

MARF Multiple Arbitrary Function Module 248t

Welcome to the 248t MARF User Manual

Before getting started, please read this page carefully.

During the development of the MARF, we gathered information about each function from every available source. Communicating this information to users of the 248t presented a challenge: how do you clearly explain such a complex device? We determined that the most effective approach would be to provide three complementary sources of information, allowing users to cross-reference them when needed:

- 1 Function and Feature Reference** – In the following pages you will find a detailed list of all functions and features, presented as a concise translation of the original 1977 user manual.
- 2 Video Manual** – A comprehensive, chapter-based video guide covering all functions, programming techniques and examples.

Watch here https://youtu.be/c_xYYVPxV6E

- 3 Original 1977 User Manual** – Written by Buchla & Associates. Although extremely comprehensive, this manual reflects certain historical differences—for example, voltage scaling (original Buchla systems use 2.4V/Octave, while Eurorack systems use 1V/Oct). Despite these differences, it remains an excellent reference and complements the two resources listed above.

https://tiptopaudio.com/manuals/248t/Buchla_248_Manual_1977.pdf

Updating Your 248t Firmware

The firmware for the 248t processors is periodically updated with bug fixes, performance improvements, and general adjustments. Firmware updates are installed on the back board using the SD1 and SD2 MicroSD card sockets.

How to Check Your Currently Installed 248t Firmware Version

Processor SD1 – On power-up, the preset LED will indicate the version number.

Processor SD2 – Located on the back of the module; on power-up, a green LED will flash a number of times to indicate the version number.

Compare your results with the versions listed on the 248t web page.

Updating Your Firmware

Prepare a MicroSD card and ensure it is formatted as FAT32 (not exFAT) and is empty. <https://tiptopaudio.com/buchla/>

Processor SD1 - Download the SD1 firmware. Make sure the card is empty, then copy the downloaded SD1 file (image.hex) onto it. With the power off, gently insert the card into the SD1 socket. Power up the unit—the gate LED will flash rapidly for about 1 second.

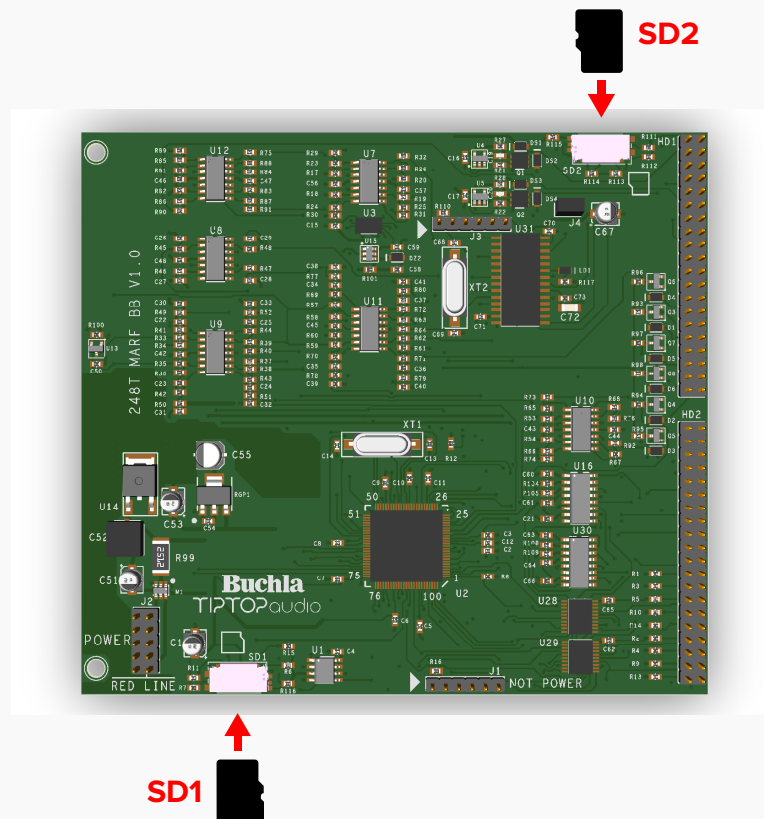
Processor SD2 – Download the SD2 firmware. Make sure the card is empty, then copy the SD2 downloaded file (image.hex) onto it. With the power off, gently insert the card into the SD2 socket. Power up the unit, the green LED will flash rapidly for about 1 second.

Common Update Failures

Update failures can result from the following:

The file name was changed during download (e.g., image.hex becomes image (1).hex) → the LED will flash endlessly.

The SD1 firmware was installed in SD2, or vice versa or the same file was upload to both. Be careful, as both files are named image.hex when downloaded from the website.



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Preparing Your 259t Oscillators to Host the 248t

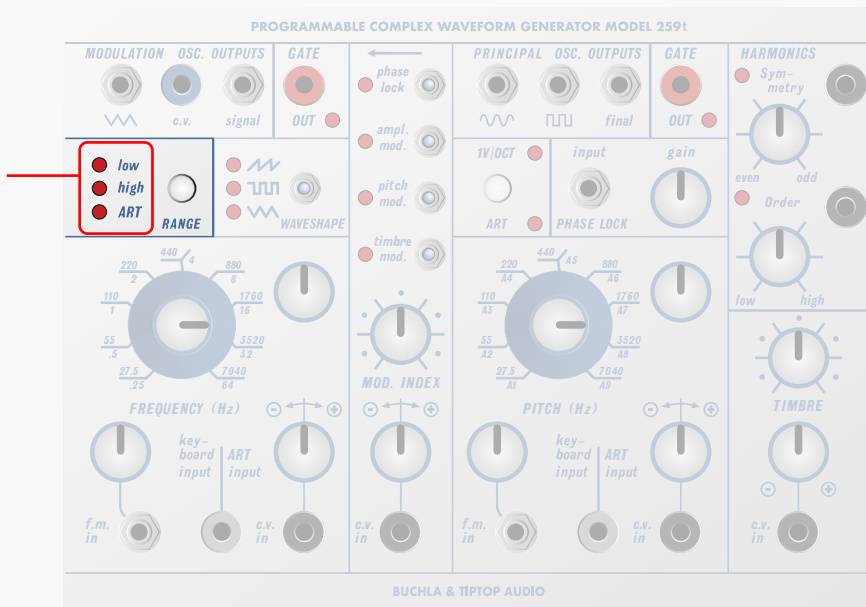
During MARF development, the 259t ART firmware was updated to utilize ART's high-speed signal capability, enabling accurate pitch slides and glide effects generated by the MARF. Before integrating the MARF into your system, we recommend updating the firmware of your 259t. The update file is available for download, and installation instructions can be found in the 259t user manual.

Upon power-up, the indication LEDs on the 259t display the firmware status using the Modulator Range LEDs while the Waveshape LEDs are off:

- All Range LEDs off - update needed
- High LED on - update done

If the ART functionality on your 259t has not been used previously, initial tuning may be required. Refer to the 259t user manual for detailed instructions. **Initial Tuning** and **Auto Tuning** switch is accessible at the lower-right section of the MARF.

These LEDs indicate the current Firmware on power up



Note: For optimal combined operation of the **248t** and **259t** seven octave range, we recommend using the **248t** in **half** (5 octave) or **limited range** modes, to avoid generating notes outside the range covered by the 259t

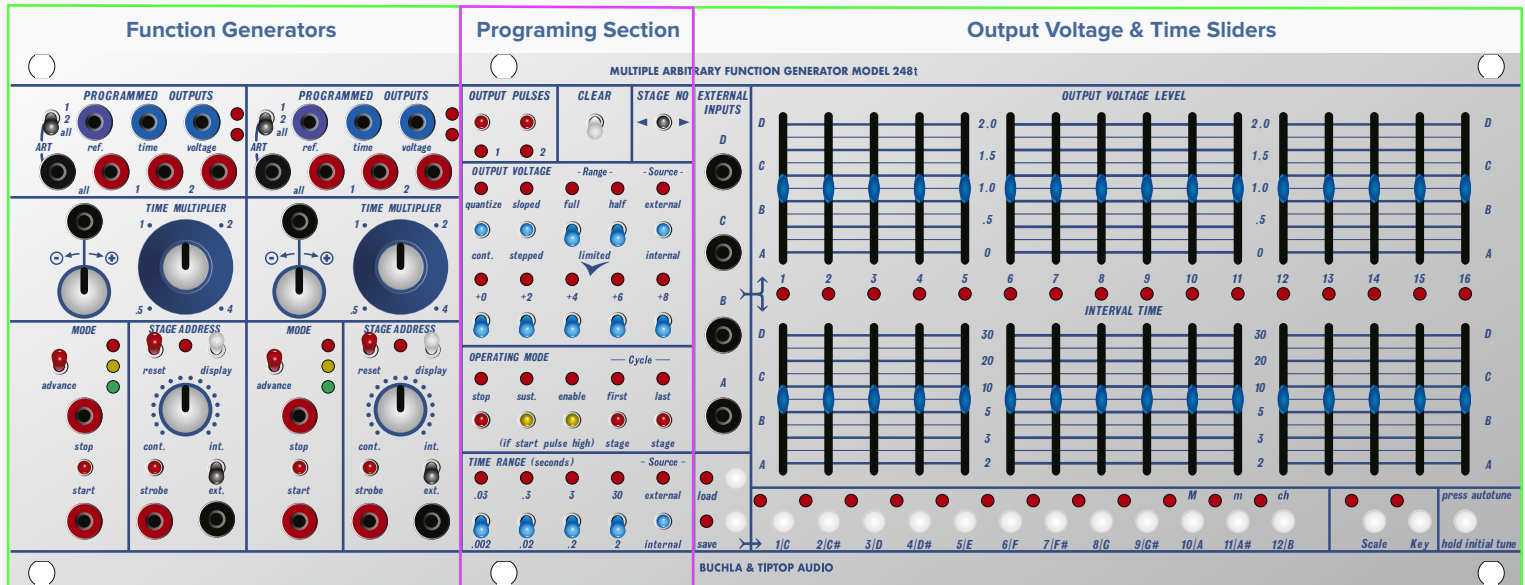
External Inputs Calibration

This is usually done at the factory and rarely needed again. If you notice an offset (e.g., 0V in doesn't give 0V out), do the following:

- Unplug everything from inputs A–D
- Set both function switches to STOP
- Press the External switch 4 times (LED flashes ~2 seconds)

Calibration is complete. Offset should now be minimal or gone..

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The image of the module shows that the MARF is divided into **three main sections**.

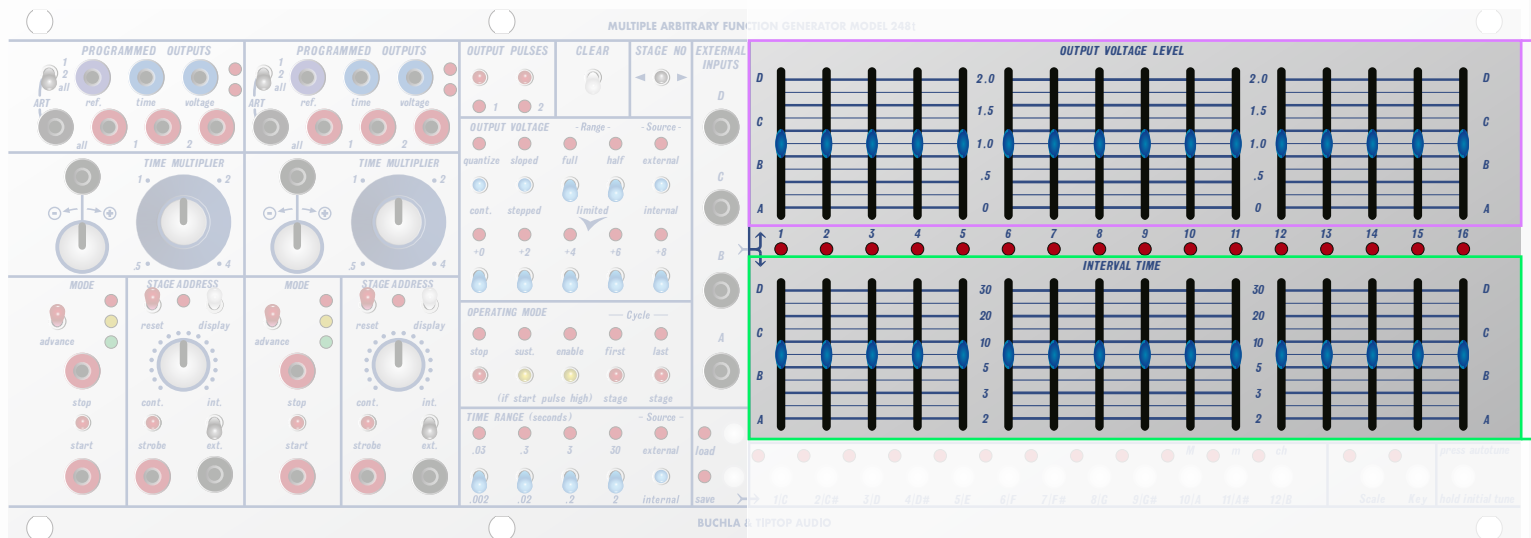
The **two Function Generators** make the module “arbitrary”. They work independently of each other and can access the **16 stages** in multiple different ways. Throughout this document they are referred to as “FGs”.

The Programming Section works in conjunction with the **Output Voltage & Time Sliders** to make modifications to each stage’s voltage level, length of time, and how each stage operates amongst the rest of the stages.

BREAKDOWN OF THE OUTPUT VOLTAGE & TIME SLIDERS

Output Voltage Level: The top row of sliders sets the main output voltage level in conjunction with the Output Voltage programming section per stage. Alternatively, they select which of the external input voltages (**A, B, C, D**) are passed through the output voltage modifier programming and out through the voltage output jacks.

Stages: The 16 LEDs along the middle represent the 16 stages, and light up when they are advanced and displayed by the FGs, or when using the Stage Number edit switch.



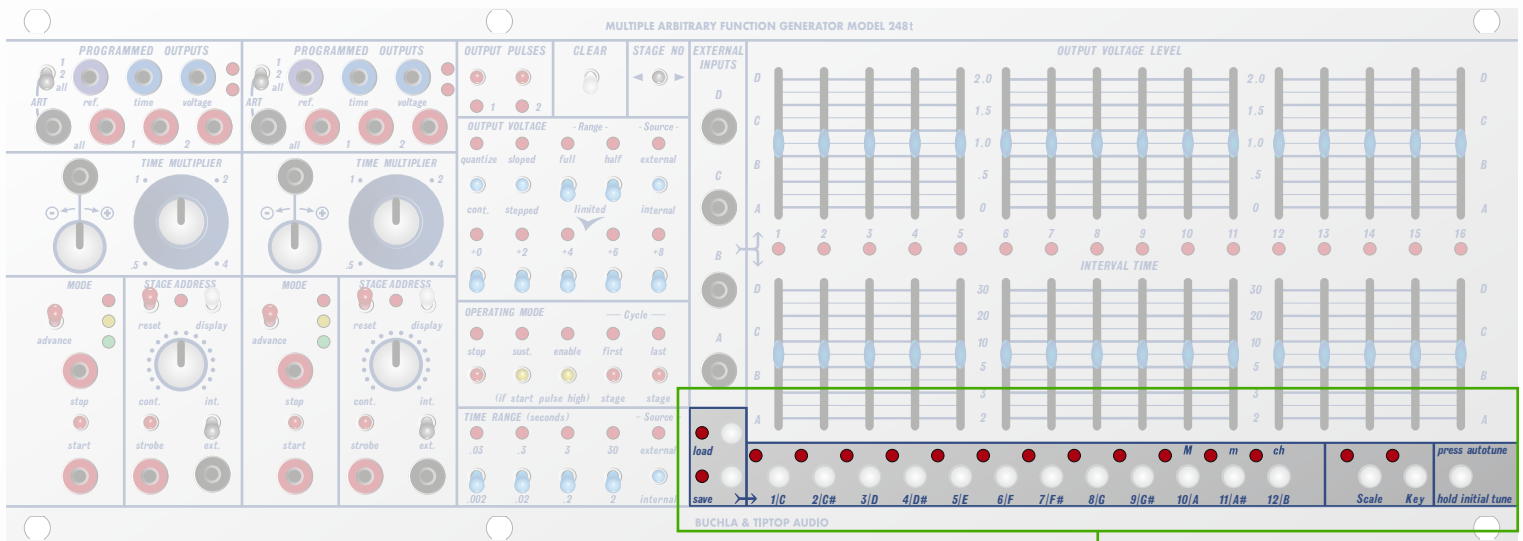
Interval Time: The lower row of sliders sets the interval time of each stage in conjunction with the Time Range programming section. The default time range is set from 2 seconds at the bottom of the slider to 30 seconds at the top of the slider, as indicated on the panel. The sliders also output a voltage based on their settings at the Time output on the FGs.

Video manual - Chapter 1 Panel Overview : https://youtu.be/c_xYYVPxV6E?si=thdg4Cb_ySgwsK58&t=42

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PRESETS AND QUANTIZATION SCALES

The row of buttons under the 32 Voltage and Time sliders allow for storing and recalling **12 Presets** with an alternate function of selecting the **scale** and **key** for the stages with **Quantize enabled**. In addition, there is a button for sending an Auto-Tune message to ART equipped oscillators.

Loading a preset : press the **Load button** and then cycle one of the buttons labeled **1 to 12**. The settings in that memory location are immediately recalled for all **16 stages**. Note that the sliders values are replaced by saved values and the sliders are only active once they have **moved past the stored value**.

Saving a preset: press the **Save button** and then one of the buttons **1 to 12**. All stage settings including the slider positions are saved to non-volatile memory.

Changing Key: Press the **Key button** and then one of the **12 Keys (C to B)**.

Changing Scale: Press the **Scale button** and select **Major (10)**, **Minor (11)** or **Chromatic (12)**.

Auto Tuning: Pressing the Autotune switch once will send the tuning message to both **ART outputs**. Holding the switch for a few seconds sends the Initial Tune message.

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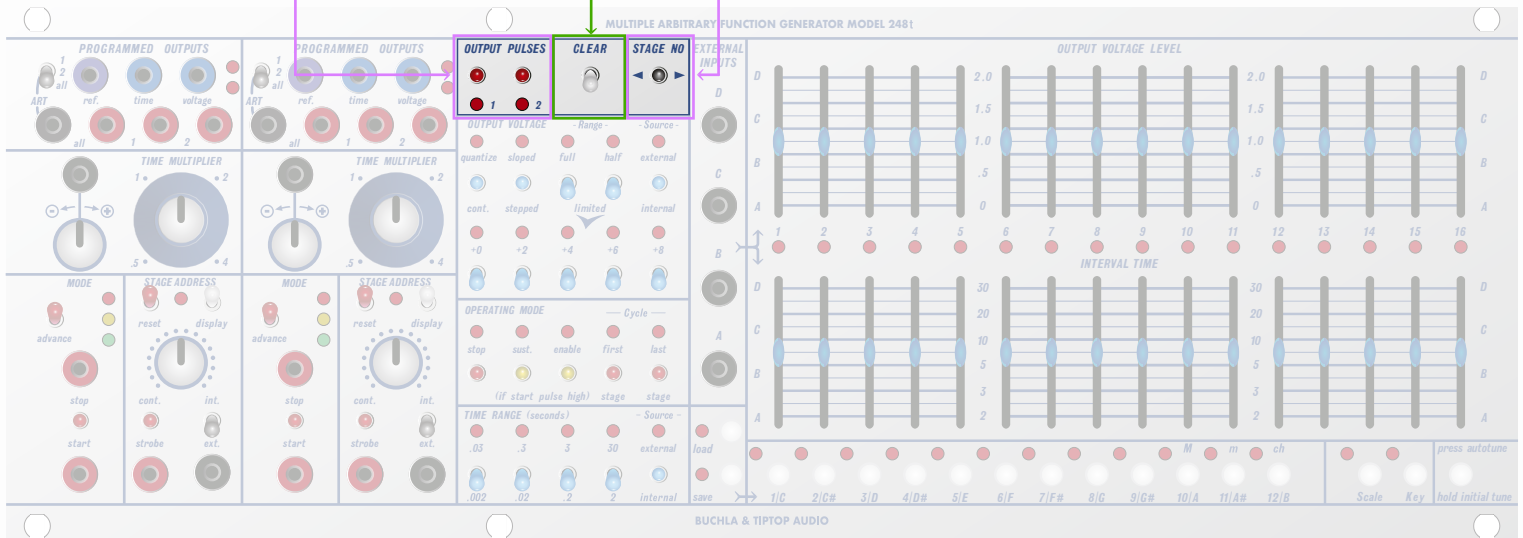
Output Pulses: Each stage can have two independent pulse outputs programmed to it. Each switch is a **three-position momentary switch**. Pressing the switch **upward** adds the pulse to the stage and lights the LED. Pressing the switch **downward** removes the pulse from the stage and turns the LED off.

Clear: It is a **momentary switch** in the down position. Pressing up clears the programming on all **16 stages**. **Output Pulses 1 and 2** are cleared. **Output Voltage** is set to **Continuous, Full Range and Internal Source**. All settings in **Operating Mode** are cleared. **Time Range** is set to 2 to 3 seconds. **All slider values** are set to their current physical position (overriding the saved values if applicable).

Stage Number: This **3-position momentary switch** is used to scroll through and locate specific stages in order to edit their programming. This can be done while the **Function Generators** are in use and will not inhibit their operation unless a stage's programming is changed.

Flipping the switch left or right while displaying one of the FG's functions will make the LEDs jump to stage 1. The stages work in a circular fashion: advancing past stage 16 returns to stage 1, and moving backward from stage 1 goes to stage 16.

Holding the switch left or right scrolls through all stages in approximately 2–3 seconds. Once the stage indicator lights start moving, pressing any of the center programming functions will apply that setting to all 16 stages. For example, holding the switch and then pressing Pulse 1 will activate the pulse on every stage.



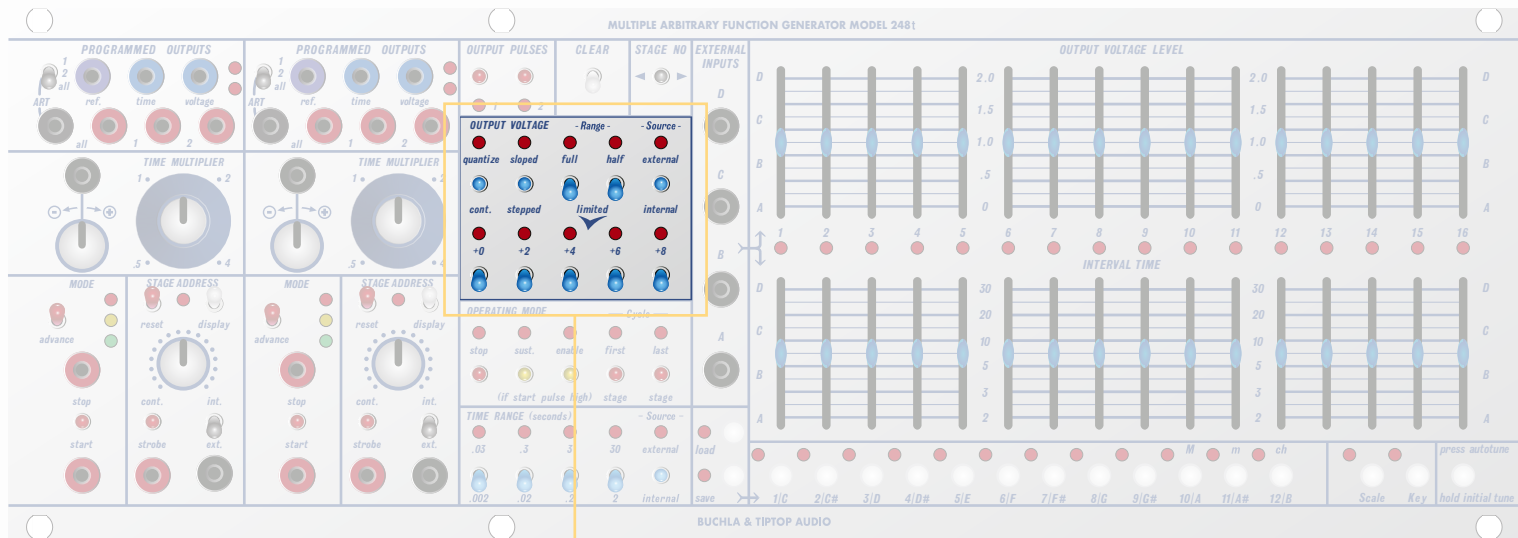
Video manual - Chapter 2 Programming Section: https://youtu.be/c_xYYVPxV6E?si=Y9hySMsb5O1NDhQk&t=189

Video manual - Chapter 3 Enter Programming Data: https://youtu.be/c_xYYVPxV6E?si=jTguRhIhD5s5MZEn&t=317

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VOLTAGE PROGRAMMING MODIFIERS

Quantize/Continuous: A **three-position momentary switch** that defaults to the unquantized continuous voltage setting. Pressing up quantizes the voltage to a one-volt-per-octave scale. Pressing down removes quantization.

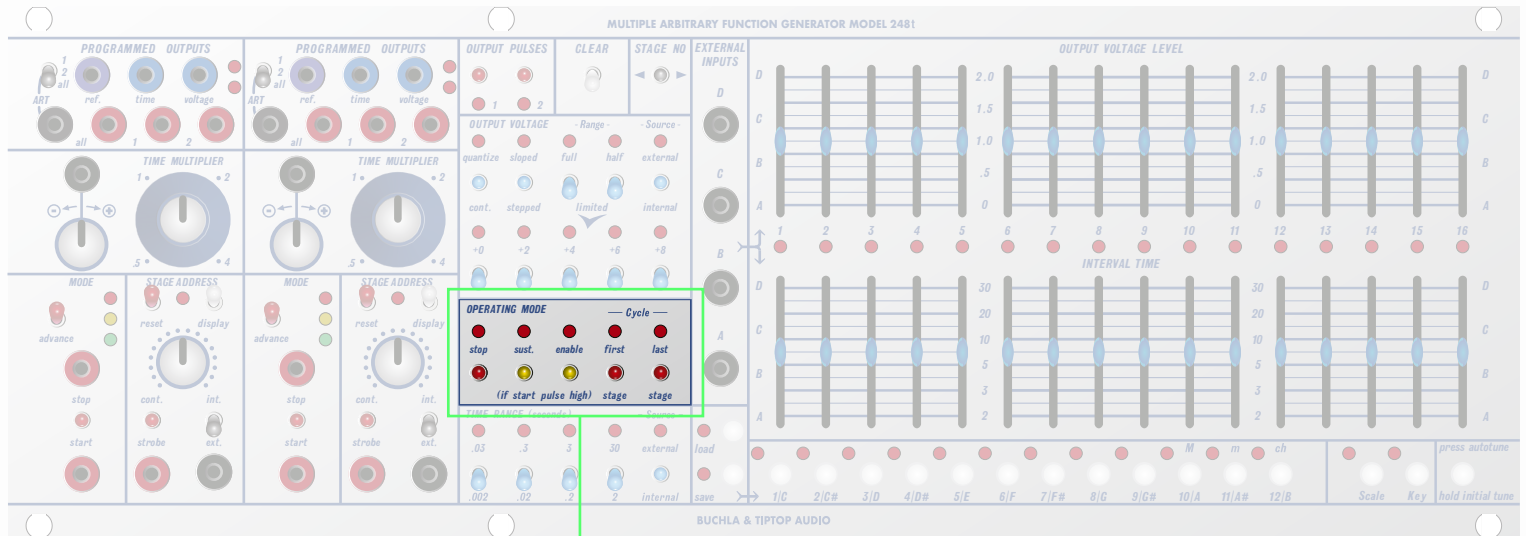
Sloped/Stepped: A **three-position momentary switch** that defaults to stepped mode. Pressing up adds slew time to the stage. The slew time is based on the interval time of the stage. Pressing down removes the slope.

Range - Full Range/Half Range/Limited: A **momentary switch** that defaults to **full range**, meaning the output voltage sliders produce **0–10V**. **Half Range** cuts the output to **0-5 V** which approximates the original **5 octave** range and makes it easier to dial in exact pitch compared to Full. The five limited range switches restrict the slider to a 2 volt span with octave offsets. The original module was only one octave, while the Eurorack 1V/octave range allows for two.

Source - External/Internal (Voltage): This **three-position momentary** switch defaults to internal mode, meaning the stage's slider and modifiers determine the output voltage. In **external mode**, CV sources patched into inputs **A, B, C, or D** are routed through the voltage modifiers, and the slider selects which external inputs is active.

Video manual - Chapter 4 Output Voltage Programming: https://youtu.be/c_xYYVPxV6E?si=QoIZsWLZLhoJf10W&t=353

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OPERATING MODE MODIFIERS

Stop: (three-position momentary switch) Pressing up adds a stop modifier to the stage. When a Function Generator reaches a stop stage, it will not advance until a start pulse is received. The stop stage still respects its interval time.

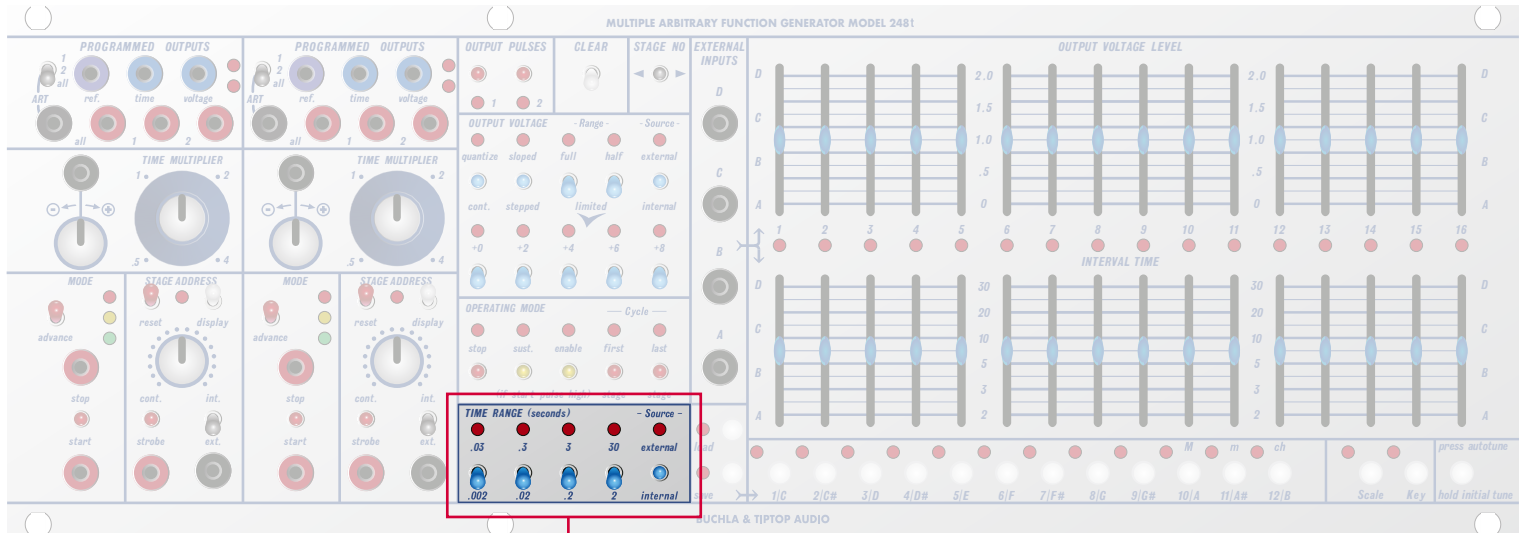
Sustain: (three-position momentary switch) Pressing up adds the sustain modifier. When a high pulse (gate) is present at the start input, the Function Generator will hold on that stage for as long as the pulse remains high.

Enable: (three-position momentary switch) Pressing up adds an enable modifier. The Function Generator pauses on the stage until a voltage above 5V is applied to the start input.

Cycle – First / Last: (three-position momentary switch) These modifiers define the start and end points of a cycle. Function Generators begin at the first-marked stage and loop back to it after reaching the last-marked stage.

Video manual - Chapter 5 Operating Modes: https://youtu.be/c_xYYVPxV6E?si=pZa2gvX42zm56yFN&t=415

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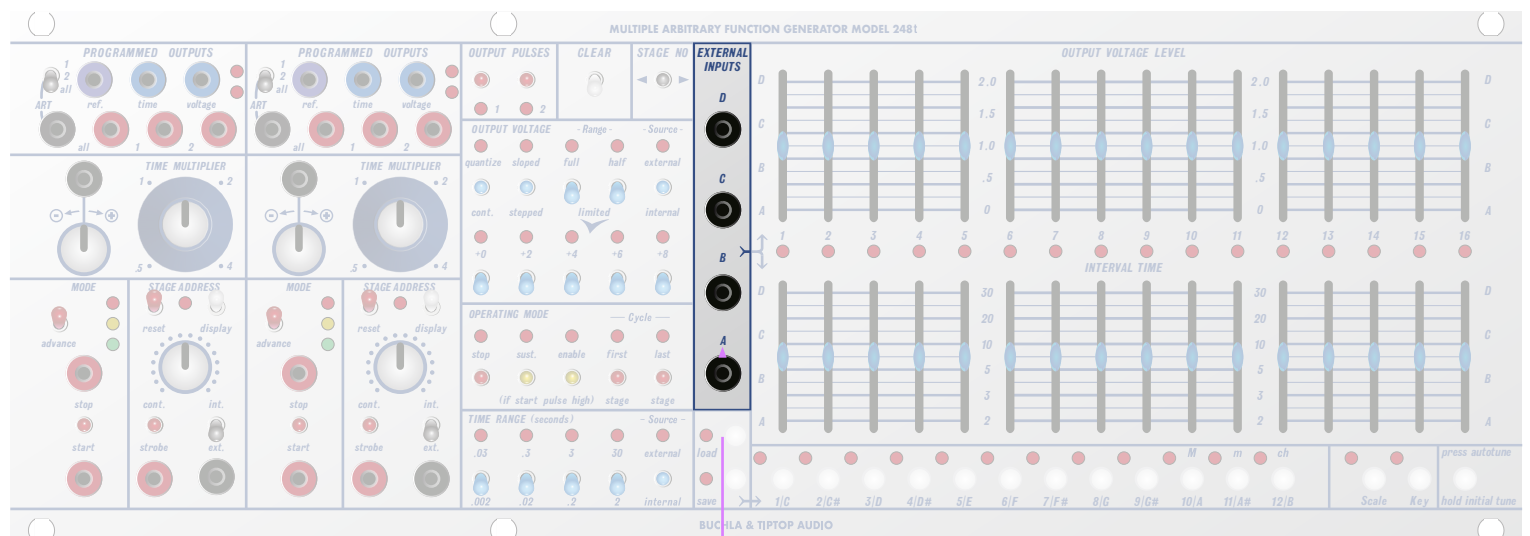


TIME PROGRAMMING

Time Range Switches: Four momentary switches select the interval time range, from very fast (.002 seconds) to very slow (up to 2 minutes).

Source - External/Internal (Time): three-position momentary switch. Internal mode uses the sliders and time range switches to define timing. External mode allows CV sources patched into A, B, C, or D to control the interval time.

Video manual - Chapter 6 Time Range Programming: https://youtu.be/c_xYYVPxV6E?si=O3-sf49M7hy7ulv9&t=490



EXTERNAL INPUTS

Four external CV input jacks allow external voltages to be used either to control timing or to be processed through the output voltage modifiers. If a stage's time range source is set to external and no CV is present, the interval time defaults to the fastest value of the selected range.

Video manual - Chapter 7 External Inputs: https://youtu.be/c_xYYVPxV6E?si=nDveUjnjEBkyRwKh&t=553

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OUTPUTS AND INDICATORS

ART Output (Black Jack): Outputs a digital signal for precise pitch based on the output voltage slider and applied modifiers. Plug into the 259t ART input and set the 259t to ART mode.

On the MARF, use the **switch** above the **ART outputs** to select the gate source: **Pulse 1**, **Pulse 2**, or pulses on all stages (**ALL**).

When using ART to control an oscillator's pitch, the gate for the envelope can be taken either directly from the oscillator or from the MARF itself, providing two different envelope response options. These gates are not identical when modifiers are used.

Voltage Output (Blue Jack): Outputs CV based on the output voltage slider and applied modifiers. The output is 1V/Oct when a stage modifier is set to Quantized.

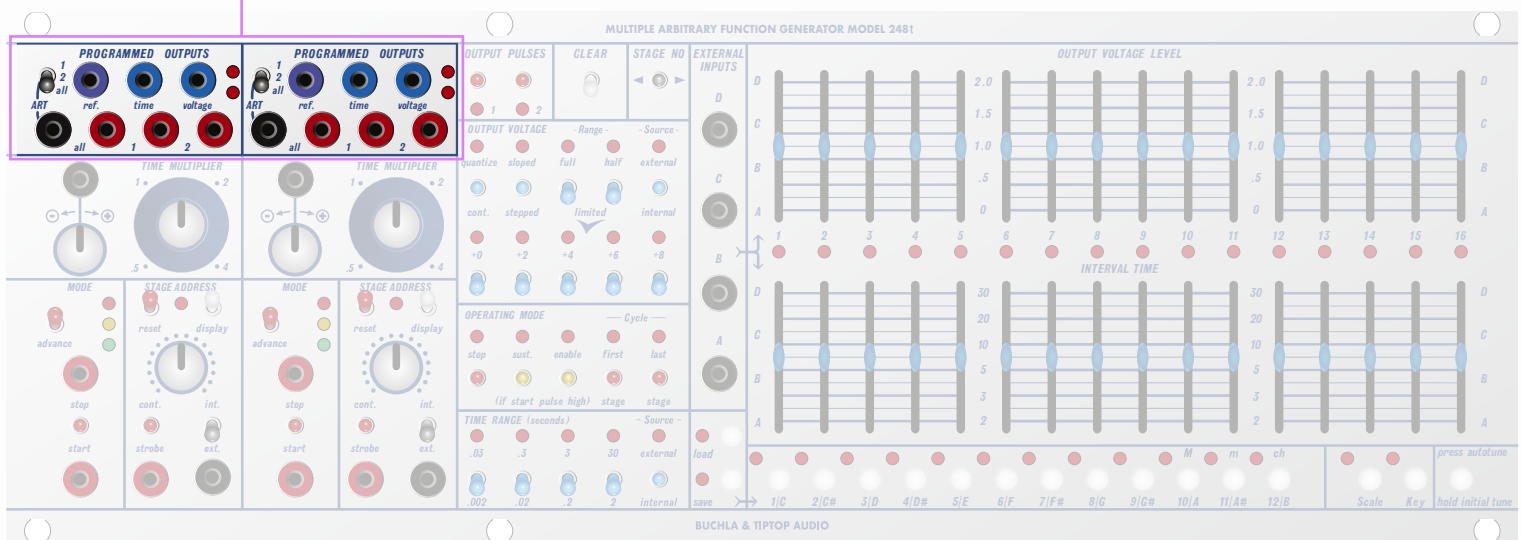
Time Output (Blue Jack): Outputs a CV proportional to the interval time slider. Can be used as a second CV source without affecting the time when the TIME RANGE modifier Source is set to External.

Programmed Pulse Outputs (Red Jacks): Two outputs provide gates on stages programmed with Pulse 1 or Pulse 2 switches.

Output LEDs (Two Red LEDs): Display the gate outputs.

Reference Output (Purple Jack): Outputs a downward ramp spanning the interval time of the stage. Useful for driving a 292t LPG directly without an envelope.

All Pulses Output (Red Jack): Outputs a pulse each time a new stage is addressed. Useful as a clock source for other devices.



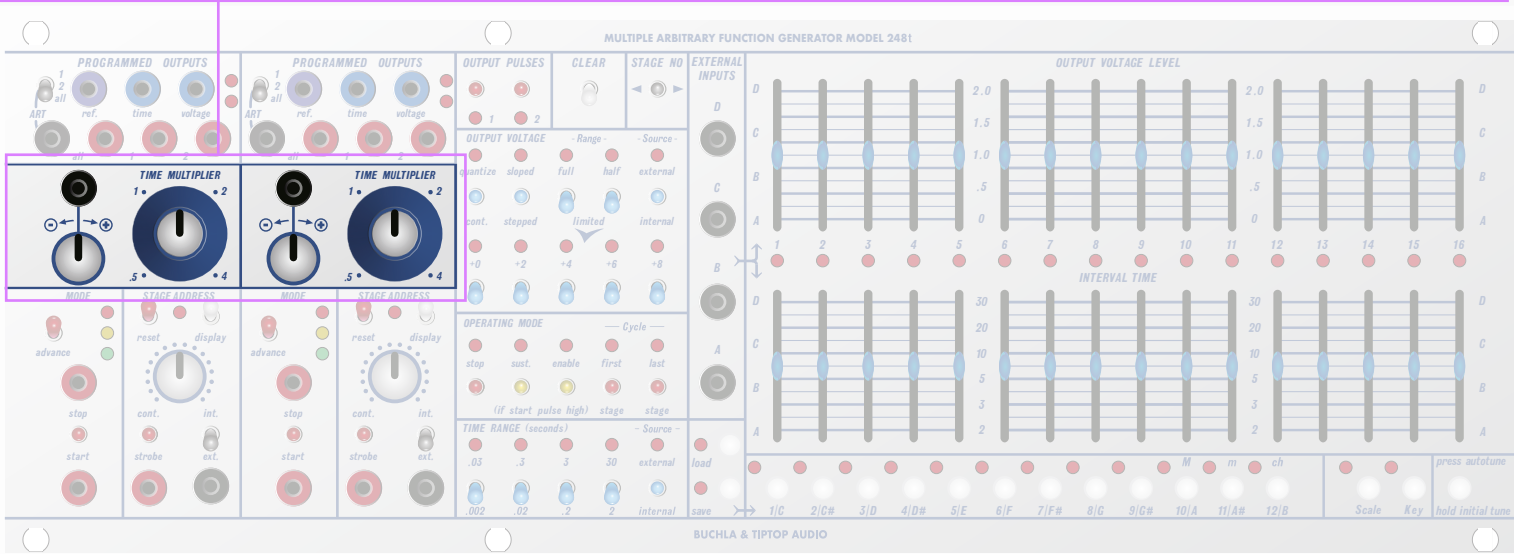
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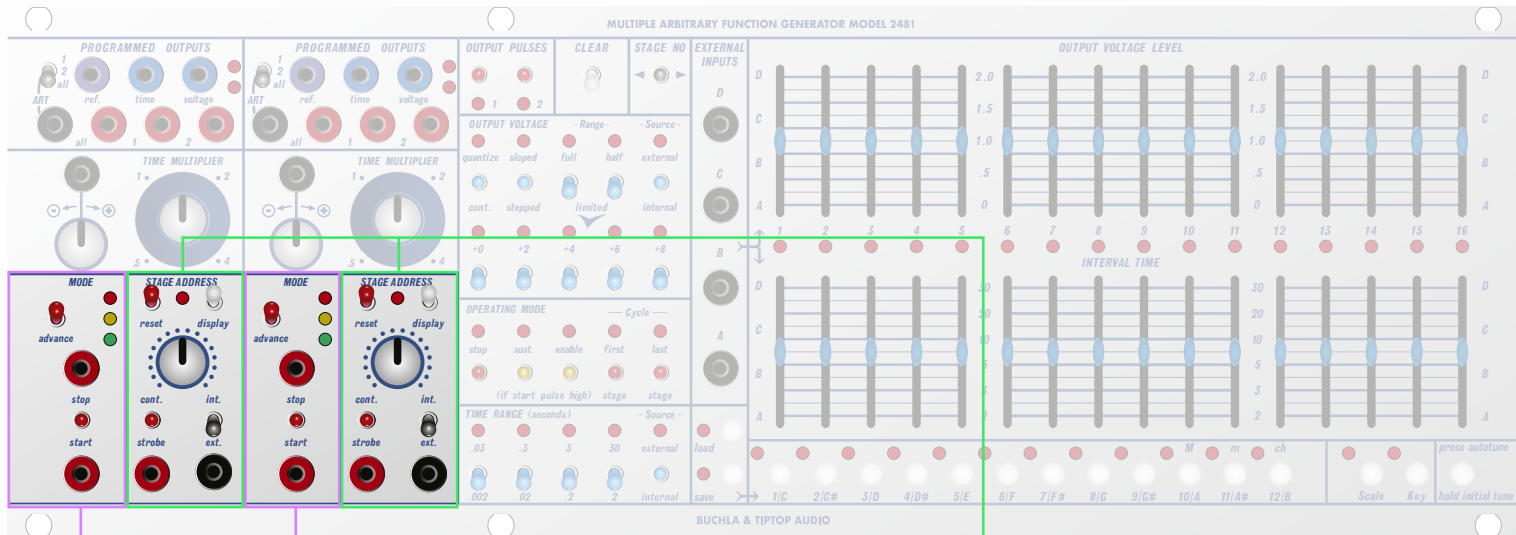
TIME MULTIPLIER

A global time multiplier knob and CV attenuverter allow stage times to be scaled from half-time to four times longer.



Video manual - Chapter 8 The Function Generators: https://youtu.be/c_xYYVPxV6E?si=pwTJ5GDwnGNto3sY&t=574

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FUNCTION GENERATOR CONTROL – MODE

Advance: Manually advances the Function Generator to the next stage.

Start / Stop: Controls the internal clock manually or via pulse inputs.

Status LEDs

Three LEDs indicate the clock state:

Green – Run

Internal clock is running and advancing stages.

Yellow – Hold

Clock advance is interrupted. This occurs when:

A stage contains a Sustain or Enable condition and is waiting for the required Start input condition.

Red – Stop

Clock is halted by:

Stop control or Stop pulse
Programmed Stop stage
Stage Address set to Continuous

FUNCTION GENERATOR CONTROLS - STAGE ADDRESS

Reset two-position momentary switch

Returns the Function Generator to the first programmed stage. If no stage is programmed as First, the generator resets to Stage 1.

Display two-position momentary switch

Shows the current stage position without interrupting operation.

Display LED

Indicates which Function Generator is currently selected for Display. Only one Display LED is active at a time.

Cont / Strobe three-position switch (momentary down, latching center and up)

Continuous sweeps through stages using the Address control and stops the internal clock.

Pressing **Strobe** loads the stage corresponding to the current Stage Address value.

Internal and External two-position latching switch

Selects whether stage position is controlled by the knob or by external voltage

Video manual - Chapter 9 Stage Adress: https://youtu.be/c_xYYVPxV6E?si=egRtsbVAHB9ZvWN5&t=696

Video manual - Chapter 10 A generative MARF driven patch: https://youtu.be/c_xYYVPxV6E?si=WlyVr4lh0p-NQyLs&t=748

Size: 72 HP - Depth: 45mm

Power: +12V 340mA / -12V 30mA

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Special Thanks

First, to the **team** at **Tiptop Audio**: thanks to **Chris Clepper**, who spent nights and days figuring out the very complex firmware of the MARF. Thanks to **Piero Fragola** for another great translation of the 200 4U module into a Eurorack 3U panel size, as well as hundreds of hours of testing and refining features. Also, special thanks to **Kamonrat** (Ole), who hand-soldered all the prototypes—this beast contains many parts that require great attention to detail.

Additionally, we would like to thank **Todd Barton**, **Kyle Swisher**, and **Bart Wolff** for helping us cross-check functions and clarify the mysterious ways of the MARF.

Special thanks to **Kurt Kurasaki** and **Julien Guillot** (STAZMA) for beta-testing the 248t with curiosity, love, and passion.

Thanks to **Buchla USA** for allowing all this to happen, bringing the old man's work to the people.

And thanks to **Don Buchla**, a visionary who saw beyond the moment and made the world a better place.

Finally, thanks to **all our users**, none of this could have been done without your support.

Gur Milstein

Lead Designer and CEO
Tiptop Audio

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