Cecilia Organ System
bare electronics module AEOS-unit3_0
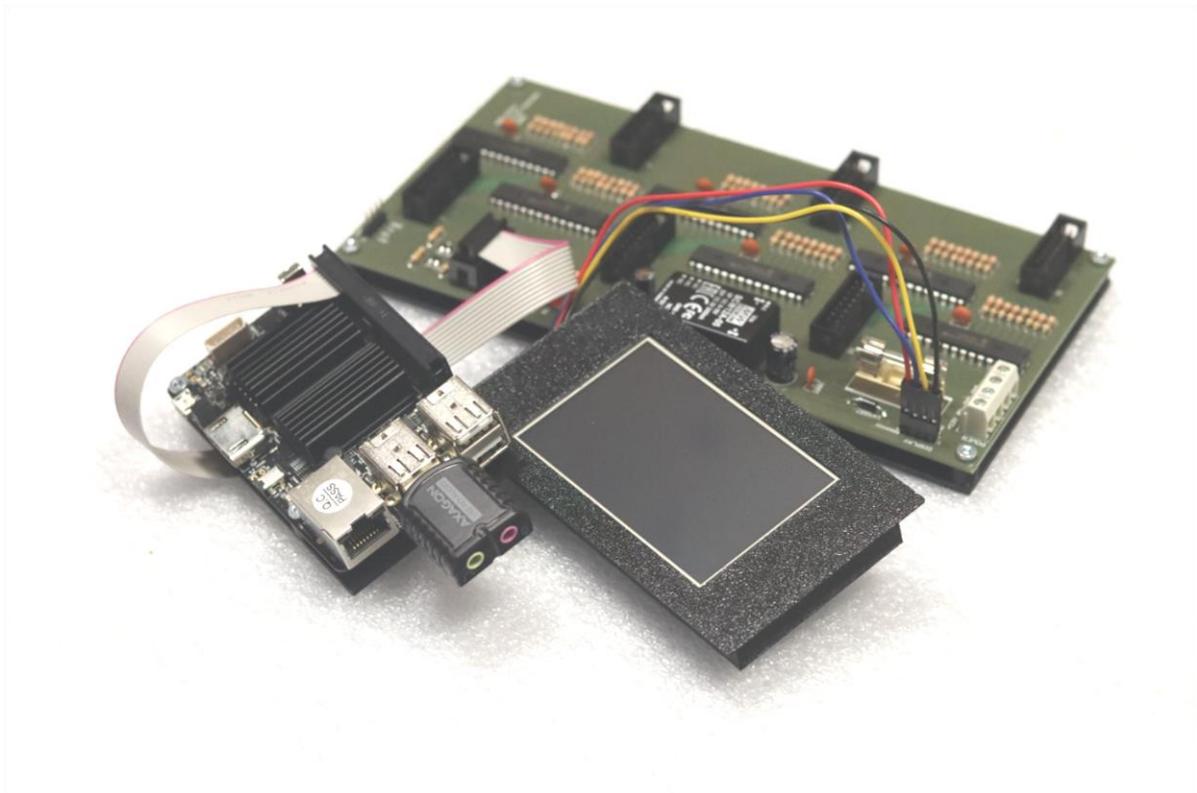
organ
MLNARIK

Dimensions for mounting cutout

55,00 mm

107,00 mm

Touch display

G
Rx
Tx
+5V

Stereo 3.5 audio out

USB audio card

4x USB

Microcomputer

120,00 mm

86,00 mm

57,00 mm

Power indication

G
Tx
Rx
+5V

DC + 9-18V
Power -
2x signal GND

DC/DC
converter

Microcomputer

33

17

1   2

16

Inputs

IDC 16pin headers

33

1 kΩ

5 V

17

out 1   out 2

48

16

Outputs

100,00 mm

195,00 mm

...

Inputs 1 - 48

...

LED outputs 1 - 48
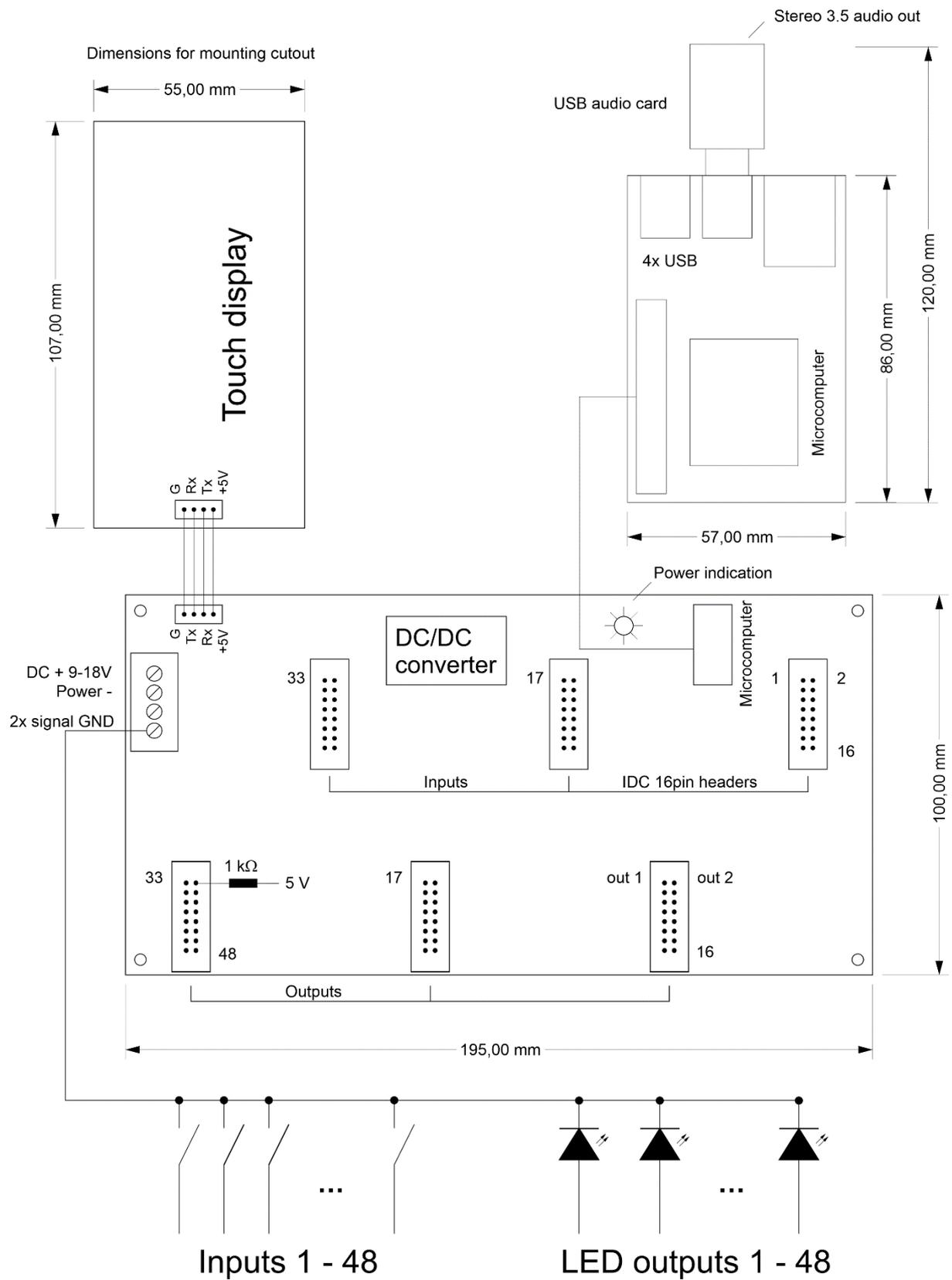
Description

The Cecilia Organ System is based on a universal MIDI organ expander module (hereinafter "*organ expander*"); in order to achieve a high degree of realism, the organ expander employs, when in operation, organ sound samples that have been recorded from real pipe organs. The number of stops differs according to which given sample-set is loaded into the organ expander. The organ expander is supplied as a compact unit that is equipped with 48 inputs and 48 outputs; these are provided via I/O ports. The inputs can be used to control stops or memories by employing mechanical switches (push buttons or on/off buttons), whereas the outputs are suitable for controlling an illumination of indication LEDs. Individual I/O ports function in a manner as defined by the user. The user can define the individual pins to control all I/O elements like stops, couplers, memories, pre-sets…

 All organ functions and control elements (stops, enclosures, memories, tremulants, and so forth) can be also controlled by using MIDI messages. These MIDI messages can be set easily and conveniently by the user via use of a touch display of the organ expander.

The organ expander employs highly stable proprietary software (Linux-based), providing rapid loading of sample-set data, as well as providing data memory retention of various user-definable operating parameters at switch-off. Moreover, the MIDI organ expander exhibits a low power dissipation, when in operation, of usually less than 10 Watts.

Technical parameters:
* 48 input pins, 48 output pins.
* Supply: DC 9-18 V/1 A.
* Extra galvanic isolation is utilized.
* Input MIDI IN: USB.
* 16bit/44100 Hz-sample-rate audio card is utilized.
* Audio output: stereo JACK 3.5.
* Polyphony: 600 parallel samples (sample-set dependent).
* Latency: <15 ms.
* Core firmware is saved on a read-only partition of the solid-state disc (SSD) card of the organ expander, thereby enabling the organ expander to be resistant to an incorrect power connection or an abrupt power disconnection (e. g. it can be encountered when the organ expander is incorporated into OEM digital organs). The software "*Power down*" is needed only when you change some properties, in order to be correctly saved for the next time.

Module functions:

* Stereo audio output total loudness/ volume setting; individual registers setting, and also individual pipes relative loudness/ volume.
* Maximum loudness/ volume limitation is safe (i.e. a limiting attenuation is automatically applied if a maximum dynamic range of the organ expander is likely to be exceeded, thereby avoiding signal clipping–effects, such as clipping in audio power amplifiers coupled to the organ expander).
* True tone height (pitch shift) setting is continually adjustable (+/- one semitone adjustment range).
* Transposition (+/-12 semitone adjustment range).
* Three types of tuning: equal, ¼ coma middle tone, young well-tempered tuning.
* Adjustable enhanced reverb model: there is an option available to use samples without naturally sampled release (i.e. dry samples); this allows external reverb modules to be employed, if desired.
* "Random tuning" – an arbitrary pitch deviation of virtual pipes - setting from their nominal values. It gives a more authentic sound, especially on a "whole organ" to provide a dense lush chorus of sound. During the switch on of the organ expander, the distribution of such deviations in each

sample-set change randomly within the given adjustable tolerance limits, thereby it provides variety occurring would occur in a true pipe organ as humidity and temperature change.

- "Pipe coupling" function: this is a unique and original approach only in our organ system. Every pipe is randomly pitch-shifted before every attack. After given time, this deviation disappears and pipes are "coupled" together. The effect is stronger for lower pipes and negligible at the highest frequencies (higher pipes). This makes the sound very live, pleasant and realistic.
- A "*dynamic wind pressure*" function is provided. It simulates wind pressure variations in a pipe organ wind supply system, wherein available wind chest pressure depends on how many pipes sound at any given time; particularly in a case of smaller pipe organs with modest wind supply systems. Smooth changes in pressure during organ play occur according to an actual air consumption by pipes, which results deviations of intonation. The organ expander contains an algorithm that simulates such a wind pressure variation phenomenon.
- Enclosures for all divisions are provided with adjustable parameters; this allows various "swell boxes" to be accurately simulated.
- Tremulant is provided with an adjustable period, an adjustable amplitude and an adjustable frequency response. Now, it is enhanced by randomisation of its period and phase shift for individual stops. Tremulant can be used in all divisions.
- 99 stops memories, with "*setzer*" for setting stop combinations to be invoked from manual thumb pistons, pedal pistons, etc.
- Programable pre-sets (fixed stop combinations like *Tutti, PP, mf*…).
- Programable stop crescendo.
- Automatic MIDI channels setting via an easy-to-use "*MIDI listen*" function.
- "*MIDI learn*" functions are provided for all stops, couplers, memories, tremulants, enclosures, or crescendo.
- Filtering of a given number of MIDI messages during "*MIDI learn*". It is convenient for digital organs sending some unwanted MIDI messages per one control element.
- Reset function allows restoration of manufacturer's initial settings; it is useful if an error occurs while setting up the organ expander and if original settings need to be reapplied.

System backup by using your own USB pen drive.

Connection and switching on/off

1. Connect earphones or amplifier to JACK 3.5 stereo audio output (on the external USB audio card) of the organ expander. The microcomputer of the organ expander has a galvanic isolated power amplifier; thus, when the amplifier is used, an effect of earth loop remains suppressed. (Note: the external USB audio card MUST remain connected to the microcontroller unit constantly during operation; disconnection of the USB audio card from the microcontroller unit when the organ expander is in operation may potentially cause device damage or data corruption. Without the USB audio card, software employed in the organ expander is not capable of working as intended).
2. Connect a USB/MIDI converter or another USB MIDI device to any USB connector on the microcomputer.
3. Connect some other MIDI device: it is possible to connect more MIDI devices (for example, stop controller...) through the USB. The organ expander provides automatic mixing of MIDI messages from a plurality of MIDI sources. The organ expander also supports "*hotplug*" operation (namely connecting of new MIDI device during operation of the organ expander).
4. Stops, couplers, memories and other on/off properties can be controlled via simple eternal switches, for example. Any individual input pin of input connector (IDC 16 header) can to be wired to a corresponding mechanical switch (momentary push button or on/off switch). For this organ expander, a maximum of 48 input positions are possible to accommodate.

5. To any given switch, it is possible to use simple indication LED's (48 outputs are provided for such purpose). This is useful when memories, pre-sets or crescendo are implemented. The unit contains inbuilt 1K resistors form 5V level, so common types of LEDs are possible to wire directly. Any output belongs to the input with the same pin number.

6. Switches and also LEDs are wired to common ground that must be connected to "signal GND" screw terminal (see a figure above). This ground is galvanically isolated from a power GND. Don't connect this signal ground to any other ground wires in your instrument.

7. The organ expander is conveniently powered from a *DC 9-18 V/2 A* power supply, for example operating power is conveniently delivered from a compact switch-mode power supply. After power is connected to the organ expander, a logo appears on the screen. The organ expander starts to load sound samples automatically within several seconds; progress loading the sound samples is indicated by the screen. After loading a given sound sample, a main screen appears on the display.

8. Now, in response to the main screen being displayed, it is time to match MIDI channels to the individual divisions (wind-chests) according to the used sample-set. Also, individual stops should be matched to specific MIDI controllers, if needed. This can be done via touch screen; a description of a corresponding procedure is provided in dedicated sections below.

The organ expander can be switched off by using a special "*switch off*" item in the menu. It is necessary after changing some values or properties in the MENU to be saved correctly. Even without changing anything, you are free to power off the module by disconnecting it from the power source. This way is safe.
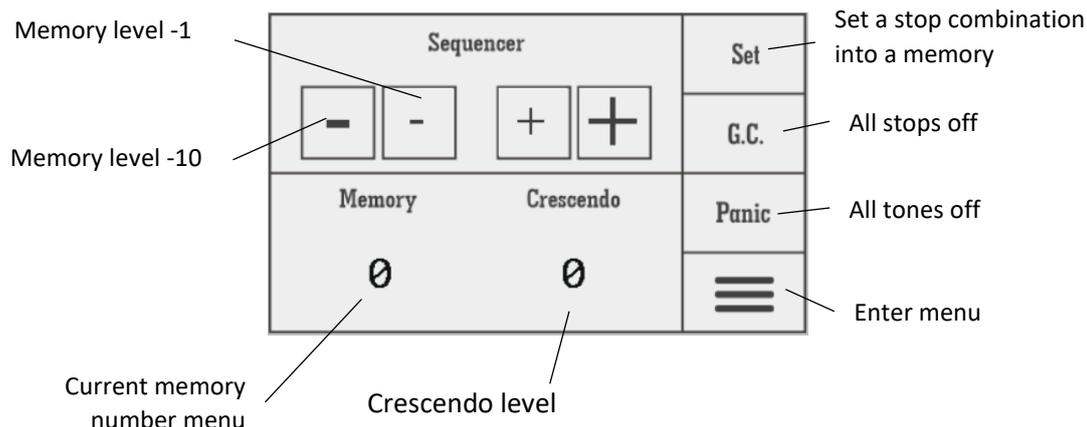
WARNING:

The organ expander unit should not be switched on without supervision; it is advised (as a precaution) to unplug the organ expander from its power supply after use.

Touch screen, description of functions

Main screen, stop memories (a sequencer)

- The stop memories appear after all samples are loaded; after loading samples, the organ expander is prepared and ready for the user to play.
- The MAIN screen is a main interface for working with stop memories (a sequencer). There are 100 memories in total. There is possible to map the complete sequencer (0-9, +-1, +-10, SET, G.C.) via switches or via MIDI directly from your MIDI console. Memory levels are represented by tens (10, 20, 30…) and can be switched by left/ right arrows in the main screen. Each stop combination can be saved into the memory. Just touch a "*Set*" button and press a desired memory button (0-7). Combinations set remain in the memories after powering down the organ expander.
- A general cancel (G.C.) button deactivates all active stops, and a "*Panic*" button deactivates all sounding tones (important if a problem with a MIDI connection occurs; although MIDI is usually extremely reliable, data glitches can occur, especially in electrical noisy environments).
- The main menu is accessible from the main screen.

Memory level -1

Memory level -10

Sequencer

Set — Set a stop combination into a memory

G.C. — All stops off

Memory   Crescendo

Panic — All tones off

≡ — Enter menu

Current memory number menu

Crescendo level

Main menu items

- The main menu consists of three screens, wherein various buttons are provided for a user to select preferred user-definable settings.
- "Turn off" button: use this button to switch off the organ expander safely, namely to avoid any loss of data. Unplug the organ expander once you are prompted by a message on the screen (the message informs you to save all the recorded data). You can set many properties at the same time (i.e. concurrently), but after finishing, please use "*Turn off*" to save your current settings permanently.
- A "*Volume*" button: this button should be used to set total loudness, as well as loudness of individual stops and individual pipes.
- A "*Pitch*" button: this button should be used for setting of the pitch of total tuning in cent units (in range of -99 to +99).
- A "*Transp.*" button: this button should be used for setting transposition of the organ expander (in a range of -12 to +12 semitones).
- A "*Reverb*" button: this button should be used to set a level of reverberation. There are three parameters: "*Room size*" – the basic parameter (set 0 to deactivate reverb completely). "*Damping*" parameter that simulates sound reflexions by the room damping – especially damping of high frequencies, and "*Dry level*". The last parameter controls amount of the original sound that does not go into the reverb algorithm.

  NOTE: Deactivation of the reverb is convenient if the organ expander is used for acoustic environments having good natural acoustical properties.
- A "*Midi*" button: this button is a very important menu item. MIDI channels for the divisions (wind-chests) are set here, using the "*Midi*" button. Moreover, the button also enables matching many other controllers to MIDI events; a more detailed description is provided below.
- A "*Temper*" button: this button should be used to set a temperament system (equal, ¼ coma middle tone, young well-tempered) employed into the organ expander.
- An "*Enclose*" button: this button allows user-setting enclosures, for example for implementing "swell" boxes that for example allow volume adjusting by using a pivotal "swell pedal". The organ expander supports enclosures for all wind-chests (but typically, the enclosure is set only for the second manual). The loudness level can be set when the enclosure is closed and also while high frequencies damping (typical for real enclosure; high frequencies are damped relatively more when the swell box is closed, instead of when the swell box is open).
- A "*Tremul*" button: this button allows user to set tremulant parameters. The number of tremulants accommodated depends on the specific sample-set that is employed. The user can adjust a tremulant period (tremulant rate), an amplitude (tremulant depth) and frequency response of the tremulant effect (tremulant frequency shift). Moreover, there are also two "random" parameters

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to make the tremulant model more realistic: "*Frequency random*" to set random tremulant frequency and "*Phase random*" to set random phase shift between individual stops.

- A "*Presets*" button: here the user can build own pre-sets (fixed stop combinations), set stops in pedal when using "*Pianopedal*" function and finally can set combinations in crescendo; more detailed description is provided below.
- A "*Switches*" button: the user can set individual switches of the *Cecilia module* flexibly. In this case, it is possible to change layout of all control elements such as stops, automatic couplers, pianopedal; more detailed description is provided below.
- An "*Advanced*" button: there is possible to adjust more advanced sound models like tuning randomization, pipe coupling model and dynamic pressure model; more detailed description is provided below.
- A "*System*" button: the user can restore original factory settings, namely cause a reset of parameters to default values. It is feasible to restore MIDI events (all previously paired MIDI messages for wind-chests, stops, enclosures are cleared when "*Restore MIDI*" is invoked), sound properties (all properties other than MIDI) and also the original layout of the switches. Moreover, there is a wizard for making a backup of the whole system and a screen with system information.
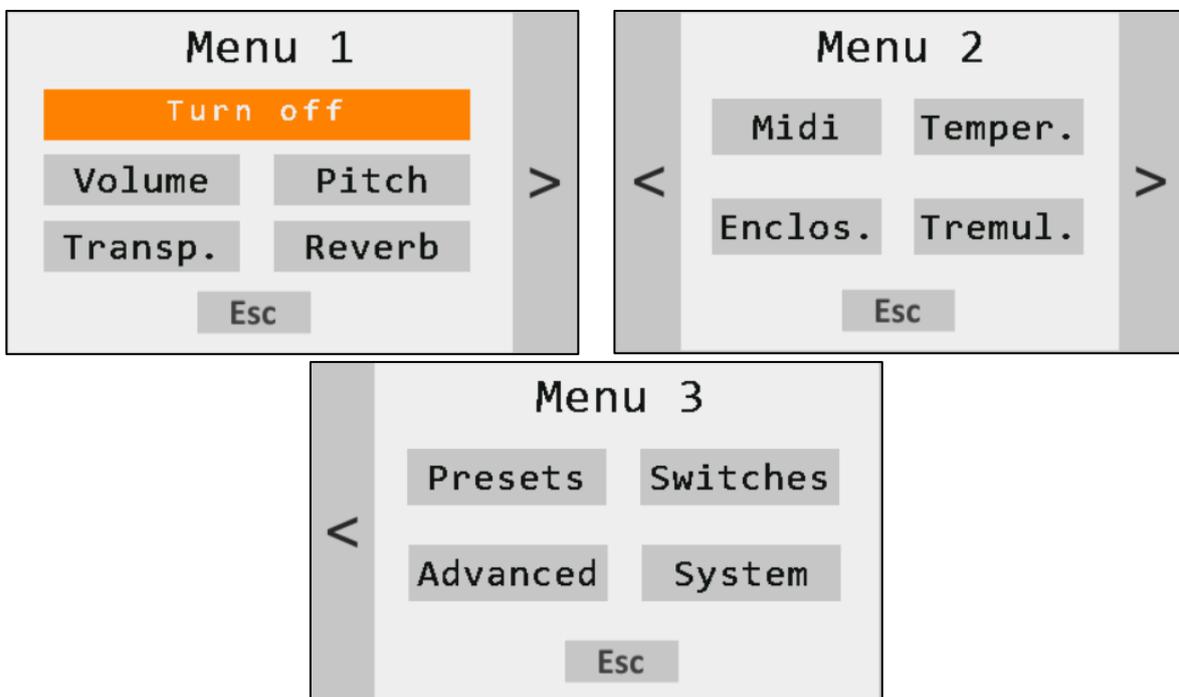

Working with individual properties (total loudness setting)

A majority of the sound properties are accessible via simple screens that are quite similar to each other ("*Master volume*" setting as the example in the figure below) that are presented on the screen. There is a slider provided for implementing fast changes as well as two buttons provided for implementing fine changing of a given property. Sometimes there are right/ left arrows to roll submenu items. In advance, a "*Master volume*" screen, which also has an indicator for showing total sound level, is provided. While playing the organ expander, this indicator should remain under the top line, namely not to reach amplitude limitation that risks cause of audio clipping or saturation effects.

Level indicator

Fast change

Roll the submenu

Back to the Menu

Fine change

Master volume (%)

50

− − + +

Esc
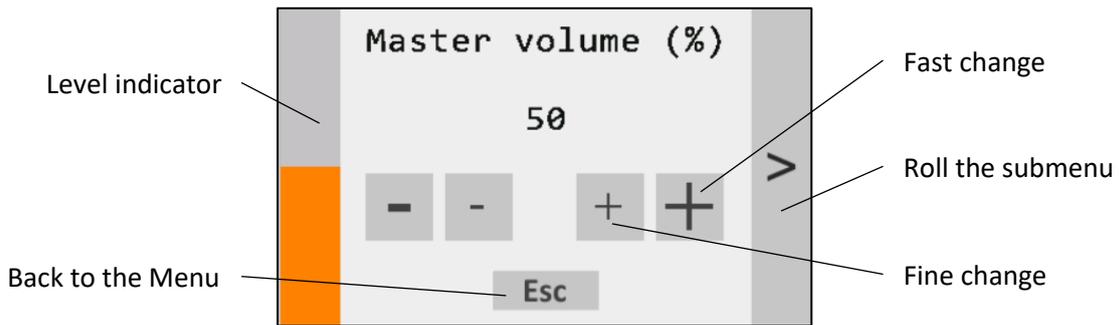
Properties of individual stops

Some properties belong to individual stops (e. g. stop volume, MIDI messages…). In this case, menu screens are provided on the screen which contains scrolling lists of all stops according to the given loaded sample-set.

Stops volume

< 1: Principal 8 >

< >

− − 100 + +

Esc

Particular stop name

Roll through stops
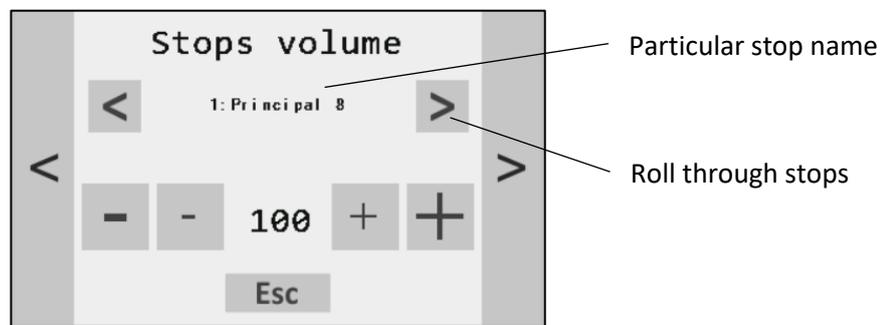
Properties of individual pipes

Especially volume can be set for individual virtual pipes and be adjusted with the pipe set into a particular stop and the tone index. Numbering stars is typically from the lowest C (C has index 0, C# has index 1…).

Pipes volume

< 1: Principal 8 >

< 0 >

− − 100 + +

Esc

Particular stop name

Particular tone index
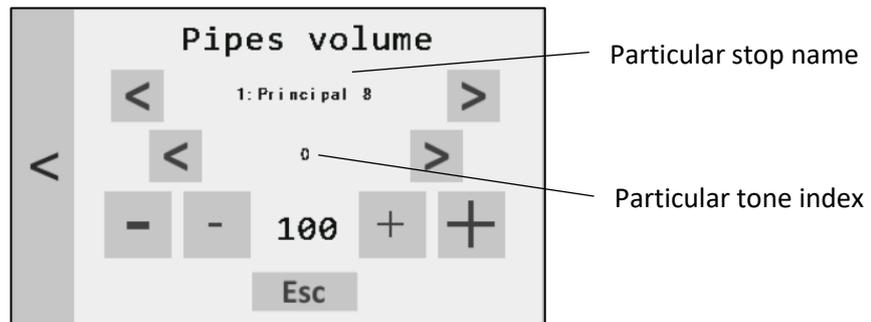
MIDI setting

NOTE: Basic MIDI channels setting for common use is simple, straightforward and always smooth. However, MIDI stops setting enclosures and other elements can be more time consuming and need some basic knowledge of MIDI communication. Also, we cannot guarantee 100% compatibility with any MIDI console or a digital organ.

There are simple "wizards" which are provided and enable all MIDI functions to be set in an easy manner. These "wizards" avoid a need for the user to be familiar with quite complex MIDI structures; for the organ expander, all MIDI controlled functions are based on listening to the received MIDI messages and are as simple as possible for the user to set. On the other hand, it would be appreciated if implementations of MIDI could differ a lot from one given musical instrument to another; therefore,

we cannot guarantee full compatibility with every MIDI device. Please find additional help in case if any problems occur and you are unable to resolve them.

If there is any problem, please check if your device transmits MIDI signals (while using USB/MIDI adapter, you can observe a LED indicating MIDI messages). There might sometimes be problems with transmitting too much MIDI events. Some instruments transmit a large amount of MIDI events in a steady and continuous manner. There are often some service messages not related to play. This is not a problem during setting basic properties like MIDI channels; however, occasionally, while matching stops, couplers and especially enclosures, such service messages, can potentially disturb the procedure using aforesaid listening functions. It could cause problems with sliders like enclosure or crescendo foot pedal, when it is in a "middle state" between sending MIDI positions. In this case, a lot of MIDI messages are transmitted. In such case, please try to shift the pedals to some other position not to be in "between" state.

Setting MIDI channels
NOTE: If you see anywhere an inscription "Waiting for MIDI…", it means the screen is blocked. You are not allowed to get away until some MIDI event occurs.
All MIDI messages other than NOTE *ON/OFF* are filtered during listening basic MIDI channels – this is always smooth. The number of independent divisions (wind-chests) depends on a particular sample-set being employed in the organ expander; most often, employed sample-sets related to two manuals and a pedalboard. However, it would be appreciated that, in practice, the organ expander will potentially receive MIDI signals from at least one of a special MIDI console (e.g. custom-designed MIDI console), a digital organ or also a simple MIDI keyboard. Using the organ expander, it is feasible to match each wind-chest with its own independent corresponding MIDI channel. Moreover, by using the organ expander, it is also possible to use all registers with the single MIDI keyboard only; in this case of a single MIDI keyboard, all divisions are matched with the same MIDI channel number. As the organ expander module enables the automatic selection of MIDI channels, it is not necessary to know explicitly the corresponding channel number.
In the menu presented on the screen of the organ expander, choose "*MIDI*" and find a "*Set MIDI channels*" screen. As the next step, press the "*listen*" button (the inscription of "*Press a tone*" appears on the screen of the display, namely it means that the system is waiting to receive a MIDI message corresponding to a pressed note of a manual, a pedalboard or similar). Thereafter, press any tone on the keyboard (or pedalboard, if appropriate); the corresponding MIDI channel is identified by the organ expander and then stored into data memory of the organ expander. As long as the inscription "*Press a tone*" remains on the screen (namely, remains "light"), it means that no MIDI message has not been received yet. In a situation that the inscription "*Press a tone*" still remains on the screen, please check the connection of MIDI cable up and verify the right setting of your keyboard for MIDI transmission.

Setting MIDI for stops, couplers and other button-like elements

Individual stops of the organ expander can be controlled by external MIDI controllers. The individual stops are individually accessible by employing a scrolling list. Using the scrolling list, it is possible to set a MIDI event for "*stop ON*", "*stop OFF*" or "*Toggle*" activity. "*Toggle*" activity means that only one MIDI event is used for activating/ deactivating the stop. After touching some of the buttons, the device receives a MIDI message. When the first (or not the first – continue reading) MIDI message is received at the organ expander, it is paired to the particular activity. Two different MIDI messages can be used for implementing "*stop ON*" or "*stop OFF*", for example. One MIDI message can control more stops/ couplers/ other simultaneously. On the other hand, it is not possible to match more MIDI messages to one controlled element.

MIDI messages can be used to control not only stops, but also couplers, tremulants, memory elements (memory buttons, +-1 increment/ decrement, +-10 increment/ decrement, Set button, General Cancel (G.C.) button). Moreover, there is possible to control pre-sets, automatic couplers and pianopedal. Display dialogues are quite similar. For the memory elements and pre-sets, there are assumed to be employed only momentary switch buttons. From this reason, it is feasible to match only one MIDI event through "*Listen switch*" function. If required, it is feasible via use of buttons on the screen to deactivate MIDI controlling for every element independently; such as individual control facilitated by use of the a "*disable*" button.

NOTE: Be careful especially during setting MIDI for tremulants and enclosures. Such elements are typical for 2/3. manual, but it is possible to control these elements for any division, the first division (Pedal) is listed in default. You must list the right division using the scroll menu.
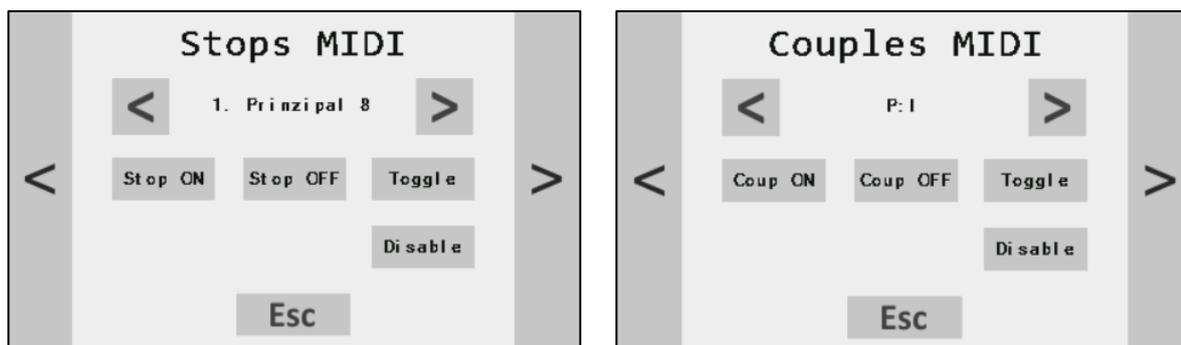
Setting MIDI for enclosures and crescendo

Enclosures (e.g. swell boxes for various manual divisions) and crescendo can be controlled by an external MIDI potentiometer (or by employing a pivot or "pull-down" foot pedal). The organ expander supports enclosures for every wind-chest. There is a simple wizard provided for MIDI setting in order to achieve such enclosures. Whole using the wizard, a following procedure should be followed:

- select a given specific enclosure to be configured by using the scrolling list,
- set a given specific foot pedal to be employed to a fully "enclosure open" position,
- touch an "*Opened*" button in the screen,
- set the given specific foot pedal to be employed to a fully "enclosure closed" position,
- touch a "*Closed*" button on the screen,
- move the given specific foot pedal again, to complete setting up of the enclosure on the organ expander.

The wizard will guide you through this process in a simple intuitive manner.

Filtering unwanted MIDI events

In many case (especially with digital organs) one control element (like a stop tab) transmits more than one MIDI messages at the same time. The problem is when the first message is not unique. In this case MIDI listen function are receiving the same non-unique MIDI message – same for more buttons. Valid and unique MIDI message can be transmitted as the second/ third… message. For this purpose, the last screen in MIDI setting is implemented. There is possible to set the exact number of MIDI messages that will be ignored in MIDI listening functions. There is also a "*Try*" button, that invokes a simple MIDI monitor. Press this button and then some control element on your organ console. You will see a hexadecimal code of the MIDI which will be accepted by MIDI listen functions. Using this feature, you can experiment with count of ignored messages and find the correct value to get the valid and unique MIDI message from some button. Also using a "*Try*" button you can easily identify some random MIDI events from sliders like enclosure foot pedal. It is caused by the "in between" state, which means in the position in between two states that transmits a MIDI event. In this case, try to move the foot pedals a little.
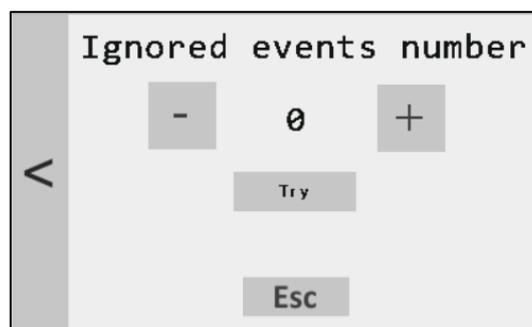
Automatic couplers, pianopedal

The module has implemented three very special elements: "bass coupler", "melody coupler" and "pianopedal". Some sample-sets have pre-defined these elements with the stop tabs. If you activate the "bass coupler", it adds stops from pedal division to the lowest played tone on the 1st manual. Melody coupler adds stops from the 2nd manual to the highest pressed tone on the 1st manual. These automatic couplers are very convenient while using only one keyboard. In this way, you can enrich melody and bass notes from other divisions.

On the other hand, the "Pianopedal" element is perfect when using a large organ console, at least 2 manuals. When activated, you can jump between manuals, and pedal stops automatically change according to what manual you play. You can choose which stops in pedal will be active if you jump

from the 1st manual to the 2nd or 3rd manual. For this purpose, use the first screen under "*PRESETS*" button in the menu. Choose the division making automatic change, choose the right stops in pedal and press a "*Save*" button.

Using "pre-sets"

Pre-sets are fixed stops combinations that are present on some organ consoles. Typical examples are pre-sets such as "*pp, mf, f, tutti*…". The user can define up to 16 pre-set buttons (presented on it's console) using MIDI or switches. The pre-set buttons must be paired by MIDI learn functions before saving and using them.

You will find a special dialogue in the menu designed for saving some stop combination (e. g. the second screen under "*PRESETS*" menu option). Select and save some stops according to your need and press a pre-set button on the organ console. It is saved now.

Using "crescendo"

Stop crescendo is usually connected to a foot pedal. It must be paired by MIDI. The user can define number of crescendo positions and save stop combinations for individual crescendo positions ("0" position is always defined to be without any stop). Both are under "*PRESETS*" menu button. Some sample-sets have already pre-defined them, nevertheless, they can be used for any sample-set.

"Switches" menu item

This is a key feature for users of bare electronic units. Input switches can be paired with the desired stop or some elements, such as automatic couples, pre-sets, etc. Pairing is simple: choose the desire stop, coupler or another control element, press a "*Toggle*" button (in case of push buttons) and any desired physical switch. In the pairing dialogue screen, there is also a choice "*on/ off*", it is for mechanical on/ off switches wired to the module.

Advanced sound models

Under an "*Advanced*" menu button you can find setting dialogues for special sound functions. The first is tuning randomization. Tuning tolerance of pipes in cents setting is provided as a parameter to adjust; within this tolerance. Virtual pipes are put out of tune randomly (in a range of 0 to 100 cents).
The next two dialogues are used to set "*Pipe coupling*". This model is world-wide unique and makes the sound very authentic and live. All pipes are randomly tuned after their attack. This tuning deviation disappears after given time. This effect is stronger for the lowest tones though. The first dialogue sets this effect strength, the second one length of the effect.
Last function is a "*Dynamic pressure*" model. This effect simulates pressure fluctuations in a real pipe organ during playing. Pressure fluctuations cause changes in tuning of the pipes in a pipe organ. It is possible to set a "*Dynamic pressure size*" button which allows a user to set the right time of dynamic pressure effect (in a range of 0 to 100); a "*Dynamic pressure depth*" button allows a user to set a frequency response of a dynamic pressure effect (in a range of 0 to 100). If both of these properties are set to a zero value, the pressure variation effect is disabled. Contrary too high values can deteriorate the reality of this effect.

System backup

It is highly recommended to have a backup USB pen drive of your system. The whole sample-set together with all the settings, MIDI events and layout changes can be stored on your own USB pen drive. For this purpose, use any USB pen drive with at least 4 GB in size. Connect it into USB connector,

find the correct dialogue (under "System" menu button) and press the button "*Start*". It takes some time (approx. 15 min.), after the process you will be asked to disconnect the disc. You can use the disc with the backup image as the base medium for changing sample-sets.

Changing the sample-set

Individual sample-sets can be changed using a dedicated external pen drive (or your own backup disc). The procedure is quite simple:

1. Switch off the organ expander, disconnect the power adapter.
2. Disconnect the USB/ MIDI cable and connect the dedicated pen drive to an USB connector.
3. Connect the power source again: the logo appears on the screen. the organ expander starts automatically the updating procedure within several seconds.
4. After the process is completed, a main screen appears on the screen. The new sample-set is ready now.
5. **REMOVE** the pen drive and connect the USB/ MIDI cable again.