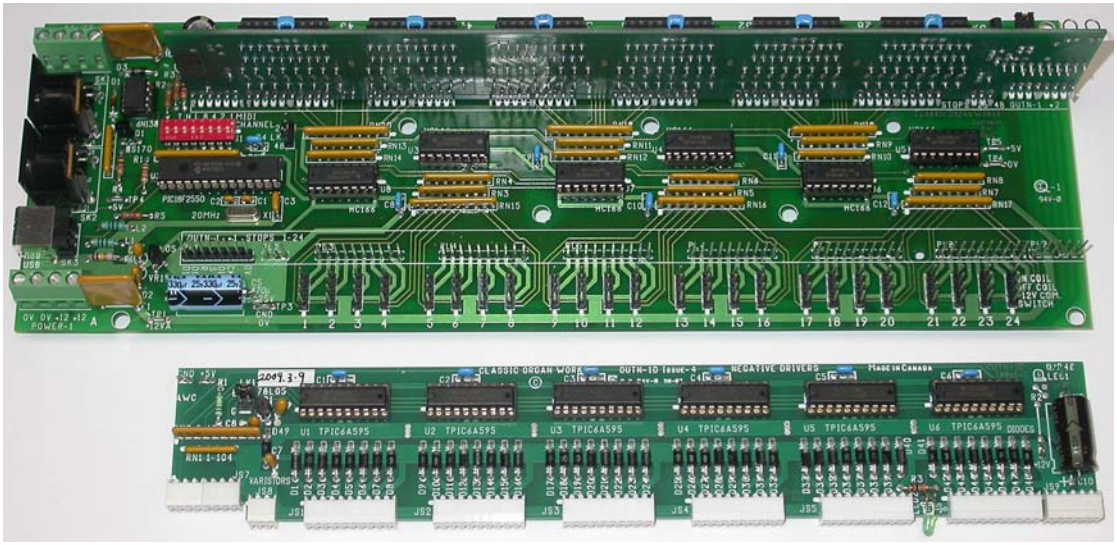
MIDI DRAWKNOB CONTROLLER
MDKC-1

INSTALLATION



Description

The MDKC-1 MIDI Drawknob Controller board is a unit that can control up to 48 dual-magnetic stops and these may be drawknobs, tongue tabs or tilt-tabs (rockers). It generates a MIDI signal from the stop switches to control an organ system such as Hauptwerk, although it could be used to control almost anything via MIDI note-on/off (Patch) messages.

The MDKC-1 is basically a small mother board that accepts two standard OUTN-1 negative-driver boards that each can handle 24 stops. The board contains an input shift register for the 48 stop switches and all the necessary controls for USB, MIDI, etc. The switch addressing creates up to 48 Note-On messages that are sent on one MIDI channel. Two DIP-Switch sections are used to select three banks so that boards can be cascaded for stops 1-48, 49-96 or 97-128.

Each stop is plugged into the mother board via a four-pin connector so it is easy to re-arrange the stop order or to cross-plug them to locate stop faults.

The On and Off stop coils are each driven with a pulse of typically 250 milli-sec (but never together). When not being activated, there is no current taken by the coils and the MDKC-1 takes only a few milli-Amps quiescent current. Furthermore, if stops are commanded to move but are already in the proper position (as determined by the switch), they are not activated, thus saving power.

A self-test/calibration mode is included that sets the optimum pulse duration for each stop to overcome sluggish stop actions. Omitted stops are ignored.

The output pins are spaced to match an OUTT-1 LED board and this may be plugged onto the pins on the underside of the MDKC-1 board to check the outputs while the OUTN-1 boards are in place.

Connection to the organ system computer is by bi-directional USB and this controls the dual-magnetic stop coils from whatever the switches are controlling, thus giving fool-proof indication that something happened. The board will not work unless USB is connected.

The 48 stop-coil actions use data returned from the controlled system as a MIDI-format signal on the same channel as the switches and use the same codes as the switches. The MIDI IN and OUT connectors allow another MIDI device such as a CMK keyboard to also control the computer (via USB) or be controlled from it (such as a display).

MOUNTING

Mounting holes are provided for eight #4 screws that pass through swaged non-threaded spacers to space the board up from the mounting surface. There are so many in order to prevent the board from flexing unduly as stops or boards are plugged/unplugged. These spacers also protect the various pins that project beneath the board. While these pins are not normally used, they can be used to operate an OUTT-1 LED test board. The MDKC-1 board should be mounted reasonably close to the stops so that all connections can be easily made. It is not necessary to provide ventilation as the board consumes little power.

CONNECTIONS

Power

No power is necessary other than the console switched +12V. However, this should be capable of driving all stops simultaneously – typically a peak current of 0.5 Amp per stop. There are two terminal blocks on the MDKC-1 because the total peak current could be as high as 24 Amps, which exceeds the current capacity of normal terminal strips. Each terminal block is independently fused at 6 Amps continuous (12 Amps Peak). In order not to cause undue voltage drops, each of these terminals should be wired independently and directly to the power supply. DO NOT simply parallel them into one thick wire or loop from one to the other. Each has two pins for each rail voltage to allow two thinner wires to be used. (The two inputs are dioded together on the board to run the logic circuitry that takes only a small current).

Output boards

Two standard OUTN-1 driver boards can be plugged into the MDKC-1 if up to 48 stops are to be controlled. When plugging in an OUTN-1 board, be sure that the LED (if fitted) between connectors is aligned with the hole in the MDKC-1 board and make sure that Link -1 on each OUTN-1 board is set to 'E'.

If both OUTN-1 boards are to be used, ensure that the MDKC-1 link is set to 48. If 24 outputs or fewer per board, omit the second board (25-48) and put the link to 24.

Components for the unused outputs may, or may not, also be omitted. For the 24-output version, there is no need to wire the input power to Terminal Block-2 if it is fitted.

Stops

Each stop should be wired to a four-pin socket that plugs into the board in one of 48 places. The connection contains the Stop Switch on pin-1, On coil to pin-4, Off coil to pin-3 and a common +12V on pin-2. There is no harm in moving these sockets while the power is on. The recommended cable connectors are polarised to prevent reversed plugging. Pin-1 (for the switch) is nearest the edge of the board. See page-4. Insulation-displacement connectors are preferred as the wires do not need to be stripped. 24 or 26AWG is sufficient.

MIDI/USB

If the DIP-Switch is changed to select a different MIDI channel, this will take effect immediately.

The main control of this board is via USB to/from the organ computer. The MIDI IN and OUT are used only if another device, such as a CMK keyboard, is to also control the computer.

Optional: Connect the MIDI OUT of the additional system to the MIDI IN of the MDKC-1 so that it can send data, using a standard 5-pin DIN MIDI cable.

Optional: Similarly connect MIDI OUT to the MIDI IN of the additional system so that it can receive return data.

SET-UP

On the eight-position DIP-Switch, switches 1-4 select the MIDI Channel as follows:

Channel (Binary)	Channel Number	Switch-4	Switch-3	Switch-2	Switch-1	Remarks
0	1	Off	Off	Off	Off	Default
1	2	Off	Off	Off	**On**	
2	3	Off	Off	**On**	Off	
3	4	Off	Off	**On**	**On**	
4	5	Off	**On**	Off	Off	
5	6	Off	**On**	Off	**On**	
6	7	Off	**On**	**On**	Off	
7	8	Off	**On**	**On**	**On**	
8	9	**On**	Off	Off	Off	
9	10	**On**	Off	Off	**On**	
10	11	**On**	Off	**On**	Off	
11	12	**On**	Off	**On**	**On**	
12	13	**On**	**On**	Off	Off	
13	14	**On**	**On**	Off	**On**	
14	15	**On**	**On**	**On**	Off	
15	16	**On**	**On**	**On**	**On**	

Note that the required number is greater by one than the actual MIDI channel binary code (as indicated by the switch positions where 0000 is for Channel-1, etc.). Switch-1 is nearest to the centre of the board.

Switch-5 is used to set the first and second bank. It should be Off for up to 48 stops and On for 49 to 96.

Switch-6 is used to set the third bank (with Switch-5). It should be Off for 1-96 and On for 97-128.

A two-position link selects stops 1-24 (or 49-72, or 97-120 for the third bank, if the second output board is omitted) or 1-48 (49-96, 97-128). Events beyond 128 are not generated so are ignored.

Switch-7 is for the Test/Calibration Mode. This automatically operates all the stop coils simultaneously to set the required pulse duration and possible repeat (to deal with sluggish stops). It does this by sensing the position of the stop switch and adjusting the pulse duration accordingly. Missing stops are ignored.

Switch-8 does nothing at this time.

A green 'Heartbeat' LED flashing every two seconds indicates that the board is operating normally. It flashes once per second during the Test/Calibration Mode, or twice a second if the board has not been calibrated. If flashing four times per second, it indicates that the USB is not operating or is not plugged in.

MIDI Messages:

Switch Output:

A Tab-On gives (Bn 51 xx), where 'n' is the Channel (0 to 15, 0-Fh) and 'xx' is the stop tab number from 0 to 127 (00-7Fh). Tab-Off gives (Bn 50 xx).

Coil Input:

Coil-On is (Bn 51 xx), where 'xx' is the stop number from 0 to 127 (00-7Fh) and 'n' is the Channel (0 to 15, 0-Fh).

Coil-Off is (Bn 50 xx). **All-Stops-Off** uses (Bn 79 00) or (FF).

The coils are energised for approximately 250 msec only when a coil-on or coil-off message is first received. Repetitions are ignored.

You can observe these messages in Hex code (..h) on a Windows computer by using MIDI Medic, a free software program, downloadable from the Classic Organ website.

Calibrate (Test) Mode (DIP-Switch Section-7):

Since the action of the stop coils moves the stop switch, this gives a simple way to diagnose stop faults.

The Test/Calibrate mode, using DIP-Switch Section-7, first pulses all the stops On. After a pause to allow manual operation of a non-moving stop, it pulses them all Off. The action is once-only at power up if the DIP-Switch is set On first. Turning the switch Off or On when powered has no effect. Valid moving values are stored for normal use.

If some associated stop magnets do not operate, there will be a problem with their magnets or with the source driving the magnets. If a switch is not operating (e.g., is Off all the time) the stop will move On but not Off. Conversely, if the switch is On all the time, the stop can go Off but will not go On. This could mean that the switch needs adjustment or is perhaps not connected or is shorted. It could also mean that the stop connector is reversed.

Under these conditions, the MDKC-1 will vary the pulses to the coils either by altering their duration or by repeating them. It then stores the new values. If, after several tries, the stop did not respond, the system abandons it, leaving the original values. Thus absent stops are ignored. Stops that work in one direction only will be correctly set for that direction. When fixed for the other direction, simply re-calibrate.

Diagnoses without using the Test Mode:

Polarised four-pin stop headers are used. If a stop connection is reversed by mis-wiring the header in reverse, the following will be noticed:

1. The switch will effectively be On (through both coils in series).
2. The Off coil may be continuously energised but only if the OUTN-1 Off output is turned on. There should be little or no physical resistance to manually turning on the stop.
3. Turning the stop on manually will have no effect. All it does is to apply the +12V to the On output of the OUTN-1 but that is not normally turned on.

A first test is to have the organ powered with all stops off while plugging in the stop connectors. No stop on the organ should turn on. If it does, it indicates that the stop switch is on, possibly via both coils in series due to a reversed stop connector.

Another check is to move all stops to the On position before applying the power. Any that move off might be mis-plugged and should be checked immediately.

If the Test-Mode indicates that the Off coil works but that the switch is stuck on, it is possible that the stop connector is reversed.

If the system controls each stop satisfactorily but they do not move properly at the same time under normal conditions when all may be required to move, such as a General Cancel, the likely cause is that the power supply has insufficient reserve. It needs to be able to supply typically a ½-Amp per stop. A regulated supply is best but an unregulated one will be alright if a large capacitor is used as a reservoir.

Typical Stop connections:

Make (MDKC-1 Pin)	*Switch (Brown 1)*	*+12V Common (Red 2)*	*Off Coil (Orange 3)*	*On Coil (Yellow 4)*	*Not Used*	*Remarks*
Klann DK56 Drawknob	1	2, 5	4	3		Join 2 to 5
Harris Drawknob, 5-pin, Std.	5	3	1	2	4	
Harris Drawknob, 5-pin, Classic	4	3, 5	1	2		Join 3 to 5
Harris Tilt-tab, 5-pin	5	3	1	2	4	Needs 0V to pin-4
Harris Drawknob, 9-pin, Std.	9	5, 6	1, 2	3	4, 7, 8	
Harris Drawknob, 9-pin, Classic	7	5, 6, 9	1, 2	3	4, 8	Join 5, 6, 9
Harris Tilt-tab, 9-pin, Std.	9	5, 6	1, 2	3	4, 7, 8	Needs 0V to pin-7
Kimber-Allen Drawknob, 7-pin	5	3, 4	1	2	6, 7	Join 3, 4
OSI Tilt-tab, 8-pin	8	1, 7	5	3	4, 6	Join 1 to 7
Peterson Drawknob, 8-pin	8	1, 6	5	3	2, 4, 7	Join 1 to 6
Peterson Tilt-tab, 8-pin	8	1, 6	5	3	2, 4, 7	Join 1 to 6
Syndyne Drawknob, 6-pin	3	1, 4	5	2	6	Join 1 to 4
Syndyne Tilt Tab, 8-pin	6	1, 8	5	3	2, 4, 7	Join 1 to 8