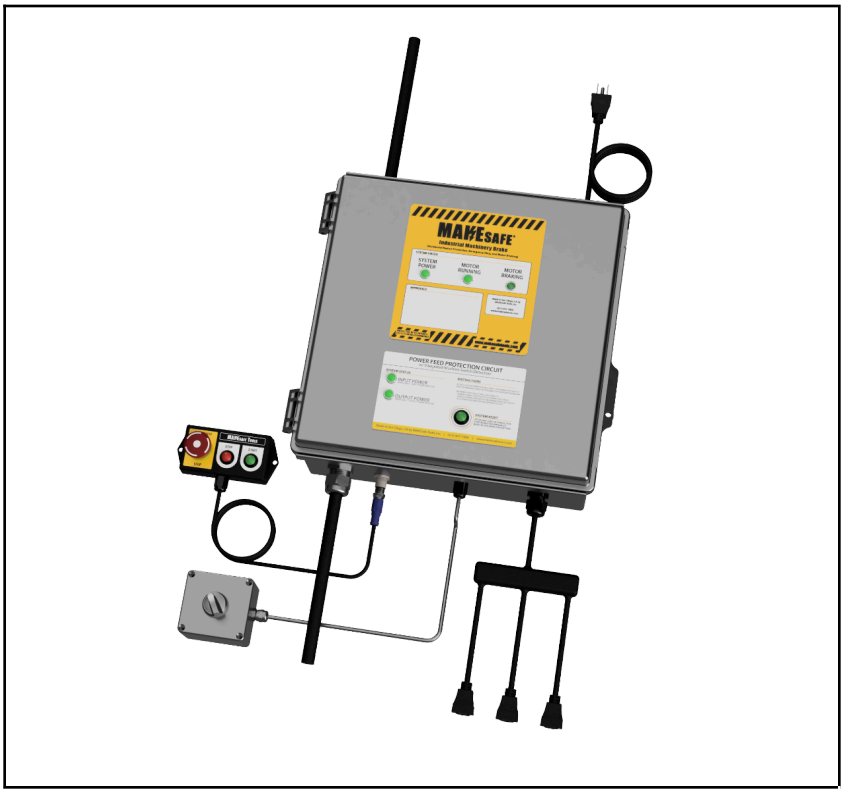
MAKESAFE® TOOLS
PREVENTING INJURIES SINCE 2016

Milling Machine Brake (MMB)

User Manual



Note: The image above represents one particular configuration of this product though this manual can be used for multiple product configurations.

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Introduction

Application

The MAKESafe Milling Machine Brake (MMB) is a safety device that provides the following safety functions to a milling machine:

- restart protection (spindle)
- emergency stop (spindle)
- motor braking (spindle)
- short-circuit protection
- motor overload protection (spindle)
- additional options include:
  - restart protection (power feeds)
  - emergency stop (power feeds)

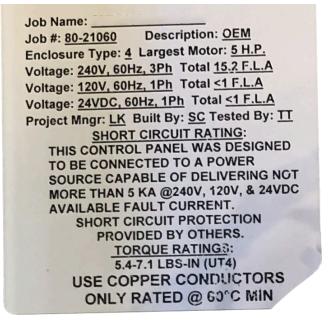
Compatibility

This safety device is designed specifically for a “Bridgeport-Style” milling machine. If your milling machine is different - please contact us and we’ll help determine if the device is compatible with your machine.

Specifications

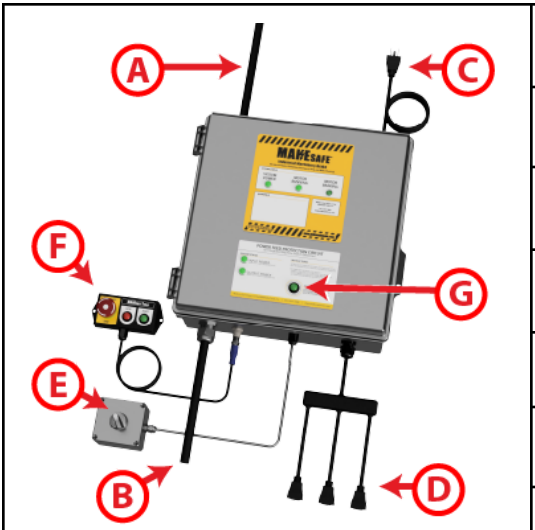
Each MMB is built-to-order to meet the voltage, horsepower, and accessory requirements of a specific customer application. To obtain the ratings of your specific MMB, refer to the ratings label on the panel itself. The label will be located on the exterior side of the panel and/or the inside of the panel lid.

(example of UL mark)



(example ratings label)

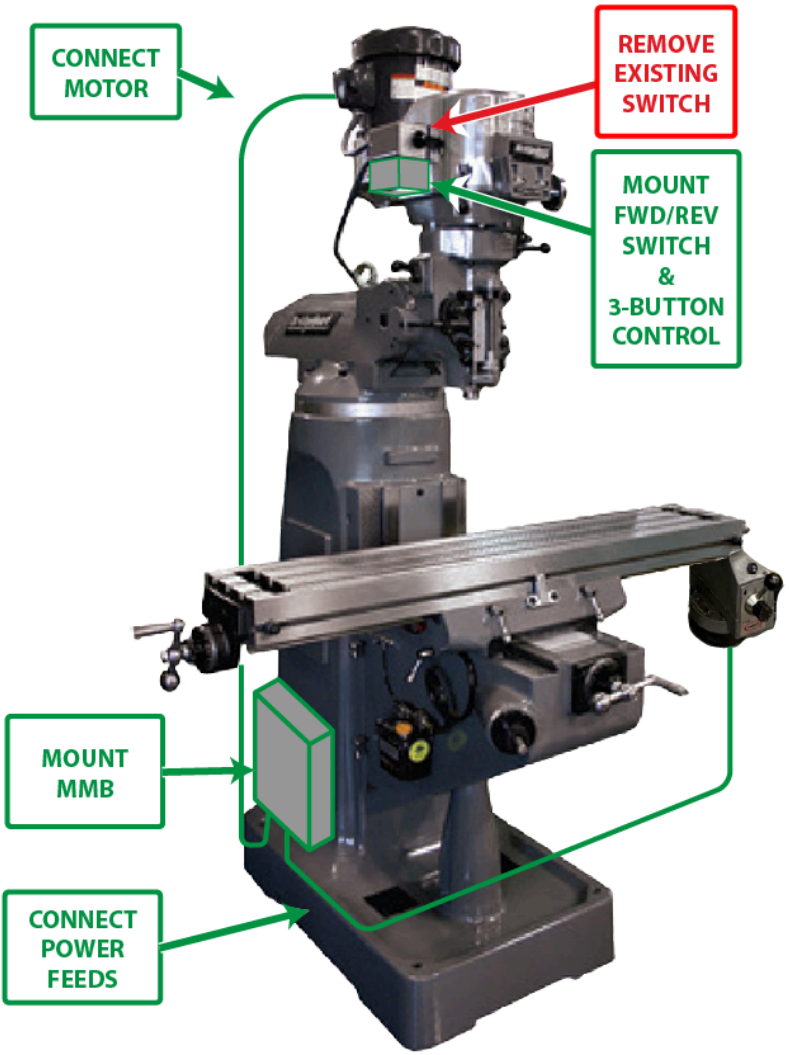
Device Diagram



A	Primary input power for the MMB
B	Output to the milling machine spindle motor
C	Auxiliary input power for the MMB (typically 120VAC) **
D	Auxiliary outputs for power feed motors **
E	Forward/Reverse Switch
F	3-Button Control Panel (start/stop/e-stop)
G	System Reset Button

** Optional configuration

Installation Overview



Preparing For Installation

1. Make plans for this machine to be completely off-line for the entirety of this installation. Include a generous amount of time for troubleshooting, verification, and shipment of any replacement parts (just in case).
2. Ensure that the machine has been disconnected from all sources of energy (electrical plugs, compressed air, etc.) then lockout and tagout any connections that could supply energy to the machine.
3. Note other machines and devices are on the same electrical circuit so you can inform other machine operators (in case a wiring error trips the breaker).
4. Have multiple spare fuses on hand (see later section for fuse locations).
5. Ensure the installation site has adequate circuit protection for the control panel supply cable and the panel itself (see panel ratings).
6. Verify that the control panel ratings match the machine the panel is being installed on.
7. Plan the physical mounting of the control panel. Additional mounting hardware and mounting flanges have been provided.
8. Open the control panel and gently remove any shipping materials or filler.
9. Once shipping materials have been removed, visually inspect the control panel interior for parts, wires, or connections that may have been damaged during shipping.
10. If the machine is three-phase, take note of the machine's existing direction of rotation.
11. Review this entire manual before beginning work.

Warning: *This guide is meant as a helpful aide but is not a replacement for electrical expertise or qualifications. All electrical work should be performed by someone qualified to do the work. It is the installers sole responsibility to perform the installation in compliance with all local codes and standards.*

Physical Installation

1. Decide where to mount your new MMB, the forward/reverse switch, and the 3-button control panel. Select locations that satisfy the following requirements:
    - the control panel door is free to swing open
    - sufficient length of portable cord is available to route from the power source to the MMB and from the MMB to the milling machine motor
    - The forward/reverse switch and 3-button control panel are easily accessible by the machine operator
    - sufficient length of control cable is available to route from the MMB to both the forward/reverse switch and the 3-button control panel.
    - the control panel and wiring do not pose a tripping hazard and do not obstruct movement of personnel
2. Once you've confirmed the locations, use the provided mounting flanges to rigidly mount the MMB, the forward/reverse switch, and the 3-button control panel to the machine frame or other solid surface.

Electrical Installation

1. Disconnect the existing forward/reverse switch from the motor.
2. Connect the primary power output of the MMB directly to the spindle motor. See the device diagram above and the attached MMB schematic for additional information.

   Note: *After installation we'll check to make sure the motor is spinning the correct direction. If it isn't, you can swap any two of the motor power wires in the spindle motor junction box to correct the problem.*

3. Connect the primary power input of the MMB to power (e.g. NEMA plug, disconnect, etc.).
4. Connect the 3-button control panel to the MMB via the M12 connector.
5. Adjust the current setting on the Motor Protection Circuit Breaker (MPCB) to match the FLA rating of the motor.
6. If applicable, plug any power feed motors into the associated outputs on the MMB.

Note: This panel replaces **ALL EXISTING CONTROLS** on the machine. Please contact us for assistance if any other controls are present on the machine.

Panel Setup

Note: *If anything unexpected occurs during the power-up or testing phase, immediately turn off then unplug the machine.*

1. Ground Continuity

1.1. Using a multimeter, check for continuity from the power supply ground to each of the following: the steel backplate inside the MMB, an unfinished surface on the fwd/rev switch, and the motor chassis. Each reading should be less than 1 ohm of resistance.

2. The first power-up

2.1. Remove all tooling from the spindle.

2.2. Ensure that the machine, the machine table, and the surrounding area is free of loose tools, debris, tripping hazards, and other secondary hazards.

2.3. Ensure you are wearing safety glasses and any other appropriate PPE and that others are nearby and available to assist if needed. Notify nearby machine operators that you are testing a new electrical installation.

2.4. Open the MAKESafe control panel and ensure that the braking torque and braking time potentiometers are at their lowest setting (full counter-clockwise, see Calibration section).

2.5. Ensure that the MPCB in the MMB is in the 'on' position.

2.6. Close the control panel.

2.7. Remove the lockout mechanism you put in place at the beginning of this project. If you need to leave before testing and validation is complete, ensure that the machine is locked out again before leaving.

2.8. Connect the primary power input of the MMB to power.

2.9. Connect the auxiliary power input of the MMB to power.

2.10. Be attentive for any out-of-place sounds or smells as you count to 10.

3. Spindle Motor Testing

3.1. Turn the fwd/rev switch to the ‘FWD’ position.

3.2. Ensure the machine is in the ‘direct drive’ configuration.

3.3. Turn the machine spindle on by pressing the ‘start’ button on your 3-button panel. Pause for a few seconds while the machine runs

3.4. Observe the direction of rotation of the spindle. If the spindle is rotating in the forward direction, move to the next step. If the spindle is rotating backwards, disconnect all power then return to the Electrical Installation section to swap any two motor wires. After that is complete, start again from the beginning of this section.

3.5. Turn the machine spindle off by pressing the ‘stop’ button on your button panel. Pause for a few seconds while the machine stops.

> ***Note:*** *It’s ok if you don’t notice braking when the machine is turned off. We’ll calibrate and test the braking feature later.*

3.6. Turn the high/low switch (F4.F) to the ‘LOW’ position.

3.7. Turn the machine spindle on by pressing the ‘start’ button on your button panel(F4.B). Pause for a few seconds while the machine runs.

3.8. Observe the direction of rotation of the spindle. The spindle should now be rotating the opposite direction.

3.9. Turn the machine spindle off by pressing the ‘stop’ button on your button panel(). Pause for a few seconds while the machine stops.

3.10. Proceed to the next section for Power Feed Calibration & Braking Calibration.

Power Feed Calibration

Many milling machines have auxiliary motors on their axes called power feed motors. Your new panel has designated outlets for powering these power feed motors. The power feed circuit includes a feature called ‘machine switch detection’. This feature prevents your power feed motors from starting unexpectedly after a power outage or emergency stop. This feature requires a one-time calibration.

Calibration Steps:

1. Ensure that your power feed motor(s) are switched off.
2. Plug your power feed motor(s) into the designated outlet on your new panel.
3. Identify the Power Feed Protection circuit board in your panel (see below).
4. Ensure the adjustment dial is at its minimum setting (counter-clockwise).
5. Power-on your panel. The following LEDs should be illuminated:

a. LED 5 - this indicates that the PCB is powered on.

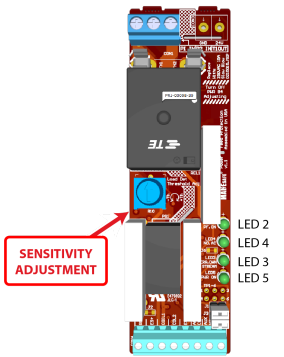
b. LED 3 - this indicates that the PCB is currently sensing a downstream fault

6. Turn the dial clockwise until LED 3 turns off. This establishes the normal ‘safe’ level for your power feed motors.
7. Turn on one of your power feed motors. The motor will not start but you should see LED 3 turn on, indicating that it’s sensing a downstream motor switch in the ‘on’ position.
8. Try to reset your panel by pressing the green reset button. The panel should <u>not</u> reset and your power feed motors should remain unpowered.
9. Turn off your power feed motors. LED 3 should now turn off, indicating that you are in a safe state.
10. Reset your panel by pressing the green reset button. LED 2 should illuminate, indicating that you have successfully reset the system. Your power feeds should now operate normally.

Normal Operation: Any time the panel loses power or the e-stop button is pressed, all power feed motors must be returned to an ‘off’ state before the panel can be reset.

Making Adjustments:
Inside your panel is a printed circuit board (PCB) that controls the power feed system. This PCB has an adjustment potentiometer and status LEDs. Adjustments to sensitivity are made by rotating the small potentiometer.

Use the knob on the potentiometer (or the provided screwdriver) to gently turn the potentiometer counter-clockwise (to turn down) or clockwise (to turn up) the respective setting. You will feel the adjustment hit a stop at the maximum and minimum values. This only requires gentle turning force - excessive force can damage the device.



Brake Calibration

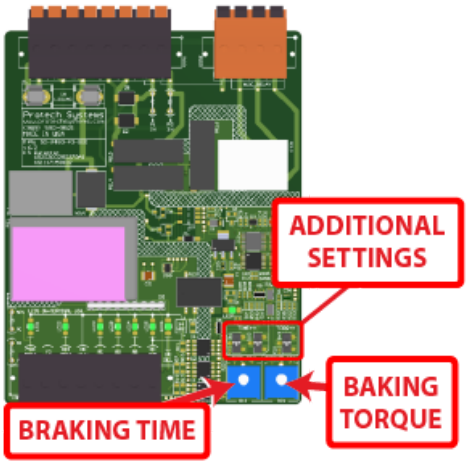
While the MMB is capable of stopping your spindle near instantly, this sudden action should be avoided. The purpose of this calibration section is to find an optimal braking setting for your milling machine. You have two primary means of adjustment on this safety device, described below:

Braking Torque	**Braking Period**
Controls how strong of a braking force is applied to your motor during braking.	Controls how long the braking torque is applied.

Notes on Calibration:

- Consider the different gearing and tooling that will be used with this mill and perform this calibration with the mill configured for a 'maximum inertia' condition. This is typically the tooling with the largest mass and/or diameter and at the highest speed setting.
- The first calibration step will apply a very small braking torque for a very short time and may not be noticeable. This is normal. Proceed with calibration, making only incremental changes for each braking attempt.
- We recommend finding a braking torque and braking time combination that brings your spindle to a complete stop in roughly 1-3 seconds. A good rule of thumb is to aim for a braking time equivalent to or greater than the time it takes your spindle to come up to speed during normal operation.
- You will hear an audible buzzing sound during and after braking. This is normal. Calibrate the device such that there is a buzzing sound for approximately 0.5 seconds after the spindle has come to a complete stop.

Making Adjustments:
The braking torque and braking time adjustments on your MMB are not externally accessible. They are accessible on the printed circuit board (PCB) inside your control panel.
Adjustments are made by rotating small potentiometers on the control PCB. Use the knob on the potentiometer (or the provided screwdriver) to gently turn the potentiometer counter-clockwise (to turn down) or clockwise (to turn up) the respective setting. You will feel the adjustment hit a stop at the maximum and minimum values. This only requires gentle turning force - excessive force can damage the device.



Warning: Remove power from the entire control panel before making any adjustments.

Calibration Steps:

1. Find the braking torque and braking time adjustment potentiometers and confirm that both settings are turned counter-clockwise as far as they will go. This will set the braking torque and braking time to the minimum for your first test. This only requires gentle turning force - excessive force on the adjuster can damage the device.
2. Turn on your machine by using the green start button on the control panel. It should start normally.
3. Once your machine has come up to speed, press the red stop button on the 3-button control panel. This will immediately disconnect power from the tool and apply a braking torque for a set period of time.
4. If this braking action does not bring your machine to a complete stop, increase your braking period or braking torque, making small incremental adjustments. Never turn an adjustment more than 1/8 of a turn at any one time.
5. Repeat until you achieve the desired result.

Additional Settings: If you need additional time or additional braking torque to meet your requirements, we have additional settings that can expand the available range. Please contact us for guidance on how to do this.

Safety Feature Testing

Thoroughly test each safety feature and document the results as part of your risk assessment. Intended performance is described below.

1.1. When the machine first receives power, after a momentary loss of power, or after an e-stop, the system will be disabled and the spindle motor and power feeds are prevented from starting.

1.2. Pressing the system reset button will reset the machine. Any of the following conditions will prevent the system from resetting:

- primary power is not available
- auxiliary power is not available
- power feed motor is still in the ‘on’ position
- the emergency stop button was pressed and has not been reset

1.3. If the machine is running, any of the following actions will turn off the spindle and activate the spindle motor brake:

- Pressing the stop button on your 3-button control panel
- Pressing the emergency stop button on your 3-button control panel

> ***Note:*** *The motor brake will not activate if power is lost to the MMB.*

1.4. If any of the following conditions are true, the spindle will not start:

- The emergency stop button was pressed and has not been reset
- Any circuit protection device has been tripped

1.5. The only way the spindle can start is if the spindle on button is pressed. No other conditions will start the machine, including:

- Resetting the emergency stop button
- Restoring power to the machine after loss of power

1.6. The only way the power feeds can start is if they are manually started. No other conditions will start the power feeds, including:

- Resetting the emergency stop button
- Restoring power to the machine after loss of power

Inspections & Maintenance

1. Inspections

MAKESafe Tools recommends that the Safety Feature Testing described above be performed regularly, with the inspection interval determined by the risk assessment.

2. Maintenance

2.1. Re-calibrate the motor brake any time new tooling is introduced or the machine is serviced.

Circuit Protection

Your MMB has multiple levels of circuit protection. Refer to the provided electrical diagrams for more information about fuse locations and replacement specifications.

*** In the event of a fault, always replace both fuses in a pair (even if only one tripped).*

Troubleshooting

Problem	**Potential Solution(s)**
Your machine will not start.	Solution 1: Reset the emergency stop button by pressing it down then twisting it gently clockwise until you feel it pop out. Solution 2: Remove power from the control panel and check all circuit protection elements. See previous section for locations. If any elements have tripped, identify the fault before resetting.
The circuit breaker or motor overload trips often.	Solution 1: Check the motor and identify faults. Solution 2: Adjust the motor overload setting on the MPCB. Solution 3: Reduce the braking torque. You can compensate for the reduction in torque by slightly increasing the braking time.

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Service & Support

If you have any questions or your device needs service, please contact us!
A real person will always answer the phone (or promptly call you back).

(415) 937-1808

(this number accepts both calls and text messages)

service@makesafetools.com

www.makesafetools.com

(live chat available on website)