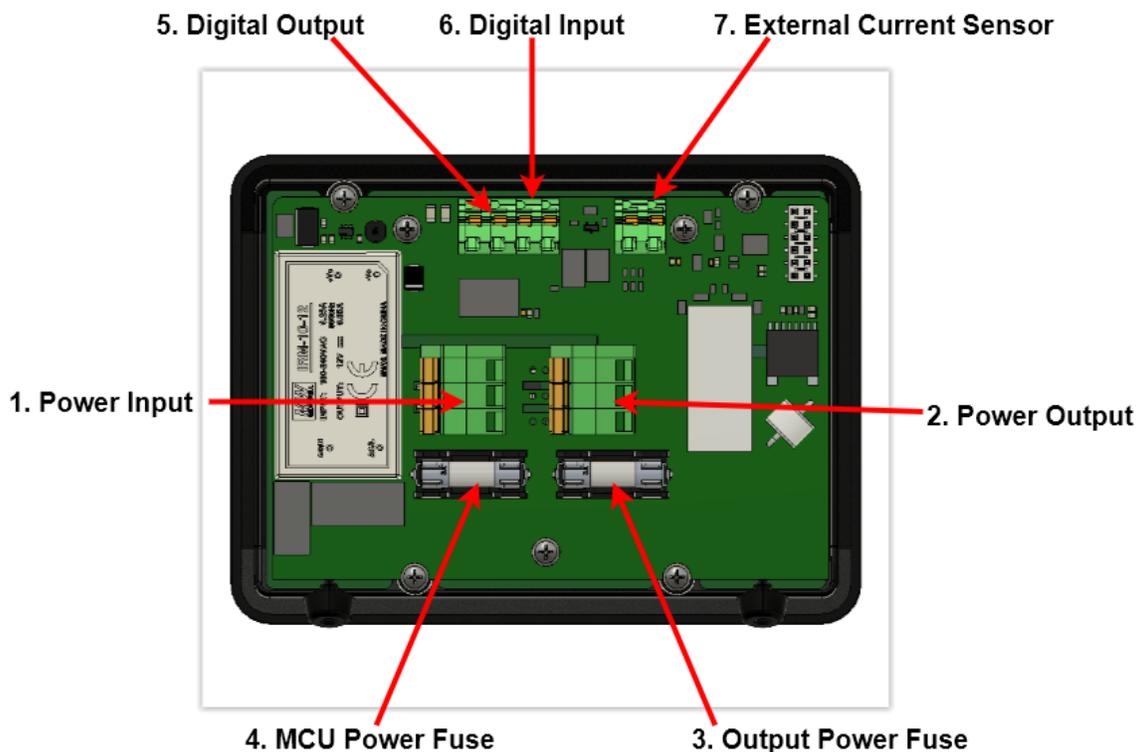
3. Via power control : the MCU switches the main power of the machine being controlled. Unlocking means switching the power on, locking is switching the power off. The power can be switched in two possible ways :
 - a. In case the machine consumes less than 10A, the MCU can directly switch the power, using an internal relay.
 - b. In case the machine consumes more than 10A, the MCU's internal relay can switch an **external** power relay, rated for switching the power of the machine.
4. Via digital control : the MCU is connected 'in series' to an existing 'safety' lock feature of the machine being controlled, eg. a limit switch, an emergency stop button, a cover closed switch, etc. Unlocking means opening/closing the safety circuit, so the machine can be used. Locking means closing/opening the safety circuit, thereby emulating a safety failure, thereby preventing the machine from operating. The digital output is connected to connector P1.
 - P1-1 : Digital Out : 24Vdc, 2A max
 - P1-2 : Digital Out : 24Vdc, 2A max
5. Via USB : the MCU is connected to a USB port of a Personal Computer running a customer application to be controlled. Over the USB connection, the software in the MCU will communicate to a Toolsquare application on the PC, which will lock/unlock the customer application.

3.5 Wiring the Unit – Monitoring Idle / Running

For the MCU to monitor the activity of the machine being controlled, select one of the three following options :

1. Via **current measurement** : the MCU measures the power consumption of the machine, and compares it against a configurable threshold. Current measurement can be done in two possible ways :
 - Via **internal** current measuring : when locking/unlocking is done through power control (chapter 3.4, option 1.a), the power powering the machine passes through the MCU, and so the MCU can measure it directly.

- Via **external** current measuring : when locking/unlocking is done through power control with an external power relay (chapter 3.4, option 1.b), an **external** current measuring probe can be connected to connector P2. See 10.1.1 Supplied accessories for possible external current sensors.
 - P2-1 : GND
 - P2-2 : Input voltage from external current sensor : 0-10V
- 2. Via **digital input** : the machine provides a digital (active low or active high) signal, which is connected to connector P1.
 - P1-3 : Digital In : - or GND
 - P1-4 : Digital In : +, 24 Vdc maximum
- 3. Via **USB** : the MCU is connected to a USB port of a Personal Computer which is the terminal of the machine being controlled. Over the USB connection, the software in the MCU will communicate to a Toolsquare application on the PC, which will monitor the activity such as mouse and keyboard activity.



3.6 Wiring the Unit – Cable connections

Depending on the selected scenario for power, lock/unlock and activity monitoring, one or more cables will be connected to the MCU, with a **maximum** of three :

1. power in
2. digital in/out
3. power out

The MCU enclosure has three optional cable throughputs for these cables. They are still closed after manufacturing and need to be opened with a drill. A pilot hole for drilling is provided.

Drilling diameters are as follows :

4. Left : power in : 15 mm
5. Middle : digital in/out : 12 mm
6. Right : power out : 15 mm

When installing a cable, a strain relief must be installed between the cable and the enclosure.

CAUTION ! In order to keep the MCU as sealed as possible from dirt and dust, only drill the holes for cable throughputs where a cable will actually be installed.

4 Service & Maintenance

Important notice : The MCU carries high voltages on its internals. Before inspecting and/or repairing the unit, always disconnect it from the main power.

The unit has an internal power supply, protected with an additional T0.63A internal fuse. In case of an electrical malfunctioning, this fuse will blow.

Before replacing this fuse, the cause of the malfunctioning must be researched and resolved.

Always replace the fuse with a fuse of the correct rating. See [Spare/replacement parts](#) for a suitable replacement fuse.

- Fuse 5x20mm : T0.63A H 250 for Fuse 1 : Power to MCU
- Fuse 5x20mm : T10A H 250 for Fuse 2 : Power to machine being controlled

5 TROUBLESHOOTING AND REPAIR

Error	Cause	Solution
Internal 10 A fuse blown	Machine being controlled consumes too much power	Replace fuse 2
...	...	Use external power control
Internal 0.63A fuse blown	Electrical fault	Inspect unit for dirt, debris or other causes of short-circuit. Replace fuse 1

6 Dismantling / Disposing of the MCU

6.1 How to Uninstall the Product

WARNING! Before dismantling the MCU, disconnect **both** the MCU and the machine being controlled from the power.

Internal Power Control

Remove the power cable between the MCU power output and the machine.

External Power Control

Remove the power cable between the MCU power output and the external power relay. Optionally remove the power relay, and the power cable to the machine.

Digital Control

Remove the digital output from P1 to the machine

6.2 How to Dispose the Product and packaging for proper recycling

6.2.1 Disposal of electronic components

The MCU contains typical electronic components which should be recycled. Dispose the unit according to electronic waste recycling instructions from your local authorities

6.2.2 Disposal of batteries

The MCU does not contain any batteries. No special battery disposal procedure does apply.

7 Technical Specifications

7.1 Inputs and Outputs

- Power input : 100-240 Vac, 50/60Hz, 10A
- Input power voltage fluctuations : maximum +/-10%
- Protection Class : IEC Class I
- Overvoltage category : II
- Pollution degree : 2
- Environmental rating : Standard
- Equipment Mobility : Fixed
- Operating Conditions : Continuous
- Power Consumption of the Toolsquare MCU : 1 W
- Power output : 100-240 Vac, 50/60Hz, 10A
- Digital Output : maximum 24Vdc, 2A
- Digital Input : maximum 24Vdc
- Current Measuring Input : 0-10V DC

7.2 Wi-Fi

Supporting IEEE 802.11 b/g/n

7.3 NFC

Supporting 13.56 MHz NFC Forum tags

7.4 Environmental conditions

- The MCU is designed for indoor use only
- The MCU is designed for use between 0 and 2000 m altitude
- The MCU is designed for operation in temperatures of 5-40°C
- The MCU is designed for operation in Maximum relative humidity 80 % for temperatures up to 31°C, decreasing linearly to 50 % relative humidity at 40°C
- IPXX : Ingress Protection not certified

7.5 Dimensions

- Width : 125mm
- Height : 92 mm
- Depth : 80 mm
- Weight : ~300 g

8 Appendices

8.1 Supplied Accessories, Consumables and Spare Parts

8.1.1 Available accessories

Image	Name	Article Number
	Mounting bracket assembly	
	Power cable	
	Digital cable	
	External current sensor	LEM AT20B10 up to AT150B10
	USB-C cable	

8.1.2 Spare/replacement parts

Image	Name	Article Number
	Fuse 5x20mm 10A : T10A H 250V	

	Fuse 5x20mm 0.63A : T0.63A H 250V	
	Strain relief bushing 10 mm	
	Strain relief bushing 8 mm	

9 GLOSSARY

Term	Meaning

RELATED DOCUMENTATION

#	Document Title	Version #	Location	Author
	Toolsquare MCU End User Manual	V1.3	www.toolsquare.io/manuals	Toolsquare