

---

**Music Technologies Group**

---

**MTG Pro One Replacement CPU  
Installation and User Guide**

**Version 1.00  
June 2010**

# CONTENTS

1: Introduction .....	4
CPU Features .....	4
CPU+MIDI Features .....	4
Precautions .....	5
Tools Required (CPU only) .....	5
Additional Tools Required for MIDI .....	5
Condition of Pro One .....	6
2: Installation .....	7
Preparation .....	7
Open the Pro One .....	7
Remove the Panel PCB .....	7
MIDI Board Installation (Optional) .....	8
Mount the MIDI Connectors .....	9
Mount the PCB .....	9
Jack Wiring .....	10
CPU Module Wiring .....	11
Another Wiring Option .....	12
CPU Module Installation .....	13
Test .....	16
3: Operation .....	17
Power-On Key Map .....	17
System-Wide Settings .....	18
Clock Source and Rate .....	19
LFO/Ext Clock Start Mode (Param 02) .....	19
MIDI Clock Rate (Param 07) v0.15+ .....	20
Sequencer Specific .....	22
Sequence Tie Enable (Param 05) .....	22
Arpeggiator Specific .....	24
Arpeggio Gate Time (Param 04) .....	25
Arpeggio Up/Down End Notes (Param 03) .....	25
Arpeggio Down Mode (Param 09) .....	25
MIDI Delays .....	27
MIDI Delays .....	27
MIDI Delay (Param 08) .....	27
MTG Factory Defaults .....	27
Bootloader Launch .....	27
Appendix A: Firmware Upgrade .....	28
Configure MIDIOX .....	28
Prepare the Pro One for Download .....	29
Test the Communication .....	29
Firmware Upgrade .....	30

Appendix B: MIDI Implementation Summary .....	31
BootLoader .....	31
Synthesizer .....	31
Appendix C: System Exclusive Implementation .....	32
Command Types.....	32
General Form.....	32
Default Responses.....	33
Restart Command.....	34
Get Port Command.....	34
Get/Set Global Parameter List.....	35
Get Global Parameter Command .....	36
Set Global Parameter Command.....	37
Get Sequence Data .....	38
Set Sequence Data.....	39

# 1: Introduction

## CPU Features

The Pro One Replacement CPU module can be used to replace a missing or damaged 8021. It also offers larger sequence memory and non-volatility. Here are the key features:

- Drop-in replacement using standard tools. Plug-n-Play. No soldering required.
- Supports the original functionality including the sequencer and arpeggiator.
- Each sequence can be up to 256 steps (compared to total of 40 steps on the original).
- Sequences are retained in memory even after power-down. The CPU module does not use a battery.
- Power-on settable parameters for clock start mode, arpeggio up/down end notes, arpeggio down mode and arpeggio gate time.
- Sequence Tie mode allows for a variety of note lengths.

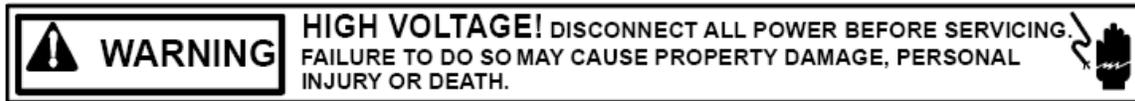
## CPU+MIDI Features

Using the MTG MIDI circuit, or one of your own, adds the following features:

- Firmware update (“re-flashing”) over MIDI (using MIDIOX or similar).
- Settable MIDI channel.
- Monophonic MIDI output of arpeggiator and sequencer data.
- Polyphonic MIDI output of keyboard data.
- Arpeggiator and sequencer sync-able to MIDI Sync in (settable clock rate).
- Load/Save sequence data over MIDI.
- Optional MIDI Thru.
- Optional MIDI activity LEDs.

*For the latest news, please see the firmware Release Notes on the website [www.musictechnologiesgroup.com](http://www.musictechnologiesgroup.com) .*

## Precautions



### **High Voltage Safety Warning**

Turn the Pro One power switch OFF and disconnect the AC power cable before opening the Pro One.

### **ESD Precautions and Proper Handling Procedures**

You should observe standard static-safe handling behavior when working with sensitive electronic equipment such as synthesizers:

- Avoid carpets in cool, dry areas. Leave the CPU module in its anti-static packaging until it is ready to be installed.
- Dissipate static electricity before handling any system components by touching a grounded metal object.
- If possible, use anti-static devices, such as wrist straps and floor mats.
- Always hold the CPU module by its edges. Avoid touching the contacts.
- Take care when connecting or disconnecting cables. A damaged cable can cause a short in the electrical circuit. Note the polarity and position for later re-installation.
- Prevent damage to the connectors by aligning connector pins before you connect the cable. Misaligned connector pins can cause damage to system components at power-on.
- When disconnecting a cable, always pull on the cable connector or strain-relief loop, not on the cable itself.

### Tools Required (CPU only)

- Standard flat-head screwdriver.
- Plastic ruler or straight edge for checking the module height in the socket.
- Hex nut driver – in the unlikely event you need to adjust the front panel sheet metal alignment (*I'm not sure how consistent they were at Sequential Circuits Inc*).

### Additional Tools Required for MIDI

- Soldering iron, solder and hook-up wire.
- Tools and hardware necessary for mounting the MIDI jacks (depends on chassis location) and printed circuit board.

## Condition of Pro One

While the Pro One replacement CPU will replace the functionality of a damaged or missing CPU, it will not correct other problems your vintage synthesizer may have. It is recommended that the synth be in otherwise good condition before beginning the installation. For instance, the keyboard bushings will need to be replaced on units that have never had them replaced before (they dry out over time and become very brittle). Keyboard contacts should be attended to as required according to the procedure in the owner's manual. Finally the two sockets at the end of the keyboard flat cable are of poor quality and are also prone to oxidation over time. Consider having them replaced.

## 2: Installation

### Preparation

Carefully remove all of the knobs on the front panel of the Pro One. You should also locate a small container to place the screws in while you work on the synth.

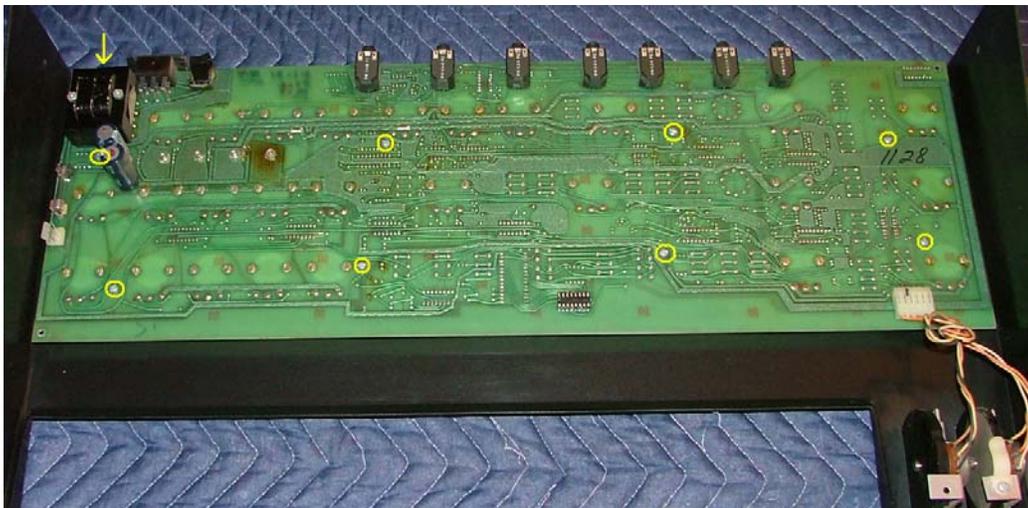
### Open the Pro One

Continue with the following steps, taken from the Pro One Operation Manual:

1. Switch the power off and unplug the power cord.
2. Remove the wooden side panels (2 screws each side).
3. Remove three screws along the front edge.
4. Carefully slide the top panel assembly forward. When the front edge is clear of the keys, lift it up just enough to allow clearance for your hand.
5. Note the position and polarity of the AC power connector. Mark the connector or take a photograph of it so that you can refer to it later.
6. Disconnect the AC power connector running from back panel to the underside of the printed circuit board (PCB), at right.
7. Note the position and polarity of the keyboard cable where it attaches to the PCB. Either mark the connector or take a photograph of it that you can refer to during reassembly. Disconnect the keyboard cable from the PCB.
8. Do the same for the bender wheel/mod wheel cable.

### Remove the Panel PCB

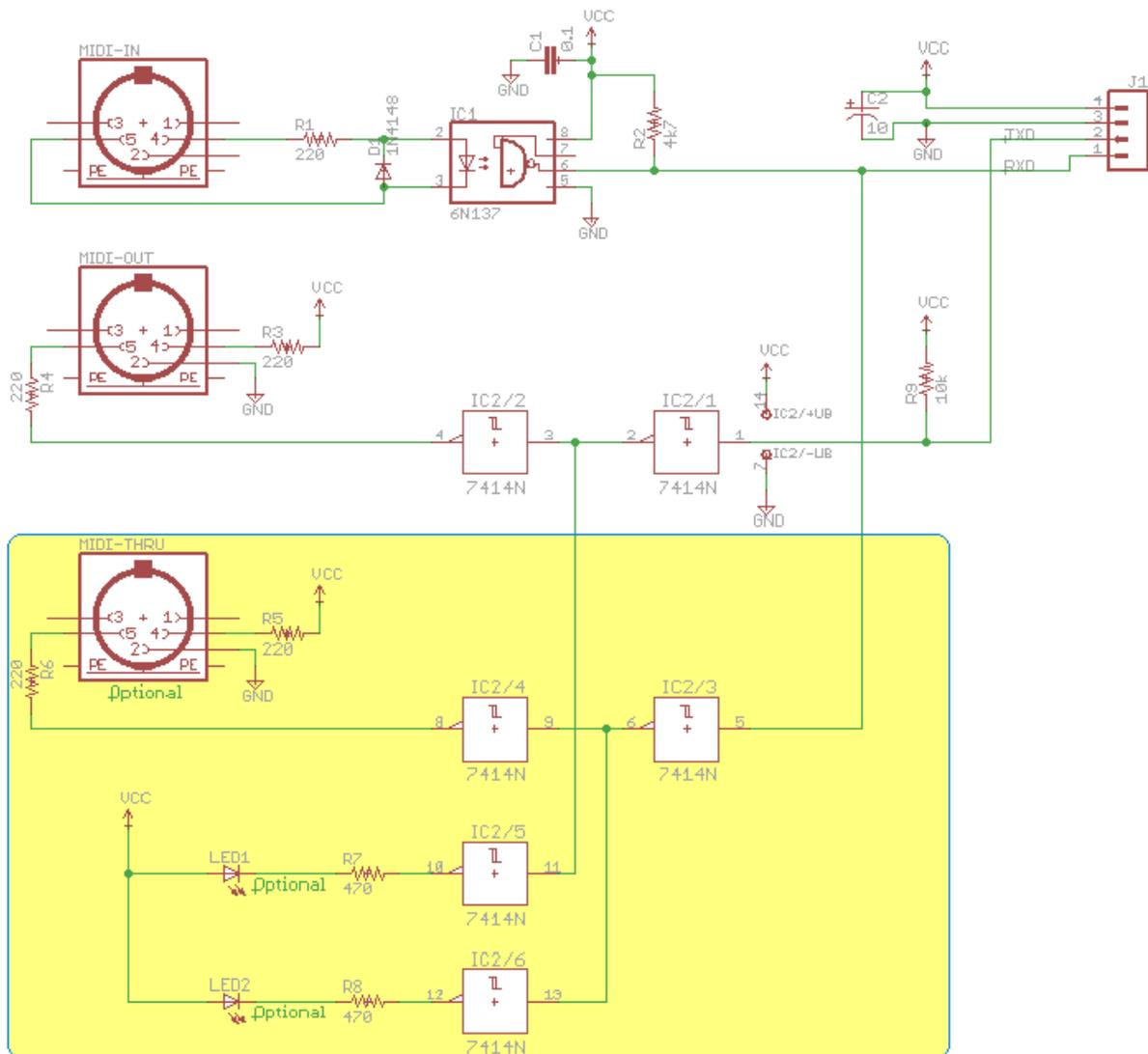
The number of screws used to attach the front panel PCB to the front panel varies by production year. Remove all screws carefully and take care not to stress the front panel PCB.



Set the panel PCB down on a static safe surface that provides uniform support for the PCB. Do not allow the PCB to flex unnecessarily.

## MIDI Board Installation (Optional)

Please read through this section at least once and **PLAN** your wiring before beginning. The schematic of the MTG Pro One MIDI board is shown below. The LEDs and MIDI Thru connector are not required.



This is one of many circuits that would do the job of converting the CPU's 3v TTL signals into the standard MIDI current loop.

See also: <http://www.midi.org/techspecs/electrispec.php>

## Mount the MIDI Connectors

Although the MIDI board supports PCB mount 5-pin DIN connectors, most people prefer the chassis mount connectors:



Chassis mount



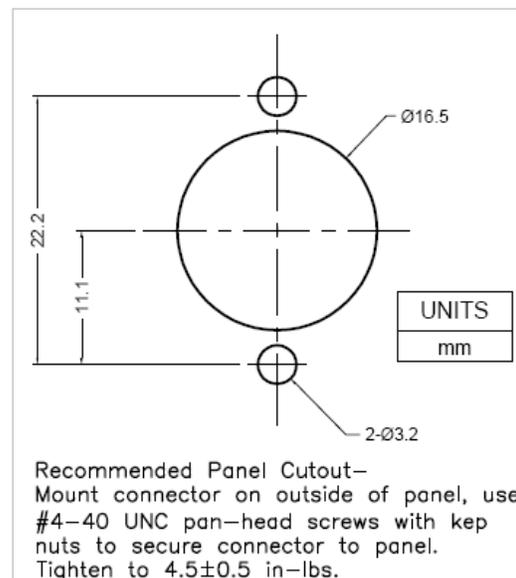
PCB mount

Remove the 37-key keyed assembly if required.

To mount the connectors in the metal chassis you will need to drill/punch holes for the connectors. Use the guide on the right for making the holes. A Greenlee punch can be used to make nice holes with a minimum of fuss.

16.5 mm is approx 5/8"  
3.2mm is approx 4/32"

Make sure any metal residue is removed before reinstalling any electronics.



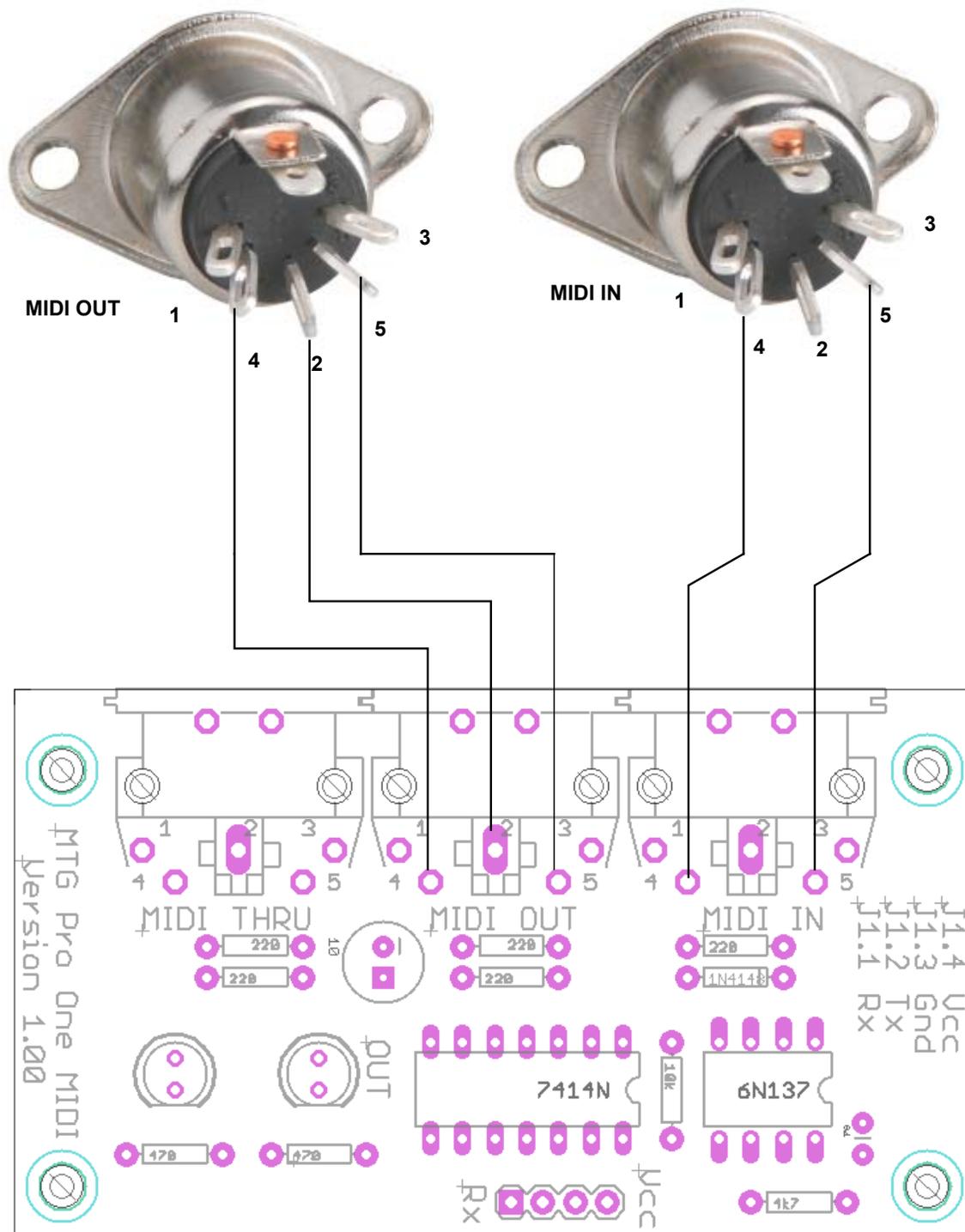
## Mount the PCB

The PCB has 4 holes that can be used to fasten it to the chassis bottom or panel side. Ideally you should mount the PCB as far away from the sound generation electronics as feasible. In lieu of nuts and bolts you may use double-sided foamy tape or Velcro for installations that will not be subject to road trips.

Once the PCB and MIDI jacks are mounted, it is a simple matter to connect a few wires to the CPU module and jacks.

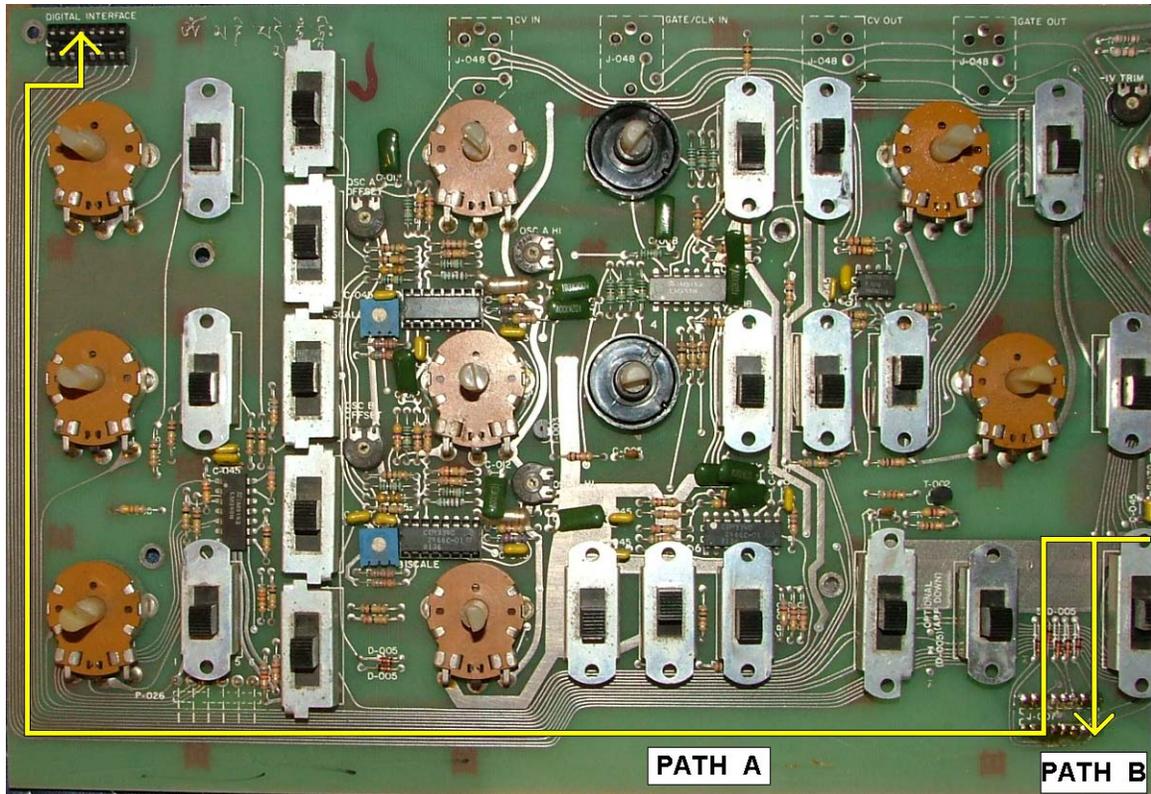
## Jack Wiring

If you are using chassis mount connectors then you will need to run connections from the PCB to the panel jacks. Use the diagram below to hook-up the wires.



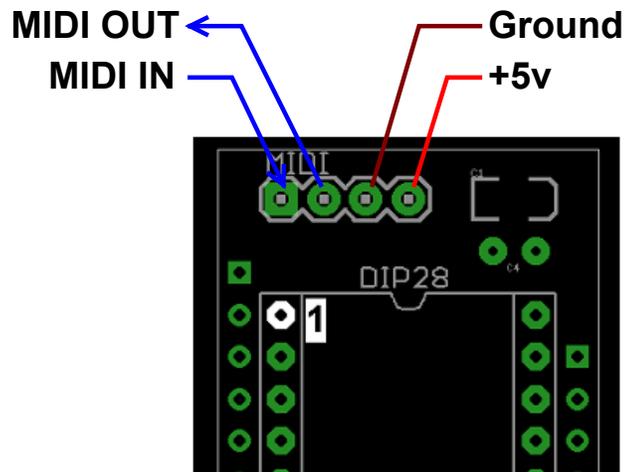
## CPU Module Wiring

Determine a path for the wiring from the jack PCB to the CPU module. If you run your wiring on top of the Pro One main board, then follow the signal path Sequential used for the expansion port. This keeps the MIDI signals away from the audio path. Alternatively run the wiring off the main PCB near the CPU module.

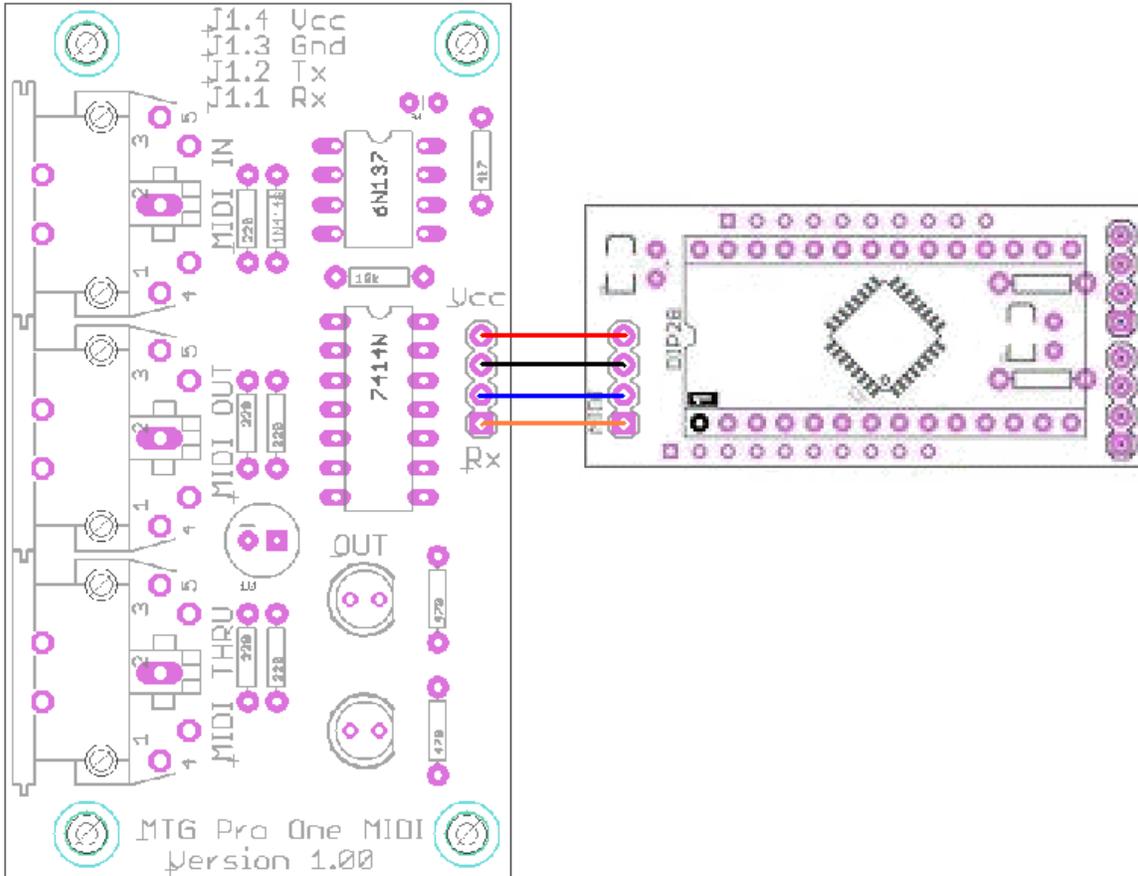


Using hookup wire, connect the four pins one-to-one between the CPU module and the jack board. Use the following two diagrams as a guide.

The wiring should run **under** the **MTG CPU** board, not on top of it. There is very little vertical space above the CPU board for anything (about a tenth of an inch). Therefore, when connecting the wires from the CPU board to the MIDI jack



board, run the wires beneath the CPU board, to the bottom pads on the CPU board and solder on top. Trim the wires neatly on top so that they do not short against the front panel when closed.



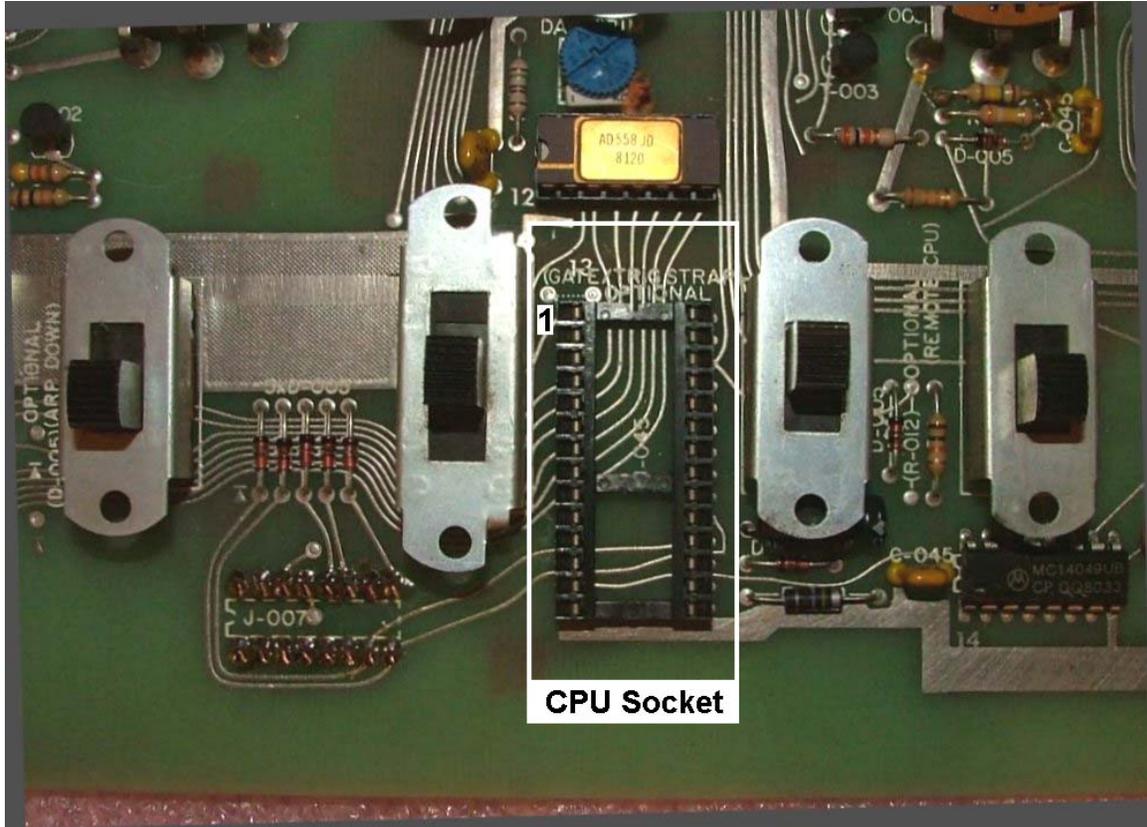
### Another Wiring Option

A third wiring option is to run the cabling outside of the Pro One to an external box or board. If you notice the top edge of the rear panel, there is a small gap near the modulation section. This was originally intended to route external cabling for the DIP “expansion” socket. It can easily be used to run a flat cable outside the Pro One.



## CPU Module Installation

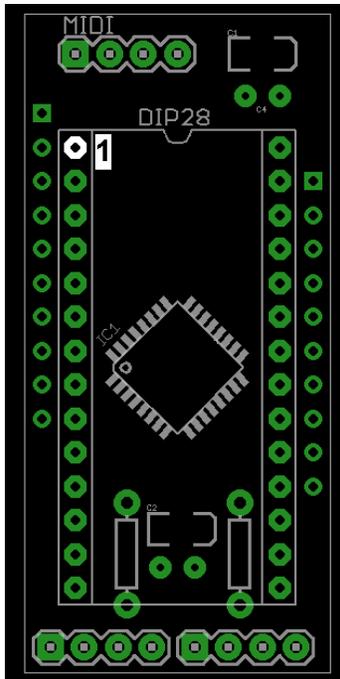
Inspect the area around the existing 8021 CPU (or socket). To the left and right of the CPU are switches. Just “above” it is the Digital-to-Analog converter (DAC) chip facing sideways. The DAC is located at the Pin 1 end of the CPU socket. Make sure you know which pin on the CPU socket is Pin 1. The new module will use up almost the entire area bordered by the DAC and the two switches.



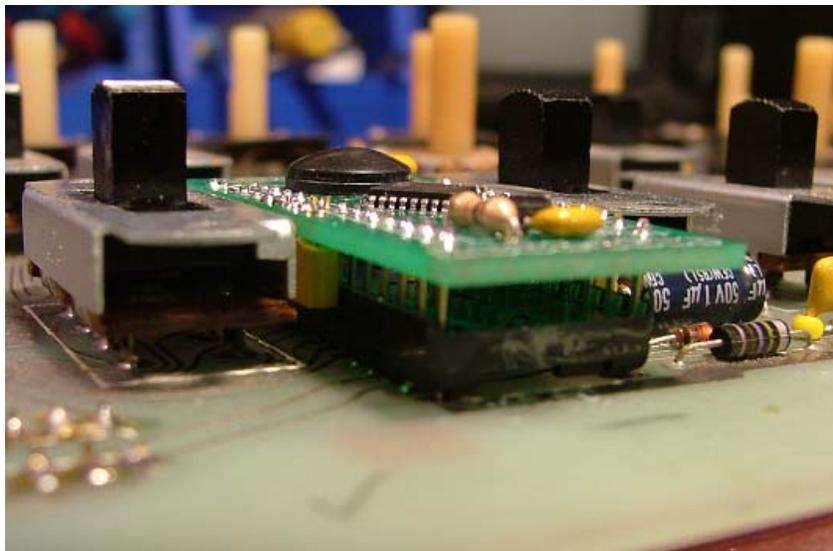
When installed, the module electronics must not sit higher than the height of the metal on the two switches because the metal front panel resets approximately on the switches. A small rubber pad has been placed on the new CPU module to keep it secure and insulate it from the front panel.

If the original 8021 CPU is present, remove it using a small flat head screwdriver. Take care not to bend the leads. Place the 8021 on anti-static foam in case you ever want to re-install it or sell it. If the CPU is defective, throw it away. Really.

Take the Replacement CPU Module out of its anti-static packing and locate pin 1 on the module. Pin 1 is located at the top left end of the board where the white silkscreen notch is printed. For verification, this end has a single 4-pin header. At the other end, near pins 14 and 15, there are two 4-pin headers.

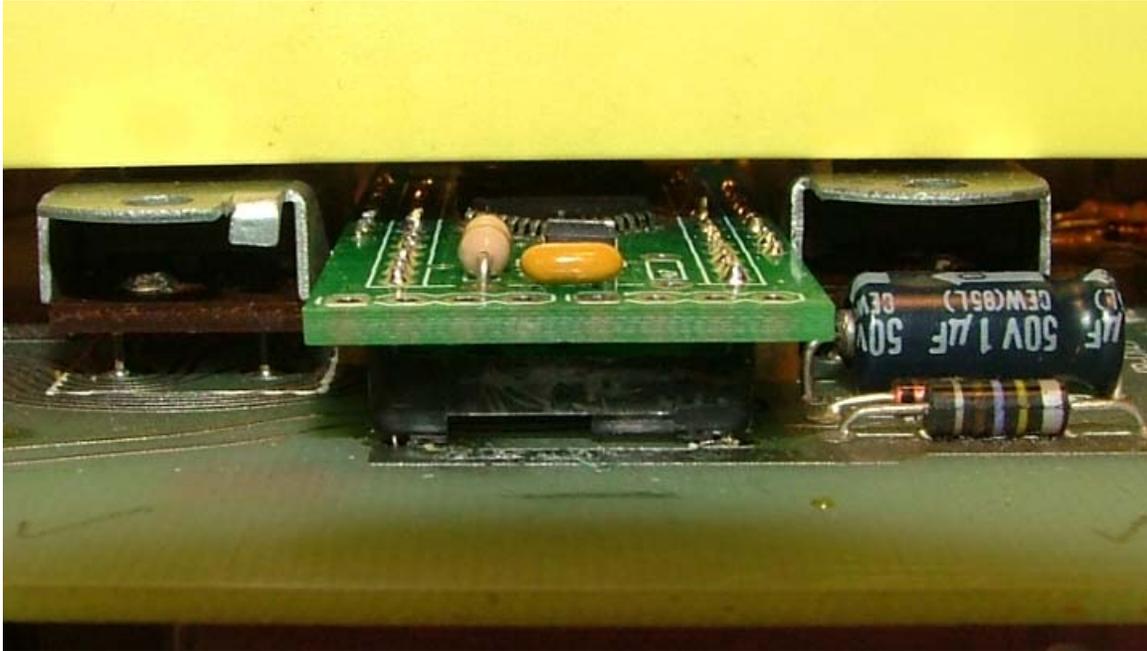


Carefully align the 28 pins of the module directly above the vacant CPU socket.



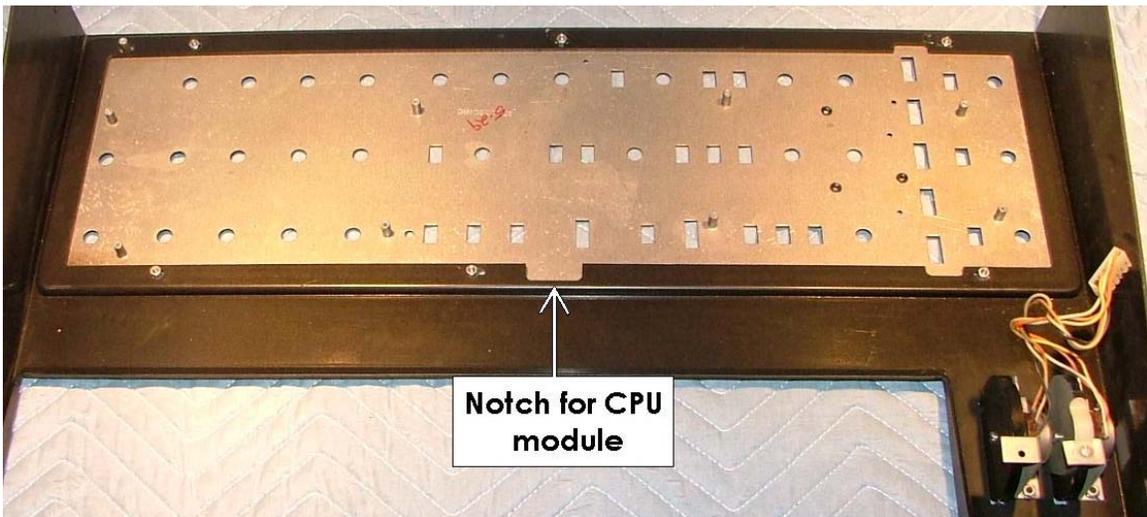
Press the module firmly and evenly into place as low as it will go. The two yellow resistor packs on each underside should either touch the panel PCB or be very near to it.

Verify that there are no electrical parts on the CPU module that extend above the line where the front panel will rest (on top of the switches).



Carefully reassemble the unit in reverse order.

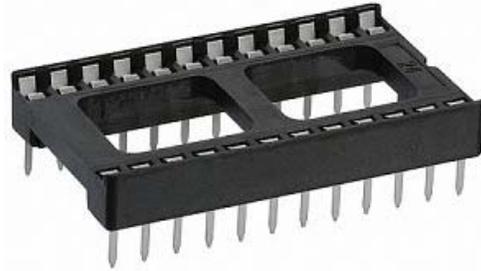
Make sure the new CPU module fits cleanly in the pre-existing notch that Sequential has provided in the plastic front panel. In the unlikely event that the plastic front panel hits the CPU module, you may need to loosen all of the front panel hex nuts and adjust the position of the plastic panel versus the metal front panel.



## Test

After carefully reassembling the unit, plug the Pro One power in and connect an amplifier. Turn the Pro One on. Verify that the module has been installed properly and is functioning. Any problems are likely to be as a result of improper pin alignment when installing the module in the CPU socket.

Sometimes the original CPU socket is in poor condition and a new dual-wiping socket is recommended. Make sure that any replacement socket is low profile.



### 3: Operation

The operation of the Replacement CPU is almost identical to the original. A few changes have been made that take advantage of modern microcontroller technology (i.e. flash memory). For the most part, the CPU (original or new) has limited control over the Pro One's sound generation electronics. However some enhancements can be made, even without carving up the existing electronics.

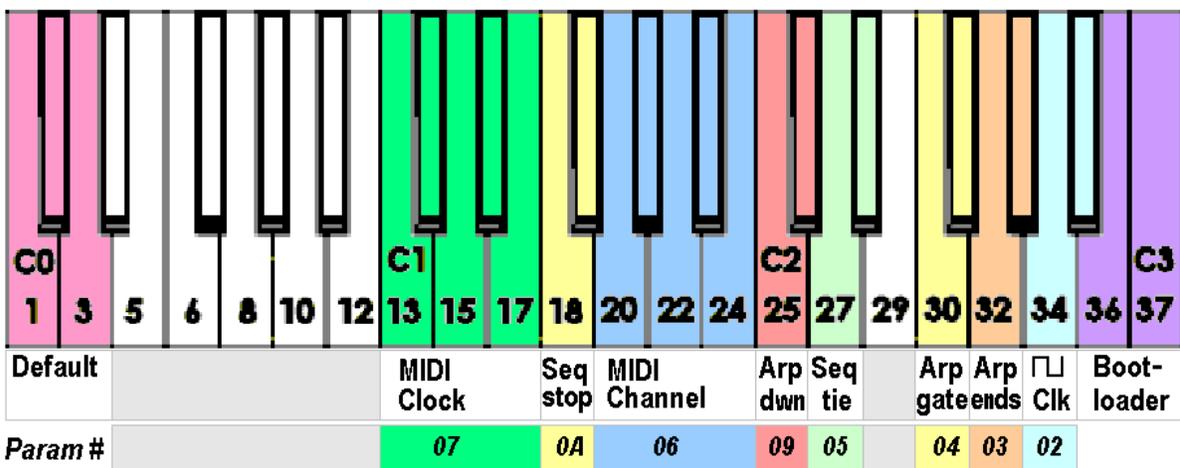
The features described in this section are configurable in two ways.

- The first way is to use MIDI System Exclusive commands (see the appendix for implementation details).
- The second (non-MIDI) way is to use power-on keyboard key combinations.

**\* Because of this, it is important to keep your hands off the keys when \*  
\* powering the unit up unless you plan on changing the configuration! \***

#### Power-On Key Map

When reading about the power-on key combinations, refer to the following diagram:



## System-Wide Settings

The following settings affect the Pro One as a whole.

### **MIDI Channel (Param 06)** (v0.13+)

The MIDI Channel is by default Ch 1 (hex 00).

To change the channel, follow these steps. Turn the Pro One off. Hold the G1 key down along with the MIDI Channel # keys (G#1, A1, A#1 and B1, keys 20 through 24) then turn the power on.

Refer to the table below:

MIDI Channel	Hex	G1 (20)	G#1 (21)	A1 (22)	A#1 (23)	B1 (24)
1	00	Down	Up	Up	Up	Up
2	01	Down	Up	Up	Up	Down
3	02	Down	Up	Up	Down	Up
4	03	Down	Up	Up	Down	Down
5	04	Down	Up	Down	Up	Up
6	05	Down	Up	Down	Up	Down
7	06	Down	Up	Down	Down	Up
8	07	Down	Up	Down	Down	Down
9	08	Down	Down	Up	Up	Up
10	09	Down	Down	Up	Up	Down
11	0A	Down	Down	Up	Down	Up
12	0B	Down	Down	Up	Down	Down
13	0C	Down	Down	Down	Up	Up
14	0D	Down	Down	Down	Up	Down
15	0E	Down	Down	Down	Down	Up
16	0F	Down	Down	Down	Down	Down

Note: This table was revised in v0.15

You can set and read the current MIDI channel using the appropriate System Exclusive command. See Appendix C.

## Clock Source and Rate

The sequencer and arpeggiator share a common clock. The clock signal can be selected from three sources:

- The internal LFO.
- An external clock-in (voltage pulse such as from a vintage drum machine).
- MIDI Clock (AKA MIDI Sync).

In addition, when using the internal LFO as the clock source (and to a lesser degree the external clock-in) you can also choose when the sound starts (Clock Start Mode):

- Sync to User
- Sync to Clock

When using MIDI clock the clock start mode is always Sync to Clock.

You must also take care when using the RETRIG switch and the REPEAT/EXT switch. If you move these switches in the wrong direction you can alter the sound or stop it entirely. If you are experiencing odd behaviour, try adjusting these switches.

### **LFO/Ext Clock Start Mode (Param 02)**

By default, the Pro One begins a sequence or arpeggio as soon as you set up mode (by using the switches and/or playing the keyboard). The LFO which drives the seq/arp starts its cycle fresh at that point. While this is fine when playing solo on the synth, it is not desirable when the syncing the Pro One to another device such as a drum machine. In this case the drum machine should provide the master clock and the Pro One should follow. Unfortunately the Pro One does not always behave as you would like. By changing the Clock Start Mode you can force the Pro One to wait for the clock before sounding any notes.

***NOTE:** This setting has no effect if a MIDI Clock Rate value is selected. If a MIDI Clock Rate is selected then the sequencer and arpeggiator always wait for the first clock after a MIDI start command.*

#### **► Sync to User**

This is the default behaviour of the Pro One (both stock and the MTG Replacement CPU). To set this mode, power the Pro One off. Hold the A2 key down (key 34). With the key still held down, turn the Pro One on.

► **Sync to Clock**

In this mode the arpeggiator and sequencer wait until the next rising edge of the LFO or external clock-in before sounding the first note. This allows for dependable and repeatable synchronization to a clock. To set this mode, power the Pro One off. Hold the A2 and the A#2 keys down (keys 34 and 35). With the keys still held down, turn the Pro One on.

**MIDI Clock Rate (Param 07)** v0.15+

The Pro One will accept MIDI Clock (F8), MIDI Start (FA) and MIDI Stop (FC) for driving the sequencer and the arpeggiator. To use an external MIDI clock, choose any setting from the table below except the first one (the first one disables the MIDI clock and uses the LFO/External Clock instead). When a MIDI clock value is chosen, the LFO/External Clock will be disabled as a clock source for the sequencer and arpeggiator. **Remember to keep the Repeat/Ext switch in the lower (NORMAL) position.**

The default clock rate is MIDI Clock DISABLED. To set the MIDI Clock Rate, follow these steps. Turn the Pro One off. Hold the C1 key down along with the MIDI Clock Rate keys (C#1, D1, D#1 and E1, keys 13 through 17), then turn the power on. Refer to the table below and the key map shown previously:

Hex	Clocks/ Quarter Note	Time Value	C1 (13)	C#1 (14)	D1 (15)	D#1 (16)	E1 (17)
00	DISABLED	Use LFO clock instead	Down	Up	Up	Up	Up
01	3	1/32 note	Down	Up	Up	Up	Down
02	4	Dotted 1/32 note	Down	Up	Up	Down	Up
03	6	1/16 note	Down	Up	Up	Down	Down
04	8	Dotted 1/16 note	Down	Up	Down	Up	Up
05	12	1/8 note	Down	Up	Down	Up	Down
06	16	Dotted 1/8 note	Down	Up	Down	Down	Up
07	24	Quarter note	Down	Up	Down	Down	Down
08	32	Dotted quarter note	Down	Down	Up	Up	Up
09	48	Half note	Down	Down	Up	Up	Down
0A	64	Dotted half note	Down	Down	Up	Down	Up
0B	96	Whole note	Down	Down	Up	Down	Down
0C	128	Whole note + ¼ note	Down	Down	Down	Up	Up
0D	144	Whole note + ½ note	Down	Down	Down	Up	Down

		<b>note</b>					
<b>0E</b>	<b>168</b>	<b>Whole note + dotted ½</b>	<b>Down</b>	Down	Down	Down	Up
<b>0F</b>	<b>192</b>	<b>Two whole notes</b>	<b>Down</b>	Down	Down	Down	Down

Note: This table was revised in v0.17

Please note that in this mode **you are free to use the onboard LFO for modulation effects independent of the MIDI clock**. Also, when using MIDI clock **you need turn the REPEAT/EXT switch off (NORMAL)**.

## Sequencer Specific

### Sequence Memory

The original Pro One sequences were lost on power down. The memory depth was only 40 notes for BOTH sequences. Sequence 1 and Sequence 2 had to share the 40 notes.

The Replacement CPU maintains the two sequences in separate 256-byte banks of flash. The sequences are retained throughout power cycles.

Sequence data can be saved or loaded using System Exclusive, even while a sequence is playing!

### Sequence Tie

The original Pro One sequencer offered two events: note and rest. Since each note included retriggering of the envelope (assuming the RETRIG switch was up) there was only one note length.

The Replacement CPU records the position of the RETRIG switch along with the note value. **Thus by lowering the RETRIG switch you can record a note with no attack/decay phase.** If the first note has been recorded with RETRIG up, then another note follows it (same pitch but RETRIG off) then the note sounds only as an extension of the previous note (assuming the same key is played). Essentially the note length is doubled. The Roland JX3P uses this technique to great effect. You can also record an entirely new note value with no attack/decay phase if you find that to be musically useful.

The factory Pro One has a sequencer gate time of 50%. As of version 0.13, if Sequence Tie is enabled, the sequencer gate time is 100%. This improves the effect of lengthening notes. **Also, here again you should keep the Repeat/Ext switch in the lower (Normal) position.**

### Sequence Tie Enable (Param 05)

As described above, the sequencer can now record quarter notes, half notes, whole notes, whatever length you want because the sequencer records the position of the RETRIG switch with each key. This then makes the RETRIG switch nonfunctional during sequence playback. If you prefer the stock behaviour of the original Pro One, you can set that here.

### ► **Sequence Tie Enabled**

This is the default behaviour of the MTG Replacement CPU but not the stock Pro One. To set this mode, turn the Pro One off. Hold the D2 key down (key 27). While holding the key down, turn the Pro One on.

### ► **Sequence Tie Disabled**

If you do not wish to use the Sequence Tie, but do want to use the RETRIG switch live during sequence playback, follow these steps. This is the default behaviour of the SCI stock Pro One. Power the Po One off. Hold the D2 and D#2 keys down. While holding the keys down, turn the Pro One on.

*Note: The Sequential sequence gate time is 50%. As of v0.13, when Sequence Tie is enabled, the sequence gate time is 100%. This improves longer note events.*

### **Sequence Stop Mode (Param 0A)**

The stock Pro One stops playing the current sequence as soon as you move the SEQ1/SEQ2 switch to the OFF position. If you set the Sequence Stop Mode to Sequence-End-Only then after you turn the sequencer off, it will continue to play until the end of the sequence data table then stop. This also means that you can switch to the other sequence in a live situation and the sequencer will switch over smoothly at the end of the current sequence.

### ► **Sequence Stop Mode Normal**

This is the default behaviour of the stock Pro one as well as the MTG Replacement CPU. To set this mode, turn the Pro One off. Hold the F2 key down (key 18). While holding the key down, turn the Pro One on.

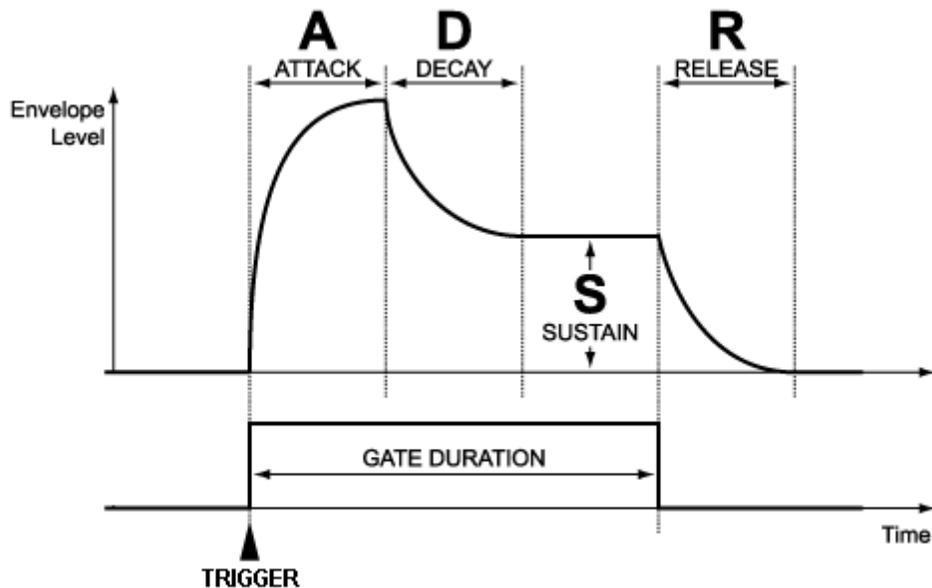
### ► **Sequence Stop on Sequence End Only**

To set this mode, turn the Pro One off. Hold the F2 and F#2 keys down (keys 18 and 19). While holding the keys down, turn the Pro One on.

## Arpeggiator Specific

### Arpeggio Gate Time

This is a fairly subtle change from the original Pro One. The LFO clock has a 50% duty cycle. That means the LFO square wave is high for half the period and low for half the period. The Sequential Pro One leaves the gate on the whole time an arpeggio runs (100% gate time). The attack/decay sound is generated by a separate short trigger pulse that occurs on every note. The Arpeggio Gate Time setting allows you to turn the gate time off half-way through the LFO clock (50% gate time). Depending on the patch you are using, it can provide a slightly different sound as the patch can enter the release portion of the ADSR cycle. For a factory Pro One you would have to lower the sustain and extend the decay value for a similar effect.



### Arpeggio Up/Down Modes

There are two settings that affect the arpeggiator when the Up/Up+Down switch is in the lower Up+Down position. The first setting determines whether the end notes are heard once (the default), or twice. The other setting changes the Up/Down mode to Down-only.

## **Arpeggio Gate Time (Param 04)**

### **▶ Arpeggio Gate 100%**

This is the default behaviour of the Pro One (both stock and the MTG Replacement CPU). To set this mode, turn the Pro One off. Hold the F2 key down (key 30). With the key still held down, turn the Pro One on.

### **▶ Arpeggio Gate 50%**

To set this mode, power the Pro One off. Hold the F2 and the F#2 keys down (keys 30 and 31). With the keys still held down, turn the Pro One on.

## **Arpeggio Up/Down End Notes (Param 03)**

When playing an Up/Down Arpeggio the Pro One only sounds the highest and lowest notes once. If you prefer for these end notes to each sound twice, you can change the mode using this procedure.

### **▶ End Notes Once**

This is the default behaviour of the Pro One (both stock and the MTG Replacement CPU). To set this mode, power the Pro One off. Hold the G2 key down (key 32). With the key still held down, turn the Pro One on.

### **▶ End Notes Twice**

To set this mode, power the Pro One off. Hold the G2 and the G#2 keys down (keys 32 and 33). With the keys still held down, turn the Pro One on.

## **Arpeggio Down Mode (Param 09)**

The factory Pro One allows for changing the Up/Down mode to Down by modifying a diode on the circuit board. Here you can make the same change but much more easily.

### **▶ Up/Down Mode**

This is the default behaviour of the Pro One (both stock and the MTG Replacement CPU). To set this mode, power the Pro One off. Hold the C2 key down (key 25). With the key still held down, turn the Pro One on.

## ► Down Mode

To set this mode, power the Pro One off. Hold the C2 and the C#2 keys down (keys 25 and 26). With the keys still held down, turn the Pro One on.

## MIDI Delays

Some older MIDI synths do not react well to MIDI note-off's followed immediately by note-on's (especially the same note). This is exactly what happens in some sequences or arpeggiations (depending on mode). For this reason the MTG Pro One CPU will insert a short delay (default is 10ms) when these problematic situations occur. This delay is not global, it only appears when it has to.

### **MIDI Delay (Param 08)**

You can shorten or lengthen the MIDI delay using System Exclusive commands. Please see Appendix C for more information.

## MTG Factory Defaults

If you wish to restore the Pro One to each of the MTG factory default settings,

- Clock Start Mode is Sync to User
- Arpeggio Up/Down is set to End Notes Once
- Arpeggio Gate is 100%
- Sequence Tie is Enabled
- MIDI Channel is channel 1
- MIDI Clock is Disabled
- Arpeggio Up/Down mode is Up/Down
- Sequence Stop Mode is Normal
- MIDI Delay time is 10ms

then follow these steps. Turn the Pro One off. Hold the lowest three notes down (C0, C#0 and D0). Turn the Pro One on.

## Bootloader Launch

If you have installed the MIDI hardware you can utilize the built-in MIDI bootloader to upgrade the firmware. To launch the bootloader, start with the Pro One turned off. Hold the two highest notes down (B2 and C3, keys 36 and 37). While holding them down, power on the Pro One. The bootloader will emit several short notes. After that the bootloader remains in control of the synth. Follow the instructions in Appendix A.

## Appendix A: Firmware Upgrade

If you have installed a MIDI interface circuit, you can “reflash” the firmware in the Pro One CPU by carefully following the procedure outlined in this section. Obtain the latest firmware in .SYX format from the MusicTechnologiesGroup.com website. We show the process using MIDIOX, but you should be able to use any similar program.

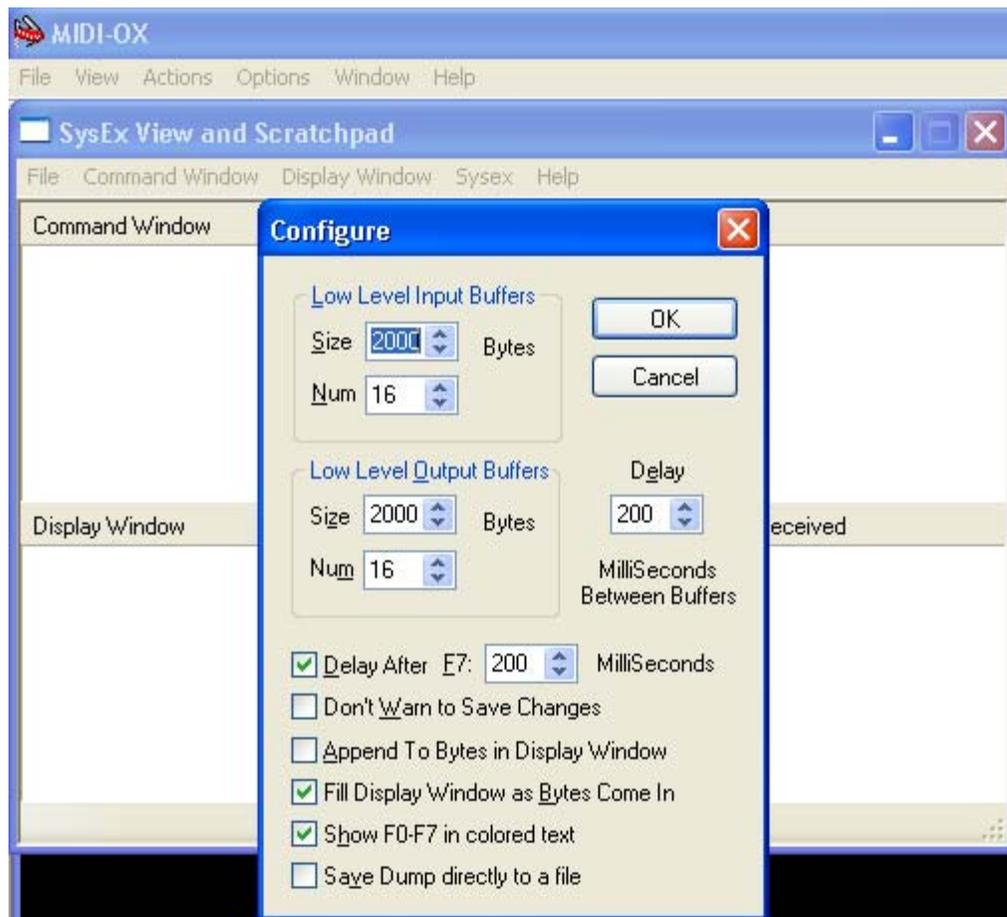
You may lose your sequencer data and user parameters as a result of a firmware upgrade.

### Configure MIDIOX

Set the Sys Ex properties of MIDIOX by clicking:

View->SysEx... and then SysEx->Configure

Use the minimum recommended setting shown here:



## Prepare the Pro One for Download

Hook up the MIDI connections to your computer and to the Pro One. Launch the Pro One in bootloader mode by turning off the Pro One, holding the two highest keys (B2 and C3) and then while holding those keys down, turning the Pro One on. You should hear several short notes that indicate the MIDI bootloader program is in control.

## Test the Communication

If you send a Universal Device Inquiry system exclusive packet to the Pro One, it will respond with the MidiLoader version packet. In MIDIOX, click:

View->SysEx...

Then from the SysEx menu click

Command Window->Load File...

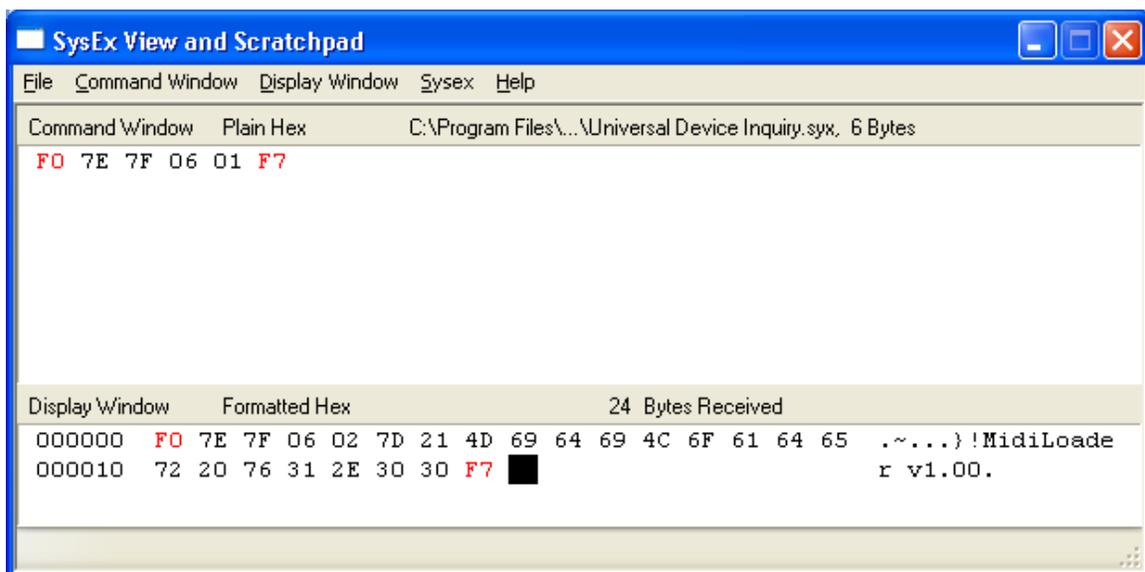
Choose the file **Universal Device Inquiry.syx** and click **open**. Click

Command Window->Send/Receive Sysex

The Pro One bootloader will respond with 24 bytes. Click on **Done**. Next click on

Display Window->Hex View Swap

You may have to enlarge the window a little, but you should see something like:



The message must say **MidiLoader** not **ProOne CPU**! If it does, you have not launched the bootloader properly. Repeat the above steps carefully. Once you verify the MidiLoader message you can proceed with the firmware upgrade.

## Firmware Upgrade

Close the SysEx View window and open it again to get an empty window. If you are prompted to save anything, click **No**. Open the new firmware file by clicking

Command Window->Load File...

Choose the file required for the upgrade (E.g. ProOne\_v1\_00.syx). You should see that a fairly large file is opened. Click on

Command Window->Send/Receive Sysex

The upgrade takes approximately 30 seconds. Do not touch the computer or Pro One during this time. At the end of the upgrade the Pro One will reboot. Also the MIDIOX screen will show a fairly large number of transactions. You can close MIDIOX (don't save anything) and begin using the updated Pro One.

If the Pro One doesn't reboot, verify that the Pro One is operational. If not, repeat the download. You are advised to perform an MTG Factory Defaults procedure on a newly reflashed CPU.

## Appendix B: MIDI Implementation Summary

The following abbreviated MIDI Implementation charts describe the Pro One CPU upgrade MIDI as of this writing for the bootloader and the Pro One synth. The bootloader and synthesizer are separate MIDI devices.

### BootLoader

Function	Tx	Rx	Remarks
System Exclusive	o	o	
Everything Else	x	x	

o : implemented  
x : not implemented

### Synthesizer

Function	Tx	Rx	Remarks
Basic Channel	1-16	1-16	Set by power-on key combinations and SysEx
Default Changed	x	x	
Mode	x	[1]	Last note priority
Default Messages	x	x	
Note Number	36-72	36-86	TBD (limited by DAC)
True Voice	36-72	36-72	
Velocity			
Note On	x	x	
Note Off	x	x	
Pitch Bender	x	x	TBD (limited by DAC)
System Exclusive	o	o	See next chapter.
Real Time			
Clock	x	o	
Commands	x	o	MIDI Sync Start, Stop.
Everything Else	x	x	

o : implemented  
x : not implemented

[1]: OMNI OFF, MONO

Please note that the synth transmits the arpeggiator and sequencer note data in monophonic form. In normal keyboard mode, the synth outputs polyphonic MIDI key data.

## Appendix C: System Exclusive Implementation

The Sys Ex engine in the MTG Pro One CPU runs in the background while the CPU performs its normal duties. Generally this means you can alter parameters at the same time the synth is being used to make music. For instance you can download a new sequence while the sequencer is running.

### Command Types

The table below shows the system exclusive commands supported by the MTG Pro One CPU. A “Get” command implies reading data from the Pro One. A “Set” command implies writing data to the Pro One. The Sent and Recv’d columns refer to how many bytes are sent from a PC (or other device) to the Pro One and then how many bytes are received in response.

Command Type (hex)	Description	Sent (# bytes)	Recv’d (# bytes)
04	Restart	5	7 (ACK)
05	Get Port	5	6
21	Get Global Parameter	8	8
22	Set Global Parameter	8	7 (ACK)
23	Get Sequence 1 Data	5	Variable
24	Set Sequence 1 Data	Variable	7 (ACK)
25	Get Sequence 2 Data	5	Variable
26	Set Sequence 2 Data	Variable	7 (ACK)
--	Universal Device Inquiry	6	24

The Universal Device Inquiry response includes the MTG Pro One CPU firmware version number.

### General Form

(hex)	F0	System Exclusive
	<id>	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	<cmd>	Command type byte (from table above).
	(addr)	Parameter number byte (if applicable).
	(data)	Data (if any) in nibble pairs.
	F7	End of System Exclusive

## Default Responses

A few of the commands to the MTG Pro One CPU return standard “yes” (**ACK**nowledge) or “no” (**Not ACK**nowledge) response. Here is the general form of those responses.

### ACK:

(hex)	F0	System Exclusive
	<id>	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	<cmd>	Echo of whatever the command was.
	(addr)	Echo of whatever the parameter # was.
	41	ACK – ACKnowledge (parameter or value accepted)
	F7	End of System Exclusive

### NACK:

(hex)	F0	System Exclusive
	<id>	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	<cmd>	Echo of whatever the command was.
	(addr)	Echo of whatever the parameter # was.
	4E	NACK – Not ACKnowledge (parameter or value was out of range, or error)
	F7	End of System Exclusive

You should receive an ACKnowledge when setting a parameter. If you receive a NACK instead, then there is something incorrect in your command.

## Restart Command

You can command the MTG Pro One CPU to reboot by issuing this command. If you are connected using USB, then you may need to close and reopen the ports in your MIDI software.

### Transmitted:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	04	Command type.
	F7	End of System Exclusive

### Received:

ACK packet (then the MTG Pro One CPU reboots)

## Get Port Command

You can query the MTG Pro One CPU to determine if it is connected using 5-pin DIN MIDI or USB-MIDI (for now only 5-pin DIN MIDI is supported).

### Transmitted:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	05	Command type.
	F7	End of System Exclusive

### Received:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	4D or 55	4D = 'M' = MIDI 55 = 'U' = USB (future feature)
	05	Command type.
	F7	End of System Exclusive

## Get/Set Global Parameter List

The following table describes the Parameter # and valid data values for the Get/Set Global Parameter commands. The Value byte is split into two nibble pairs for transmission over MIDI.

Parameter # (addr in hex)	Value (binary)	Description
02	0000 000x	Clock Start Mode 0 = Sync to User* 1 = Sync to (Ext) Clock
03	0000 000x	Arpeggio Up/Down End Notes 0 = End notes once* 1 = End notes twice
04	0000 000x	Arpeggio Gate Time 0 = 50% 1 = 100%*
05	0000 000x	Sequence Tie Enable 0 = Disabled 1 = Enabled*
06	0000 nnnn	MIDI Channel Default is 0000* (channel 1, see table)
07	0000 cccc	MIDI Clock Rate Default is 0000* (disabled, see table)
08	0ddd dddd	MIDI off/on note delay (for old synths) Default is 10ms* Range is 0ms to 127ms
09	0000 000m	Arpeggio Up/Down Mode 0 = Up/Down* 1 = Down
0A	0000 000m	Sequencer Stop Mode 0 = Normal* 1 = Stop on sequence end (wrap) only

\* default setting

## Get Global Parameter Command

By sending a Get Global Parameter Sys Ex command from a host device, the user can query the settings in the CPU. In this implementation one parameter byte is read at a time from the table listed above. Byte addresses outside of the parameter list range are ignored.

The command reads a single byte from the CPU, but the data value is received as two bytes over MIDI. The first byte is the most significant nibble of the data. The second byte is the least significant nibble of the data.

### Request:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	21	Command (get global parameter).
	<addr>	Parameter # from parameter list table.
	F7	End of System Exclusive

**Example:** Read the active MIDI Channel.

### Transmitted:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	21	Command type (get global parameter).
	0C	Parameter # from parameter list table.
	F7	End of System Exclusive

### Received:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	21	Command type (get global parameter).
	06	Parameter # from parameter list table.
	00	Most significant nibble of the value 0F.
	0F	Least significant nibble of the value 0F.
	F7	End of System Exclusive

In the above example the result, 0F, is MIDI Channel 16. MIDI channels 00 to 0F are called 1 to 16 normally.

## Set Global Parameter Command

By sending a Set Global Parameter Sys Ex command from a host device, the user can change the settings that normally require power-on key combinations. In this implementation one parameter byte is changed at a time from the parameter list table. Byte addresses outside of the parameter list range are ignored (the CPU may NACK the command attempt).

The command writes a single byte into the CPU, but the new data value is transmitted as two bytes. The first byte is the most significant nibble of the data. The second byte is the least significant nibble of the data.

### Command:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	22	Command type (set global parameter).
	<addr>	Parameter # from parameter list table.
	<msn>	Most significant nibble of the new value.
	<lsn>	Least significant nibble of the new value.
	F7	End of System Exclusive

**Example:** Set the MIDI Clock to 24 = Quarter Note = table hex value 07.

MIDI Clock Rate table excerpt:

07	24	Quarter note	Down	Up	Down	Down	Down
----	----	--------------	------	----	------	------	------

The parameter number is also 07 for setting the clock rate.

Parameter List table excerpt:

07	0000 cccc	MIDI Clock Rate Default is 0000 (disabled, see table)
----	-----------	--

### Transmitted:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	22	Command type (set global parameter).
	07	Parameter # from parameter list table.
	00	Most significant nibble of the table value 07.
	07	Least significant nibble of the table value 07.
	F7	End of System Exclusive

Received:  
ACK packet

*This command switches the arpeggiator and sequencer from LFO/Ext clock mode to MIDI clock mode. Make sure the Repeat/Ext switch is in the down (off) position.*

## Get Sequence Data

---

The sequence data is stored internally in a very simple format. Each byte contains a keyboard note value (0 to 36) that is played out when a clock-in is received (from either the LFO, an external pulse or MIDI). The TRIG switch information is encoded along with the note number in case you use the Sequence Tie Enable mode for extending note values (in normal mode this information is ignored).

REST	TRIG	n	n	n	n	n	n
b7	b6	b5	b4	b3	b2	b1	b0

- nnnnnn           – This is the note number information.
- TRIG             – This is the associated TRIG switch position.
- REST             – A rest is special byte value 80 (in hex).

End-Of-Sequence is special byte value FF (in hex). This byte should be included when sending sequence data from a PC to the Pro One.

You can actually include key values beyond 36. The encoding above accepts values of 0 to 63 (decimal). The DAC in the Pro One is also limited to 6 bits, where each LSB represents a semi-tone.

---

Commands 23 and 25 (hex) read out the data stored in the Pro One's Sequence 1 and Sequence 2 banks (respectively). The data uses the encoding shown above, but the data bytes are split into nibble-pairs for transport over MIDI.

### Request:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	23/25	Command type (set global parameter).
	F7	End of System Exclusive

Received:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	23/25	Command echo.
	<	
	:	Byte pairs of sequence data.
	>	
	F7	End of System Exclusive

## Set Sequence Data

Commands 24 and 26 (hex) write new data into the Pro One's Sequence 1 and Sequence 2 banks (respectively). The data uses the encoding in the previous command, but the data bytes are split into nibble-pairs for transport over MIDI. If you use a Get Sequence Data command first you can simply modify the Command byte value and it becomes a Set Sequence Data command.

Transmitted:

(hex)	F0	System Exclusive
	7D	Manufacturer ID. User settable – default is 7D.
	23	Device ID for the MTG Pro One CPU.
	24/26	Command type (write seq1 or write seq2).
	<	
	:	Byte pairs of sequence data.
	>	
	F7	End of System Exclusive

Received:  
ACK packet