

Installation Tubbutec uniMatrix for PPG 360A.

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Introduction:

The instructions for the uniMatrix are based on the installation of the **uniMatrix** into a **PPG Wave Computer 360A** from 1980. The uniMatrix enables precise and stable control of the PPG via MIDI. The latency is determined by the speed of the PPG's own keyboard query and not by the MIDI interface itself.

Please check whether your PPG 360A is identical to the reference model you are using. The "360" was PPG's first digital synthesizer and was built in small numbers with constant changes. Significant improvements or extensions were made from version 360 to 360A, but also within a series. There is a 360A with and without a tape connection for saving program data.

Depending on the variant presented, installing the uniMatrix requires more or less experience in using a soldering iron as well as electronic knowledge. If in doubt, installation should be carried out by qualified personnel.

The PPG 360 is considered to be sensitive to interference with the digital control signals, which are transmitted via a large number of logic components of the so-called 74xx series. The PPG 360 has only one central processor (MC6802P). Everything comes together here, from the keyboard query, the query of the control panel to the control of the hybrid sound generation. Timing problems caused by interference from the many logic components in the periphery were therefore eliminated, for example, by subsequently installing interference suppression capacitors or flip-flops.

It is therefore recommended that the uniMatrix MIDI interface be installed reversibly. This means that the uniMatrix connections are not soldered directly onto a PPG board or that the cables on the boards are not cut, but rather adapter cables or, in the most advanced version, adapter boards are used. This means that the PPG can always be returned to its original state for testing purposes.

Description of the keyboard query

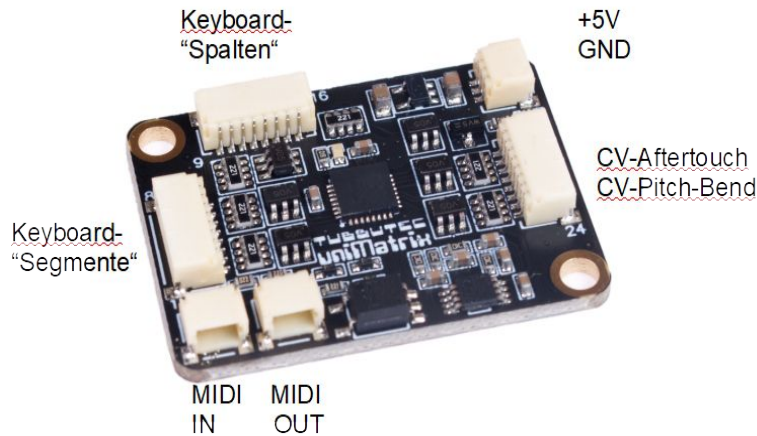
The PPG Wavecomputer 360A has a typical 8x8 matrix (8 segments / 8 columns) for keyboard query.

The internal keyboard has 61 keys, i.e. the lower 7 segments have 8 keys (columns) and the top segment has 5 keys.

Each segment is controlled by the PPG for about 20us. During this time, it is read which of the 8 keys (columns) in the segment are pressed. The segments are controlled one after the other in a fixed order (see details below). As the PPG only has one internal processor, it must also take on all other tasks between keyboard queries. The keyboard query cycle therefore only starts every 16

ms. A comparable latency can therefore be expected when controlling via MIDI. This has nothing to do with the speed of the interface, but simply with the "sluggishness" of the keyboard query in the PPG.

Necessary connections for the uniMatrix



The keyboard query as well as the evaluation of the aftertouch sensor and the pitch bend wheel of the PPG is carried out via the **I/O board**.

To connect the uniMatrix, connections to the I/O board for keyboard query and to the control panel for the aftertouch connection are necessary.

The necessary supply voltage of 5V (red cable) and GND (black cable) for the uniMatrix can also be tapped from the I/O board. Alternatively, the supply voltage can be tapped directly from the main board. See photo for examples.

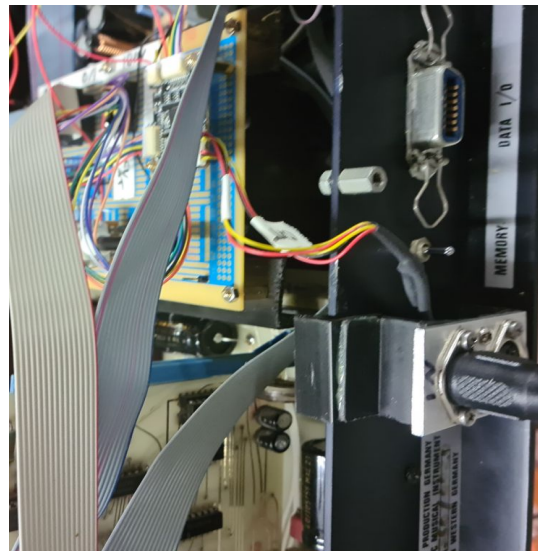
PHOTO FOLLOWS

Connection minimal version (MIDI Note on/Note off only):

A total of 16 connections are required for keyboard query (8 segments / 8 columns) and MIDI-Out.

connection MIDI jacks

There is a gap of around 10 mm between the back panel and the lid of the PPG 360A. This makes it easy to route the connecting cables for the MIDI sockets. This means that no hole needs to be drilled in the back panel of the PPG. A simple auxiliary construction (see drawing) can be removed at any time and still holds the MIDI sockets sufficiently firmly when the lid is closed.

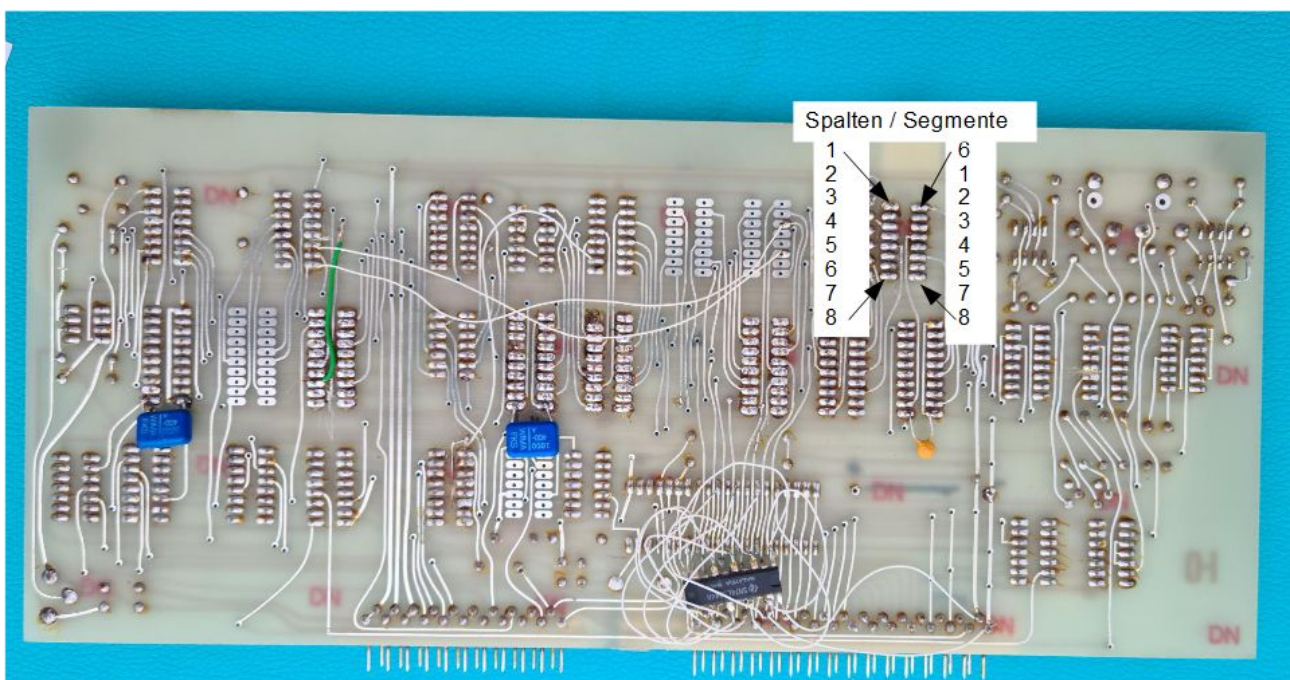


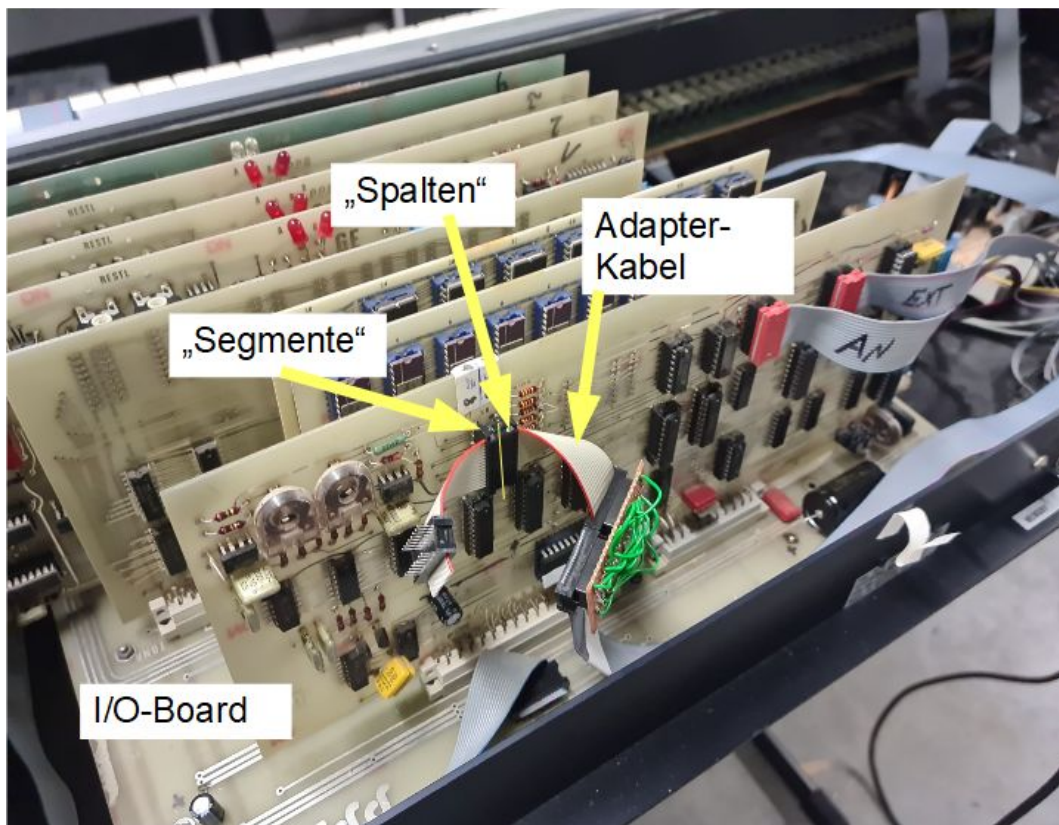
Connection keyboard query (description variant A)

The PPG's internal keyboard is connected to the PPG's I/O board via a 16-pin ribbon cable. The I/O board - for input/output - is the rear board in the PPG.

The 16-pin cable is connected via a DIL-16 connector. The I/O board has a DIL-16 IC socket into which the connector is plugged. The IC socket is marked with "KB" for keyboard.

The uniMatrix can be soldered directly to the corresponding pins of the IC socket on the back. However, it is better to make an adapter cable so that nothing has to be changed on the I/O board. This allows the uniMatrix to be connected to the additional DIL-16 connector at the end of the adapter cable.





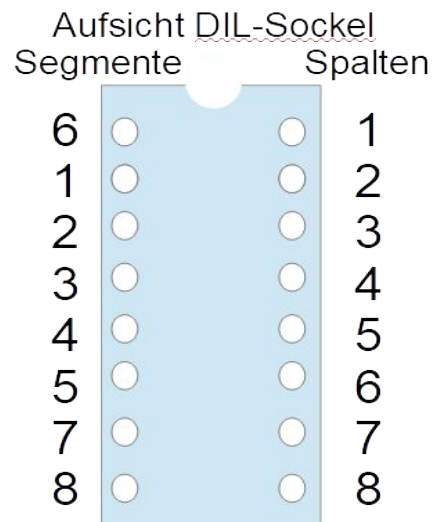
If you look at the built-in I/O board from above, the left side of the socket is for the connections of the 8 segment controls. These are pins 1-8 of the IC socket.

On the right side, the 8 "columns" of the active segment are read out. These are pins 9 – 16 of the IC socket.

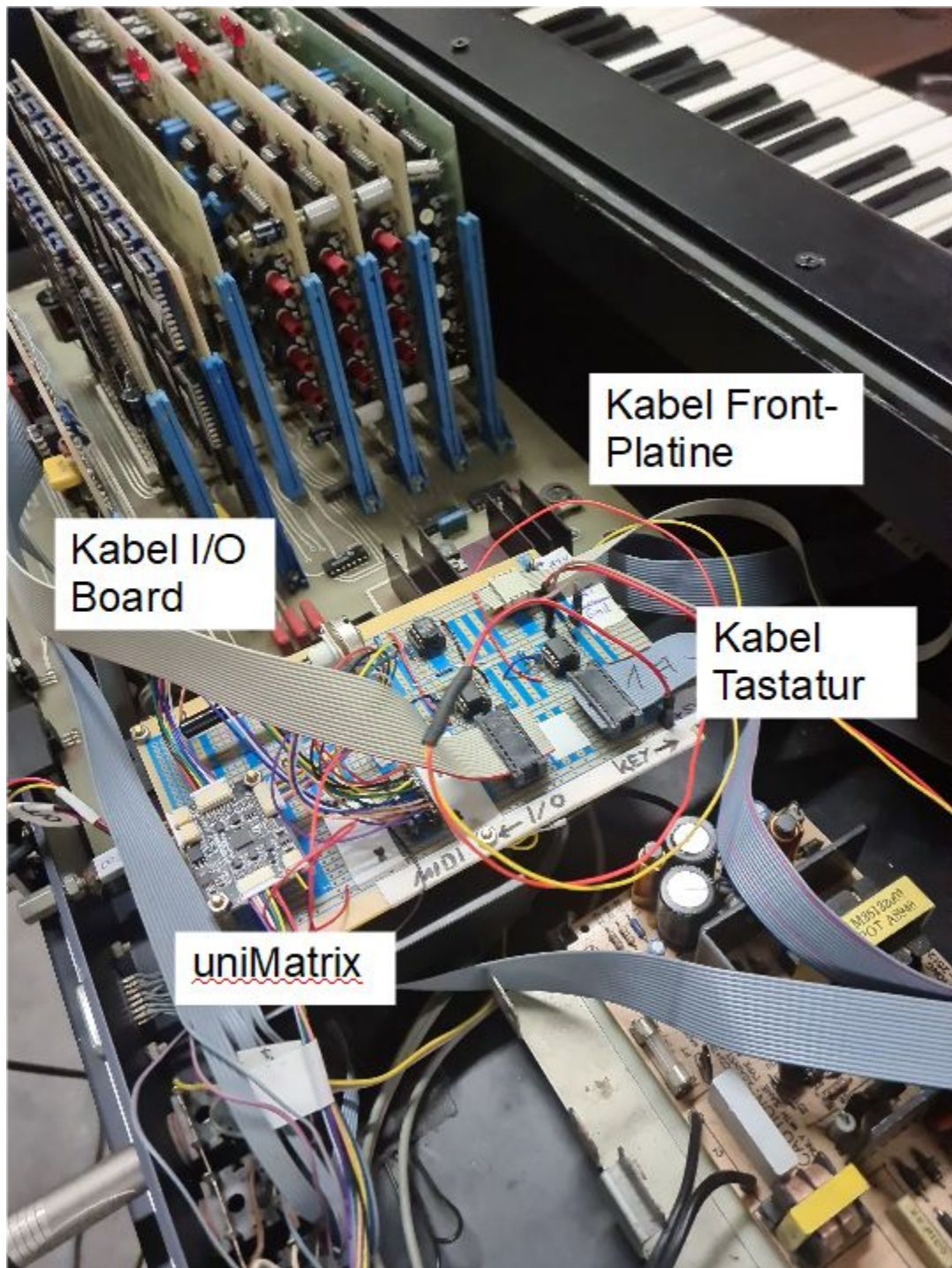
Attention: please check whether the IC socket is soldered in as described. Pin 1 is at the top left.

The order of the segments on the keyboard does not correspond to the order of the pins on the IC socket. This must be taken into account when soldering the uniMatrix cables or corrected accordingly in the configuration.

The IC socket layout is as follows:



Expansion stage connection aftertouch / pitch bend (optional)



The PPG 360A has an aftertouch sensor and a pitch bend wheel. Both controllers generate an internal control voltage in the range 0 -12 V, which is regularly queried by the PPG processor. The respective control voltage is continuously present and is only passed on to the AD converter for query at certain times for a few microseconds via a demultiplexer circuit.

Since it is not technically possible to use an external control voltage (CV Out of the uniMatrix e.g.)

In order to apply the control voltage to the AD converter synchronously with the query of the respective value, the control voltage must be applied before the multiplexer. The PPG then carries out the synchronous query in the same way as with the internal control voltages.

The easiest way to connect the CV-Out of the uniMatrix is via the front panel circuit board. This is where you will not only find the analog sliders and buttons for the PPG parameters, but also where the signal from the aftertouch sensor and the pitch bend wheel is amplified and sent to the de-multiplexer. A 2-way op-amp of the LM458 type is used to amplify both signals.

Since the resolution of the two CV outputs of uniMatrix is relatively coarse due to the 7-bit data width of the MIDI protocol, MIDI control of the pitch wheel is not used. The internal voltage of the PPG, which is applied via the pitch wheel, is also used for the general tuning of all 8 VCOs. This can lead to mistuning if an external control signal changes the value. However, the aftertouch signal can also be used for pitch up or pitch down.

The aftertouch sensor in the PPG 360 reacts to changes in pressure after a key is struck. A control voltage that is already present before a key is struck or the "note on" command is taken as a reference and interpreted as aftertouch = 0.

As mentioned, the internal control voltage is in the range 0 V (no aftertouch) to 12 V (maximum pressure).

Since the CV output of the uniMatrix only covers a voltage range from 0 V to 12 V, the signal must be amplified to cover the full range of effects in the PPG.

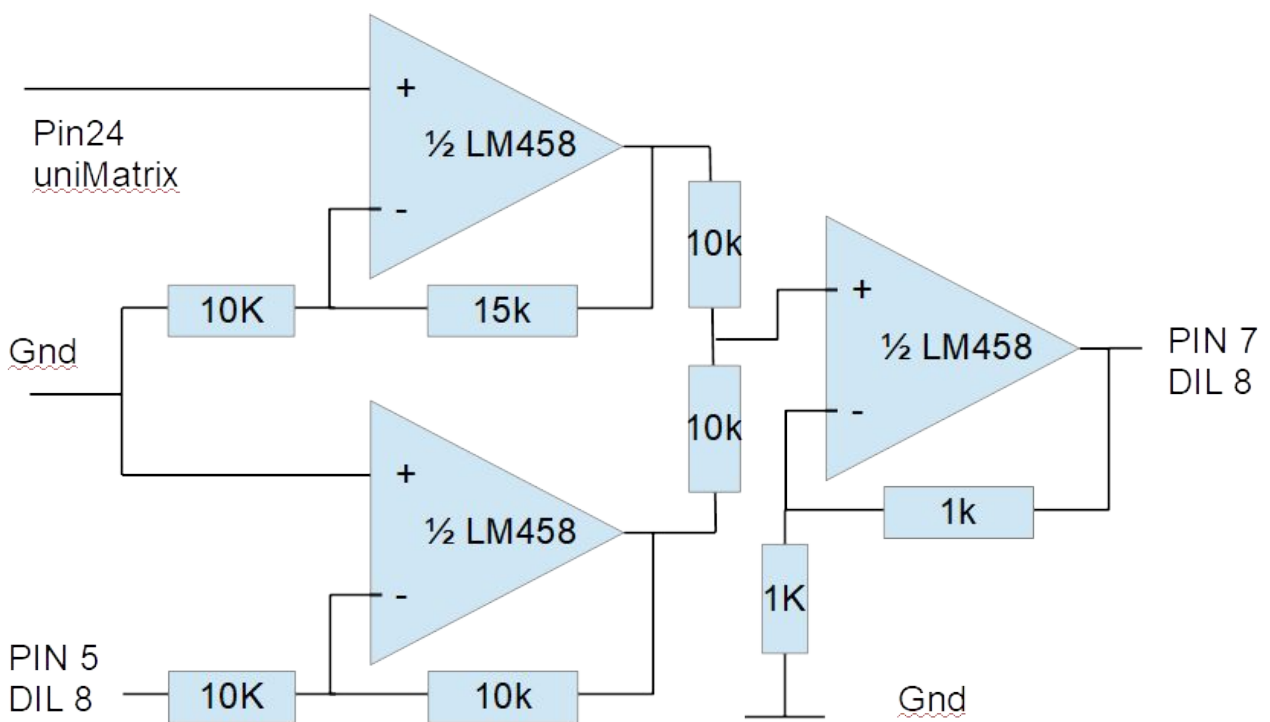
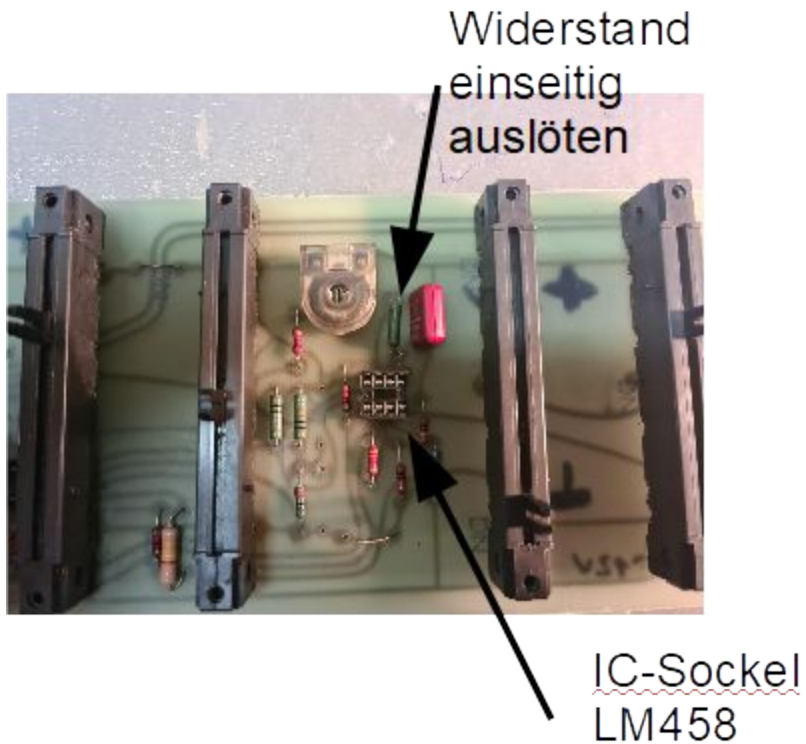
If the internal keyboard of the PPG and external control via MIDI are to be enabled at the same time, a summing circuit must also be installed.

Since the control voltages in uniMatrix are freely configurable, a modulation wheel can also be used as a MIDI source. This does not change anything in the circuit.

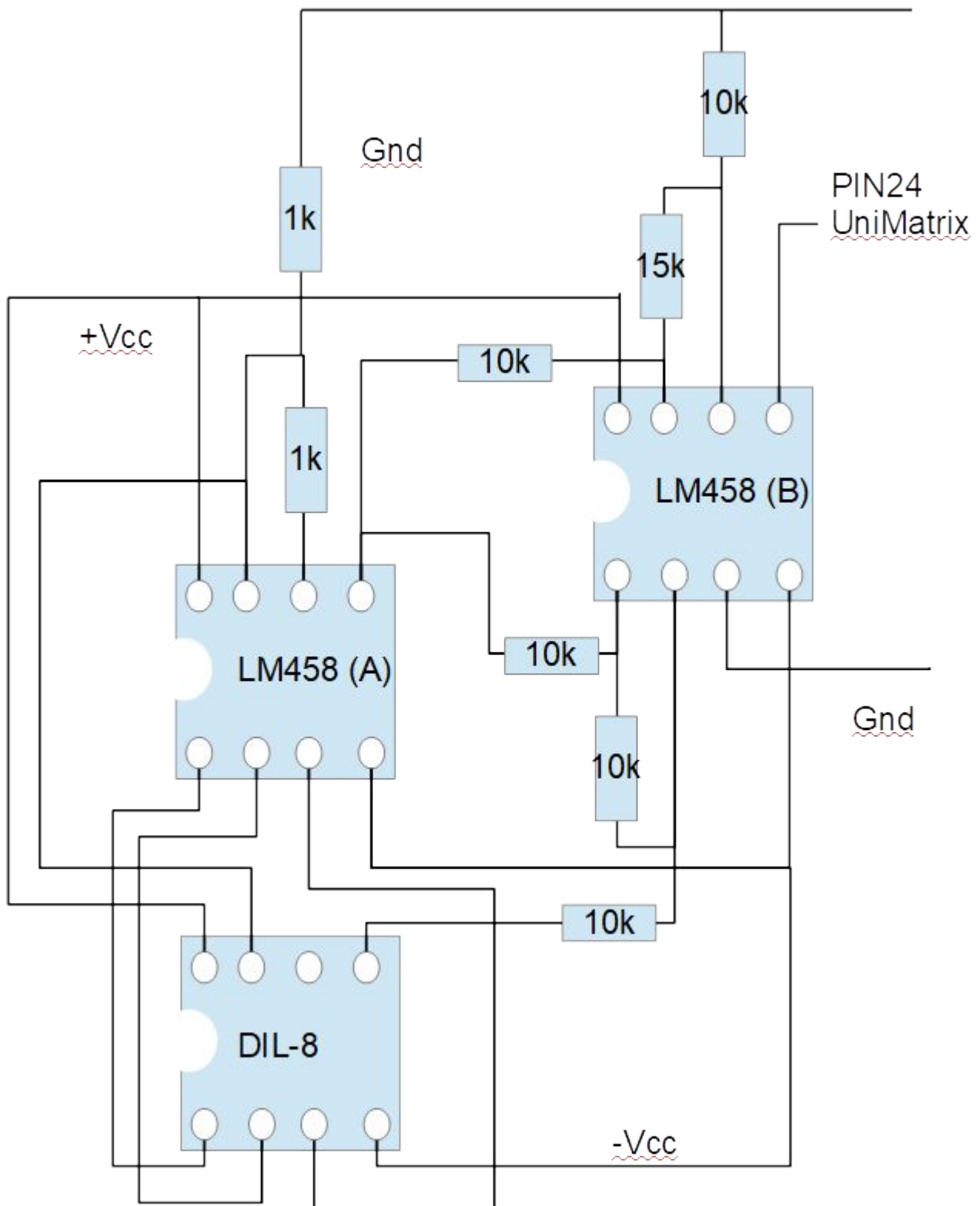
Since the CV output needs to be amplified and a summing circuit is required, it is recommended to put the keyboard query and CV control on an additional board. A circuit suggestion is included. There is enough space in the PPG to attach the additional board.

The proposal is based on removing the 2-way op-amp used in the PPG and plugging an adapter cable into the DIL-8 IC socket. This cable leads to the additional circuit board. This board now contains both the existing op-amp and the additional circuit for amplifying the CV-Out of the uniMatrix as well as the adder circuit for combining the internal control voltage and MIDI control voltage for the Aftertouch. The added control voltage is then fed back to the front panel circuit board via the adapter cable and periodically queried by the PPG without any changes.

Attention: it may be necessary to interrupt the connection between the op-amp output and the inverting input on the front panel board. After all, the control voltage generated on the adapter board is already "correct" and does not need to be processed again. There are different circuits depending on the aftertouch sensor installed in the PPG keyboard.



Circuit proposal for after-touch control. The 1/2 LM458 missing in the circuit still takes over the amplification of the signal for pitch bend/tune. The circuit for this is located on the analog panel of the PPG 360.



Suggestion for arranging the components on the adapter board. The analog panel is connected to the adapter board with an 8-pin ribbon cable and a DIL8 connector on each side. Plug the connector into the free DIL-8 IC socket. The voltages +Vcc and -Vcc are taken from the PPG 360 via pin 4 and pin 8 of the analog panel. Ground (Gnd) can be connected together with the ground for the uniMatrix.

uniMatrix configuration:

MIDI channel: as desired

Midi-Base Note: 32

Number of notes to populate: 61

Populate "FWD".

CV-Out 2: "Aftertouch" (or modulation CC=1)

Attention: if the connection cables 1-8 of the uniMatrix are connected to pins 1 to 8 in this order, the order of the segments in the configuration must be adjusted. Alternatively, the cables are soldered according to the instructions, then no adjustment in the configurator is necessary.