



MIDI THING

USER MANUAL

POWERING THE
MODULE

THANKS FOR PURCHASING A MODULE FROM BEFACO!
BEFORE YOU PLUG THIS MODULE IN...

1. **Disconnect your cabinet from the mains.**

2. **Triple check the power cord polarity.** The coloured line on the cable (pin number one) is the -12V rail.

3. Connect the cable to the POWER connector. If you plug the module backwards or to the ICSP connector, you might burn it out and unfortunately this is not covered by the warranty.

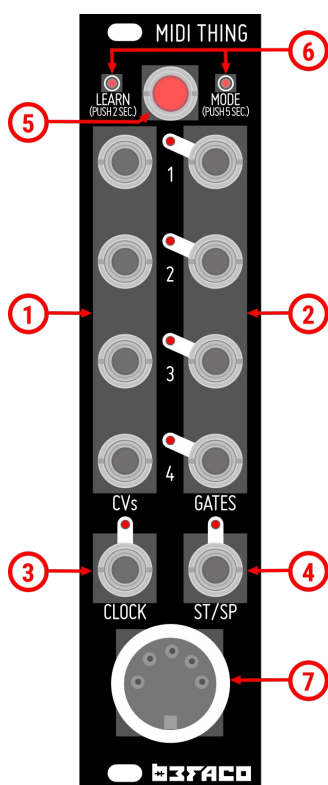
4. If you have any questions please drop us a mail.



INTRODUCTION | MIDI THING: FOUR CHANNEL MIDI TO CV INTERFACE

The module allows you to convert MIDI messages into CV/Gate signals, featuring several functional modes supporting multiple channels and polyphony as well as a drum trigger mode. With the simple press of a button you are able to change between modes, automatically detect MIDI channels, enter calibration mode and change several settings like clock resolutions or retrigger mode. **This manual has been updated for firmware version 2.0 released in April's 2018.**

FIRST LOOK | BRIEF VIEW OF THE FRONT PANEL CONNECTIONS AND CONTROLS



1. CV Outputs (1-4)
Function varies with selected mode

2. Gate Outputs (1-4)
Function varies with selected mode

3. Clock
Clock output

4. Start/Stop
Start/Stop output

5. Mode Button
Used to enter Learn or Menu mode. Can also be used to send an "All Notes Off" MIDI message.

6. LEDs
Indicates when MIDI notes are received or a mode is selected

7. MIDI in
MIDI input



INTRODUCTION

When initialised, MIDI Thing will default to QUAD mode (see modes section in page 3) listening on MIDI channels 1,2, 3 and 4 and converting the first 120 MIDI notes (0 - 119) into 10 volts (corresponding to 10 octaves with 12 notes per octave). Keep these voltage and octave ranges in mind when setting up your oscillator to ensure you get the frequencies you want. A MIDI note ON received will be converted into the equivalent voltage at the CV out (following V/oct) and a Gate High on the gate out. The gate will go down when its Note OFF is received.

MIDI Thing can be configured by using the push button on the front panel in conjunction with sending the appropriate MIDI notes. You will therefore need to have a MIDI interface attached to the module to change the modes, calibrate it or set it up. We recommend using a MIDI keyboard or the piano roll of your favorite DAW.

To configure the module you simply need to press and hold the MODE button. After holding it down for 3 seconds, the LEARN Led will light up and after 5 seconds the MODE Led will light up. Releasing the push button while either Led is lit will select the relevant menu.

You can send a **Panic! message (all notes off) by shortly pressing push button.**

LEARN MENU

In Learn mode you will teach MIDI Thing which note on your keyboard corresponds to the bottom of the scale (MIDI note 0/0 volts). While doing so, MIDI Thing will also automatically detect the MIDI channels you are broadcasting on.

To enter Learn mode press the push button until the Learn Led is lit and then release. You can cancel Learn mode at any time with a short press of the push button.


While in Learn mode, the LEARN led and first active CV channel LEDs will remain lit. As a MIDI note is received, MIDI Thing will assume this note to be MIDI note 0 (0 volts) for that CV channel. MIDI channel you are broadcasting on will be assigned for that CV channel.

Once the first CV channel has been configured the next CV channel LED will be lit and the module will be waiting for another note to arrive.

This process will be repeated for each active CV channel (Appendix 1 for Learn's blocks diagram).

Example

MIDI Thing is set up to QUADMIDI mode and we want to configure it to listen to channels 5,6,7 and 8, starting at the second octave of the keyboard (MIDI note 24). Press the button until Learn LED is lit then release it. CV channel 1 LED will be lit. Now we send MIDI note 24 on channel 5 to assign it to CV channel 1 the led for CV channel 2 will be lit and the module will be waiting for the next note to arrive. Now we send MIDI note 24 on channel 6 to assign it to CV channel 2. We then repeat the process for channels 7 and 8. When the process finishes both Learn and Mode LEDs will light for a moment, which means that data has been saved.



Splitting the keyboard: Should you wish, you can send several notes on the same MIDI channel. This will split the channel into parts and assign them to different CV outs.

Keep in mind that MIDI notes received set the low end of our CV range, so you will need to set the higher notes first.

If a higher note is sent as you attempt to split the channel note the device indicates its unhappiness by flashing the Clock LED while waiting for a valid note to arrive

FUNCTIONAL
MODES

CONFIGURING MIDI THING



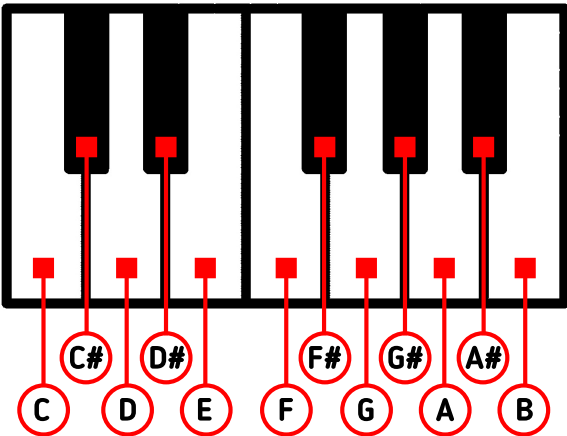
CONFIGURATION MENU
In this mode MIDI Thing can be configured and calibrated. All configuration will be done via MIDI by sending notes on certain channels. We recommend using a MIDI keyboard or the piano roll of your favourite DAW.

To enter the configuration Menu, press the push button until the Mode LED is illuminate (wait for the LEARN Led to turn off) then release the button. You can exit Mode Menu at any time with a short press of the push button.



FUNCTIONAL
MODES

MODES



There are twelve functional modes. Each of them can be selected by sending a MIDI note (in any octave) on **CHANNEL 1** while in MENU Mode. See notes in table.

NOTE	MODE	FUNCTION
C	MONO	MONOPHONIC
C#	DUAL	DUAL MONOPHONIC
D	QUAD	QUAD MONOPHONIC
D#	PERCTRIG	MULTITRIGGER
E	DUOFIRST	DUOPHONIC - PRIORITY FIRST NOTE
F	DUOLAST	DUOPHONIC - PRIORITY LAST NOTE
F#	DUOHIGH	DUOPHONIC - PRIORITY HIGHEST NOTE
G	DUOLOW	DUOPHONIC - PRIORITY LOWEST NOTE
G#	POLYFIRST	POLYPHONIC - PRIORITY FIRST NOTE
A	POLYLAST	POLYPHONIC - PRIORITY LAST NOTE
A#	POLYHIGH	POLYPHONIC - PRIORITY HIGHEST NOTE
B	POLYLOW	POLYPHONIC - PRIORITY LOWEST NOTE

FUNCTIONAL
MODES

QUICK REFERENCE TABLES

MONO
Complete monophonic mode with regular CV/Gate, Velocity, Pitch Bend and Modulation Wheel outputs. Perfect for basslines, leads and monophonic patches in general played with keyboard.

DUAL
Two channels CV/Gate monophonic mode with extra Velocity output per channel. Good to make monophonic patches with suboscilators. In this mode Gate outputs 3 and 4 are unused.

QUAD
This is Midi Thing's default mode, a our channel CV/Gate mono mode. Perfect for sequencing multiple oscillators.

PERCTRIG
This mode provides eight trigger outputs mapped to drum midi notes. Useful for percussion sets.

DUOPHONIC MODES
Duophonic CV/Gate modes with priority to First, Last, Higher and Lowest note. Each channel has its own Velocity output (CV outputs 3-4). In these modes Gate outputs 3 and 4 are unused.

POLYPHONIC MODES
Polyphonic CV/Gate modes with priority to First, Last, Higher and Lowest note. Up to four notes. Perfect for chords!

NOTE PRIORITY

We need a way to tell the synth which notes will prevail when we add a new note once the polyphony is already complete: Two notes in DUO and four notes in POLY modes.

If priority set to FIRST note, Midi Thing prioritize the first notes pressed, so new notes will never sound.

For the case that the LAST note has priority, the effect will be the opposite: Midi Thing will output the new note, removing the first note which was pressed.

The procedure is the same for HIGH and LOW priority modes but depending if a note is higher or lower than the rest.

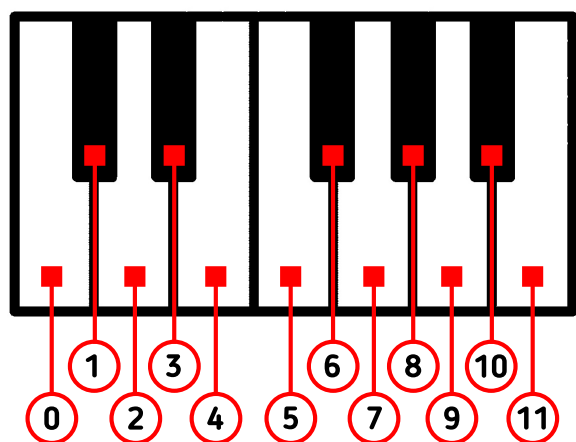
OUTPUTS
MAPPING

	MONO	DUAL	QUAD	TRIG	DUO	POLY
CV1	NOTE	CH 1 NOTE	CH 1 NOTE	36 (TRIGG)	NOTE 1	NOTE 1
CV2	VELOCITY	CH 1 VEL	CH 2 NOTE	38 (TRIGG)	VEL 1	NOTE 2
CV3	PITCH BEND	CH 2 NOTE	CH 3 NOTE	42 (TRIGG)	NOTE 2	NOTE 3
CV4	MOD WHEEL	CH 2 VEL	CH 4 NOTE	45 (TRIGG)	VEL 2	NOTE 4
GT1	GATE	CH 1 GATE	CH 1 GATE	46 (TRIGG)	GATE 1	GATE 1
GT2	N/A	N/A	CH 2 GATE	47 (TRIGG)	N/A	GATE 2
GT3	N/A	CH 2 GATE	CH 3 GATE	48 (TRIGG)	GATE 2	GATE 3
GT4	N/A	N/A	CH 4 GATE	49 (TRIGG)	N/A	GATE 4
CK/ST	YES	YES	YES	YES	YES	YES

All modes have individual **Clock** and **Start/Reset** outputs.

FUNCTIONAL
MODES

SYSTEM SETTINGS



0 (C). Retrigger OFF
2 (D). Retrigger ON

RETRIGGER MODE

4 (E). Running clock OFF
5 (F). Running clock ON

CLOCK MODE

1 (C#). /24 (Default)
3 (D#). /48
6 (F#). /12
8 (G#). /6
10 (A#). /3

CLOCK RESOLUTION

7 (G). Reset
9 (A). ST/SP Gate

ST/SP BEHAVIOUR

11 (B). Enter Calibration

CALIBRATION MODE

RETRIGGER ON/OFF

You can activate or deactivate retrigger mode pressing notes 0 (C) or 2 (D).

When retrigger is ON every time a Note ON arrives the gate will briefly go low, even if the Note OFF of the previous note hasn't yet arrived.

When retrigger is OFF, the gate will only trigger for a new note if the Note OFF for the previous MIDI note has been received. In the Monophonic modes this means that if a note is pressed and held while another note is pressed, there will be no gate for the second note (to trigger an envelope for instance), although the CV will change. In retrigger mode, every time a note is pressed a new gate is created.

SYSTEM MODE

By broadcasting on **Channel 2** while in MODE you are able to change system options and calibrate CV channels. Midi Thing has four groups of settings: **Retrigger Mode, Clock Mode, Clock Resolution and Calibration.**

Each of them is related to a specific group of notes of the **first octave**. (see the table below)

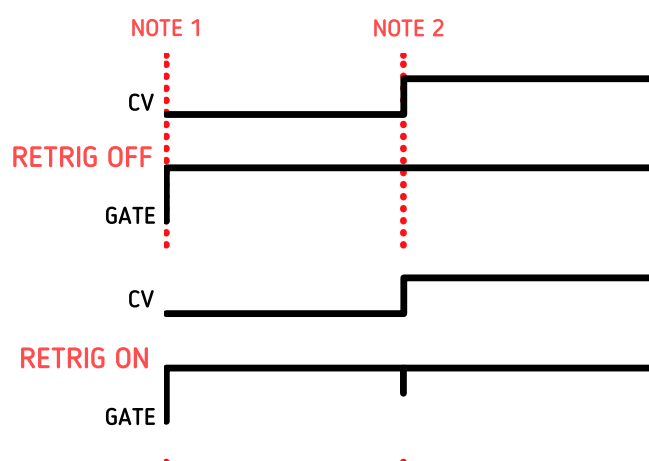
RUNNING CLOCK

Pressing Notes 4 (E) and 5 (F) will set ON or OFF running clock mode. This mode will cause MIDI Thing to turn off clock messages processing when a STOP message arrives. MIDI clock will resume when a START message is received.

This mode is perfect for machines, like those from Elektron, which keep sending MIDI even after STOP has been pressed.

CLOCK RESOLUTION

A MIDI clock signal will be sent from your MIDI device to the MIDI Thing at a rate of 24ppqn (parts per quarter note). By default MIDI Thing scales this down by a factor of six to output 4ppqn for syncing with outer devices, however it is possible to change this



ST/SP BEHAVIOUR

You can configure the ST/SP output to either behave as a reset or ST/SP gate.

Send Note 7 (G) to select Reset mode. In this mode a trigger is sent when a ST or continue message is received.

Send Note 8 (A) to select ST/SP mode. The output will be high when a ST message is received and low when SP arrives.

CALIBRATION

In this mode you can calibrate the output voltages from the CV channels. This will be accomplished by sending MIDI notes on MIDI channels 1 to 4 as described below.

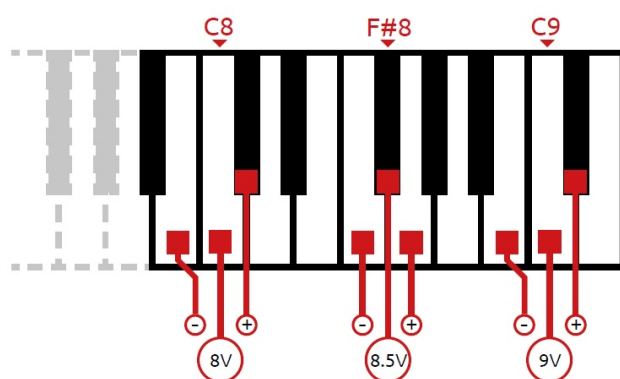
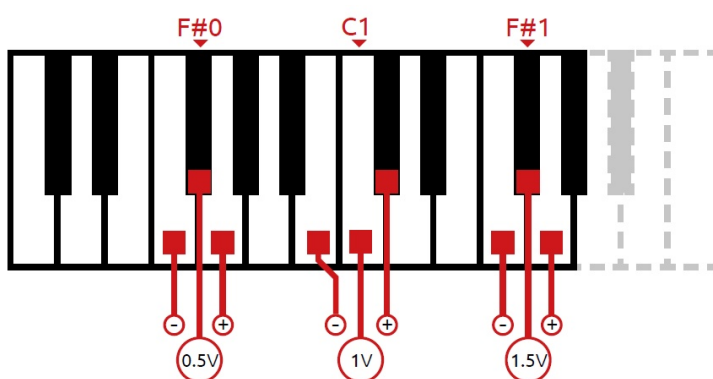
To enter calibration send midi note 11 (B) on channel 2 when in the MODE menu.

This process must be performed either with a precision multimeter (three decimal recommended) or by connecting CV out to a VCO Volt/Oct input and measuring the frequency/note value with a tuner.

The firmware calibrates between the first and middle note of each octave (C and F#), and interpolates values between them.

There are 20 calibration points. Between each calibration point there should be an increase of 0.500 volts (e.g., 0.500v for first F#, 1.000v for first C1, 1.500v for second F#, 2.000v for next C, etc...) in order to keep a linear rise and to track Volt/Oct accurately.

With your multimeter or tuner ready to measure you can change each calibration point's CV value by **pressing the semitone above or below** it on your MIDI instrument (see diagram below). Keep adjusting until you get the correct voltage reading or frequency. Press the "main" note (C or F#) after adjusting in order to double-check the current value.



Tip

You can use callibration procedure to tune oscillators that do not track at 1V/Oct to do so.

Keep in mind callibration will be only valid for that oscillator, making other oscillators misbehave.

LED activity:

LEARN LED will stay on when you press one of the calibration keys (F# and C) Every time you change a value with a higher or lower key both LEARN and MODE LEDs will blink twice.

PROGRAMING | UPDATING MIDI THING

LOADING FIRMWARE

This module is based on the Arduino platform and features an Atmega328 microcontroller with Arduino UNO bootloader. An ICSP header is available on the board to reprogram it.

Read carefully about Arduino programming via ICSP before attempting to reprogram Midi Thing.

Please beware that if you are not familiar with these concepts and you try to load a new firmware you risk disabling your module!

In order to program/upgrade the module follow these steps:

1. Get an Arduino Programmer

We normally use an USBasp programmer like this one <https://www.ebay.com/itm/USBASP-USB-ISP-Programmer-for-Atmel-AVR-ATMega328-ATMega32U4-Arduino-/322662323277>

2. Download Arduino IDE

Go to the official Arduino website <https://www.arduino.cc/en/Main/Software> and download the latest version of Arduino IDE for your operating system and install it.

3. Download the firmware

Go to <https://github.com/Befaco/midithing> and press "clone or download" to download the repository to your computer. Extract the zip file and copy "firmware" folder to your sketchbook folder.

4. Install the libraries

Download the libraries (**Bounce**, **mcp4728** and **MIDI**) and install them following the instructions from this link <https://www.arduino.cc/en/Guide/Libraries>

5. Connecting the module

Connect the programmer to the ICSP conector in the back of the module. Pay special attention to the pinout when you plug the module. You can check this link for more information about ICSP <https://www.arduino.cc/en/Tutorial/ArduinoISP>

6. Upgrading

Press "Open" and search the file "firmware.ino" located on the "firmware" folder. Go to "Sketch" and hit "Upload using programmer".

If everything goes well you should see a "Done uploading" message in a few seconds. If something happens during the upgrade, check your Arduino settings following the instructions of this link <https://www.arduino.cc/en/Guide/Troubleshooting>

An alternative without using a programmer is to use an Arduino UNO board: program it and exchange the Atmega328 chip of the board with the one in the module.

Also, you can get a pre-programmed chip from us and change it yourself.

MISCELLANEA

CREDITS

MIDI Thing firmware v1 was coded with love by **Sergio Retamero**:
sergio.retamero@gmail.com

Performance boost, bug fixing and extra awesomeness by **Jeremy Bernstein**:
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Firmware v2 coding:

Quad Polyphonic modes were implemented by **Jeremy Bernstein**.

New configuration system, duophonic modes implementation, clock modes, a touch of beauty to the interface and a gazillion little details no living person could ever imagine by **Alberto "Numerico" Navarro**:
albertonafu@gmail.com

Calibration method inspired on **Mutable instruments CVpal**.

Thanks to everyone that took the time to finger point bugs, provide feedback and made loads of suggestions. Special thanks to **Jonatan "Jessica Fletcher" Bernabeu**.

MISCELLANEA

SPECS

Power draw:
+12 **32mA** -12 **8mA** +5 **0**

Size:
6HP wide **30mm** deep

Module information:
<https://www.befaco.org/en/midi-thing/>

