# MIDI Encoder Board

# Model MK-03

**Instructions for**
**Installation and Configuration**

**Version 3.0**
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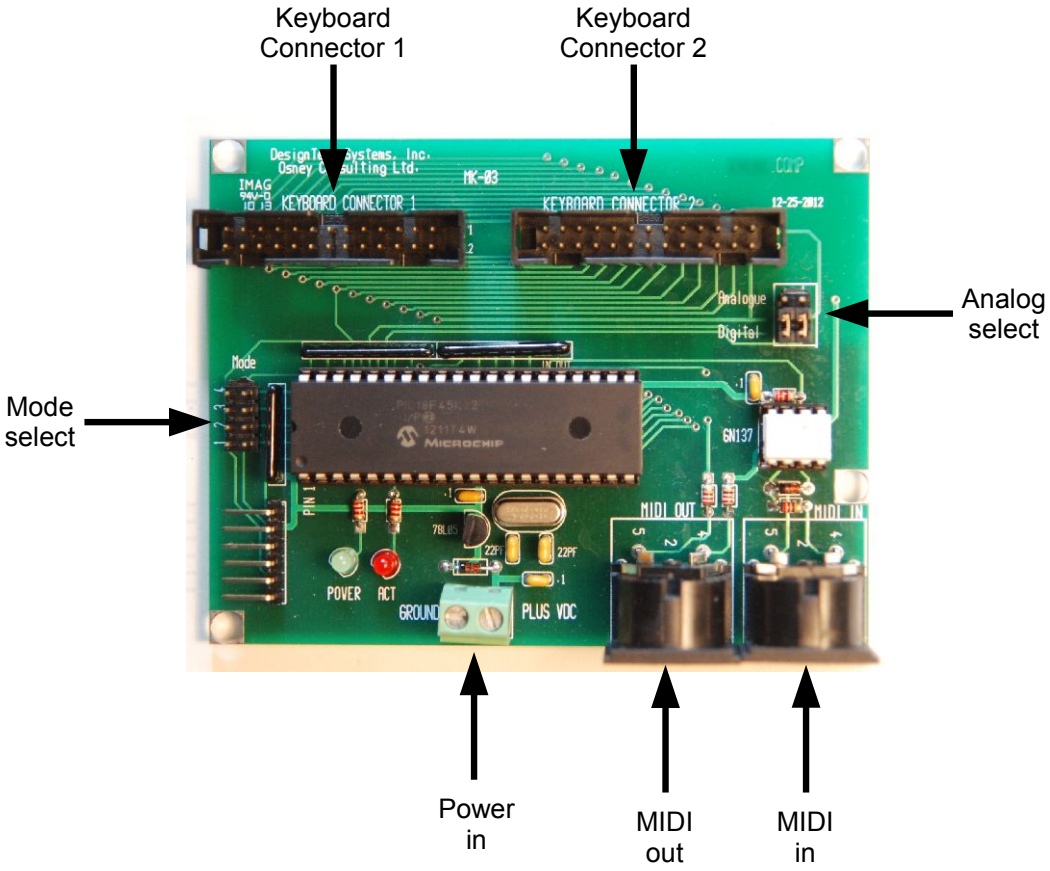
Description

DesignTech Systems' MK-03 MIDI encoder is designed to combine a large number of inputs from an organ console and convert them into MIDI messages. It can scan manual and pedal keyboards, combination pistons, stops and analog inputs from expression pedals. It is ideal for interfacing traditional pipe organ consoles to software packages such as Hauptwerk, jOrgan and Miditzer.

*Connections*




*Power in:* A 9v to 18v DC supply should be connected to the screw terminals provided, with the positive line to the right.

*MIDI out:* A standard MIDI-compliant output. The codes generated are described in detail below.

*MIDI in:* A standard MIDI input. Any MIDI information received on this port is forwarded to the MIDI output. This feature can be used to "daisy-chain" multiple encoder boards together.

*Mode Select:* Jumpers may be fitted to this connector to select between various operating modes. These are described in detail below.

*Keyboard connectors:* Both of these 26-way headers are wired identically. In many cases, you will only need to use one of them, in which case either may be used. If you are using a single encoder to scan two keyboards, you will find it convenient to use both connectors, one for each keyboard.

*Analog Select:* If you are using a mode which reads analog inputs from expression pedals (currently modes 3 and 5), the potentiometers used for these inputs will need to be supplied with +5v and 0v as a voltage reference. The analog select header allows you to choose whether pins 1 and 2 on the keyboard connectors are to be connected to the module's +5v and 0v lines for this purpose, or whether they will be used as digital inputs.

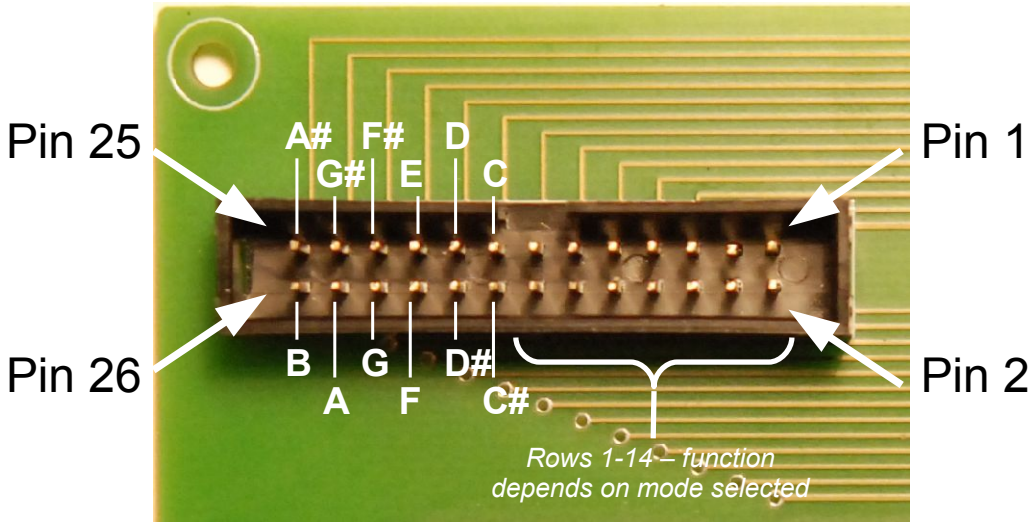
*Green LED:* Lights to show that the board is supplied with power.

*Red LED:* Flashes whenever a MIDI message is transmitted. This happens on every time a key or stop is pressed or released, every time a combination piston is pressed and every time an expression pedal is moved. There is no message generated when a combination piston is released. Note that the red LED flashes very briefly when a message is forwarded from the MIDI in port.

*Using the keyboard connectors*

Each of these headers is designed to be connected to a 26-way ribbon cable via a compatible insulation displacement (IDC) connector (e.g. Multicomp MC6FD026-30P1). The 26 pins form a 14 x 12 matrix, which can scan up to 168 switches. The 12 "columns" (pins 15-26) are inputs and represent the 12 notes of the scale, from C to B. The 14 "rows" (pins 1-14) are usually configured as outputs and are used to select between different octaves and different keyboards. In mode 3, four of the rows are used as analog inputs for reading expression pedals. In mode 5, one row is used in used as an analog input.

A fairly high pressure is needed to close the IDC connector onto the ribbon cable onto the ribbon cable, but this pressure also needs to be even. We have found that a good way to attach the connector is to assemble it loosely around the cable, and then gradually stand on it whilst wearing soft-soled shoes such as slippers or sneakers.




The unit automatically reads each "row" in turn, by switching one row select line at a time to logic 0 (0v). When this happens, keys which are pressed in the relevant octave will be read as 0 and keys which are not pressed will be read as 1 (5v). The entire matrix is read approximately 100 times per second.

You can test the unit by connecting any of the "column" pins (i.e. the notes C to B shown in the diagram above) to any of the "row" pins with a wire link. When the connection is made, the red LED should flash. Be careful never to connect two "rows" together, as this could damage the unit.

In order to avoid ambiguity when several keys are pressed simultaneously, a signal diode (e.g. 1N4148) needs to be connected in series with each switch. The cathode of the diode (usually shown by a black stripe on the diode) must be connected towards the row select line.

Full wiring details for each mode are provided below.

*MIDI messages and channel assignment*

The following MIDI messages are produced by the encoder:

| *Event* | *MIDI message* | *Hex code (x = channel number)* | | |
|---|---|---|---|---|
| Note on | Note on | 9*x* | <note value> | 40 |
| Note off | Note off | 8*x* | <note value> | 40 |

*The bottom note on an organ keyboard is MIDI note 36 (decimal), so that is the lowest note value that the encoder will ever send. The last byte in these messages represents velocity. The encoder always sends 40 (hex) for this value, which is half of maximum velocity.*

| | | | | |
|---|---|---|---|---|
| Stop on | Note on | 9*x* | <stop number> | 40 |
| Stop off | Note off | 8*x* | <stop number> | 40 |

*Stop change messages begin at note 0, not note 36.*

| | | | | |
|---|---|---|---|---|
| Piston on | Control message | B*x* | 51 | <piston number> |
| Expression pedal | Control message | B*x* | 0B | <pedal position> |

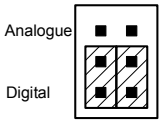
The following channel assignments are used:

| | |
|---|---|
| Swell / solo manual and pistons: | Channel 1 |
| Great manual and pistons: | Channel 2 |
| Pedalboard and toe pistons: | Channel 3 |
| Choir / accompaniment manual and pistons: | Channel 4 |
| Accompaniment second touch (theatre organs): | Channel 5 |
| Pedal second touch: | Channel 6 |
| Stops 0 – 119: | Channel 7 |
| Stops 120 – 167: | Channel 8 |

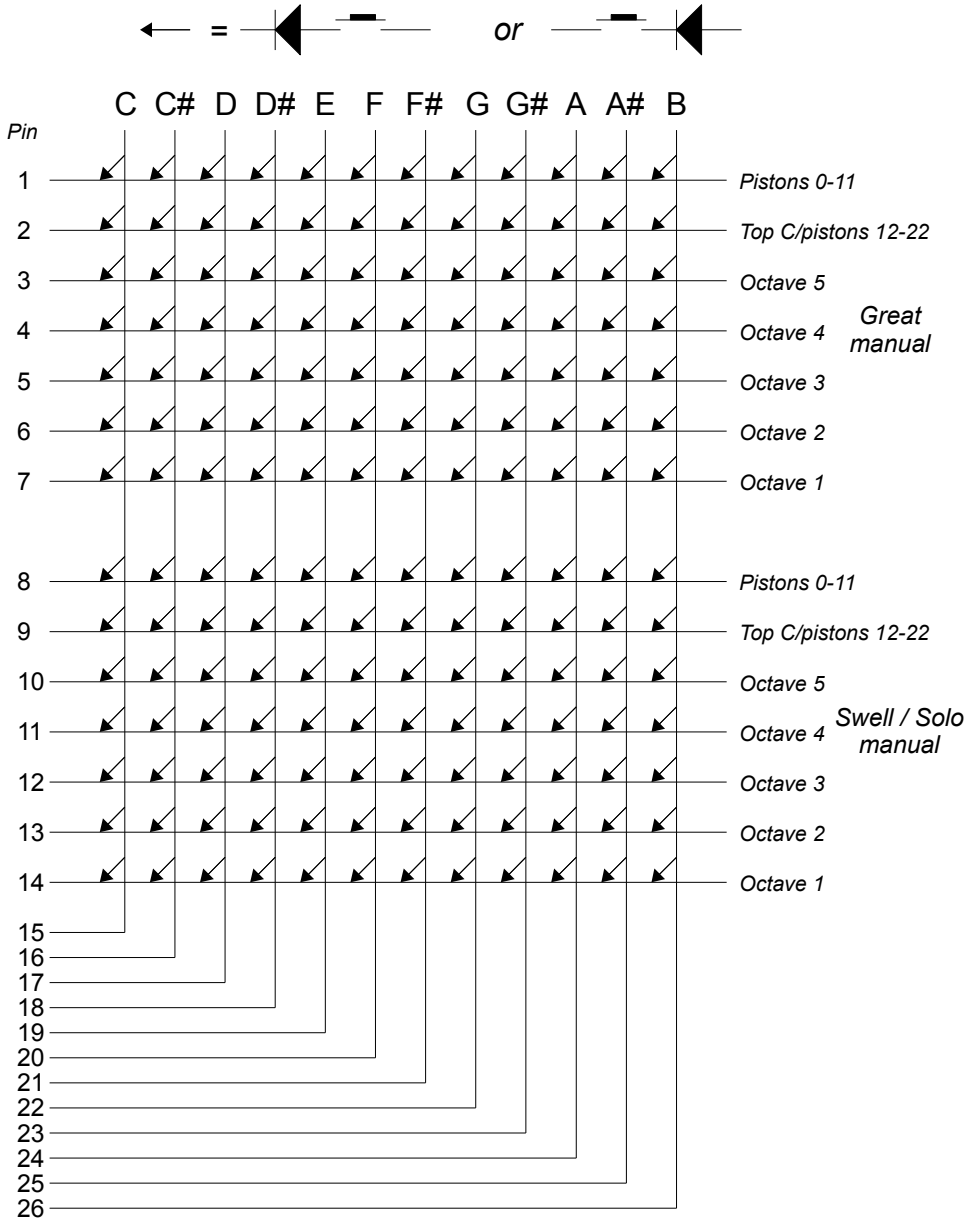
| | |
|---|---|
| Expression pedal 1: | Channel 1 |
| Expression pedal 2: | Channel 2 |
| Expression pedal 3: | Channel 3 |
| Expression pedal 4: | Channel 4 |

Mode 1: two manuals with pistons

To select mode 1, there should be no jumpers on Mode Select. The jumpers on Analog Select should be set to "Digital".



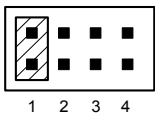

*Mode 1 wiring diagram:*



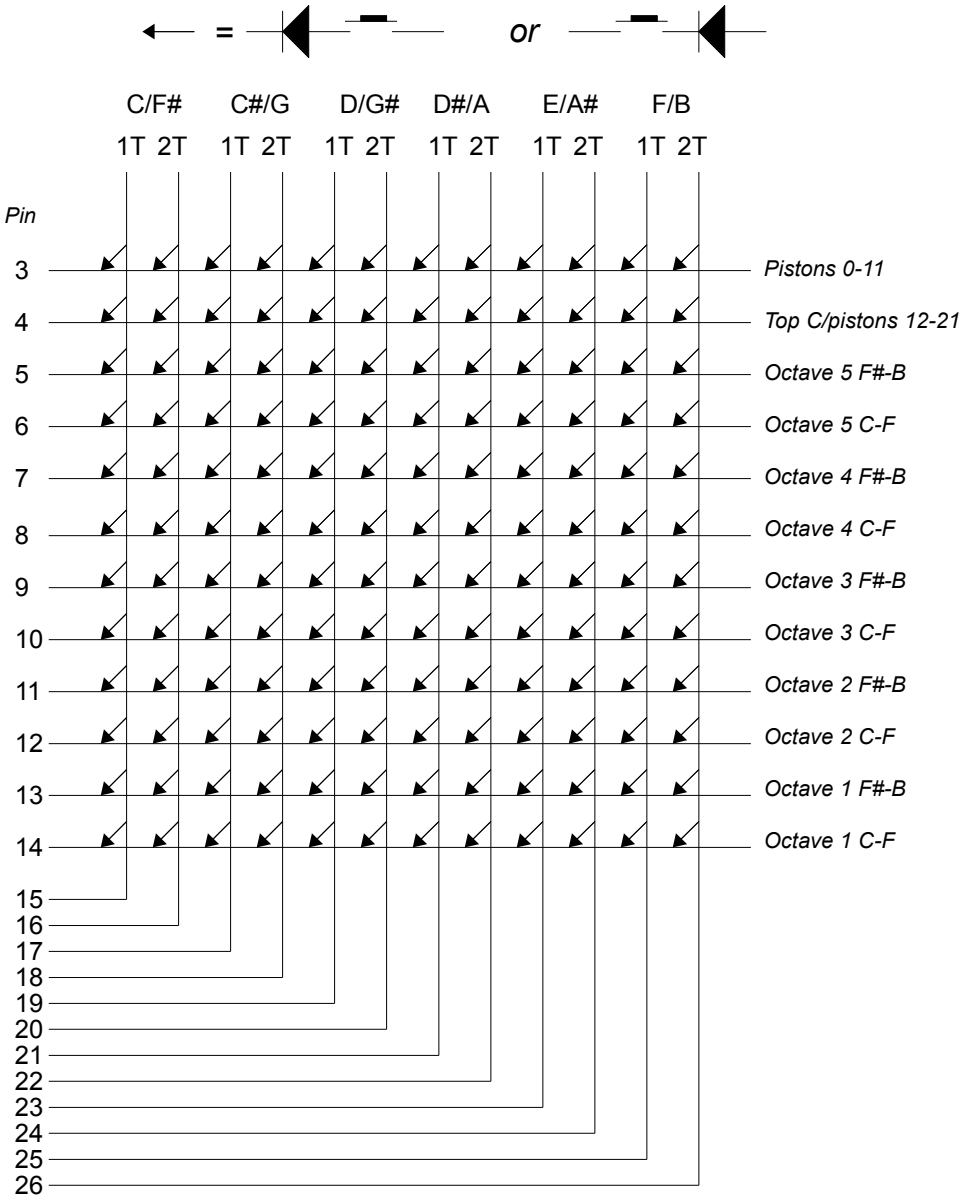
Mode 2: manual with second touch and pistons *or* Allen MOS keyboard

The wiring for a keyboard with second touch needs to be slightly different because the first touch and second touch contacts are usually connected to a shared return line.

To select mode 2, connect a jumper on Mode Select as shown below. The jumpers on Analog Select can be omitted.

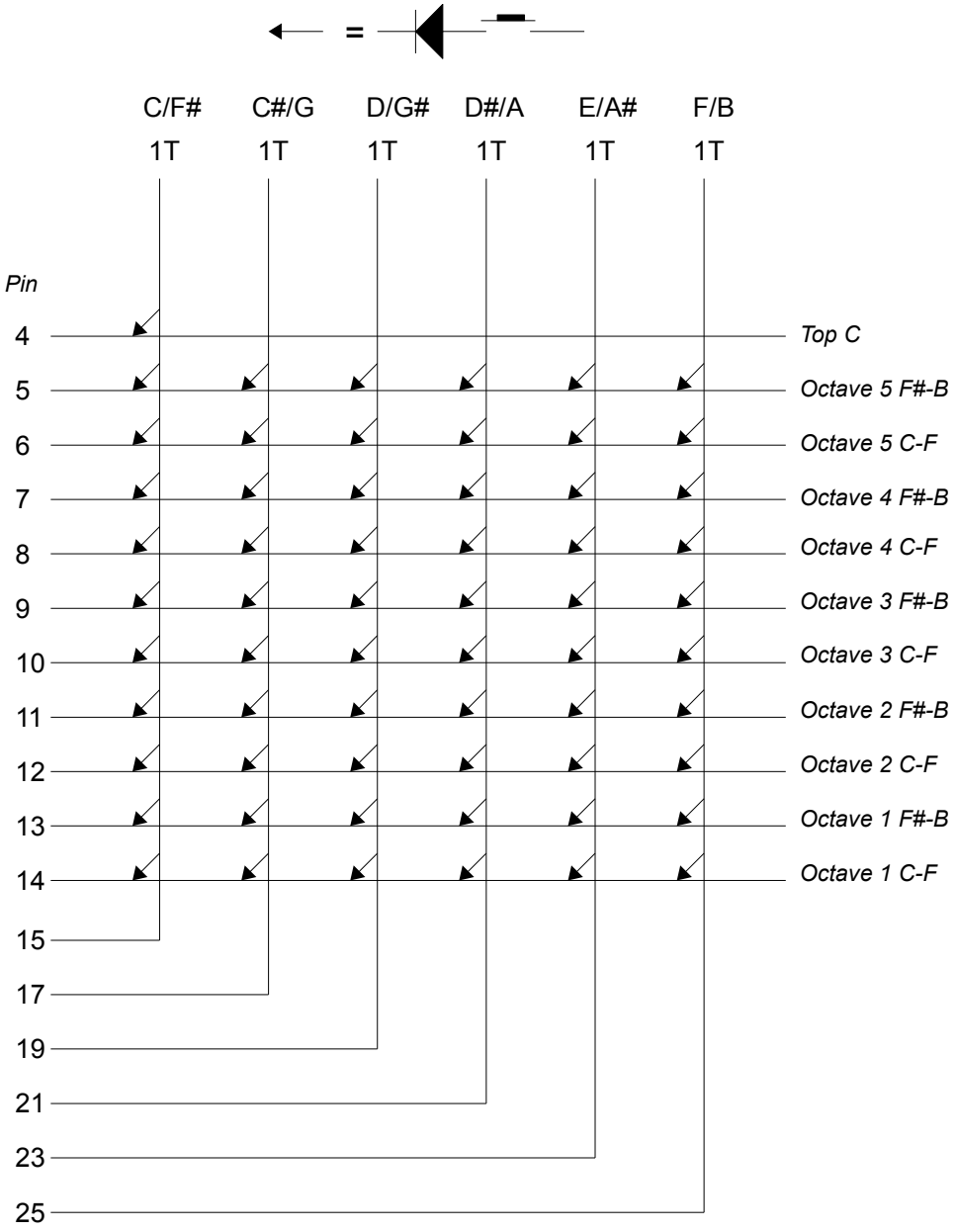



*Mode 2 wiring diagram for second touch:*



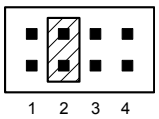
Mode 2 can also be used for connection to an Allen MOS keyboard. These use a 6 x 11 matrix of switches, which is essentially the same as our mode 2 without second touch.

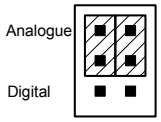
An Allen MOS keyboard should be wired as shown below:



Mode 3:  Pedalboard with second touch, toe pistons and expression pedals

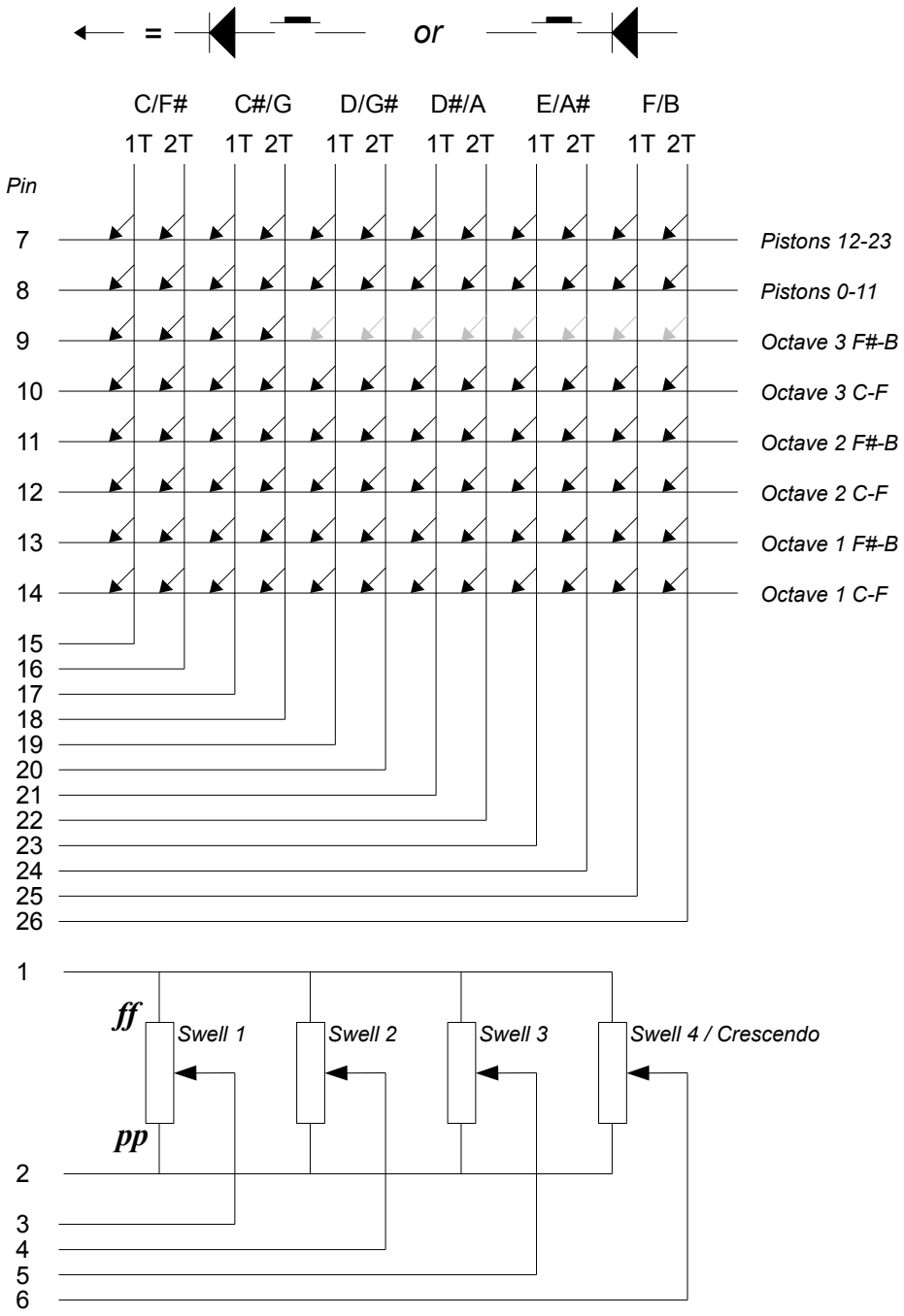
To select mode 3, connect a jumper on Mode Select as shown below.  The jumpers on Analog Select should be set to "Analog".




Note that the input lines for any unused expression pedals (pins 3, 4, 5 and/or 6) should be connected to ground (pin 2).  Failure to do this will cause the board to "see" expression pedals constantly moving, and generate a corresponding stream of MIDI messages.

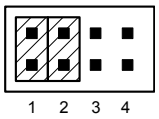
The wiring diagram for mode 3 is shown below:

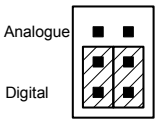



*Note: Contacts shown in gray are not normally used, but they will be read by the encoder if they are present.*

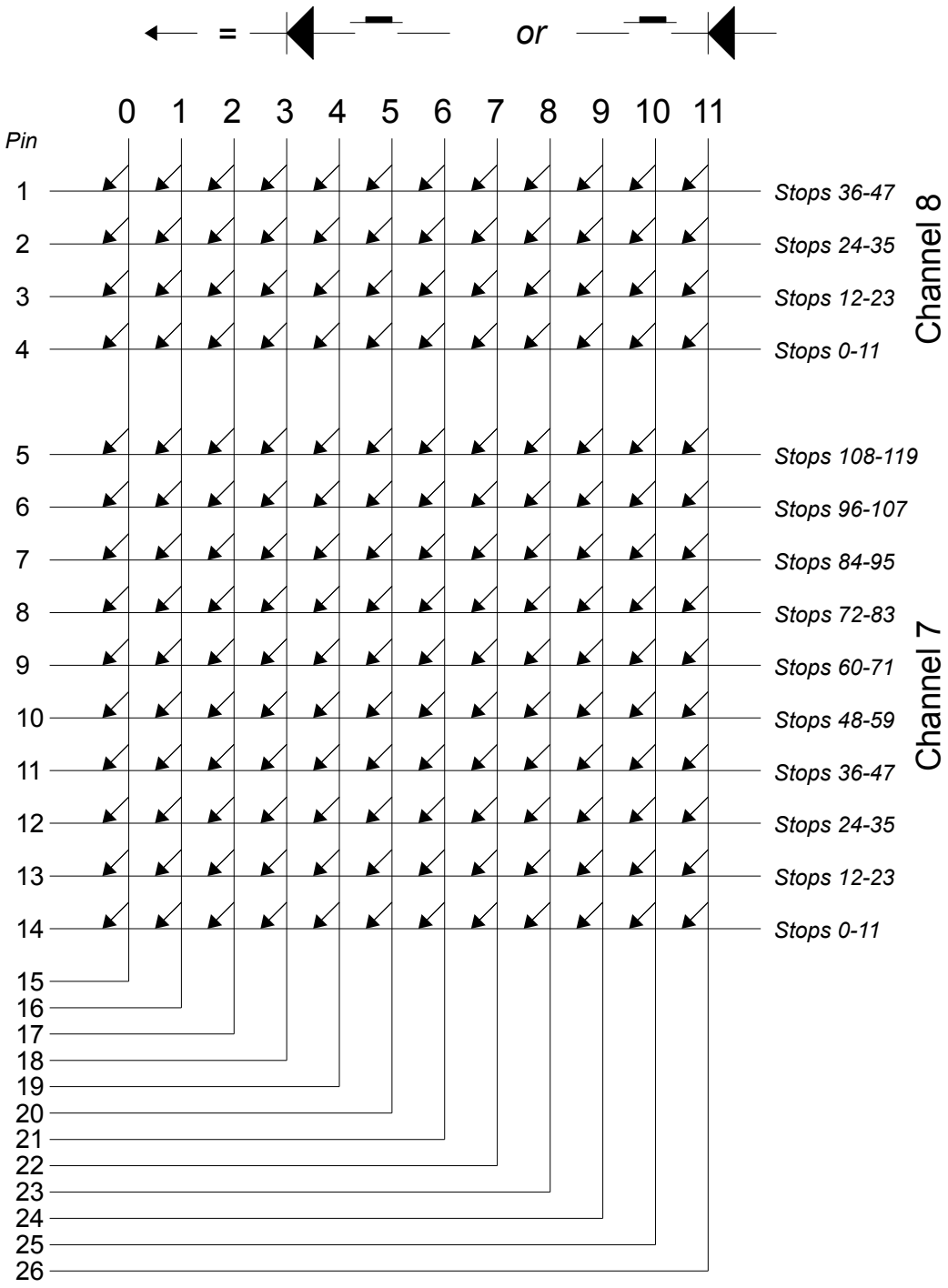
Mode 4:  Stops

To select mode 4, connect jumpers on Mode Select as shown below.  The jumpers on Analog Select should be set to "Digital".



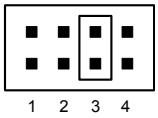



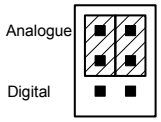

*Mode 4 wiring diagram:*



Mode 5:  Manual and pedalboard, both with combination pistons, plus expression

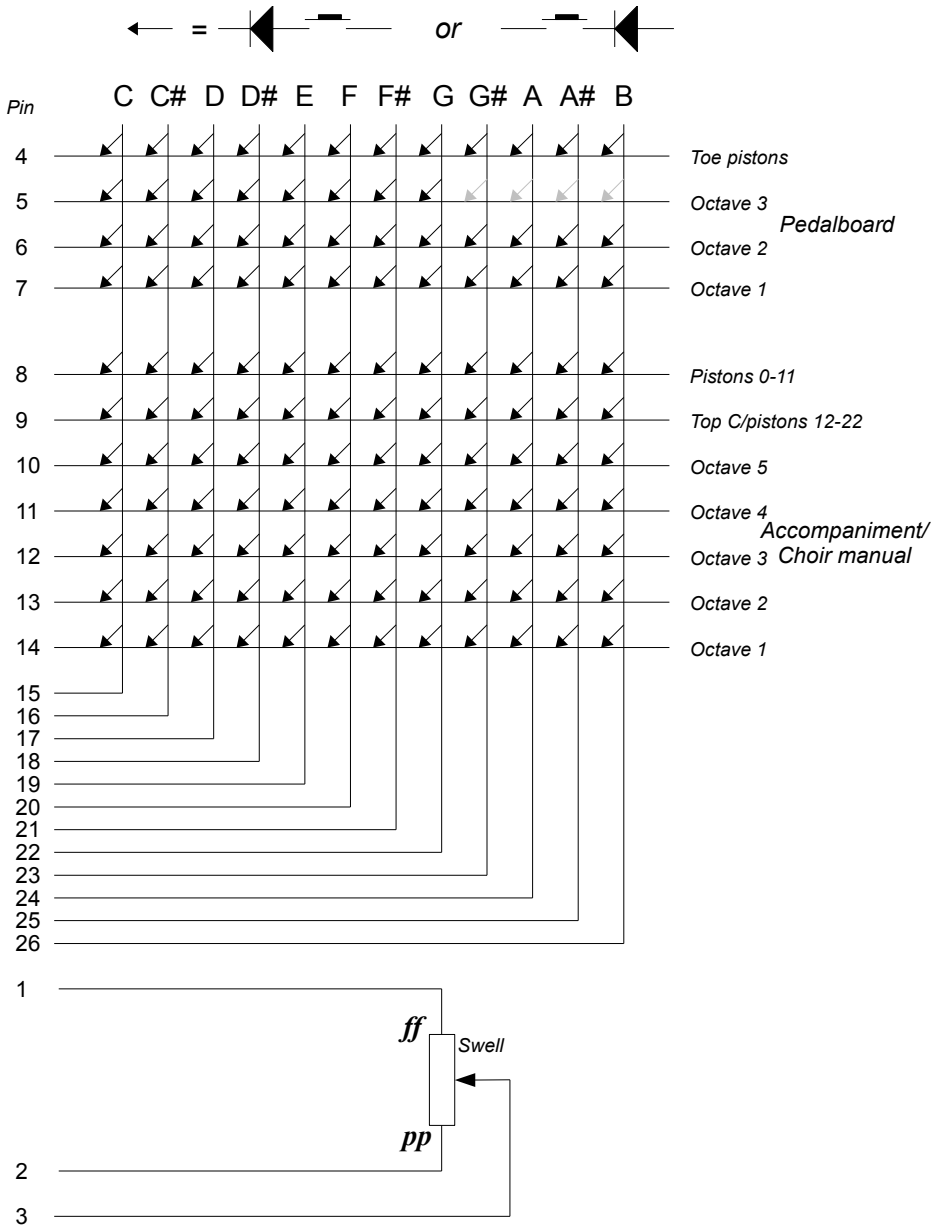
To select mode 5, connect a jumper on Mode Select as shown below.  The jumpers on Analog Select should be set to "Analog".




If you are not using the expression pedal, then its input (pin 3) should be connected to ground (pin 2).  Failure to do this will cause the board to "see" the expression pedal constantly moving, and generate a corresponding stream of MIDI messages.

The wiring diagram for pin 5 is shown below.

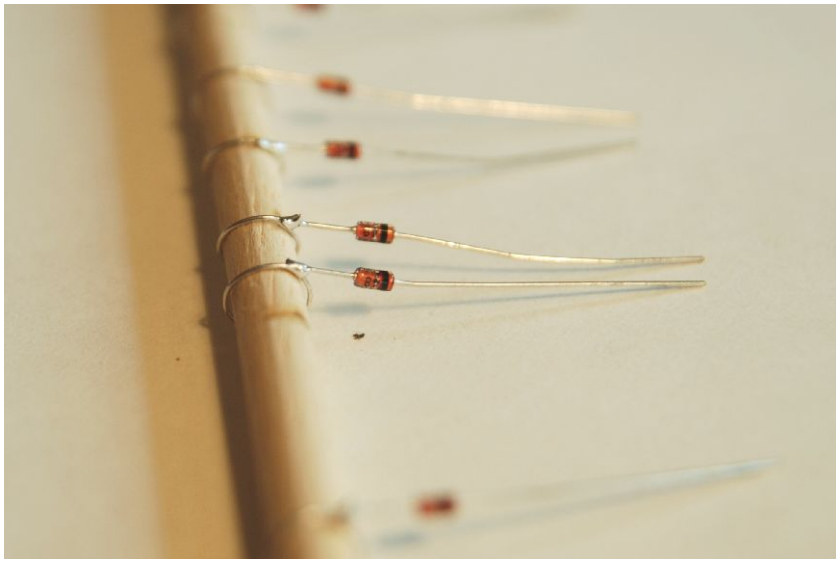



*Note: Contacts shown in gray are not normally used, but they will be read by the encoder if they are present.*

Appendix:  Wiring keyboards

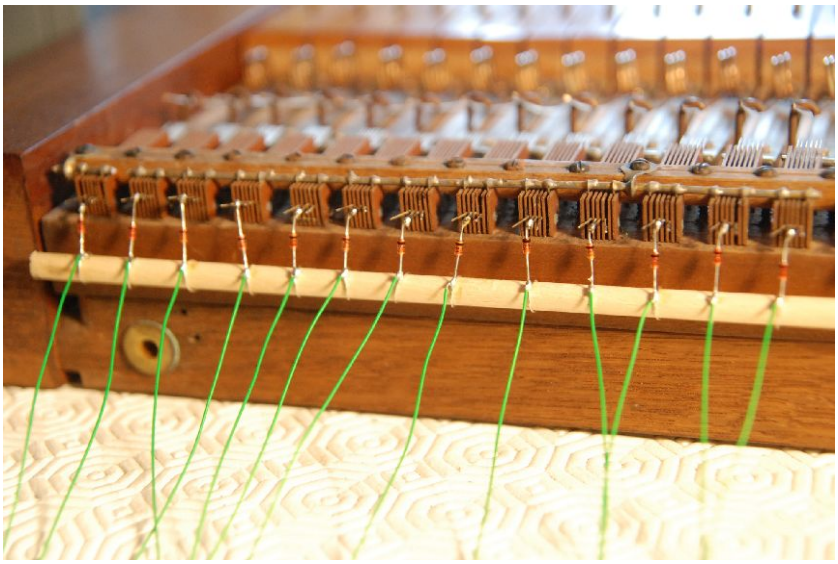
The matrix scanning approach used by this product greatly reduces the number of circuit boards required to read all the inputs on a typical organ console.  However, in order to ensure neatness and ease of maintenance, the task of wiring the keys needs to be approached methodically.

We have found the following to be a good way to go about wiring an organ keyboard.  As described above, you will need a signal diode, such as 1N4148, for each contact.  We also recommend using a length of 1/4" diameter dowel, equal in length to the width of the keyboard.  Loop the anodes of the diodes around the dowel as shown:



The ends should be soldered so that the loop cannot become undone.  Try not to wrap the anode lead too tightly around the dowel; you will find the next step much easier if you can slide the diodes along the dowel without too much resistance.

Next, position the dowel slightly below the contacts and solder each contact in turn to a diode cathode. Solder a length of wire (approximately 8”, i.e. slightly more than the length of one octave on the keyboard) to each anode as shown:



Next, solder each wire to the diode twelve positions to the right of it. In this way, you join up all the C's, all the C#'s, and so on.

This step completes the “columns” of the matrix scanner. Next, you should form the “rows” by connecting all the notes on the bottom octave, then all the notes on the next octave up, and so on. On our keyboard, there was already a bus running across all 61 notes. You can see in the photograph how we cut this bus to form five one-octave sections, plus an additional “row” for top C.