

MOTM

Modular Synthesizer Products

February 2000 Catalog



synthesis
technology

Thank you for your interest in the MOTM line of studio-quality modular synthesizer components.



Whether purchased pre-assembled & tested or as kits, our products are of the highest quality and represent our “No Compromise” attitude in bringing modular synthesis to you. Our circuit designs use state-of-the-art engineering and components, using older parts only where a specific ‘vintage’ characteristic is desired. The mechanical designs are solid and as exceptional as the electronics. All jacks are manufactured by Switchcraft; the rotary controls are Spectrol or Bourns 100% sealed potentiometers (or “pots”). The PCBs themselves are double-sided, pre-tinned, LPI-masked circuit boards, and cable ties are used to secure the cables to them. All audio connections are made with coaxial shielded cable. The front panels are attractively screened with a durable finish.

Kits are shipped with detailed step-by-step instructions that even a beginner can follow—we even provide the solder! No arcane or “secret” parts are used—in fact, the manuals provide an in-depth explanation of the included circuit diagrams to help understand exactly how each instrument functions. Module dimensions were designed around the ‘grid’ of a standard 19” equipment rack, which provides for great flexibility in mounting options.

Yet, the MOTM modules are affordably priced, whether buying kits or assembled & tested units.

“MOTM” stands for “Mother of all Modulators.” Some customers informally refer to it as the “Module of the Month,” because we try to add a new module to the product line approximately every 4-6 weeks. New designs take into account customer feedback and needs. In fact, MOTM users stay in close contact with each other through a private Email list, where ideas are debated, support is offered, suggestions made, and clever uses of equipment are exchanged.

Synthesis Technology stands behind its products. Kits are the best way to save money (your savings will quickly pay for the tools you need to build them, as well as paying for more modules!), and you will enjoy the experience and pride of building your own professional-quality instrument. Our goal is for you to be comfortable owning a MOTM modular, and not spend time worrying over support issues down the road. We offer toll-free tech support, and the MOTM user community is active via Email nearly 24x7—ask a question and usually fellow users will offer help almost immediately. Finally, we offer the following promise: if you build a kit and for *any reason* you think it is not 100% functional, return it to us with \$5 and we will fix it for free, usually within 24 hours.

We are confident that you will be pleased with the MOTM modules’ features, specifications, appearance, longevity, and support.



www.synthtech.com • 888-818-MOTM (6686)

The Modular Synthesizer Renaissance

Why modular synthesizers?

In the first half of the Twentieth-Century, a handful of pioneers experimented with the use of electronics to create, shape, and control sound for musical purposes. During the 1960s and '70s, electronic instrument design progressed rapidly, culminating in the modular voltage-controlled synthesizer. These were temperamental, often enormous, but extremely flexible (and visually impressive) devices that captured the public eye as much for their physical appearances—the complex mazes of patchcords, knobs, and flashing lights—as for their fresh and unique sound creation abilities.

In a modular synthesizer, all of the elementary aspects of sound manipulation are separated into discrete devices, and the user is given point-access to every parameter via patchcords and jacks through the use of 'Voltage Control.' Voltage control inputs and outputs allow modules to affect each other in precise user-variable ways. Each module is in effect a separate sound-shaping instrument, and these instruments can be connected together in any order desired. The large knobs, switches, and patchcords provide a comfortable, rich, tactile experience. The line between audio signals and control signals can be deliberately ignored, widening the horizons even further—there are no rules. The choice of modules in each system is determined by the needs of the user, so every synthesizer is a personal expression of its owner, and because they are modular they can grow in new directions to suit the users' needs. The patchcord system provides a strong visual indication of the signal and control paths. As intimidating as the 'wall of knobs' may have seemed at first, one quickly forms an understanding of their function, and of the physics of sound. Sometimes a 'mistake' can reveal whole new directions in sound creation.

With a modular synthesizer, one can just *play* with sound. Making changes comes easily and intuitively.

But little more than a decade after these machines were developed, their popularity began to wane. They were expensive—while many musicians dreamed of owning one, the only exposure most had to them was at universities. Their size made them difficult to transport; their nascent solid-state electronics consumed a lot of power, gave off considerable heat, and drifted easily. Musicians began asking for less expensive, less time consuming access to sounds, with the ability to remember 'patches.'

Emerging lower-cost digital electronics arrived, offering rapid recall of sounds in smaller packages. Manufacturers realized that they could further reduce size and cost by getting rid of all of those bulky control knobs—the users' interface to the electronics! Patchcords disappeared. Most instruments shrank down to narrow, rack-mounted devices with a single small display and a couple of pushbuttons for paging through menus. Musicians rarely created their own sounds, relying rather on purchasing sounds from third-party vendors, or worse, using only whatever sounds shipped with the instrument. Finally, the majority of devices calling themselves 'synthesizers' were little more than static sample-playback machines. The term 'synthesist' disappeared in favor of 'keyboard player.' Something was missing.

Those who remembered working with the old modulators knew what that was: synthesizers weren't 'fun' anymore. Those who used them often did so without learning anything about sound, and the sounds themselves were suitably lifeless. The machines lacked individuality.

These people began finding each other on the emerging World Wide Web. What began as reminiscing soon turned into a revival of analog sound creation. At the same time, producers at first searching for 'retro' sounds were discovering a life and depth in analog synthesis that had been all but absent from recent recordings. The old instruments came out of the closets—in fact, they began to fetch higher prices in the used-gear market than their original list prices, very rare for electronic devices!

It was in this environment that Synthesis Technology was born. Combining the best of the old modular interface with the latest developments in low-power, high-stability, "CD quality" electronics and engineering techniques, musicians and sound designers are rediscovering a way of working and a depth of animated sound that is as pertinent today as it was thirty years ago. You'll see what we mean the first time you hold a patchcord in your hand and think, "What if I use an audio oscillator to alter the pitch of *another* audio oscillator? What if I invert the output of an envelope generator, force it to re-trigger itself, run that voltage through a lag processor, and apply that to the resonance control input of a lowpass filter?"

What if.

Try it and see what happens...!

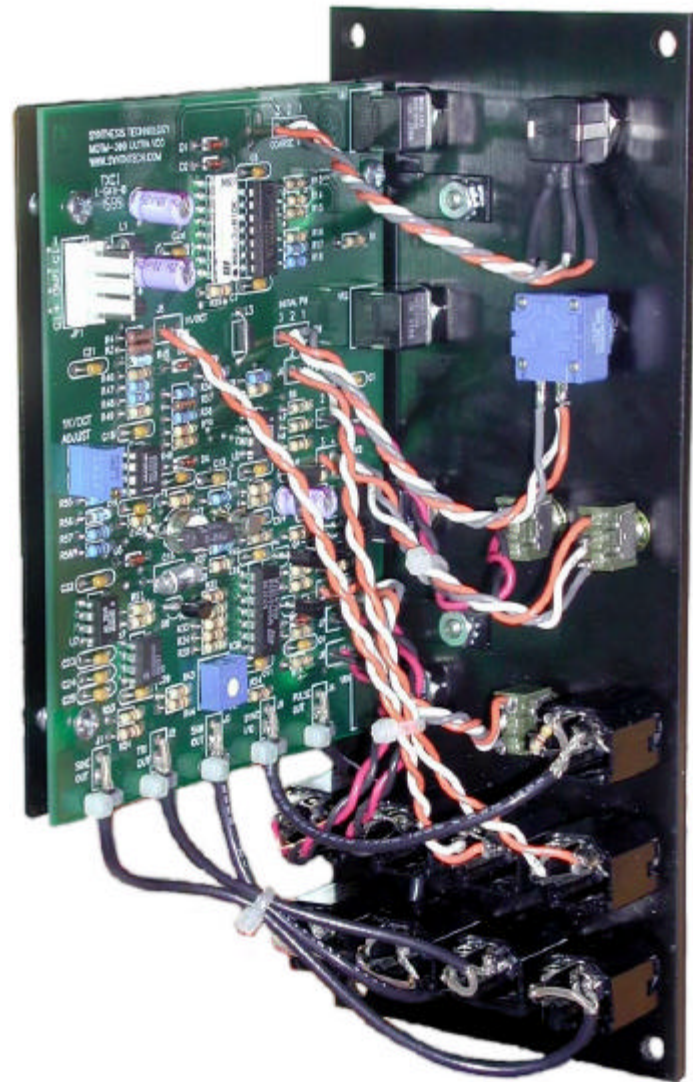


An MOTM system in a custom rosewood inlay cabinet

System Specifications

Physical

MOTM modules have been designed to be easily mounted into standard 19" EIA equipment racks commonly used for holding rack-mount synthesizers, mixers, and effects devices (this same rack standard is also used for computer networking and telecommunications equipment). The useable width of 19" rack is slightly larger than 10 'rack units' (or "U") spaces wide ($1U \cong 1.75"$ [there is a 0.015" tolerance 'slop gap'])). MOTM modules are in multiples of 1U in width, and 5U in height. Most modules are 2U wide, so 5 of these modules will fit across a rack. We offer the MOTM-19A Mounting Rails for this purpose—they bolt into the 19" rack rails using #10x32 rack bolts, and the modules fasten to these with #8x32 bolts (provided with each module). These rails are stackable vertically, so multiple rows of MOTM modules can fit in the rack.



Reverse side of an MOTM-300 VCO Module

Synthesis Technology will also soon be offering a simpler type of rail for the woodworking do-it-yourselfer who wants to build a custom cabinet, and in the near future a "Road Case" that is 18U wide and 11U tall. In this manner, 18 2U wide modules can be mounted, with room for a Kenton Pro2000 MIDI-to-CV converter! The power supply will be inside the case, and will therefore not take up additional spaces. We will also have pre-assembled, pre-configured systems ready to unpack, patch up, and start playing.

MOTM module panels are 0.125" aircraft aluminum coated with a black, durable, baked-on textured finish with white epoxy silk-screening. Circuit boards attach to sturdy steel brackets that fasten to these panels.

Connections between modules are made with robust ¼" phone plug patchcords (the same as standard unbalanced instrument cables).

Electronic

The MOTM system was designed to be compatible with existing synthesizer equipment, featuring:

- 1 volt-per-octave response for control of pitch-related parameters (i.e., VCOs and filters)
- Positive-going voltage Gates (+1.5V threshold)
- Positive-going voltage triggers
- Audio levels of 10V peak-to-peak
- VCAs respond to amplitude control voltages from 0 to +5 volts
- Modules use +/-15VDC (some modules use internal regulators)
- Power supply connector is standard AMP MTA-156 4 position

Kits

Every kit is shipped with detailed step-by-step instructions for assembly, as well as calibration and testing procedures, the circuit schematic, and a description of the circuit's theory of operation.

Kits are also supplied with all hardware, including #8x32 bolts for mounting the modules to optional MOTM-19A rack rails, as well as wire and cable, and all solder necessary for assembly.

Components come packed in sorted, labeled re-sealable plastic bags by type ("Resistors," "Capacitors," etc.). These bags are shipped encased in 'bubble-wrap,' as is the front panel.

MOTM Modules Product Line



MOTM-100: Noise Generator / Precision Sample & Hold

Kit: \$125; Assembled: \$175; Kit difficulty - medium

This is a dual function module, 2U x 5U. The Noise section uses 2 Zener diodes to produce *white* noise, commonly used to create woodwind 'chiffs,' percussion, and other unpitched effects. This is amplified and filtered to create *pink* noise (a 650Hz low-pass filtered version of white), a slow random voltage (white noise low-pass filtered at 10Hz), and a unique 'random vibrato.' This vibrato is a high Q, 7Hz bandpass filter. A front panel control sets the maximum overall amplitude, which randomly varies over time.

The second half of the module is a high accuracy, very low droop rate (on the order of less than 1 semitone per minute) sample and hold. A sample and hold is an analog switch with 'memory': the value of the input voltage is 'saved' at the output (the 'hold' part) each time a 'sample' command is received. The S&H circuitry can be switched, using a front panel switch, to either quickly sample the input (using a 1millisecond internal one-shot) or to track the input as long as the input clock voltage is above 1.5 volts.

The MOTM-100 contains an internal clock generator of 0.2Hz to 50Hz. This clock is fed to a switched input jack on the front panel. Any zero-crossing signal of at least 3 volts peak-peak amplitude can be used if patched into the External Clock input.

The most common use of a S&H is to sample white noise, and use the output into a VCO to generate random pitches. The input jack is internally connected to the white noise output, but any signal plugged into the jack switches out the noise source.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Vibrato, Internal clock speed, Input signal level, Track/Hold

INDICATORS: LED is lit when the sample clock is active

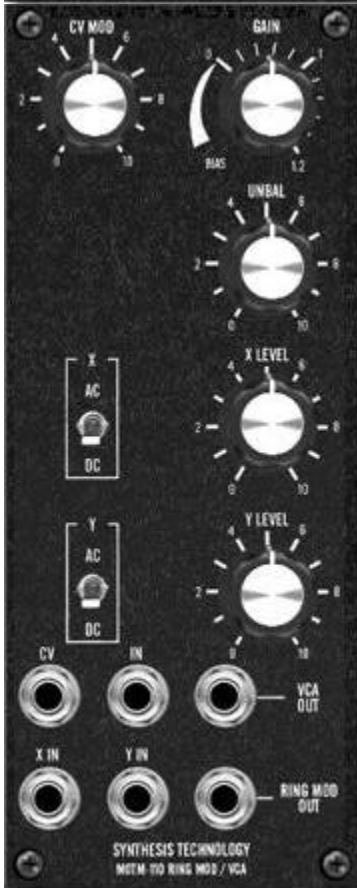
JACKS: Noise section: White, Pink, Random, and Vibrato out

S&H section: External clock in, Signal In, S&H Out

LEVELS: Noise outputs (internal level trim) are nominally set for 10 volts peak-to-peak. The random output may average less.

The External Clock threshold is set for +1.5 volts.

POWER: +15VDC at 30ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-110: Ring Modulator / Voltage Controlled Amplifier

Kit: \$130; Assembled: \$185; Kit difficulty – medium

The MOTM-110 is a dual-function amplitude modulator based on the Curtis CEM3330 integrated circuit. This is a very low noise design, using OP275GP 'CD quality' op amps.

In its capacity as a VCA, a signal (typically an output from a VCO or VCF) is patched to the "In" jack and a control voltage (such as the output of an Envelope Generator) is connected to the "CV" Jack. The CV controls the amplitude (gain) of signal appearing at the "VCA OUT" jack. The Gain pot adjusts the initial amplitude; it can be set to a starting level of zero, through unity gain to amplification, but it also has a special "Bias" region below zero for 'burying' the control voltage, preventing the VCA from passing signal until the CV has cleared the biased setting. This can be used to compensate for wider-ranging control voltages from other systems. An initial gain higher than zero with a negative-going CV will cause the VCA to work 'backwards.' The CV can also be attenuated with the "CV Mod" control.

The Ring Modulator is a 'four-quadrant amplitude modulator.' It multiplies two input signals $((-X * -Y)/5)$, presenting the sum and difference partials of these signals at the output jack. These partials do not have the same harmonic relationships to each other than were present in the original signals. This is useful for creating dynamic enharmonic sounds not possible with VCOs or Noise. The RM is often used to create metallic sounds, gongs, cymbals, and 'robot voices.' The MOTM-110 has a unique "Unbalance" control that adds a bias to the Y input, altering the tone in ways difficult to describe. Both the X & Y inputs have a switch for AC/DC; with one of its inputs set to DC, the RM acts as a second VCA (a 'two-quadrant multiplier').

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 mounting bolts included. Depth behind panel is 4.5 inches.

PANEL CONTROLS: VCA CV, VCA Gain, X & Y Level, X & Y AC/DC coupling

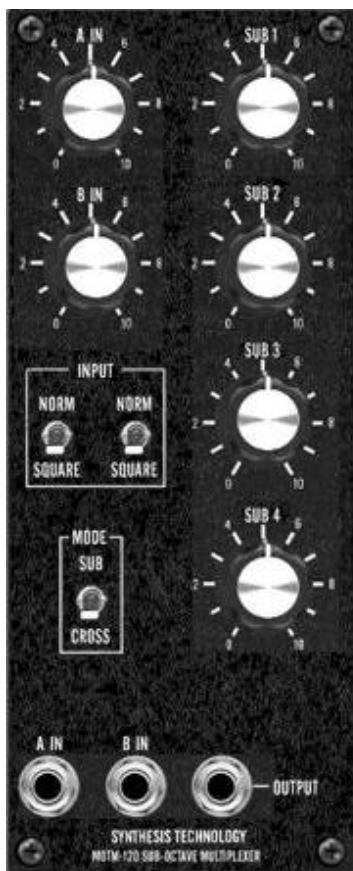
JACKS: VCA section: CV In, Audio In, Audio Out; Ring Mod section: X In, Y In, Signal Out

SIGNAL LEVELS: VCA: CV 0 - 5V, Audio In/Out 10V peak-to-peak (+/-5v); Ring Mod: 10V peak-to-peak

CONTROL LEVELS: -10v to +10v dependent on initial gain setting

IMPEDANCES: 50k minimum input / 1k output typical

POWER: +/-15VDC at 30ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-120: Sub-Octave Multiplexer

Kit: \$130; Assembled: \$180; Kit difficulty - easy

This unique MOTM module is used to add depth to “thin-sounding” timbres. The MOTM-120 contains two 4-octave sub-dividers. When the input(s) are above 80mv peak-to-peak, the dividers generate 1, 2, 3, & 4 octave-below-input square waves, based on the input signal. Individual level controls allow precise mixing of the input signal (switch selectable between the input and the squared version) and the four sub-octaves.

What sets apart the MOTM-120 from other pulse dividers devices is the *cross mode*. When selected, the two inputs are each sub-divided, and then the 4 suboctaves ring modulated with each other. This produces huge timbre modulations. Even the simplest of sine waves can turn into a complex 16-partial sound.

The MOTM-120 is very easy to use, but can add a new dimension to any mix.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches

by 8.250 inches (standard rack spacing). #8-32 hardware.

Depth behind panel is 4.5 inches.

PANEL CONTROLS: 6 level controls (2 input, 4 suboctaves), input select and mode switches

INDICATORS: none

JACKS: A In, B In, Output

LEVELS: 80mv pk-pk min., 10V pk-pk max.

POWER: +-15VDC at 25ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-300: Ultra-Stable Voltage Controlled Oscillator

Kit: \$239; Assembled: \$319; Kit difficulty - difficult

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

The foundation of any synthesizer lies in it's VCOs, and here again is where the MOTM system rises above the old and new modulators. The MOTM-300 Ultra VCO is the most accurate and stable analog VCO ever designed for music synthesizers. Previous VCOs used 1 or 2 simple temperature stabilization loops, or expensive heat-generating “ovens” to keep the pitch from drifting. The MOTM-300 uses five separate temperature compensation loops, which keeps the pitch accuracy within <1Hz over the entire musical scale! The average 24 hour drift is less than 0.4Hz at 8Khz, which is less than 0.005%. No other VCO comes remotely close to this drift stability.

How is this done? Several ways: careful selection of components is a major factor. Attention to design is coupled with absolutely the best parts, such as military-spec summing resistors (0.1% tolerance at 20ppm drift) and state-of-the-art ultra-low drift op amps. The PC board uses controlled impedance, balanced-pair traces and a low capacitance ground plane. These and many other design details make the MOTM-300 the new standard for modular VCOs. The front panel pots are all cermet, sealed construction for reduced temperature drift.

Temperature stability is just one area where the MOTM-300 stands out. Other features include 3 CV inputs (1 fixed at 1V/Octave, the other two can allow up to 1.75 Octaves/Volt scales), Linear FM, PWM, and Hard and Soft Sync. All 4 waveforms are available simultaneously at full 10V peak-to-peak levels.

The MOTM-300 is our most difficult kit to assemble. It is NOT for a beginner. A good oscilloscope is recommended for properly calibrating and debugging the VCO if trouble arises. But, like all other kits, we have a 100% satisfaction, 30 day return policy. If you have questions about the skill level required, please call us!

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Coarse and Fine Initial pitch, FM1 and FM2 attenuators,

Initial Pulse Width, Pulse Width Modulation attenuator

Switches: FM1 Linear/Exponential response, AC/DC coupling, Hard/Soft Sync

JACKS: Sync I/O, 1V/Oct in, FM1 in, FM2 in, Sine, Tri, Saw and Pulse outputs

LEVELS: Audio voltages 10V pk-pk, control voltage -7V to +7V; Sync I/O is a 2uS pulse 0-+5V (active high)

POWER: +-15VDC at 45ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-320 Voltage-Controlled LFO

Kit: \$139; Assembled: \$209

The MOTM-320 is a full-featured Voltage-Controlled Low-Frequency Oscillator (VC LFO). LFOs are typically used to create vibrato effects (patched to the FM input of a VCO), tremolo (patched into the control input of a VCA), or other oscillating sweep effects when used to control filters, phase shifters, etc.

Unlike the crude LFOs found in most synthesizers, the MOTM-320 has 4 individual outputs simultaneously available, plus a master Shape control. This control voltage will shift the shapes of the Pulse, Sine, and Saw outputs in unison. Both 1 volt/octave (temperature compensated!) and variable FM (through a reversing attenuator to go up or down) inputs are available.

Another unique feature is a *Sync* input: a positive voltage will reset all 4 waveforms. You can sync to just about any waveform, from another LFO to Envelope Generators.

The MOTM-320 is not your standard LFO: it has a full-blown VCO core with discrete waveshaping based on the Moog modular and the VCS3! This core has an astounding frequency range of 1 cycle in **30 minutes** to about 2800Hz. A bi-color LED flashes at the LFO rate, and can be set with a jumper to indicate 4 different ways!

Don't sacrifice a VCO as a full-featured LFO: get the MOTM-320 and let the modulations begin!



MOTM-410 Triple Resonant Filter with Dual VCLFO

Kit: \$189; Assembled: \$269

The MOTM-410 module is based on the Korg PS-3100 Resonator filter structure. It contains three voltage-controlled bandpass filters, and a dual voltage-controlled sinewave LFO. It uses the same "vintage" components as the PS-3100: Vactrol resistive elements for a smoother, 'liquid' phasing sound, and JRC4558 bipolar op amps. However, the control section has been updated to include:

- Voltage-controlled LFO Rate (0.02Hz to 100Hz)
- Voltage-controlled LFO Depth (0-100%)
- Individual filter outputs
- Master SWEEP control voltage

The MOTM-410 can be used as a "fixed" filter bank: just set the DEPTH to zero. Since narrow filters are used, vocal formants can be obtained since each filter has **independent** center frequency controls.

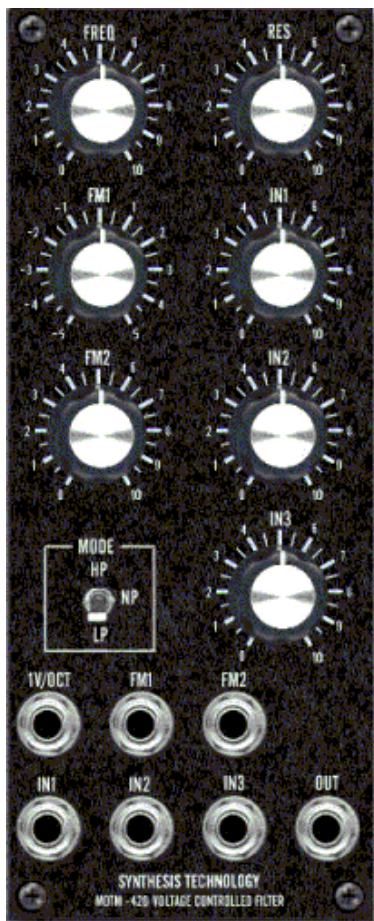
The on-board LFO structure contains 2 "detuned" voltage-controlled LFOs (one LFO is running 20% slower than the other one). The LFOs have true sinewave outputs for best sweeping effects. You can use the panel controls, or plug in up to 3 separate control voltages (SWEEP, RATE and DEPTH)!

Another unique LFO feature is the MODE switch. It controls how the 3 filters are swept as:

- **Single** - All 3 filters are swept together by LFO #1.
- **Dual** - Filter #1 sweeps with LFO #1. Filters #2 & #3 sweeps with LFO #2.
- **Dual Reverse** - Filter #1 sweeps UP with LFO #1, Filter #2 sweeps UP with LFO #2 while filter #3 sweeps DOWN.

The MOTM-410 has 3 separate audio outputs, which can be used to create **frequency-dependent stereo panning**. Using 3 inputs on your mixer, you manually pan Filter #1 LEFT, #2 to CENTER, and #3 to RIGHT. The LFOs then sweep the stereo field, based on the frequency content of what you are playing. Or, turn off the LFOs and use the fixed filter to "direct" the sound to a specific mixer channel, again based on input frequency.

The MOTM-410 can be used with any line-level audio source (synth outputs, mixer effect sends, etc) or integrated in a modular system. The kit version is moderately difficult (4 -5 hours construction time). Or, order it completely assembled and tested!



MOTM-420: Voltage Controlled Filter (LP/HP/Notch)

Kit: \$159; Assembled: \$219; Kit difficulty – medium

Note: this kit will require a small amount of heat-sink compound (NOT supplied).

A VCF dynamically changes the harmonic content of an input signal, and is often used to filter VCO waveforms. The MOTM-420 is based on the filter from the Korg MS-20, which has a widely recognized “glassy” or “squeaky” tone found on techno, house, acid, and other electro music songs. Unlike the ‘Moog filter,’ with its 24dB/oct slope and bass punch, the MS-20 used 12dB/oct filters with very high resonance. This resonance was inadvertently input-amplitude dependent, which was a large contributor to its unique sound.

The MOTM-420 uses the same “badness” in the design and the same older bipolar op amps to duplicate the MS-20 sound. The MS-20 used 2 filters in series: a HP (high-pass) followed by a LP (low-pass). The MOTM-420 has switch-selectable HP or LP and adds a Notch function! To exactly duplicate an MS-20 filter section, you will need 2 MOTM-420s. But a single MOTM-420 will still separate your mix from all the other boring LP filters out there! Cutoff Frequency is variable from 1Hz to 28kHz.

Besides being 3 filters in one, the MOTM-420 features a reversing attenuator on one of the CV inputs. This single panel pot allows a CV to be continuously set for negative to positive frequency modulation. This allows an envelope generator to sweep up *or* down. By using two MOTM-420s, a single LFO can sweep one filter up while the other sweeps down, and each has a separate depth control!

The last great feature: 3 separate audio inputs, each with its own level control. This eliminates the use of a separate input mixer module for most synth patches. The MOTM-420 can be used with most audio sources, such as other synthesizer outputs, drum machines, “direct” boxes, or guitars with active pickups.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware included. Depth behind panel is 4.5 inches.

PANEL CONTROLS: Initial Frequency, Resonance, FM1 & FM2 attenuators, and IN1, IN2, and IN3 audio input attenuators.

Switches: filter mode LP/NF/HP

JACKS: Audio: IN 1, IN 2, IN 3, OUT; Control voltage: 1V/Oct (fixed), FM1, FM2

Impedances: Output 1k-ohm nominal

LEVELS: Audio voltages 12V pk-pk max 50mv pk-pk minimum, control voltage -13V to +13V

POWER: +-15VDC at 18ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



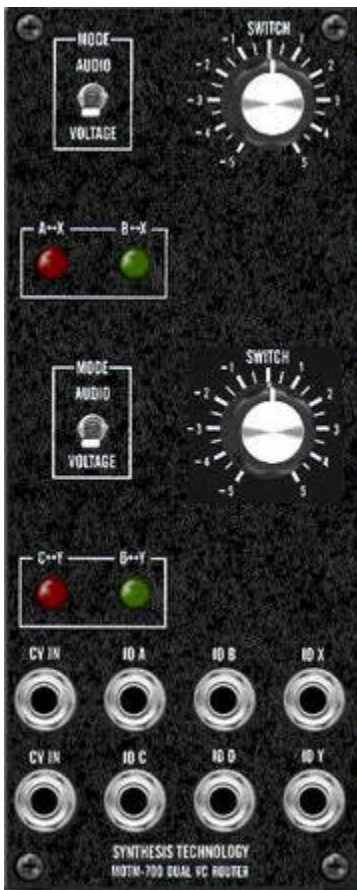
MOTM-440 Discrete OTA Voltage-Controlled 24dB/Oct Lowpass Filter (featuring VC Resonance)

Kit: \$179; Assembled: \$239; Shipping date: mid-Feb.

If you are familiar with music electronics, you have certainly heard of the SSM2040 filter chip, used in the Prophet 5 Rev. 2 synthesizer, the Voyetra 8, and other classic designs. Although the production run of this coveted chip was short-lived, the SSM2040 filter has a unique sound different from a Moog, ARP or other 4-pole lowpass filter. Why? The design used a clever discrete OTA gain cell.

The MOTM-440 offers an updated SSM2040 architecture using matched NPN/PNP pairs and features a switch that adds in a second audio feedback path to boost bass response at higher Q levels. This makes the filter “growl and rumble” even more! In addition, voltage-controlled Q allows for more flexible and unique sweeping effects. Three audio inputs and three CV inputs make the MOTM-440 the killer lowpass in your system. The internal gain structure is such that over-driving the filter is now possible (unlike the Prophet 5) to get even more nasty sounds.

Order an MOTM-440 filter for a fraction of the price of a P5 Rev. 2, but without the worry of obsolete parts!



MOTM-700: Dual 2:1 Voltage-Controlled Multiplexer

Kit: \$125; Assembled: \$180; Kit difficulty - medium

This module contains 2 identical bi-directional electronic SPDT switches that are controlled by front panel controls and/or input control voltages. If the input voltage is less than the pot setting, then the switch is in the 'A to OUT' position. If the control voltage exceeds the pot setting, then the switch 'flips' to the 'B to OUT' position. Either audio or voltages may be switched, and these can be in any direction.

Special circuitry handles the case of switching audio signals or control (DC) signals. Since switching of audio can easily cause "pops", the MOTM-700 uses a quick 10ms cross-fading VCA circuit to prevent this. For switching DC control signals, a high-speed, very low resistance, very low charge-injection circuit is used. A front panel switch selects the mode.

This module has hundreds of uses in any studio. For example, you can feed 2 drum loops (one in A, one in B) and with a control voltage select which one is heard. The fun is picking the source of the control: it can be a footpedal, an envelope generator, your keyboard CV (instant programmable split point!) or the S&H output of a MOTM-100 (this allows a voltage-controlled probability!) Feeding a LFO triangle as the CV will cause the A and B signals to 'ping-pong', with a duty-cycle easily selected by the panel control.

The more you use it, the more ideas you will find for the MOTM-700.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing).

#8-32 hardware. Depth behind panel is 4.5 inches.

PANEL CONTROLS: 2 SWITCH control pots, -5V to +5V selection

INDICATORS: A<>X, B<>X, C<>Y, D<>Y

JACKS: A, B, C, D in/out, X and Y in/out

LEVELS: Audio: 10V pk-pk, CV: -12V to +12V

POWER: +-15VDC at 20ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-800: ADSR Envelope Generator

Kit: \$89; Assembled: \$129; Kit difficulty - easy

The MOTM-800 is a 1U wide, ADSR envelope generator. Envelope generators create voltage contours when 'fired' by a trigger or gate input. These contours are typically applied to the control inputs of VCAs and VCFs to dynamically alter the loudness and harmonic content of a sound over time.

Three different modes of operation are possible:

- both GATE and TRIGGER are used. This will generate a retriggerable full A, D, S, R cycle.
- GATE only. Commonly found in Roland and other keyboards. Will generate a single A, D, S, R cycle.
- TRIGGER only. Commonly found in drum pads. Will generate a AR cycle.

The MOTM-800 features both positive-going and negative going envelopes simultaneously. Since envelope generators are tweaked constantly, the MOTM-800 features long-life Bourns conductive plastic, sealed pots for many years of service. Unlike standard carbon pots on other synths, these pots are not only 100% sealed against dust and moisture, but have silicone lubricant inside the elements for quiet operation for over 500,000 full rotational cycles!

The MOTM-800 is a very easy kit to assemble: the average build time is 1 hour or less.

SIZE: 1.735 inches x 8.735 inches. Mounting holes are 1.250 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 2.5 inches.

PANEL CONTROLS: ATTACK, DECAY, SUSTAIN, RELEASE

ATTACK, DECAY, RELEASE 1ms to 15 seconds, typical

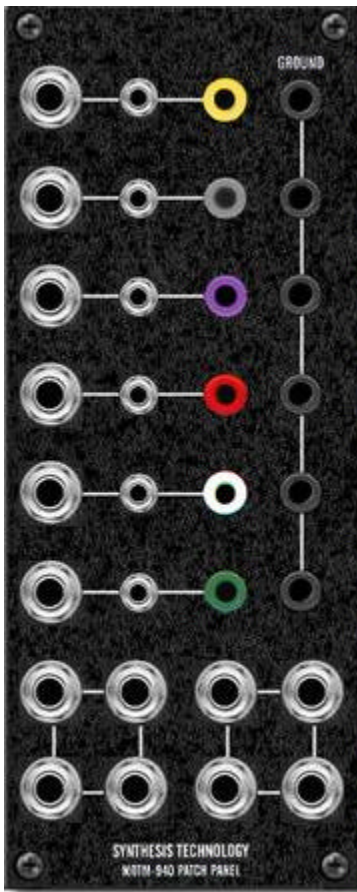
SUSTAIN VOLTAGE: 0 volts to +5V (OUT +) or -5V (OUT -)

JACKS: GATE in, TRIGGER in, OUT +, OUT -LEVELS:

GATE +1.5V to +13V, TRIG 1ms positive pulse, +3V min

Envelope is 0V to +5V (OUT +) and 0V to -5V (OUT -)

POWER: +-15VDC at 10ma max. Uses AMP MTA-156 4 position connector and cable (supplied)



MOTM-940: Patch Panel

Assembled only: \$89

The MOTM-940 is a 2U wide module that has:

- a) two 4-way multiples using 1/4" jacks
- b) 6 "adapter" connections using 1/4", 3.5mm, and banana jacks
- c) 6 banana jacks centered 3/4" from the signal jack, tied to ground

This module is entirely passive: no power is required. The main purpose is to allow interfacing with outside equipment that does not use 1/4" cables, without the use of expensive and hard to find adapters. Also, a pair of 4-way multiples using 1/4" jacks is provided to allow multiple feeds of a signal without using "Y" cords.

SIZE: 3.470 inches x 8.720 inches. Mounting holes are 3.0 inches by 8.250 inches (standard rack spacing). #8-32 hardware. Depth behind panel is 2 inches.

PANEL CONTROLS: none

INDICATORS: none

JACKS: 6ea adapters: 1/4" to 3.5mm to banana. 2ea 4-way 1/4" multiple

LEVELS: n/a

POWER: none

MOTM-000: DIY (Do It Yourself) Breadboard: \$25

MOTM-000-A1: \$35 w/power cable/bracket

The MOTM-000 is a single-sided 'perf' board used for building your own circuits. It uses the same basic form factor as the MOTM PC boards. The MTA-156 power connector is included. There are 4 mounting holes for #6-32 screws that align with the support bracket used in the kits.

There are 4 locations for pots, with the 3 signals brought to pads. The 'footprint' is for the Spectrol Model 149 series pots used in the kits, but if you mount the pots to the panel, you can just solder in the holes.

There are 18 uncommitted 'power busses' on the board, that are generally connected to ground and +-15V. There are also pads for connecting to front panel jacks.

The PC board is SMOBC (solder mask over bare copper) with an LPI (the best there is) solder mask. A top side silkscreen locates all the busses.

SIZE: 5.470 in x 4.250 in., 0.062 thick

MOTM-19A: Mounting rails for 19 inch racks \$39/pair

MOTM-1UB: blank 1U wide panel \$11

MOTM-2UB: blank 2U wide panel \$18

MOTM-3UB: blank 3U wide panel \$23

The MOTM-19A rail kit contains 2 heavy-duty, 11ga. Steel bars 19 inches long and 0.500 inches wide. They mount vertically across a standard 19 inch equipment rack using #10-32 screws (supplied). You install them 5U (8.250 inches, mounted) apart. Up to 10U width of MOTM modules attach to the rails. Rows of MOTM modules can stack on top of each other using the rails.

The rails are tapped with #8-32 threads, and are painted flat black.

The blank panels are black (no silkscreen, mounting holes only) for building your own modules, or filling empty spaces. 0.125 inch thick aluminum. Screws are supplied.



MOTM-900US: Medium Duty power Module

Kit: \$125; Assembled \$170; Kit difficulty - easy

MOTM-900ECC: non-US Version

Kit: \$125; Assembled: \$170 (specify country)

US_CORD: US power cord 3m \$7

The MOTM-900 is a 3U wide, +-15VDC at 800ma power supply sufficient to drive between 20 and 25 MOTM modules. The power supply uses a pre-assembled, pre-tested linear supply with 'universal' input voltages. The kit requires very little soldering; most of the connections use pre-assembled 'FASTON' wiring that push on the terminals.

The kit contains a small PC board with 12 MTA-156 connectors. The power supply outputs are connected to this board. The other MOTM kits plug into this card using a 20 inch long, 18ga wire harness (supplied with each kit).

This power supply uses LM723 voltage regulators, not the more common '3 terminal' types. The advantages are:

- 100 TIMES lower output noise
- 10 TIMES better load regulation (adding more modules does not affect the output voltage)
- 5 TIMES better line regulation (when the AC input varies)

The ECC version uses a different fuse rating. Both units use standard 5mm X 20mm fuses. PLEASE NOTE: The ECC version is shipped configured for 110VAC input. Full instructions are included to configure the AC input to match your country's requirements.

The AC input is the IEC 3-prong standard. The AC cable IS NOT SUPPLIED. We do

stock 3m (9.5 ft.) US power cords.

SIZE: 5.220 inches x 8.720 inches. Mounting holes are 4.75 inches by 8.250 inches (standard rack spacing). #8-32 hardware.

Depth behind panel is 4.5 inches.

PANEL CONTROLS: AC power, IEC input jack with fuseholder

INDICATORS: none (Power ON is part of the switch)

POWER: 90-240VAC input, 50/60Hz.

Output: +-15VDC @800ma (@25C)

PWR-20: Power distribution cable, 20 inches long: \$7

PWR-30: Power distribution cable, inches long: \$9

MOTM-900-PCB: Power distribution board with 12 connectors: \$16

This is useful if you wish to build your own power supply. Can also be used to 'daisy-chain' to a MOTM-900 supply and drive 23 modules (you just have to figure out where to put it!)

What Modules do I Need?

A modular synthesizer by its nature is extremely flexible and extensible. The choice of its components can also be very personal, its module complement selected to fit the needs of its owner. So in a way, this question is kind of like asking, “What color car should I drive?” It’s entirely up to you!

That said, there are some guidelines that can be given to help a beginner decide what s/he needs to get started.

The first, most basic component you need is a good power supply. Without one, nothing else works! It may not be the most ‘fun’ module you will add to your system, but a quality power supply is a critical component that can make or break the noise level specifications and stability of every other module in your system. The MOTM-900 module provides power for twenty or more standard modules and has a connector distribution board to make power hookup simple.

Once you have power, you can start selecting your sound creation, modification, and control modules.

Many MOTM modules can be used as stand-alone modifiers for other instruments, like effects “stomp boxes” or studio post-processing equipment. Look at the line of MOTM filters for this application. Specifically, the MOTM-410 Triple Resonant Filter, which has a self-contained modulation source, can provide stereo spectrum sweeping effects something like a phaser or flanger. Using the (forthcoming) Envelope Follower with one of the lowpass or bandpass filters can produce “auto-wah” effects. The MOTM-120 Sub-Octave Multiplexer can be used to “fatten up” the sounds of monophonic synthesizers, adding incredible low-end. The MOTM-110 Ring Modulator can be used with any 2 audio signals, not just those generated from other MOTM modules, to create enharmonic timbres typically described as ‘metallic’ (it makes for great ‘robot voices,’ too!).

If your plan is to construct a comprehensive modular synthesis system, the choices are wide open, but you can choose your modules in such a way that you can get a small, useable core of modules built up first, and then add functionality as you grow your system. We can offer some advice based on experience.

A ‘standard’ analog synthesizer voice consists of a VCO, VCF, VCA, and EG. For ‘unpitched’ sounds, woodwind ‘chiffs,’ and sound effects, add a Noise Source such as the MOTM-101. This is the basic arrangement you find in classic machines like the Roland SH-101 or Korg MS-10. It is the functional bare minimum to create acoustic instrument simulations or ‘lead synth’ sounds. Synthesis Technology offers several different kinds of module for each of these functions—consult the detailed module descriptions to see what functions are available.

You can build on that framework in many ways. Adding a second oscillator, another filter, and another envelope generator creates an instrument similar to a Korg MS-20. The two VCOs allow you to create rich harmonics, the two filters provide flexible spectrum-shaping possibilities, and the two Envelope Generators allow you to control the VCA and filters independently. For creating vibrato and tremolo, you could use one of the VCOs in a low range to control the other, but you’ll probably want to add an LFO for this. The addition of a lag processor will let you control the rate of change of other control sources, so that you can create portamento or ‘glide’ effects. At this point you have an instrument that can do anything that the venerable Minimoog could do, but with even more features and the added flexibility of a modular synthesizer.

Here are some suggestions for small “starter” systems. Please call or email if you have questions on what modules best suit your musical needs.

System #1: The Absolute Basic Synth

1ea MOTM-900 Power Supply

1ea MOTM-300 VCO

1ea MOTM-420 VCF

1ea MOTM-800 EG

1ea MOTM-110 VCA/RM

1ea MOTM-19a rails

This system fits in 1 row of a 19” rack. It allows the creation of a simple monophonic “voice”, although limited by the single envelope generator.

System #2: The Small Modular

1ea MOTM-900 Power Supply
2ea MOTM-300 VCO
1ea MOTM-320 VC LFO
1ea MOTM-440 or MOTM-420 VCF
2ea MOTM-800 EG
1ea MOTM-120 Sub-Octave Mux
1ea MOTM-100 Noise/S&H
1ea MOTM-110 VCA/RM
1ea 1U Blank (reserved for future module!)
2ea MOTM-19a rails

This system is ideal for “replacing” a Minimoog, ARP2600, or other vintage synth. For near the same price, you can get brand-new electronics, free tech support, and a true modular! And, you will find that the MOTM system will generate a much wider tonal palette.

Don’t forget that you need a way to *control* your system. The most common way to do this is with a keyboard. Because high quality velocity & pressure-sensitive MIDI keyboards are ubiquitously available at a reasonable cost, and because many synthesists will already own one or more of these, Synthesis Technology does not offer a keyboard controller of its own at this time. Be aware that you will need something to convert the digital MIDI control signal into control voltages that you can use with your modular. A few devices are available for this function, and Synthesis Technology stocks the high quality Kenton line of MIDI-to-CV converters. Contact us or visit our web site for more details and current prices on these units. A good MIDI keyboard and a MIDI-to-CV converter will give your MOTM modular advanced features that vintage modulators never had, such as velocity and aftertouch response, and it will also allow you to use your modular with a PC-based sequencer. With enough modules, you can even create a true analog polyphonic synthesizer!

Other controllers are possible, too, such as ‘[wood]wind controllers’ Theremins, joysticks, and ribbon controllers. The flexibility of your modular may encourage you to experiment with these. The horizons are wide open.

Can I build these kits?

Even if your experience with assembling electronic devices is limited (or non-existent), you *can* successfully build these MOTM kits. What you absolutely need are two things: a bare minimum of tools, and *patience*. Patience is as important as the soldering iron to properly build these kits. As the assembly manuals stress, building these modules is not a *speed* contest, but an *accuracy* contest. The instructions will lead you through the entire assembly, testing, and calibration process, but you must read them carefully and take your time.

The kits may appear overwhelming to some at first, just because even the simple kits have lots of parts. That’s the nature (and fun) of analog electronics: parts, parts, parts! That’s why they look so cool inside! The #1 rule to remember is that *you do not have to build the kits in one sitting*. All you have to do is clean the solder residue off (with running warm water in the sink) whenever you want to stop.

You can purchase cheap tools and get the job done. But remember this—the modular synthesizer that you build is an investment, both in money and time. Quality tools will make the job much more enjoyable, and will reduce the possibility of damaging components or scratching the module panels. Since you’ve decided to invest in a modular synthesizer, we urge you to invest in a set of decent tools as well. An investment of between \$125-\$200 should suffice, depending upon what you may already own.

Here’s what you’ll need; some of these tools are absolutely necessary, and others are best thought of as ‘must have or you’ll be miserable’ items:

Soldering iron—A good, temperature-controlled soldering iron (not necessarily a temperature *variable* one) is a must. A non-variable iron is perfectly good for this type of work; a variable iron over the years will be an asset. We recommend the Weller model #WTCPT. The tips are quickly interchangeable. This unit typically costs about \$100. The variable temperature version is model EC1002, about \$250. (Trust me: if you buy the WTCPT soldering iron, it will give you 20-30 YEARS of service: just buy a couple of new tips (about \$5/ea.) every year or so.) Another solution is a Weller model WP35P, 35W iron (about \$43) and a model PH60 stand (about \$19).

Cutters and pliers—Next to a good soldering iron, you *must* have good diagonal cutters. Each module will require about 150 wire cuts of the leads, so a full synthesizer entails *thousands* of cuts. There are many good ones available, ranging from \$90 (EREM) to \$12. Figure on spending about \$20 on a good pair.

Chain-nosed pliers (I use 4 ½” models) are used to bend the leads, pull parts out, etc. Figure on spending about \$12.

A ‘Solder Sucker’—This is a vacuum de-soldering tool. You’ll be doing an awful lot of soldering, but no matter how careful you may be, eventually you will need to *unsolder* something. There are high-end pedal-controlled electric de-soldering stations available, but all you really need is something like the Soldapullt model AS196, about \$21. You ‘cock’ it, then press a button to release a spring-loaded plunger that sucks molten solder right up. It has Teflon tips; it will last a good 5 years if you clean it. Smaller versions are available, but they just don’t have the vacuum of this big boy.

A lead-bending guide—The best \$3.00 you will ever spend. It looks like a narrow plastic triangle about 6 inches long. That’s because it *is* a plastic triangle, six inches long. There are notches along each edge that are calibrated in 0.1” increments. You lay the component in the center channel, placing the leads in the slots, bend the leads downwards with your fingers, and presto! The component is ready for easy insertion into the PCB. Note that most MOTM axial leaded components are on 0.400” lead spacing, which this has a spot for. We recommend Mouser catalog number 5166-801.

Common tools—A set of hollow shaft nut drivers, a good Phillips #1 & #2 screwdriver, and a set of hex keys. There are lots of nuts and screws on an MOTM system, so having these nut drivers is a must. You can buy them individually, but it’s much easier to get these in a set, such as those sold by Xcelite or Craftsman. Just be sure the shafts are hollow, so the nuts on pot and switches can be driven. Using a pair of pliers to tighten the hardware is a bad idea. First, you risk needlessly scratching up the paint. Second, you will never get the nuts tight as with using nut drivers. You will need ¼”, 3/8”, 5/8”, and ½” sizes; plan on paying between \$35 and \$55 for a full set. Again, a good set of these will last you many, many years.

Hex keys are needed for the setscrews on the knobs. You will need a 1/16”; even Radio Shack sells them.

A Digital VoltMeter (“DVM”)—Radio Shack has a wide selection. Even Sears carries good models at a reasonable price. Spend about \$50-60 on a model and that will be adequate. It’s awful tough to de-bug a non-working module without one.

A scrub brush—For cleaning the solder flux residue off of the circuit boards. Even a small nail brush is fine.

A magnifying glass—Not necessary, but this is handy for inspecting your solder joints before moving on to the next step, and it can also be useful for reading the tiny markings on some components. Even a small plastic magnifier is helpful; extendable workstation lamps with a fluorescent tube surrounding a large magnifier can be a real help to the serious hobbyist.

Lastly: there is quite a bit of heat-shrink tubing in the kits. Use of this tubing is optional (but it is supplied). You can shrink the tubing with the heat from a cigarette lighter, or by holding the soldering iron tip close to the tubing for a few minutes, but a heat gun (about \$45) will come in handy if you plan to build more than 10 modules. Note that this is NOT a hair dryer (it just happens to look like one). Both Ungar and Weller make good heat guns for <\$50.

If you have trouble locating any of these electronics tools, try the following sources:

Mouser: 1-800-346-6873; www.mouser.com

Newark: 1-800-4-NEWARK

Digikey: 1-800-DIGIKEY; www.digikey.com

Allied: 1-800-433-5700

Special MOTM Programs

MOTM Subscription Service

We offer an optional 'subscription service' at no charge. *Please read the following carefully!*

If you wish to be put on the subscription list, all you have to do is say 'Put me on the subscription list' on any order you send in. From that module forward, you are 'subscribed,' and every new module that is ready to be offered for sale will be automatically shipped to you and billed. You will receive a notification 10 days before the shipping date explaining what the module is, how much it costs (including postage), and offering you a chance to refuse it.

Obviously, only credit card holders can be on the list. You can ask to be dropped anytime. No problem. Hopefully, this will be a painless way to 'stock up' without having to constantly monitor the web site for new developments. You are allowed to refuse two modules, and then you're off the list

MOTM Bonus Points

This is the same concept as 'frequent-flyer miles.' For every module you buy, you get 1 point. Subscribed or not. These are lifetime totals--they never expire. They are *not* transferable if you sell your system, however. This program was implemented to reward loyal customers.

Points are redeemed by indicating so on your order. Here is what you can get with accumulated points:

6 points: 20% off any module

8 points: 33% off any module

11 points: 50% off any module

14 points: *free module* up to \$190, FREE shipping

20 points: *2 free modules, free shipping*, up to \$400 total.

Points are accumulated for *all* orders, for as long as Synthesis Technology is around! There is no expiration date.

Payment Methods

We accept, VISA, MasterCard, and American Express. You can also mail a money order/credit card info for the correct amount. If possible, use the secure order form on www.synthtech.com. However, some 'firewall' programs will not allow the secure form to be sent. You can either:

- FAX it to 817-498-3782
- Mail the order/credit card info to:

Synthesis Technology/MOTM
6625 Quail Ridge Dr.
Fort Worth, TX 76180 USA

Foreign payment can also be mailed in with a bank draft on a US bank.

Purchase Orders

Purchase orders (net 30) for orders over \$250 accepted by individual case basis.

Shipping

MOTM kits & Modules

US: \$6 first module/order, \$4 each additional module.

Foreign (2-3 weeks delivery) \$18 first module, \$14ea additional module

EXPRESS service (foreign): 1 week delivery, \$35 first module, \$20ea additional

MOTM-19A Rack Rails

US: \$8

Foreign: \$14

Accessories

US: \$3/order

Foreign: \$7/order

Questions?

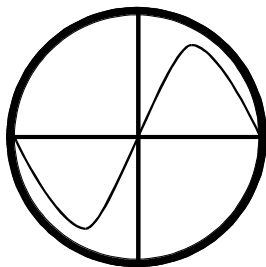
We offer toll-free phone support at (888) 818-MOTM 4PM-11PM weekdays Texas time. There is a fax machine at 817-498-3782.

Thanks for your interest in Synthesis Technology and MOTM. There are many exciting modules to follow!

6625 Quail Ridge Dr.
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(888) 818-MOTM (6686)

Email: synth1@airmail.net

URL: <http://www.synthtech.com>



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