TOOLSQUARE

User Manual

Machine Control Unit

Model Type : V2.0

TOOLSQUARE

DISCLAIMER

NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A SPECIFIC PURPOSE, THE PRODUCTS TO WHICH THE INFORMATION MENTIONS MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS, OR OF ANY OTHER NATURE ARE MADE WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION MENTIONS. IN NO CASE SHALL THE INFORMATION BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE.

Toolsquare BV – Generaal Drubbelstraat 32, B-2600 Berchem

www.Toolsquare .io

team@Toolsquare .io

TRADEMARKS

TOOLSQUARE

Document Revisions

Date	Version Number	Document Changes
03-12-2020	1.0	Initial draft
12-01-2021	1.1	Added USB variant
22-01-2021	1.2	Corrections after feedback from SGS
28-01-2021	1.3	Added NFC reader compatible tag types

TOOLSQUARE

Table of Contents

1 Before you start...

1.1 Audience

This manual is the **User Manual** for the **Toolsquare Machine Control Unit**.

It describes how to correctly and safely use the product by :

- lab or workshop machine operators
- lab or workshop manager.

In order to use the Toolsquare Machine Control Unit, no specific technical knowledge is required, other than the information in this manual.

Important Note : In order to use the machine which is **being controlled by** the Toolsquare Machine Control Unit, further technical and safety knowledge may be required. This is however not part of this manual. Please consult your lab or workshop manager and/or the user manual of the machine being controlled.

Important Note : installation and de-installation of the Toolsquare MCU are to be done by Toolsquare Technical Support Engineer or Toolsquare certified technicians. Installation is not permitted by the customer. Installation procedures are described in a separate Installation and Service Manual.

1.2 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.

1.3 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

1.4 Obtaining Documentation and Information

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

http://ww.toolsquare.io/manuals

1.5 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 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.

A typical application is as follows :

- A lab user who wants to use the machine, registers by swiping a badge on the MCU.
- The MCU will check if the user is granted access, and if so, will **unlock** the machine.
- The user is now able to use the machine. The MCU will track the usage time and other parameters.
- After the job is completed, the user swipes his badge again, which ends his job on the machine and **lock**s it.

2.2 Product elements

In Figure 1 the Toolsquare MCU is shown and how it is connected to the other parts of the solution :

Figure 1 : Top-level diagram of Toolsquare MCU setup

a. The lab or workshop machine being controlled, eg 3D-printer, Laser-cutter, CNC or any other machine
b. The Toolsquare Machine Control Unit
c. The Toolsquare Lab Management Application

2.3 Product connections

In order to be able to control (lock / unlock) the machine, and to monitor its activity (running / idle). the MCU needs to be connected to this machine.

In a **typical** setup, the Toolsquare MCU is connected to a standard power outlet socket, and the machine being controlled is connected to the MCU power output.

However, there are many other possible ways to connect the MCU, depending on the specific needs and possibilities of the machine being controlled.

The complete list of supported connection setups is described in the Toolsquare MCU Installation Manual.

2.4 Activity Monitoring

The MCU can determine the activity of the machine in a number of ways.

In a typical setup, it will monitor the power consumption of the machine, as the power to this machine is flowing through the MCU.

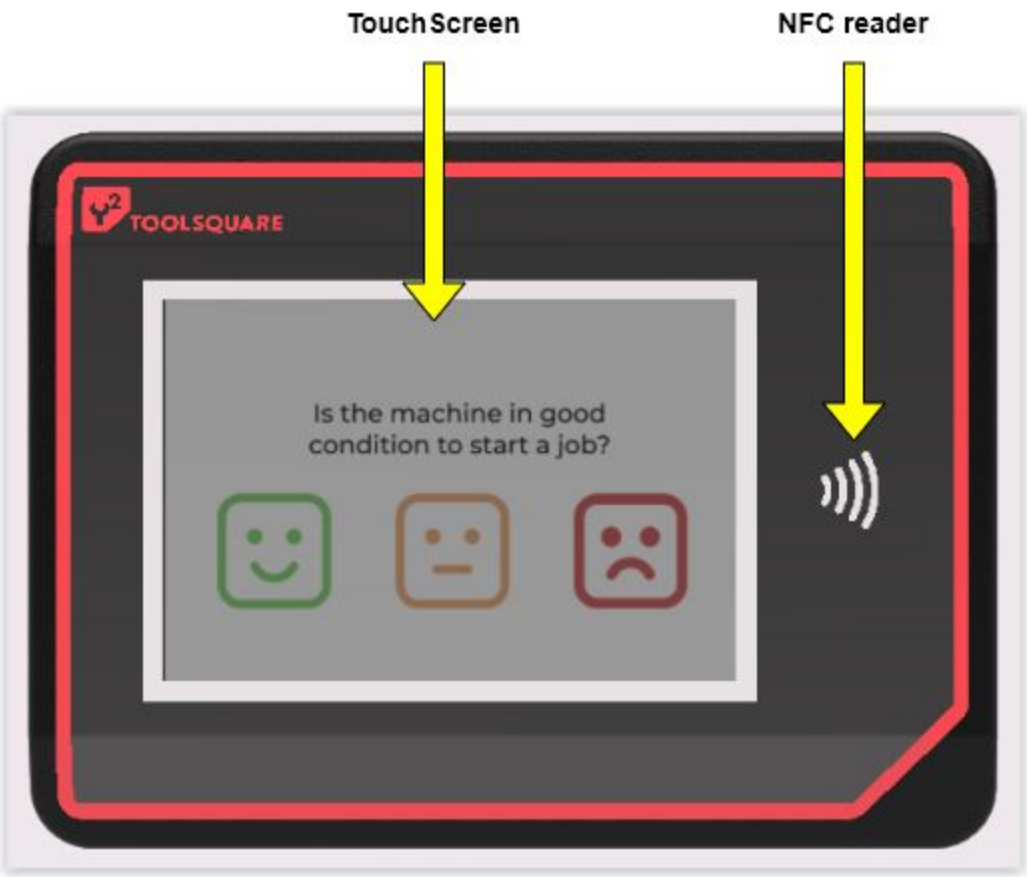
However, there are many other possible ways to monitor the activity, depending on the specific needs and possibilities of the machine being controlled.

The complete list of supported activity monitoring setups is described in the Toolsquare MCU Installation Manual.

2.5 Understanding the user interface

The Toolsquare MCU has the following user interface elements :

- A touchscreen display
- A badge reader
- A buzzer (not visible)



2.6 Operating Panels

Home screen :

- indicates the name of the machine (and machine category)
- indicates if the machine is ready for use, or out-of-order

Unlocked Idle :

- user has registered and is allowed access to the machine, but the machine is not yet running
- when idle, the MCU will log the user out after a certain timeout.
- user can log out by swiping his/her badge

Unlocked Running :

- the machine is running. The actual running time is monitored.

Feedback :

after logging in, and before logging out, the MCU will ask the user for feedback regarding the condition of the machine :

- after logging in, before starting to use the machine : is the machine in good condition

- before logging out, after using the machine : is the machine in good condition

In case the user considers the machine to be in a bad condition, there is an additional question to put the machine out of order.

3 Safe Operation

Important Note : The instructions below are provided for a safe operation of the Toolsquare MCU. These instructions do **not** include the safe operation of the **machine being controlled** by the MCU. For safe operation of the machine being controlled by the MCU, please consult your lab or workshop manager and the user manual of the machine.

This manual is part of the product and must be kept with the product.

Safe Operation

Only operate the machine through the MCU if you are able to safely operate **both** at the same time.

- Before operating the MCU, verify that there is no damage to the unit as well as all cables. Do not operate the unit in case of damage or poor cable connections
- Do not operate the unit when the unit, the user or its environment is wet.
- Do not operate the unit outdoors.
- Do not operate the unit if the display is not or poorly readable.
- Do not open the unit for service or disconnect / reconnect cables. There are no user serviceable parts inside.

Improper Use

- Using the MCU in ways other than described in this manual, may result in damage to the unit, damage to the machine being controlled by the MCU and/ or other hazards
- The MCU uses radio communication (WiFi) via a **non-exclusive transfer medium** and therefore is **not certified** for safety applications such as emergency stop, emergency call

4 Technical Specification

4.1 Inputs and Outputs

- Power input : 100-240 Vac, 50/60Hz, 10A Fuse – not user serviceable
- Power Consumption of the Toolsquare MCU : 1 W
- Power output : 100-240 Vac, 50/60Hz, 10A Fuse – not user serviceable
- Digital Output : maximum 24Vdc, 2A
- Digital Input : maximum 24Vdc
- Current Measuring Input : 0-10V DC
- USB : Type C

4.2 Environmental Conditions

The MCU is designed for use under the following environmental conditions :

- indoor use
- altitude : up to 2 000 m
- temperature : 5 °C to 40 °C
- maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C
- mains supply voltage fluctuations up to ±10 % of the nominal voltage
- Input power voltage fluctuations : maximum +/-10%
- Overvoltage category : II
- Pollution degree : 2
- Protection Class : IEC Class I
- Environmental rating : Standard
- Equipment Mobility : Fixed
- Operating Conditions : Continuous
- IPXX : Ingress Protection not certified

4.3 Wi-Fi

Supporting IEEE 802.11 b/g/n

4.4 NFC

Supporting 13.56 MHz NFC Forum tags :

- Mifare Ultralight
- Mifare Classic
- Mifare Plus
- Mifare DESfire

4.5 Dimensions

- Width : 125mm
- Height : 92 mm
- Depth : 80 mm
- Weight : 250 g

5 Using the MCU

5.1 Power up

In general, the MCU will be powered 24/7, and as such the user experience starts in Home - Locked . If for whatever reason, the MCU was shut down, switch it on by plugging the power cable into the mains socket.

The MCU will start, perform an internal self-test, and then connect to the network. After connecting to the network, the unit will be ready for use in the Home - Locked state

Note : if for whatever reason the unit restarts while the machine is running, it will continue where it left off in the Unlocked - Running state.

5.2 Home - Locked

In this state, the MCU is waiting for a user to log in, and the machine being controlled is **locked**. Swipe your badge to proceed. Successful reading of a user badge is indicated with an audible 'beep'.

After detecting your badge, the MCU will consult the Cloud Service to validate your login attempt. The result will be one of the following :

- Login accepted : machine will be unlocked, and the usage of the machine will be tracked.
- Login denied : machine remains locked, user is informed of the reason.
- User unknown : the user is not yet known by the system. The system responds with a special token. The user can register at the Cloud Service as a new user, using this token.

5.3 Feedback Before Use

After a successful login, the user is asked to give feedback about the condition of the machine he/she is about to use. The feedback has 3 levels : OK, Neutral, Not OK.

If the user selects Not OK, the system will propose to take the machine out of order.

5.4 Unlocked

In this state, the machine is unlocked, and the user is able to use it. The MCU will determine if the machine is IDLE or RUNNING, and the total time of both states will be tracked.

5.4.1 IDLE

The machine is unlocked, but not yet running. The user is preparing the job to be executed.

After the job is completed, the MCU will also return to the Idle state.

Note : In the Idle state, there is also a timeout running for inactivity. Typical this timeout is 5 minutes. If there is no machine activity for this timeout, the user will be logged out automatically. This is a safety measure to prevent machine access after a user forgets to log out after his/her job.

5.4.2 RUNNING

The MCU detects that the machine is running. The total running time will be tracked.

When the machine is running, it is not possible to log out, i.e. the user must first finish the job, then the machine will return to idle, and only then he/she can logout.

5.5 Feedback After Use

Similar to Feedback Before Use, at logout there is the possibility to give feedback about the condition of the machine. The feedback has 3 levels : OK, Neutral, Not OK.

If the user selects Not OK, the system will propose to take the machine out of order.

5.6 Disabled

If for some reason the MCU is not able to stay connected to the Cloud Service, the MCU may go into a state called ‘Disabled’. This will unlock the machine so it can be used, but the usage is not being tracked.

This feature is provided to prevent the whole lab or workshop being locked down in case of a general network error.

5.7 Out-Of-Order

If a user gives a negative feedback before or after his job, it is possible to put the machine Out-Of-Order. Also the lab manager may decide to put a machine out of order from the Cloud Service Console.

The machine remains locked and cannot be used until the problem is solved and the lab manager puts it back into service.

6 MAINTENANCE

6.1 How to Maintain the Product

Unit Hardware

Checks : Visually inspect the product for any damage to the MCU unit and the cabling. In case of any damage, do not use the MCU and/or the connected machine and report the damage to the lab or workshop management.

Cleaning : When needed, clean the unit's front with a soft cloth and display cleaning product.

Unit Software

The MCU can obtain a software upgrade from the Cloud Service, a so-called 'Over-the-Air' update. This update is triggered by the MCU and only occurs when the unit is in the Home – Locked state. After a software upgrade, the MCU will restart.

NOTICE: For more maintenance information, please consult the Installation and Service manual.

7 TROUBLESHOOTING

7.1 How to Identify and Solve Problems

7.1.1 Troubleshooting by the end user

Error	Cause	Solution
No information is shown on the MCU display	The MCU power cable is not properly connected	check of the unit is properly connected to power
...	The MCU's internal fuse is blown	Ask for repair by Toolsquare technical support
The MCU does not recognize my badge	The badge / RFiD card is unsupported	check if you are using a supported 15.62 MHz NFC Forum type badge

8 INDEX

9 GLOSSARY

Term	Meaning

10 RELATED DOCUMENTATION

#	Document Title	Version #	Location	Author
	Toolsquare_MCU Installation Manual	V1.2	www.toolsquare.io/manuals	Toolsquare