Espressivo

Manual

Version 5.3 (Master 3v2 Firmware 5.23, Slave Firmware 4.x)

Date: 2023-05-30

Please note:

The Espressivo Master 3 module requires a new Windows software of generation 4.x for setup via laptop.

Please download this software free of charge from the support area of orgelpunkt.com.

For setting up master modules of generation 2, the software version 3.x or 2.6 is still required. You can install both versions on your Windows laptop or tablet without any interference and use them optionally depending on the application.

Your direct line to the specialists:

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Tel.: +49 9331 9894069

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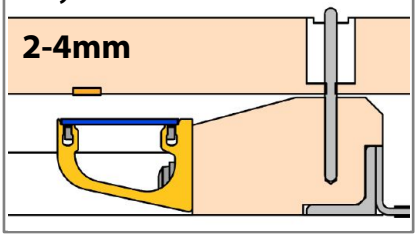
Quick guide

Essential considerations at a glance

Key travel at the sensor

2-4mm

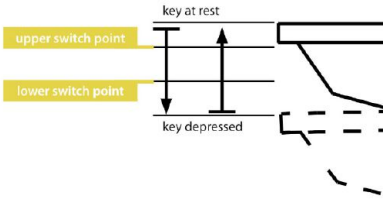


Separate Espressivo

Power supply

12-24V, 4A

Switching point spread



DI-Module

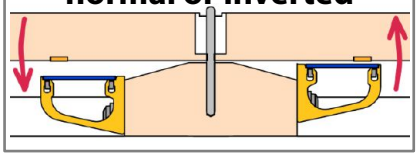
64 classic key contacts
or 32 key contacts and 32
stop switches

Pre-travel and switching points

adjustable via PC software

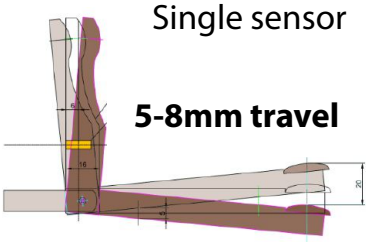
Mount on the balance rail:

normal or inverted



Single sensor

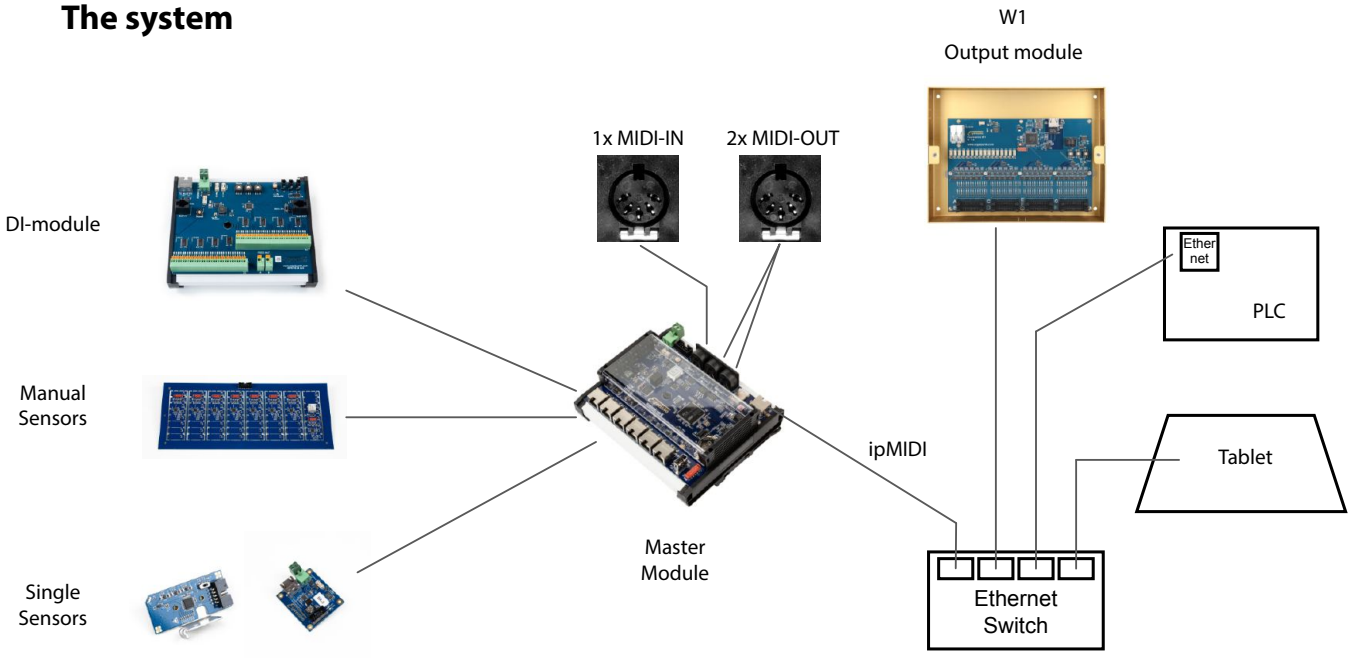
5-8mm travel



CAT cable between manual sensors and master module

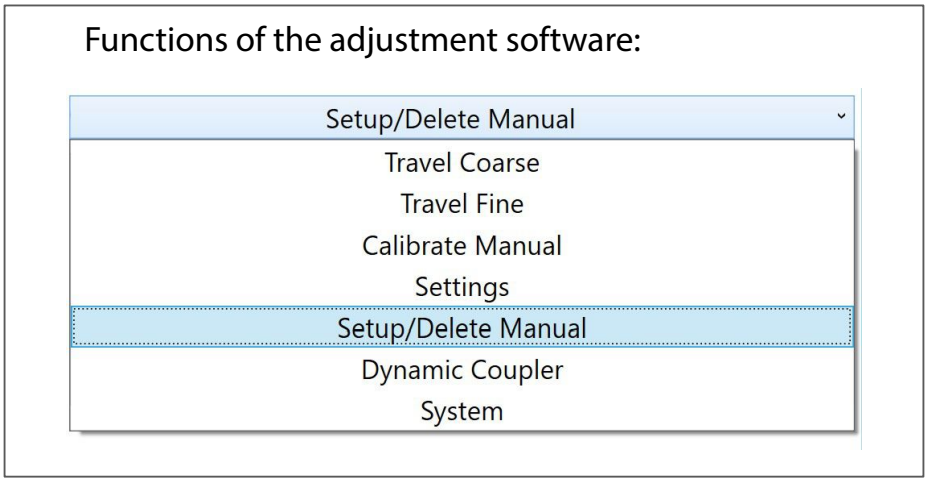
max. length 2m

The system



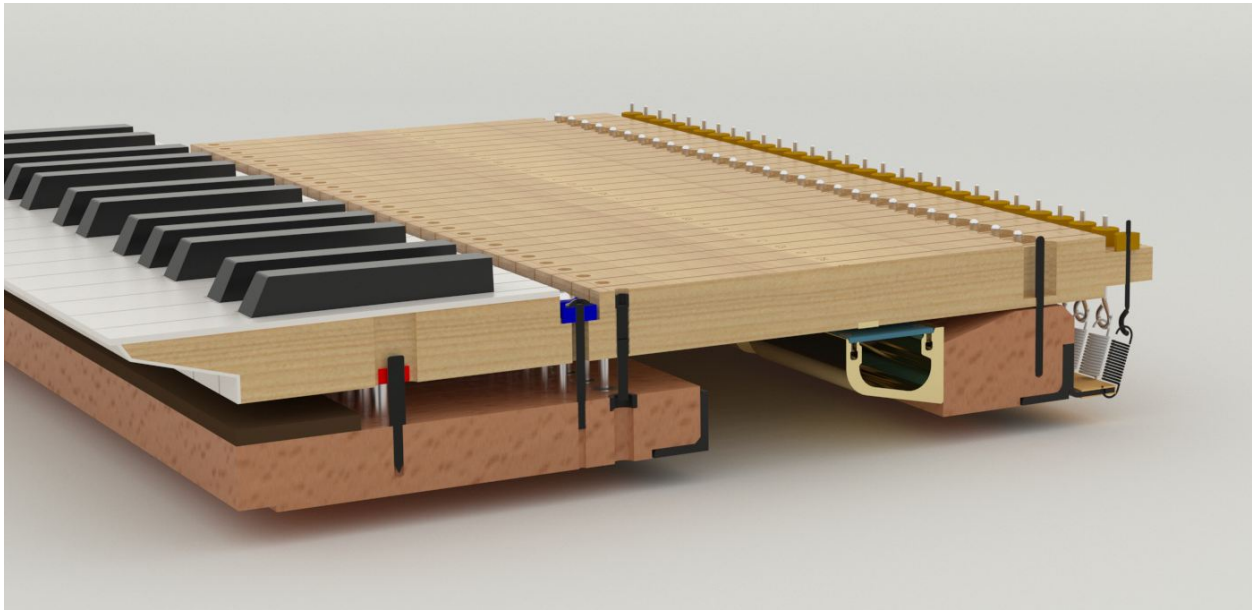
Getting started

- Switch on the organ.
- Connect the Ethernet port of your laptop/tablet to the Ethernet switch of the organ control system or directly to the Ethernet port on the top edge of the Espressivo master module (see p. 36).
- Do not accidentally connect your computer to one of the six manual ports on the lower edge of the master module!
- Check that the green power LEDs are lit on the master module and that the yellow Ethernet LED is flickering.
- Check the network address of your laptop:
  In standard systems, the "automatic" setting should work. For safety, you can also manually set the IP address 169.254.1.100.
- If your control system uses special addresses for the Espressivo master module, such as 10.0.0.101 (in Laukhuff systems with two consoles), or SSOS systems using the subnet 192.168.1.xxx set your PCs IP address accordingly.
- Start the Espressivo adjustment software ("Espressivo Master"). You can find the current version for free download at https://orgelpunkt.com/Support/.
- The Master 3 requires version 4.x software. Older versions cannot communicate with the new master module.
- Select the correct IP address of the Espressivo master module and click on "connect."
- Select the desired function, e.g. "Set up manual" and follow the instructions of the software. More detailed information is given in this manual from p. 40.

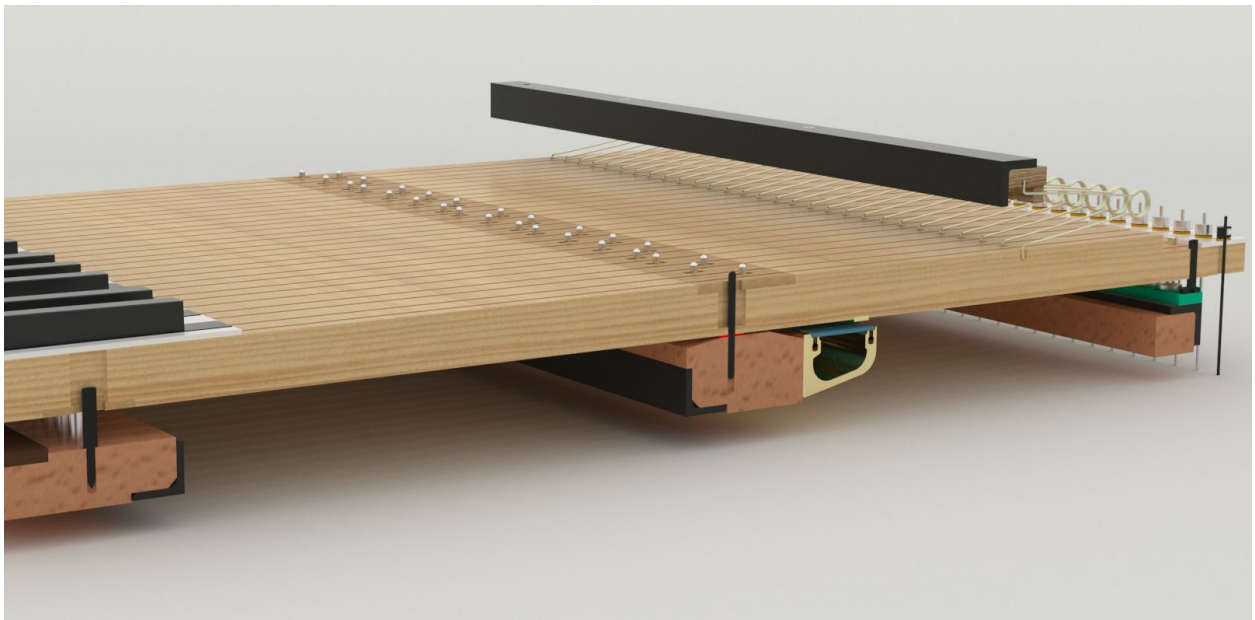


Contents

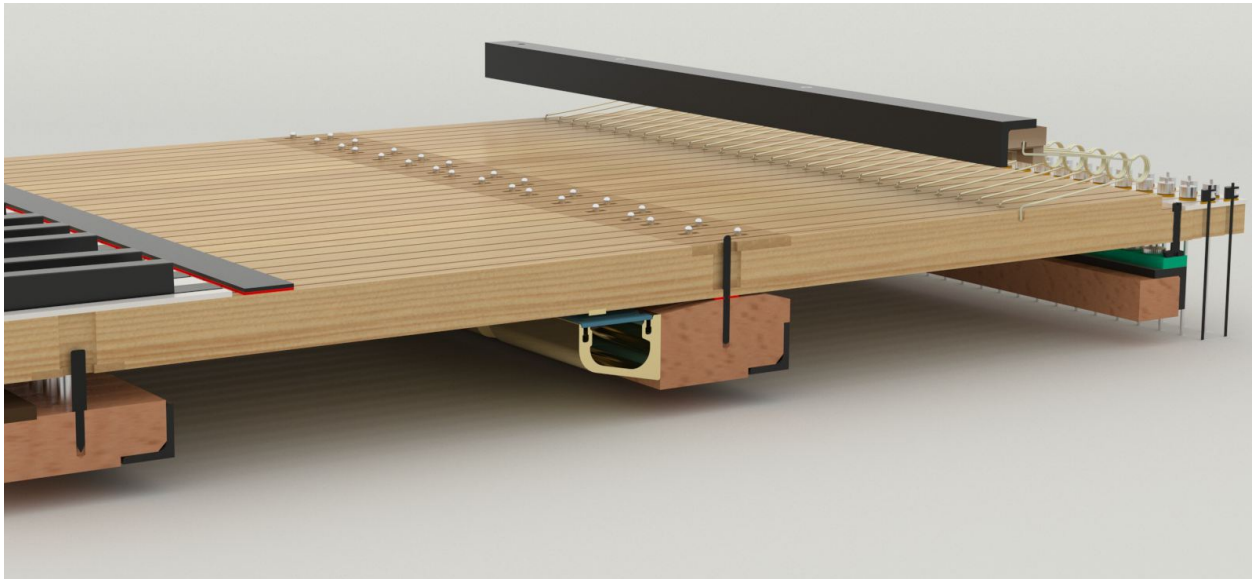
Espressivo installation types



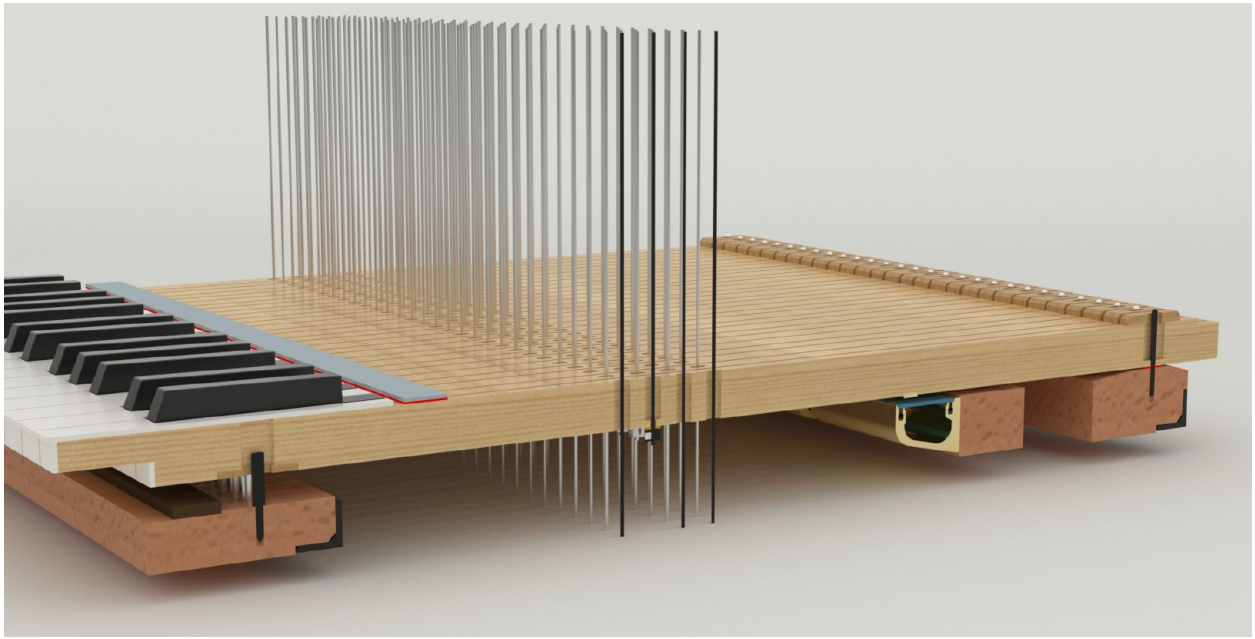
One-armed keyboard with pluck simulation and mounted Espressivo sensor rail on the front of the balance rail.



Two-armed keyboard with stop rail and Espressivo sensor rail in inverted mounting on the balance rail.



Two-armed keyboard with stop rail and Espressivo sensor rail mounted on the balance rail.



Keyboard for suspended mechanical action, with Espressivo sensor bar on an additional support bar in front of the balance rail.

With suspended action, the rest position of the keys must have a fixed reference point. A lead bar is not sufficient for this. When playing fast, unintentional activation of sensors can occur without an upper stop.

Special features of the Espressivo system

The Espressivo system does not contain contacts in the conventional sense. It uses magnetic field sensors to continuously measure the position of the keys. When a note is switched on or off is not determined by the mechanical adjustment of a switching element (such as a contact plate or the breaker of a light barrier), but is triggered by variable signal thresholds during the evaluation of the sensor data.

This makes playing characteristics possible that cannot be achieved with conventional contacts:

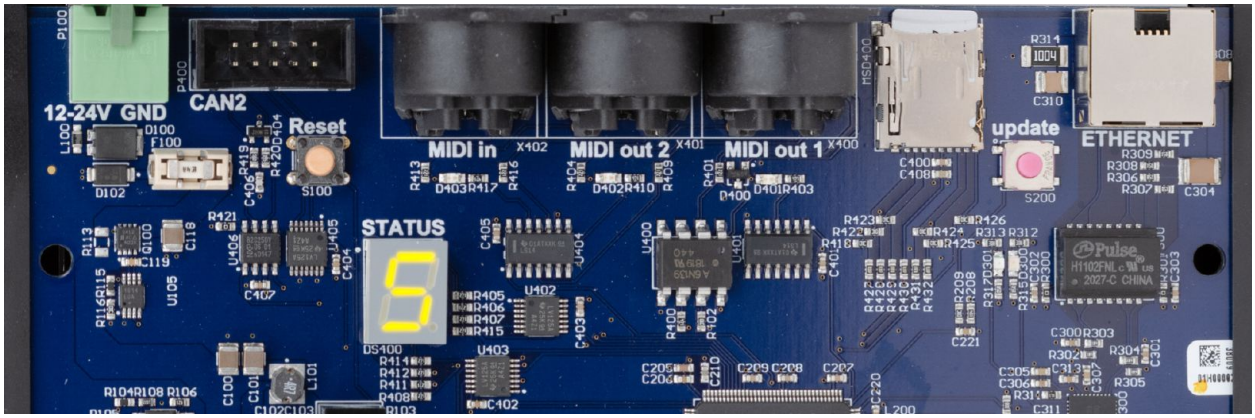
- Adjustment of the switching points without mechanical access to the contacts
- Spreading of switch-on and switch-off point
- 2-point repetition for fast note repetitions with small key movements
- Dynamic coupling depending on the velocity of the keystroke

With the Espressivo system, the pre-travel of the keys before the note is triggered can be adjusted with accuracies of approx. 0.1mm. This high level of accuracy is possible because the sensor bar is usually placed at the most stable point of the keyboard, directly on the balance rail. In addition, the system measures the current rest position of the keys every time the keyboard is switched on and adjusts the switching thresholds accordingly.

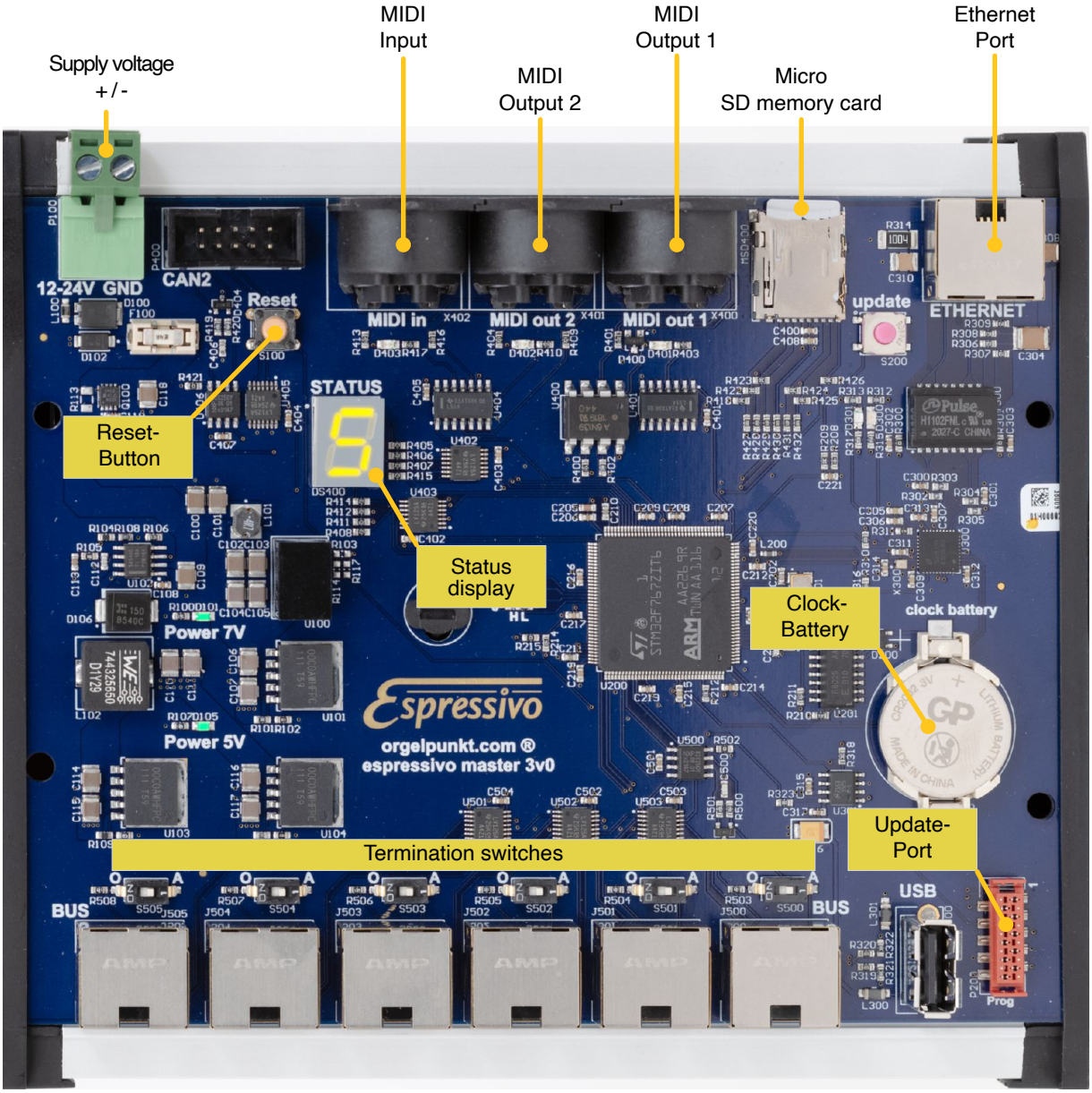
Espressivo keyboards output information about the velocity of the keystroke with the MIDI data. This "MIDI-velocity" controls the volume and timbre of suitable sound generators. This enables the organist, for example, to play keyboards connected to the MIDI interface with velocity.

During power-on calibration, the system also recognizes keys that could cause ciphering due to technical problems and mutes them. This mechanism also silences keys that are held down when the organ is switched on.

Therefore, point out to the organist that he should avoid putting his hand on the manual or leaving a foot on the pedal when switching on the organ. With conventional organs, this negligence has no consequence as long as no stop is pulled. With an Espressivo action, however, the key in question is muted until the organ is switched off and on again.



The Master Module



Up to six manual sensor rails and two groups of single sensors can be connected to the master module. It supplies the sensor modules with power, evaluates the data and generates the MIDI signals for controlling electric action or other tone generators.

The master module is supplied via the plug-in operating voltage terminal.

The masters of hardware version 1v1 (green board) can only be supplied with 12V. Newer modules (blue circuit board) can be supplied with voltages of 12-24V.

The Espressivo system should not be operated on a common power supply with the high-current components of the organ action. A **separate power supply** (for example a DIN rail mounted switching power supply 24V) with 4A ensures interference-free operation. The power supply unit must be switched on and off with the organ. When the system is started, automatic calibration of the key sensors takes place.

Only plug and unplug manuals when there is no operating voltage at the master module.

Do not connect the manual bus connections to the Ethernet interface of a PC! Although they are the same connectors, the pin assignment differs. Mixing up the connections can cause damage to the PC and the Espressivo master.

Do not connect a PC to the USB interface. This socket is intended exclusively for connecting expansion modules such as Bluetooth receivers (currently not yet supported by the firmware).

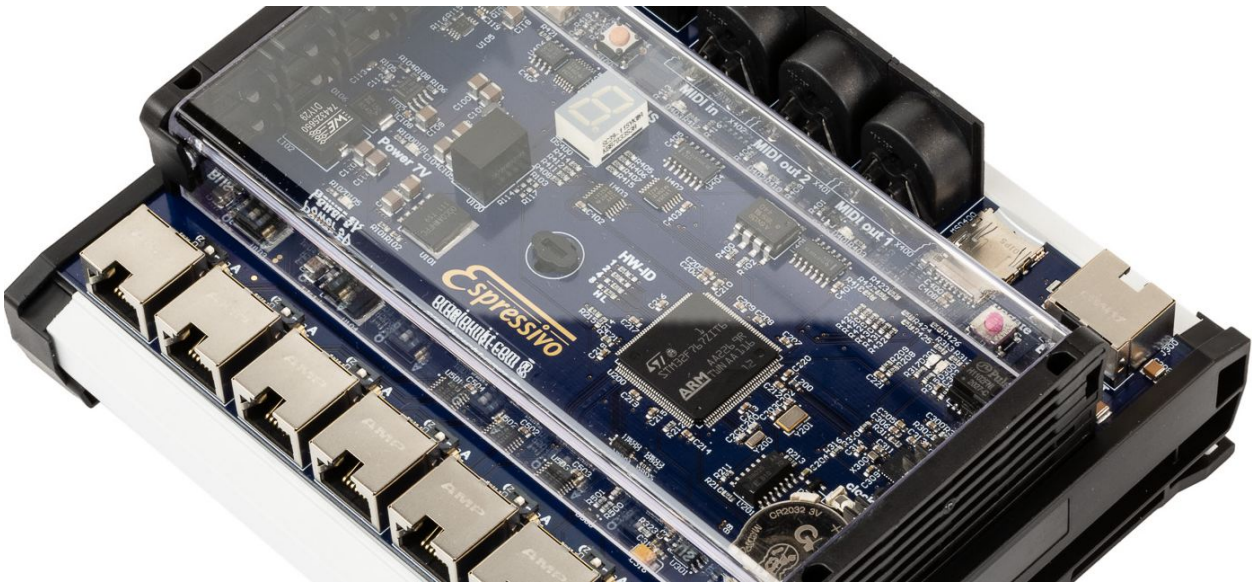
The manuals are connected to the six connectors of the manual buses on the master module via Ethernet cables. Use good quality cables so that the power supply to the sensors is reliable. The cable length between manual and master module must not exceed 2 meters. It is best to place the master module close to the manuals in the console. This also makes sense because only one Ethernet cable has to be routed for the usually longer cable path to the organ control system. The length of the ethernet cable to the organ control is not critical (max. 100m).

All bus sockets are identical, no special assignment of manuals to the connections is necessary.

At active manual connections the corresponding termination switch must be set to "A" (active), at unused manual connections the switch must be set to "0".

The note control signals are output via the standard MIDI interface (DIN socket). In addition, the data can be sent in the standard format "ipMIDI" via the Ethernet interface as UDP packets (see configuration). This interface works about 300 times faster than the Midi standard. Various manufacturers of action systems, such as SSOS, Laukhuff, Heuss or Sinua already use this standard. Drivers for Macintosh and Windows PCs are also available, which allow direct data traffic without the use of serial a MIDI interface.

The button cell is used to power the built-in real-time clock. This is used for the log file functions. The battery should last much longer than 5 years. If the battery is empty, this does not limit the function of the unit, as the clock is only important for the logging functions.



Controls and displays

The Espressivo master module has no switches or dials for normal operation. All settings are made via communication via the Ethernet interface. These commands are sent from the graphical interface of the free Espressivo software (Windows).

The reset button is used to restart the system after certain changes of configurations. A basic diagnosis of the function is made possible by the following LEDs:

POWER:

Two LEDs indicate the presence of the supply voltages for the master CPU and sensor rails. They should always light up during operation.

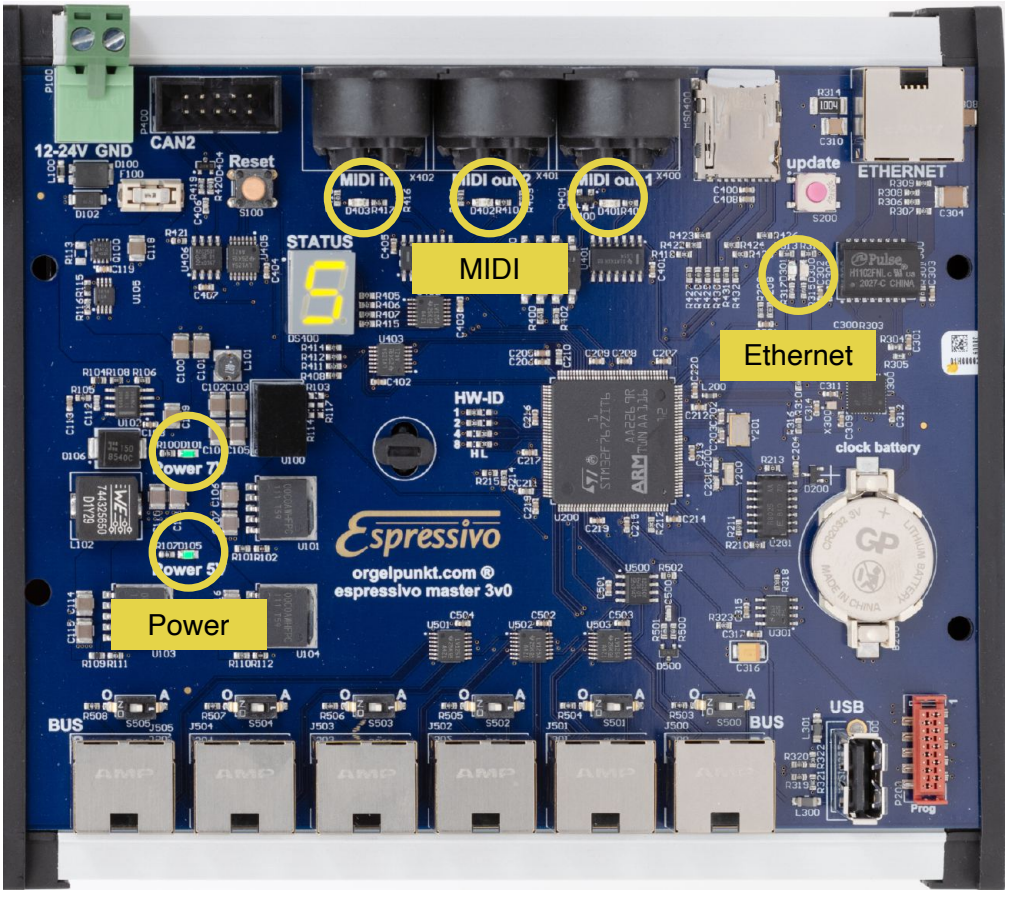
MIDI:

indicates the generation of MIDI data. The LED should flash briefly each time a key is pressed or released - provided the keyboards is fully configured.

Generation 3v0 boards only have one MIDI-LED. From hardware version 3v2 each MIDI connectors has its own LED which indicate MIDI input as well as traffic on MIDIout2 (see MIDI)

ETHERNET:

The green LED lights up when the Ethernet port is connected to a functioning remote station (PC or organ control). The yellow LED flickers when there is data traffic on the Ethernet.



The status display

The Espressivo master module 3 has an LED display that provides information about the various operating states and gives troubleshooting tips in the event of problems.

After switching on, "0" is briefly displayed, then the boot process passes through the stages b0...b8. The intermediate stages are usually so short that they cannot be recognized.

If errors occur when starting the system, the display gives information about the type of problem.

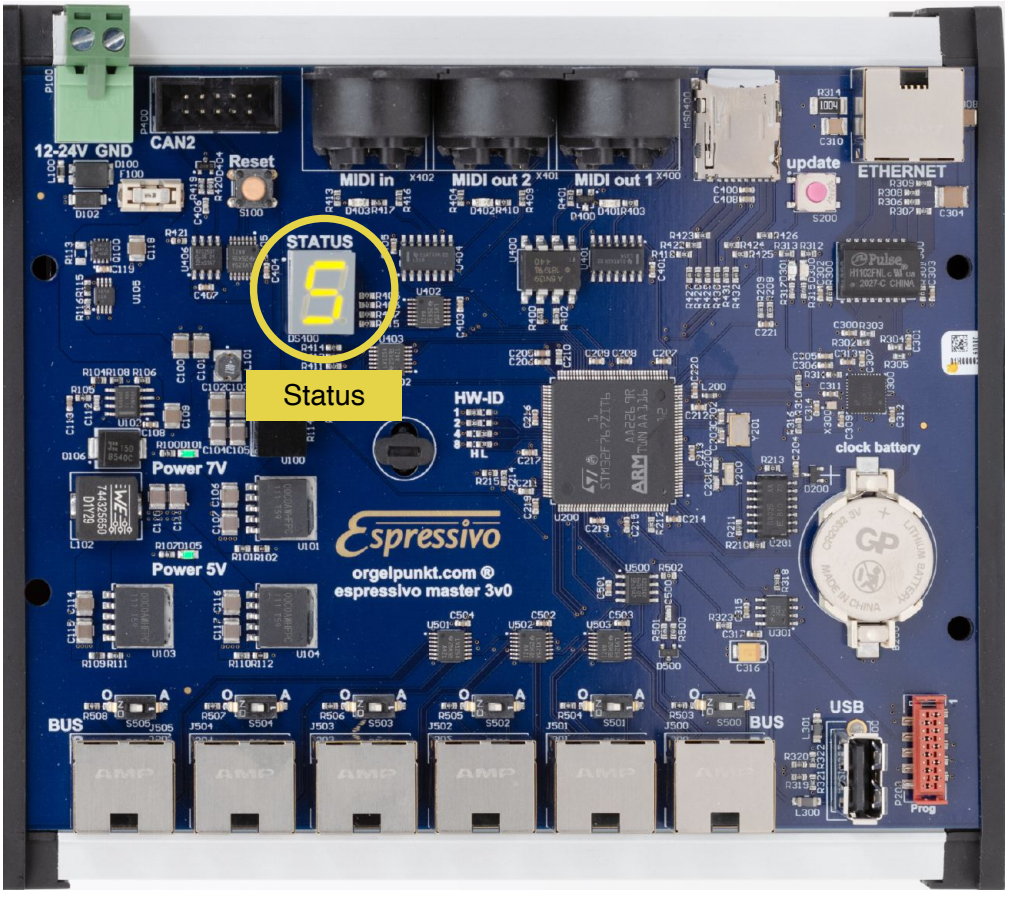
An abort with "b1" indicates a missing or unreadable memory card.

During normal operation, the number of manuals set up and ready for operation is displayed.

If set-up manuals are missing, the manual numbers are displayed alternately with a minus sign, e.g. "-2".

If the automatic calibration at switch-on shows a deviation of the current rest position of keys from the original calibration of more than the pre-travel of these keys, a drift warning is displayed (e.g. "d1").

The manual will continue to function thanks to the automatic switch-on calibration, but the warning indicates possible mechanical problems of a keyboard or the need for a new basic calibration.



The MIDI connectors

The Espressivo system outputs the action data through standardized MIDI signals. In the technical appendix you will find the usual assignment of channels and ranges in organ building.

In the standard settings of the configuration file, the signals are output via Ethernet port in ipMIDI format as well as via a classical serial MIDI socket, which is designated as "MIDI out 1".

As a rule, the organ control system is connected via Ethernet, as this interface transmits about 300 times faster and can easily be connected to any number of devices via network components.

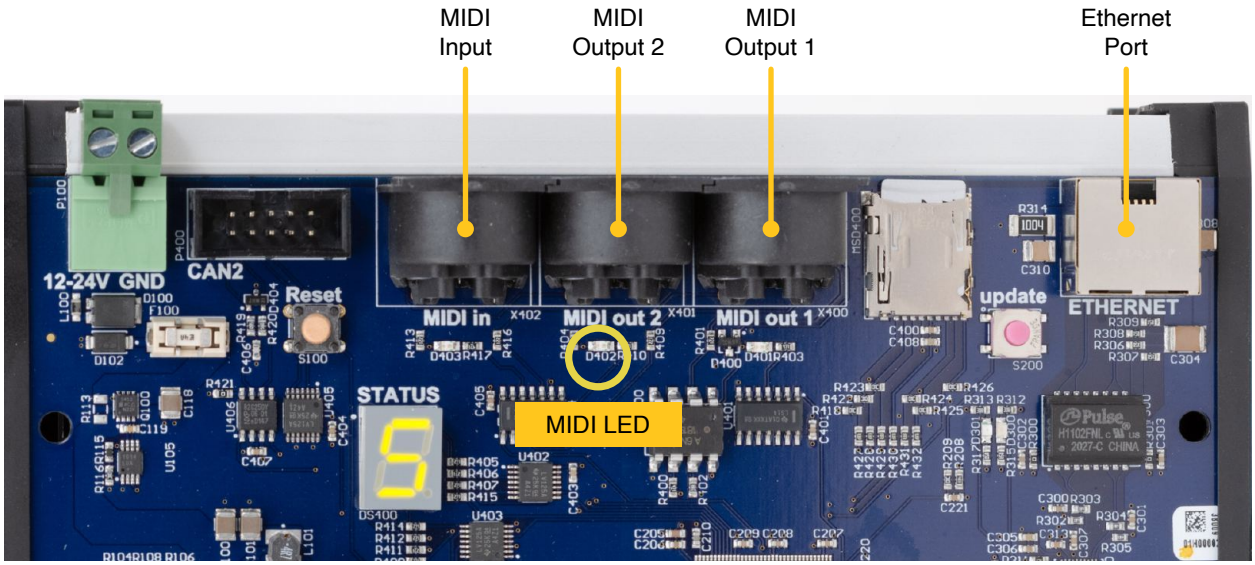
The MIDI sockets are suitable for connecting additional devices, such as sound generators, which are then played via the organ keyboard. Since Espressivo outputs velocity-sensitive data, you can also play keyboards with piano sounds, for example, in a nuanced way.

The master module 3 has additional MIDI inputs and outputs with which the connection between classical MIDI devices and the organ control can be established on an ipMIDI basis.

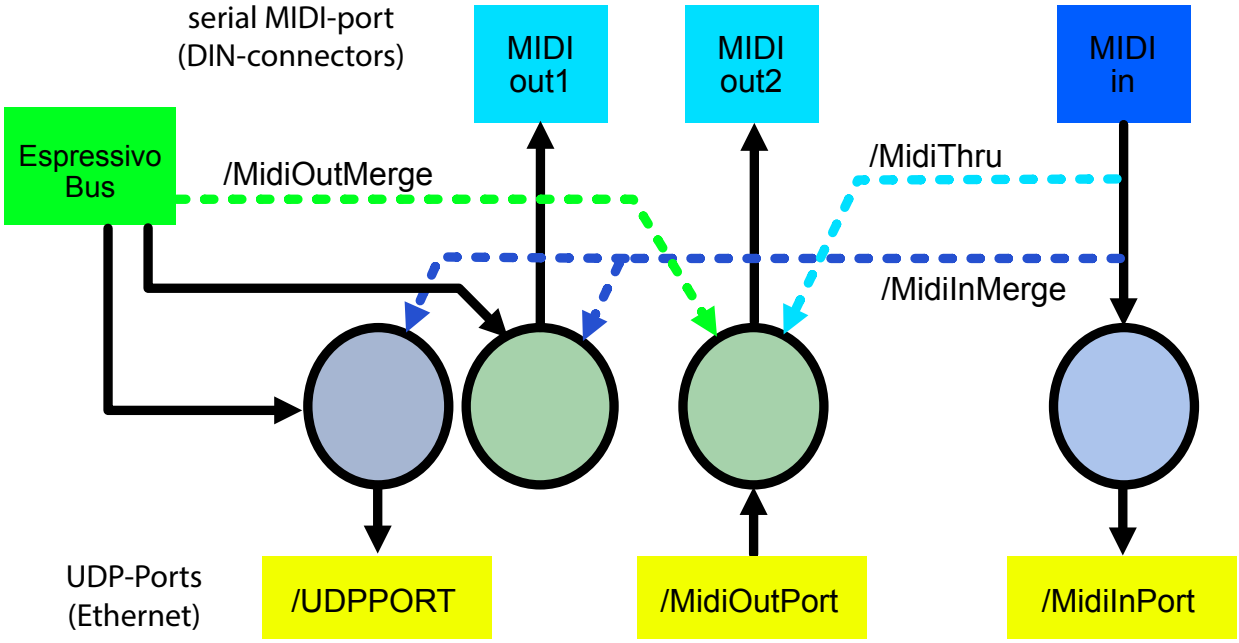
In the future, signals can be received via the MIDI input and transmitted to the network of the control system.

The diagram on the next page shows the different possibilities of connection if the corresponding options are activated in the configuration file on the memory card (orgel.cnf). Without these options the sockets "MIDI in" and "MIDI out2" have no function.

The firmware 5.1.2 when the first units were delivered does not yet serve these additional sockets. If you would like to use these functions in the future, we will be happy to update your module to the latest version.



MIDI-Options of the in/out ports



In addition to the classic MIDI jack for outputting keyboard notes ("MIDI out1"), the Espressivo Master3 has another pair of MIDI input and output.

This allows many scenarios in which MIDI data can be sent back and forth between serial ports and ip-MIDI data on the Ethernet. For example, MIDI in and out2 can be used for MIDI connectors on the console to connect external sound generators or recorders, or to play the organ from a MIDI keyboard. Depending on the configuration, the organ control system can control these ports independently from the Espressivo keyboards, or e.g. receive the external keyboard data together with the Espressivo manual signals.

The configuration of the MIDI interfaces is set by parameters in the "orgel.cnf" file on the Espressivo master's memory card:

```
# ---------- MIDI in/out configuration ----------------------------

/MIDIOUTPORT 21932
/MIDIINPORT  21931
/MIDIOUTMERGE
/MIDIINMERGE
/MIDITHRU

# MIDIOUTPORT
When defined, the Espressivo Master receives ipMIDI data on this UDP port
and forwards it to the "MIDI out2" jack.

# MIDIINPORT
When defined, the Espressivo Master receives MIDI data on the "MIDI in" jack
and forwards it as ipMIDI messages to this UDP port..

# MIDIOUTMERGE
This option sends Data from the Espressivo components to the MIDI out2 jack
in parallel to the
MIDI out1 jack. ipMIDI Data received via the MidiOutPort is merged.

# MIDIINMERGE
This option merges MIDI data received via "MIDI in" with the data from
Espressivo components

# and forwards them to both the "MIDI out1" jack and the main UDP-port.

# MIDITHRU
This option forwards MIDI data received via input "MIDI in" to the output
"MIDI out2"
```

Firmware update and version display

Starting with firmware version 5.21, the master module can also be updated in the field with new firmware without special tools, if this should be necessary for troubleshooting or extending the range of functions.

In this case we will provide you with a special update file via email, which you copy from your laptop to the memory card of the module using a card reader.

The procedure in detail:

1) Switch on the system.

2) After the boot process, remove the memory card.

3) Copy the update file to the memory card. It has a name like "fwma0523.srec". Do not change the name or file extension. **Make sure that there is only one file with the extension ".srec" on the memory card. If there is still a file from a previous update on the card, delete it.**

4) Insert the memory card again.

5) Press the reset button.

The master module recognizes the update file. If it contains a newer version than the currently installed firmware, the update process starts immediately.

While the update is running, the display shows an "F". This process can take up to one minute. Do not interrupt the power supply during this time and do not press the reset button again!

As soon as the update is finished, the display shows three bars for a short time, then the normal boot process starts with the usual display b0...b8 and the normal status display.

Installing an older firmware version:

The update to a newer firmware happens automatically from a corresponding update file. If for some reason the installation of an older firmware is desired, hold down the "Update" button while pressing the reset button to start the update. Then the firmware will be loaded from the SD card without any version check.

Do not perform such operations without consulting the Orgelpunkt support. Under certain circumstances, this could render the master module inoperable!

Query the firmware version and IP address:

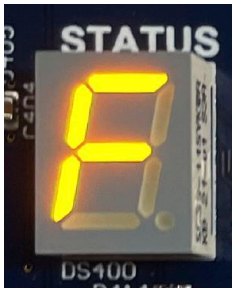
If you press the update button during normal operation of the system, the display shows the current firmware version and the IP address of the master module.

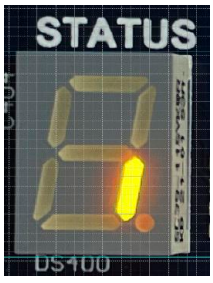
The display proceeds by showing single digits and separators. First the firmware version is displayed between the signal characters "F" and "F.". For this e.g. the character string F 0 5 2 3 F. for the firmware 5.23 is displayed.

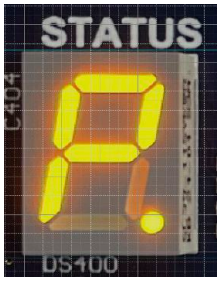
Then the IP address is displayed starting with the signal characters "i" "P". The address is then displayed digit by digit with a hyphen between the groups of three, e.g.

1 6 9 - 2 5 4 - 0 0 1 - 0 0 2

This way, in case of any ambiguity, the IP address can be determined without needing to examine the orgel.cnf file on the memory card.





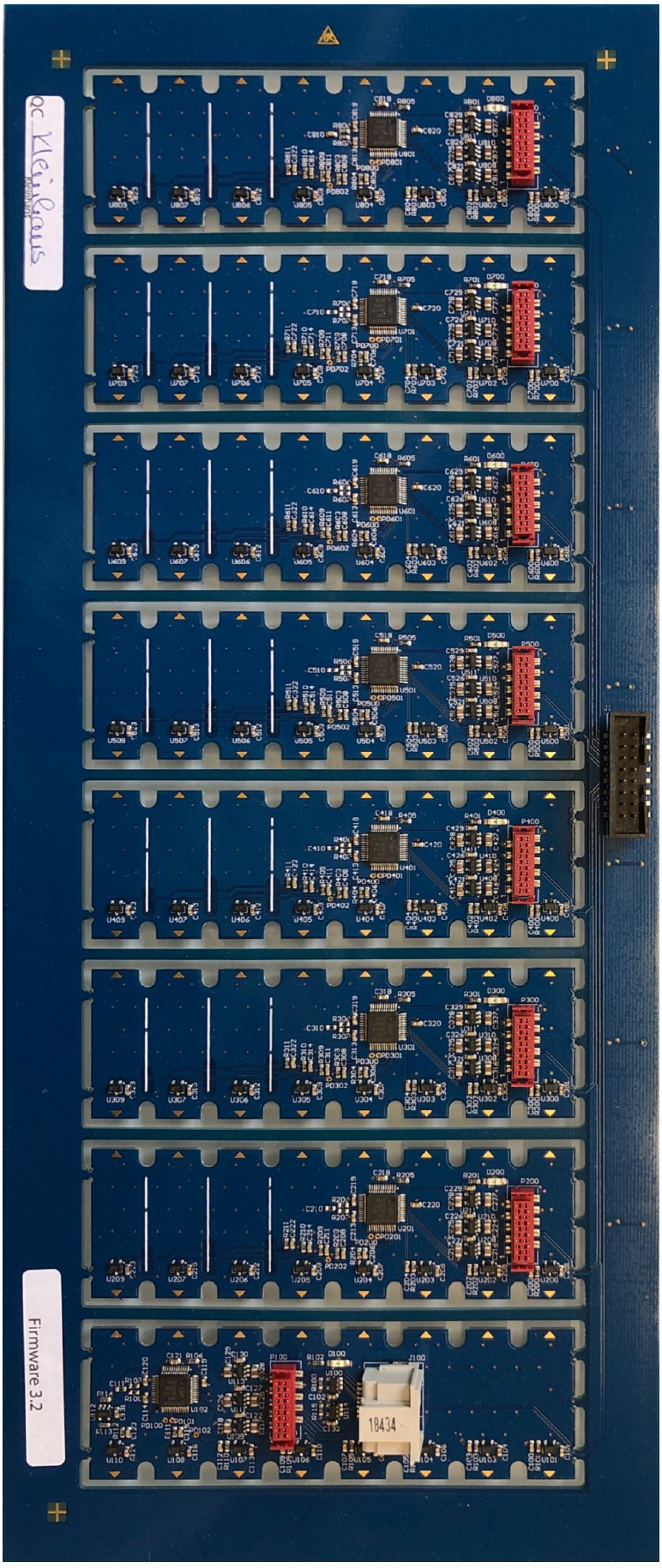


The sensor modules

The Espressivo system consists of up to 8 sensor modules per manual, each with 8 keys ("slave"), so that up to 64 keys can be detected. For manuals with an even larger number of keys, additional modules can be mounted. These are initially treated as a further manual, but can be configured so that the pitch range is seamlessly connected.

The modules are supplied in a circuit board panel. The holding bars of the frame can easily be cut with a side cutter

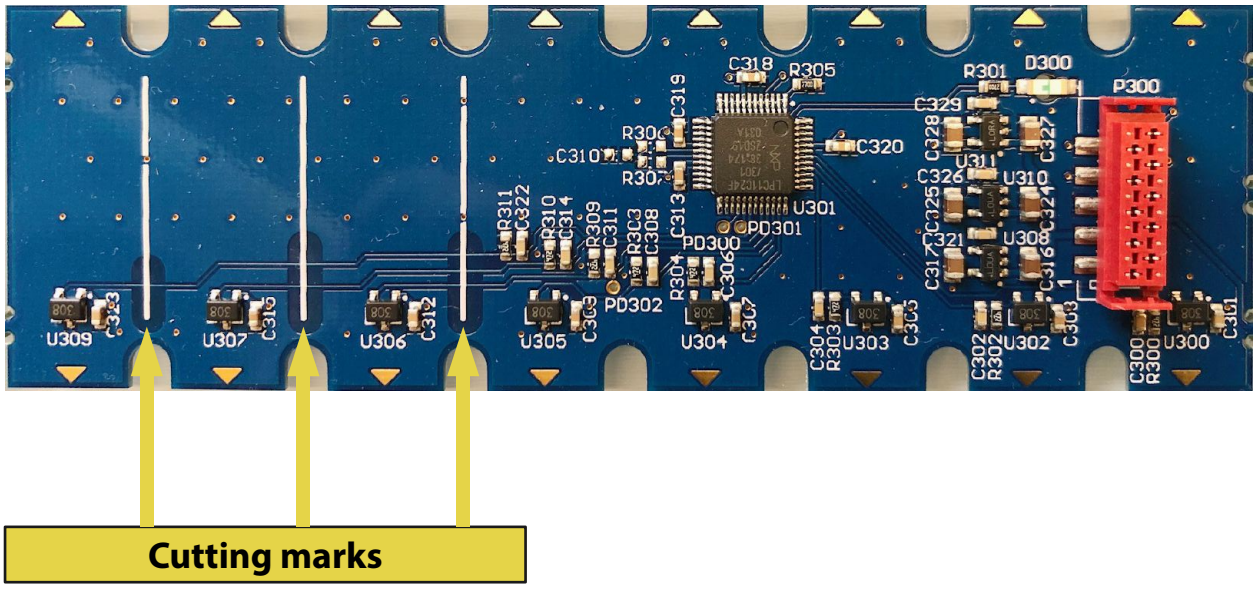
Sensors of hardware version 1 (green boards) must not be connected to the master module when in use! Internal connections on the frame lead to short circuits in the power supply. Blue PCBs can also be connected to each other while still mounted in the panel with manual ribbon cables and to the master module for test purposes.



Adapting sensor modules

To equip manuals with different numbers of keys, one or more sensor boards can be shortened at the cutting marks on the component side. To do this, use impact shears or a hacksaw. The interfaces should be as smooth as possible (rework with a file if necessary) to prevent short-circuits from separated conductors.

Do not use a grinding wheel to smooth the cut edges. This heats up and deforms the copper of the conductive tracks, leading to an increased risk of short circuits.



Normal and inverse sensor arrangement

The modules can be mounted in different positions

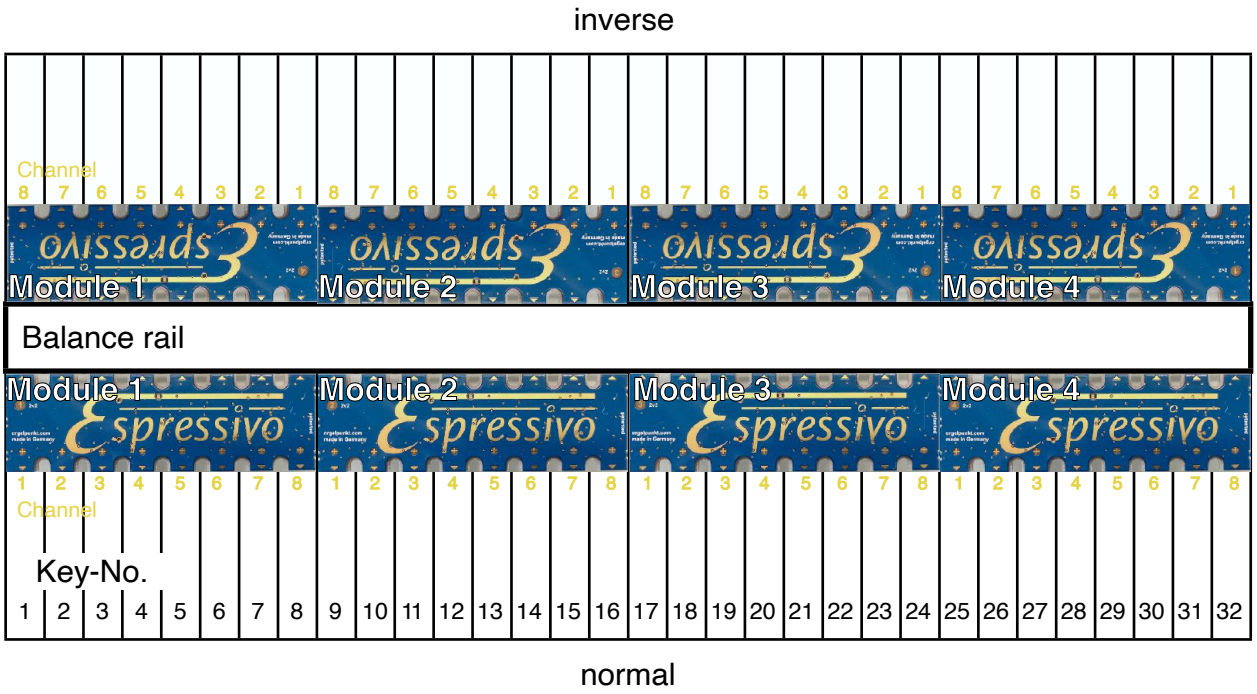
a) "normal": the key magnet approaches the sensor board when the key is pressed. In this case, the sensor rail is mounted on the front arm under the keyboard or on the rear arm above the keyboard.

b) "inverse": the key magnet moves away from the sensor board when the key is pressed. This situation occurs when mounted under the keyboard on the rear arm of a two-armed keyboard or when mounted suspended above the front arm of the keyboard.

The position of the sensors is always facing away from the balance beam. Therefore, with normal mounting, the circuit board with the number 1 is located on the left side of the console, with inverse mounting it is located on the right side.

The system recognises the mounting type automatically during set-up. The module number is always assigned from left to right. In the case of inverse mounting, the sequence of keys is therefore the opposite of the board numbering.

The channels of each module are numbered from left to right if the PCB labelling is legible. With inverse mounting, the assignment of the buttons to the channels is therefore opposite in sections on each module.

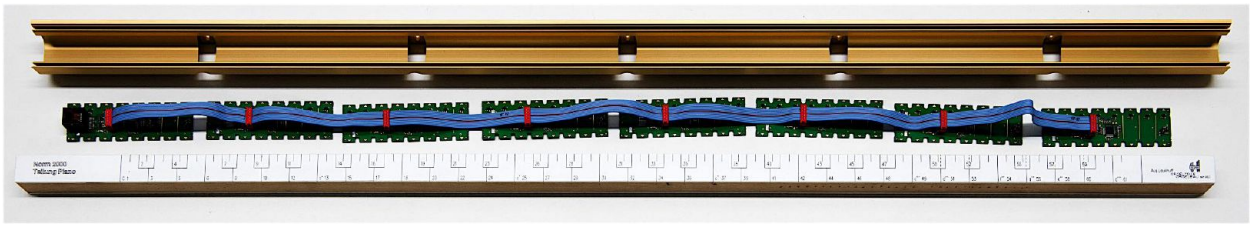


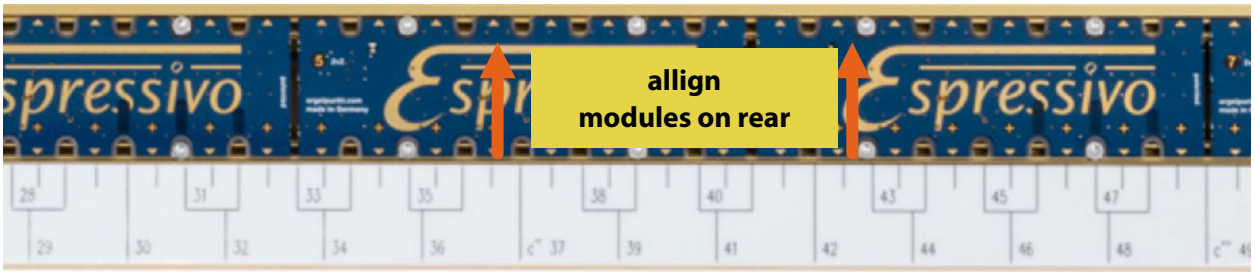
Preparing the sensor rail

The Espressivo sensor modules are mounted in a special aluminum profile that allows the modules to be moved along the manual to easily adapt the sensor positions to all common manual pitches.

The mounting profile has a length of 100cm. To adapt to the manual width, it should be shortened from the left and from the right so that the milled slotted holes for mounting are evenly distributed over the keyboard. The modules are connected to each other with the pre-frabricated ribbon cable and inserted into the aluminum rail.

The golden triangle markings on the edge of the board are aligned with the manual pitch, then each board is fixed in the profile with four screws. The boards should rest against the rear mounting edge of the profile.





Only use the special screws supplied, which can be easily screwed into the profile groove at any point without any further work steps (such as pre-drilling or punching).

These are thread-forming screws, DIN7500, ISO 14581 M2.5x6 or M2.5x5 (e.g. Würth art. no. 0209722506). A Torx screwdriver TX8 is required for driving the screws.

Connecting the sensor rails

Arrangement of the modules:

The slave modules are electronically identical, they can be arranged in any order on the manual. The numbers on the circuit boards are only for differentiation and do not prescribe an installation order.

The only exception:

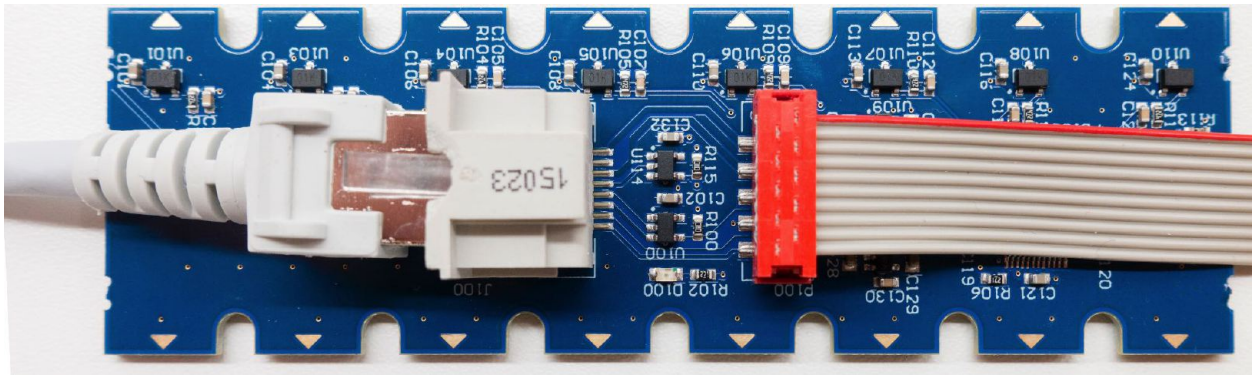
Module 8 contains the terminating resistors for the bus system, it must always be plugged in at the last position in the ribbon.

If fewer than 8 modules are used, the one with the board number 8 must be installed in the last position.

Cables:

Only use high-quality and highly flexible cables to connect the Espressivo sensors (e.g. Dätwyler CU 7702 4P flex).

Since the sensors are also supplied with power via the cable, inferior connectors lead to malfunctions. Rigid standard cables are difficult to route inside manuals and mechanically stress the connection sockets.



Module 1 contains the RJ45 socket (Ethernet cable) for connection to the master. The easiest way is to mount it at the end of the sensor rail so that the connection cable can be plugged in at any time when the unit is installed.

In some situations it may be advantageous to install module 1 as the second module of the ribbon chain. This way, the RF45-plug is positioned fully inside the sensor rail making it easier to e.g. bend the cable around to have it exit the rail on the other side.

The data cable from the keyboard to the master module should not be longer than 2m. Therefore, one usually mounts the master module near the keyboard block. The length of the Ethernet cable from the master module to the organ control is not critical (maximum 100m).

Adjusting to the keyboard scale

Since the spacing of the sensors on each board is identical, there will inevitably be slight deviations from the manual pitch within a module. Each board should be aligned to the pitch so that the maximum error is as close as possible to 1mm in each direction.

This is particularly obvious with pitches whose spacing is not constant. For example, with the piano pitch, there are quite large deviations at module no. 3 in the positive direction at the left edge of the board and in the negative direction at the right edge. Such deviations are completely uncritical for the function of the system, but care should be taken to ensure that the differences are conveyed.

Completely assembled sensor rail

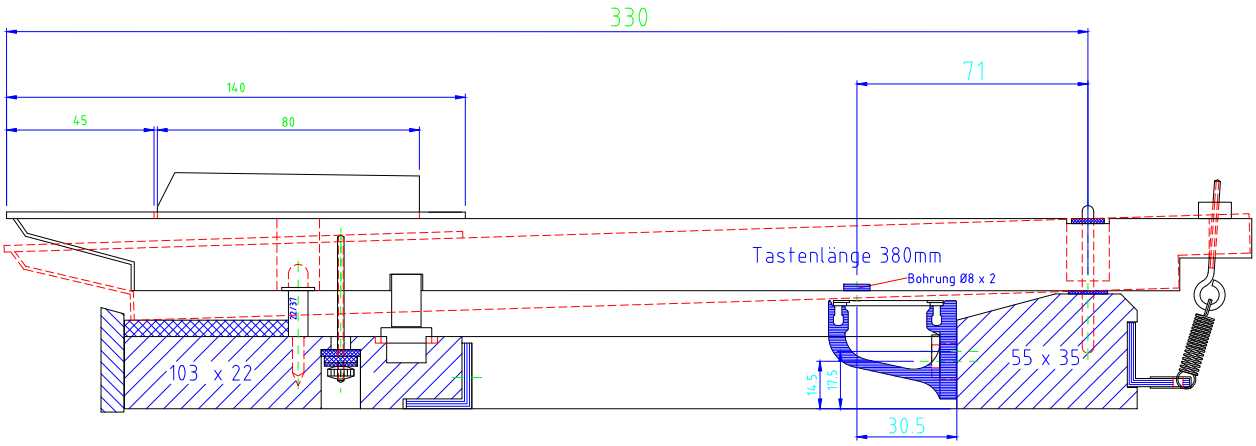
In this state, the function of the bar can already be checked. To do this, connect it to the master module (see below) and switch on the system. The control LED of each module (in the Espressivo-E) flashes for about one second when switched on.

If you then move a key magnet (observe polarity) or the test pin (yellow tip) to a sensor position, the LED of the corresponding sensor module lights up briefly for each sensor.

Mounting on the keyboard

The Espressivo system is designed for a key travel of approx. 2-4mm. The sensor bar can therefore usually be mounted directly on the balance rail. The illustration shows typical dimensions of an electric keyboard and the ratios of the lever arms that achieve a suitable key action at the sensor.

In the case of particularly long keys, as used in some mechanical actions, the key travel may be too small near the balance beam. In these cases, it is necessary to create a stable support for the sensor bar further forward on the keyboard frame.



When the key is pressed down, the distance between the sensor strip and the bottom of the button should not be unnecessarily large. The ideal is 1.5 mm. This can be easily determined with a spacer made of two strips of credit card glued on top of each other.

Be sure to use the screws, washers and spring washers supplied to fix the sensor bar so that a permanently stable connection between the sensor bar and the keyboard frame is guaranteed. Unstable connections will cause the precise switching points to shift when the metal rail and wood expand or contract at different rates.

Gluing in key magnets

The sensors of the Espressivo system detect the movement of the keys by changing the field strength of magnets attached to the keys. The distance of the sensors from the mounting surface of the sensor rail is 30.5mm (see drawing on the previous page). The magnet must also be mounted on the button at the corresponding position.

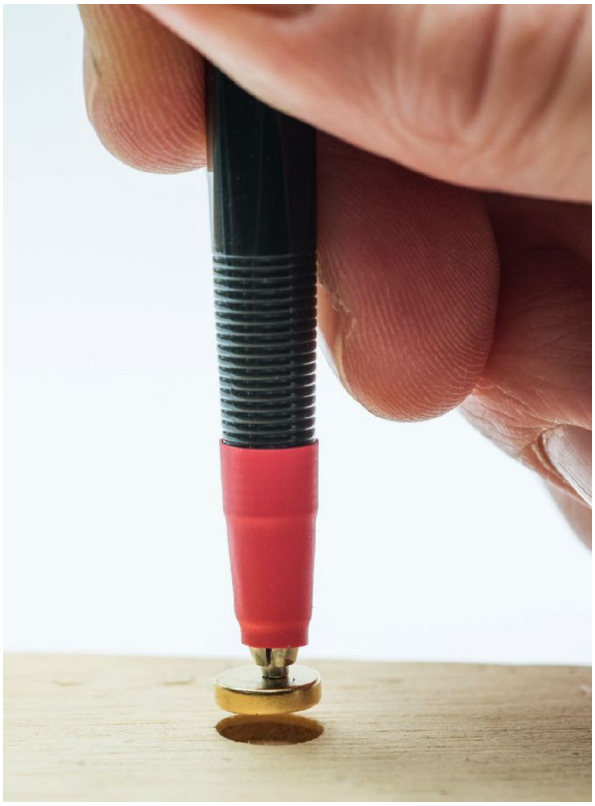
The most accurate way to do this is to drill a blind hole 8mm x 2mm when the keys are made. The deviation from the optimal alignment above the sensors should not be more than one millimeter.

For retrofitting keyboards without holes, we recommend the screw-on magnets (see next page).

Only use the magnets supplied with the Espressivo system. Their strength is designed exactly for the distances and the key action, so that an optimal control of the sensors and thus the desired precision is achieved.

The magnets have two poles, referred to as the North Pole (usually marked Red) and South Pole (usually marked Green).

For the Espressivo sensors to work, the south pole must face the sensor board.



Correct alignment of the magnets can be easily ensured with the mounting pin (red tip). The pin contains a magnetic north pole at its tip. Since opposite magnetic poles attract each other, a keyboard magnet always sticks to the pin with its south pole.

Place the magnet on a non-magnetic surface and touch it with the mounting pin. It will only be attracted if the polarity is correct, otherwise it will move away. With a little practice, it is even possible to flip a magnet that is lying the wrong way round into the correct orientation.

Place the magnet with the mounting pin in the prepared hole in the button and pull the pin away to the side.

Screwing on key magnets

When retrofitting older keyboards, the precise drilling of holes can be problematic. It requires the complete disassembly of the keys, and some organ builders distrust the long-term stability of the adhesive bond between wood and metal.

That is why we have developed this special magnet with a countersunk hole. It is simply screwed onto the key. We also have a special screw made of barely magnetic stainless steel in stock, as well as the ideally matching cross-slotted bit size PH00 with an extended shaft.

Despite the tiny screw size, the drive system is so robust that it is sufficient to pierce a hole with a scriber to screw in the screw. Retrofitting existing keyboards is easier than ever with the new magnet system, and the intervention in possibly historic substance is smaller than with any other contact system.

Just like the standard magnets, the screw-on magnets have a size of 8mmx2mm. Here, too, the key travel on the magnet is between 2mm-4mm. The minimum distance to the sensor board has been reduced from 1.5mm to 0.5-0.7mm (single thickness of a credit card). The space required for installation under the manual is therefore only increased by about 1.5mm compared to recessed adhesive mounting.

Adhesive

For gluing in the magnets, we recommend a thick liquid acylate glue ("superglue"), e.g. Toolcraft "Ropid 200".

Low-viscosity glues have poor adhesion to rough wooden surfaces, especially in drilled holes.

Use fresh adhesive!

Acrylate adhesive starts to age after the first opening of the dispensing bottle. Adhesive joints made with older adhesive become brittle and fragile after a few months. The magnets can then fall off the keys.

Observe the safety instructions for the adhesive!

You should wear a glove on at least one hand when you press the magnet into the hole with your finger after inserting it.

The adhesive is also available in our online shop.

https://shop.orgelpunkt.com

Unfortunately, we cannot ship adhesive to countries requiring air transport due to safety regulations.

Pedal lever with integrated sensors

The easiest way to equip purely electric pedal keyboards is to use the pedal levers with an integrated Espressivo sensor.

The 20mm travel at the tip of the pedal key is perfectly translated to the working range of the sensor. High-quality Igus bearings, a pre-tensioned spring and an oversized felt pad ensure silent operation.

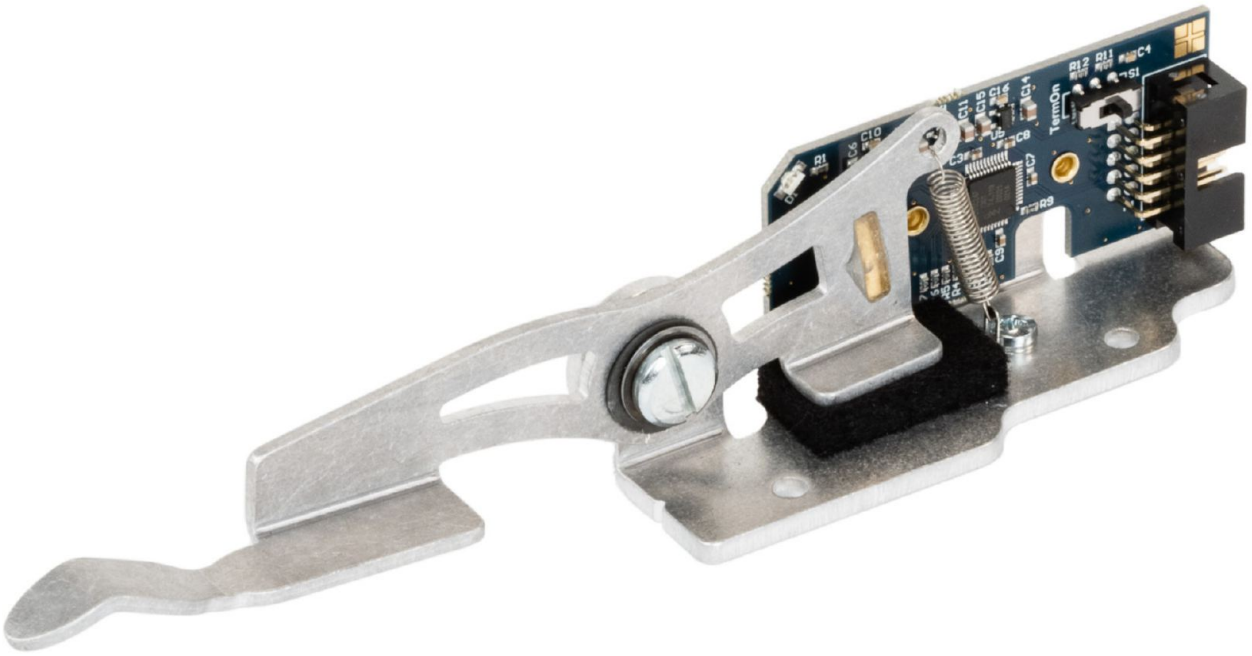
The levers only need to be screwed onto a carrier plate in the appropriate pitch.

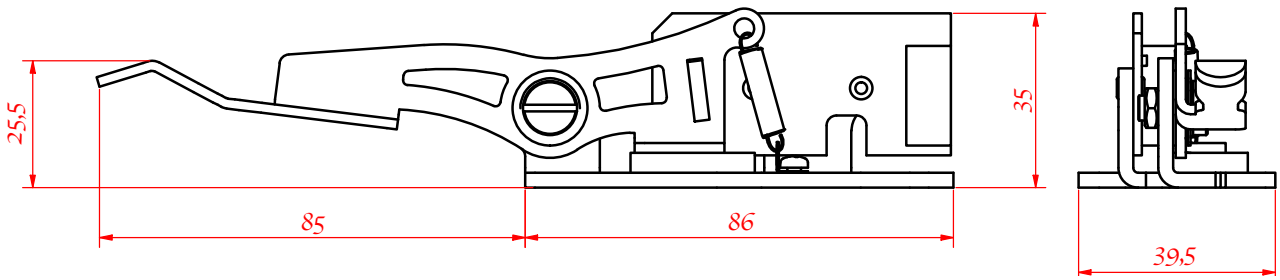
Thanks to the particularly slim design of the aluminum lever, you build the pedal board as a flat insert that you can slide into the console from the front for easy access.

At https://shop.orgelpunkt.com you will find drawings with all the reference dimensions, which greatly simplify correct positioning in relation to the pedal key.

The sensors of a pedal keyboard are connected to each other with a pre-fabricated ribbon cable. An adapter board is used to connect to the standard RJ45 (Ethernet) bus connector, which is used to connect to the Espressivo master.

All functions known from the Espressivo manual (setting pre-travel, switching point spread, etc.) are also available for the pedal. For a reliable function, a switching point spread of at least 10% should always be set for the pedal during commissioning (see "Spreading the switching points").





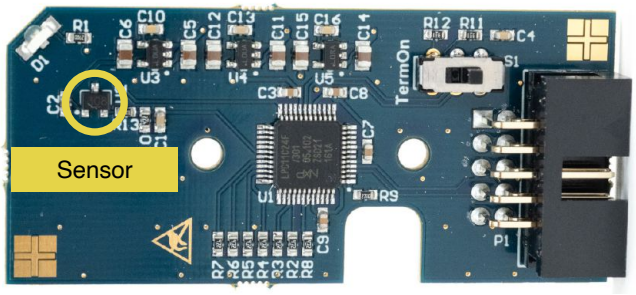
Individual sensors for pedal squares

Espressivo single sensors are available for equipping mechanical pedal keyboards with electric couplers. These are mounted on the side of the action bracket. The corresponding cylindrical magnet 4mm x 12mm is glued into a hole in the angle and moves laterally past the sensor.

The lateral distance between sensor board and square should not be more than 2mm.

The circuit board is attached to an aluminum bracket which is fixed to the capsule of the tracker square.

The angle has a guide nose for easier positioning, which is adapted to the standardized Laukhuff capsule. If this nose gets in the way of positioning on other capsules, it can easily be broken off at the predetermined breaking point.



The maximum detectable travel of the pedal lever on the front support is +/- 15mm from the horizontal. The usual is +/- 10mm.

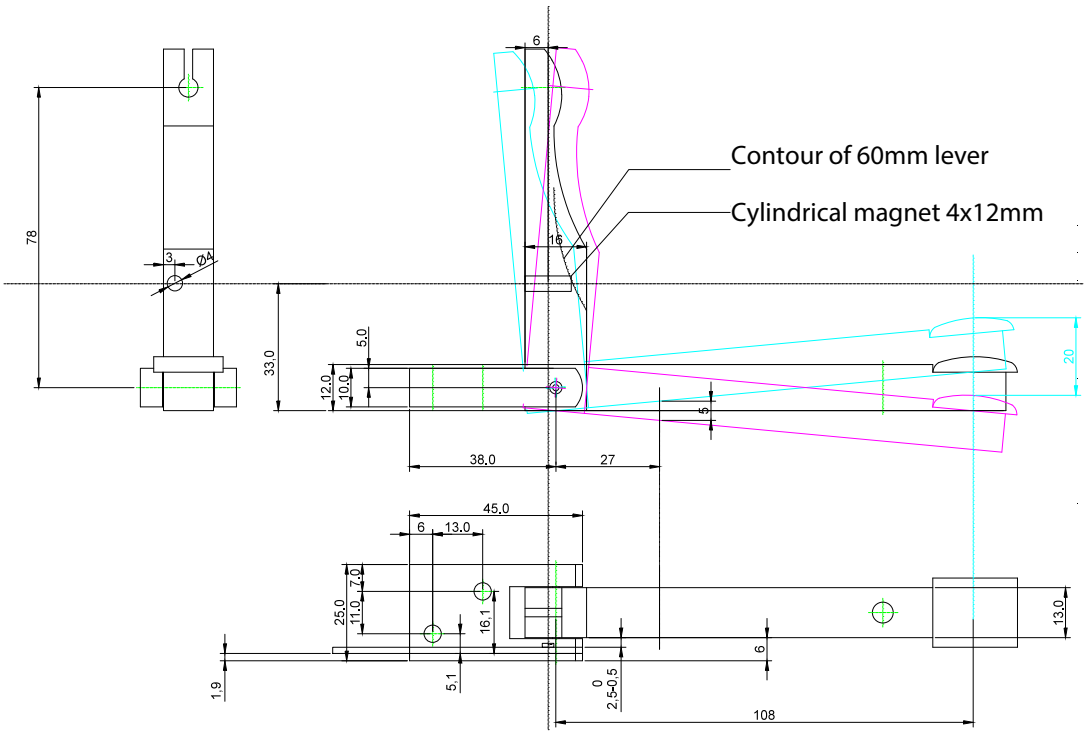
Please note:

The magnet in the pedal bracket and the sensor on the circuit board must be arranged in relation to each other in such a way that the ends of the magnet do not move past the sensor over the entire actuation travel.

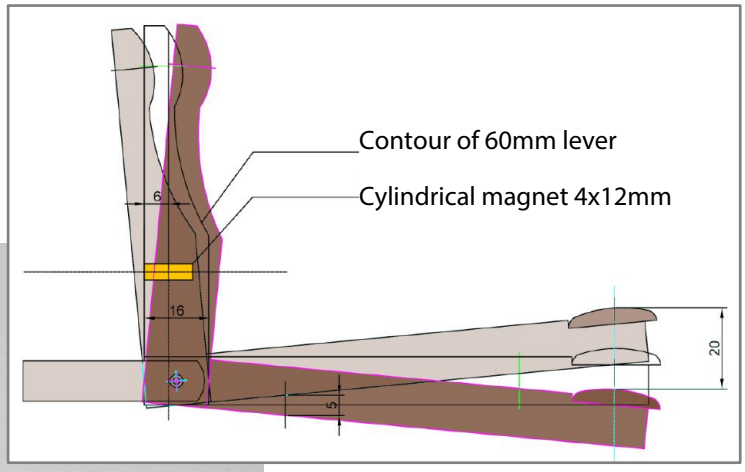
If the magnet leaves the sensor's measuring field, the magnetic signal is no longer clear. This means, for example, that a pedal note might switch off again when the pedal key is pressed deeper.

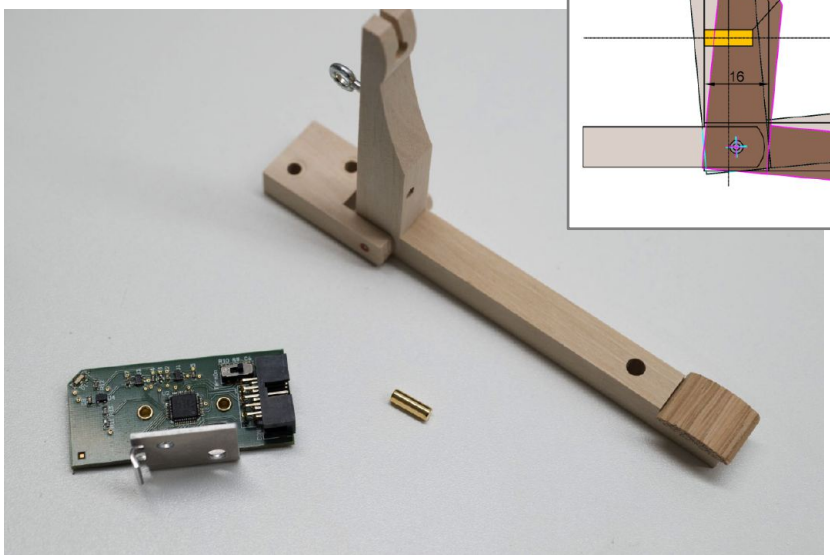
The sensors of a pedal keyboard are connected to each other with a prefabricated ribbon cable. An adapter board is used to connect to the standard RJ45 (Ethernet) bus connector, which is used to connect to the Espressivo master.

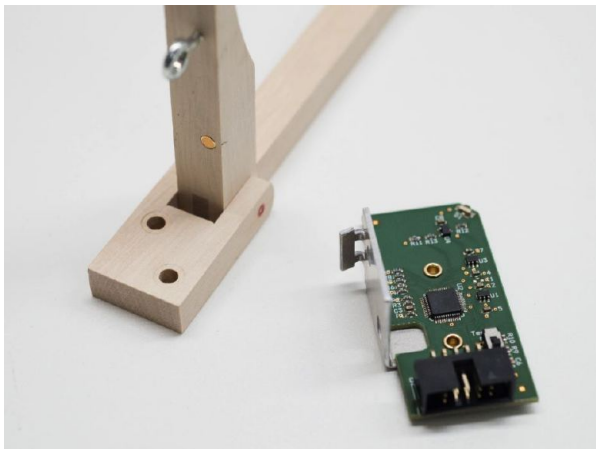
All functions known from the Espressivo manual (setting the empty travel, switching point spread, etc.) are also available for the pedal. For a reliable function, a switching point spread of at least 10% should always be set for the pedal during commissioning (see "Spreading the switching points").

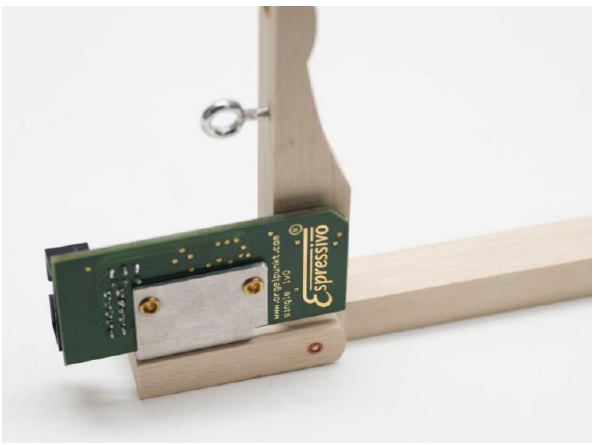


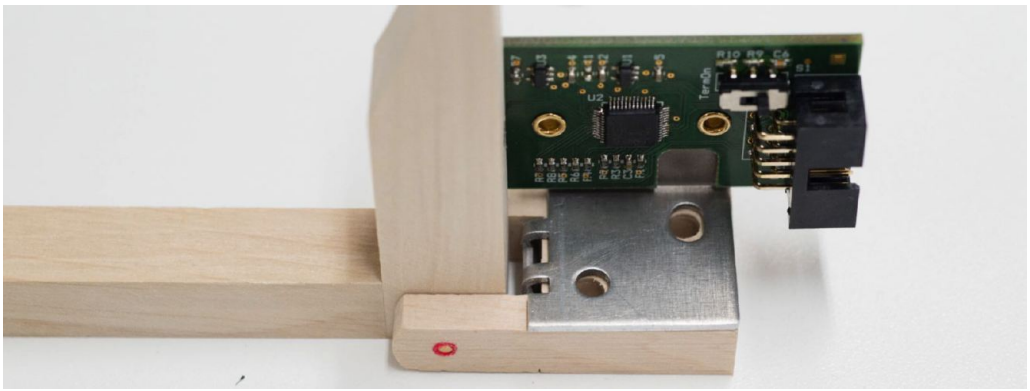
Mounting the sensor on the square







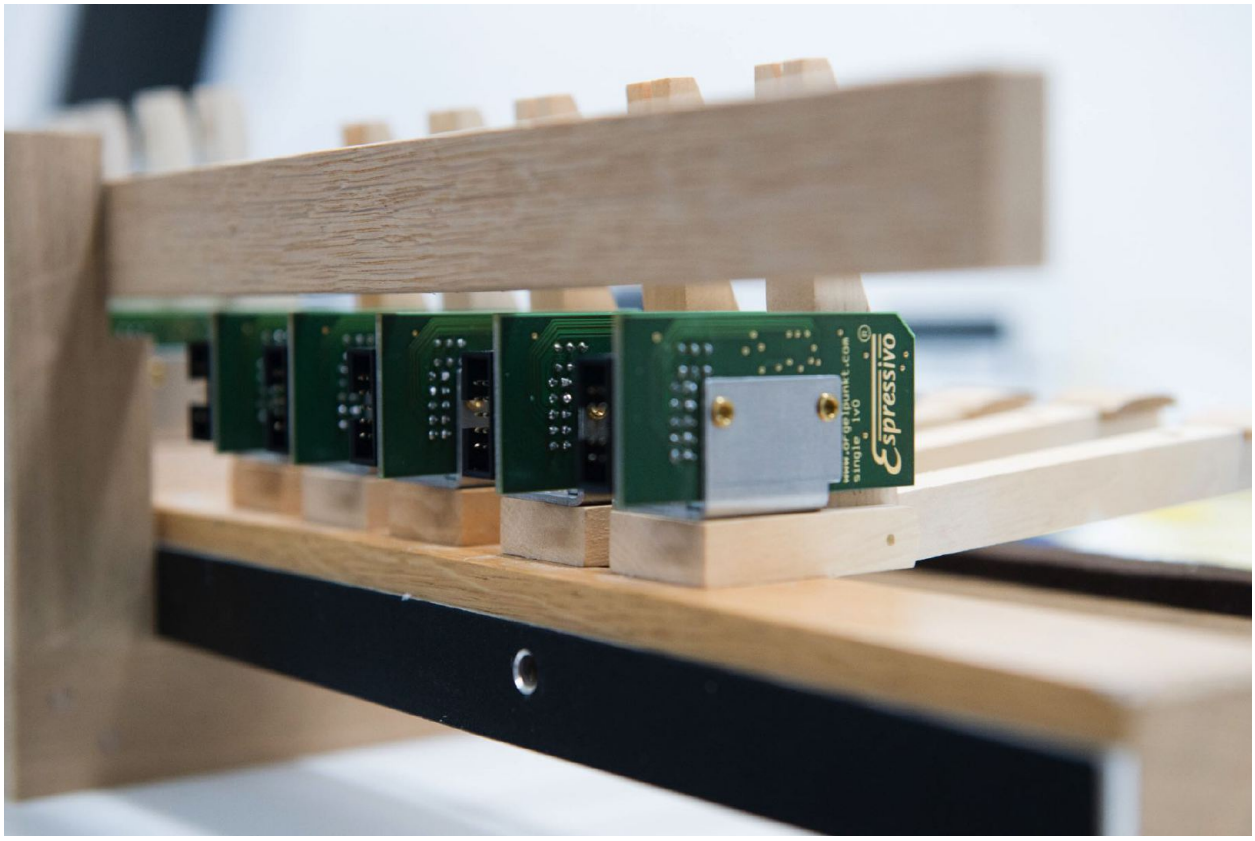




Espressivo single sensor with mounting bracket, magnet, action square

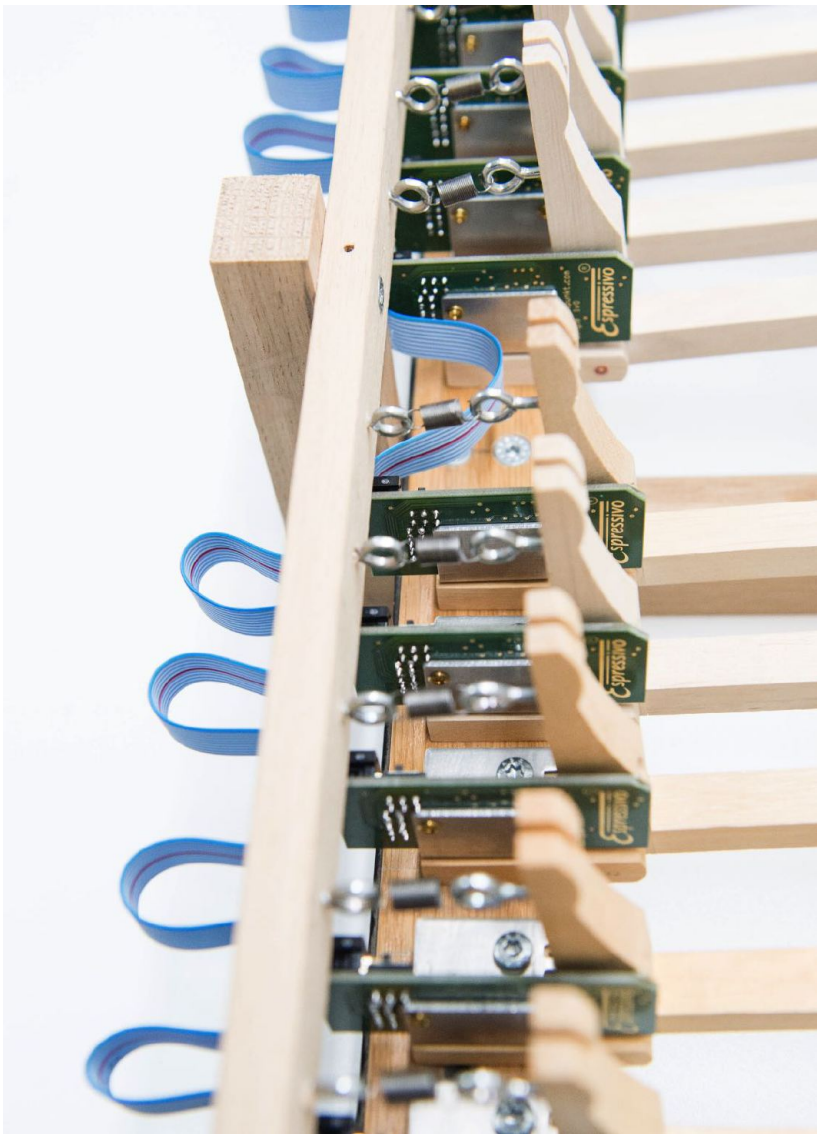
Positioning of the sensor on the pedal square. The polarity of the magnet in the hole of the square is irrelevant. It is automatically recognized when the pedal is set up.

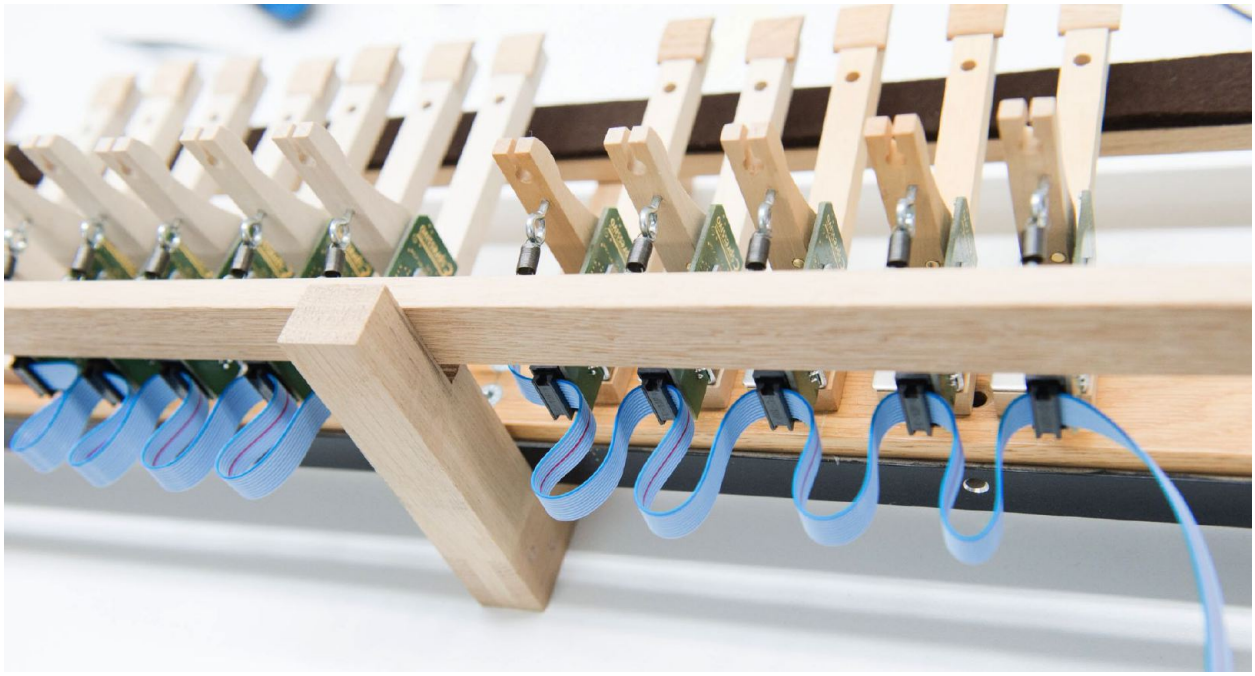
Equipping a pedal keyboard



(here with stop bars and return springs for action simulation)

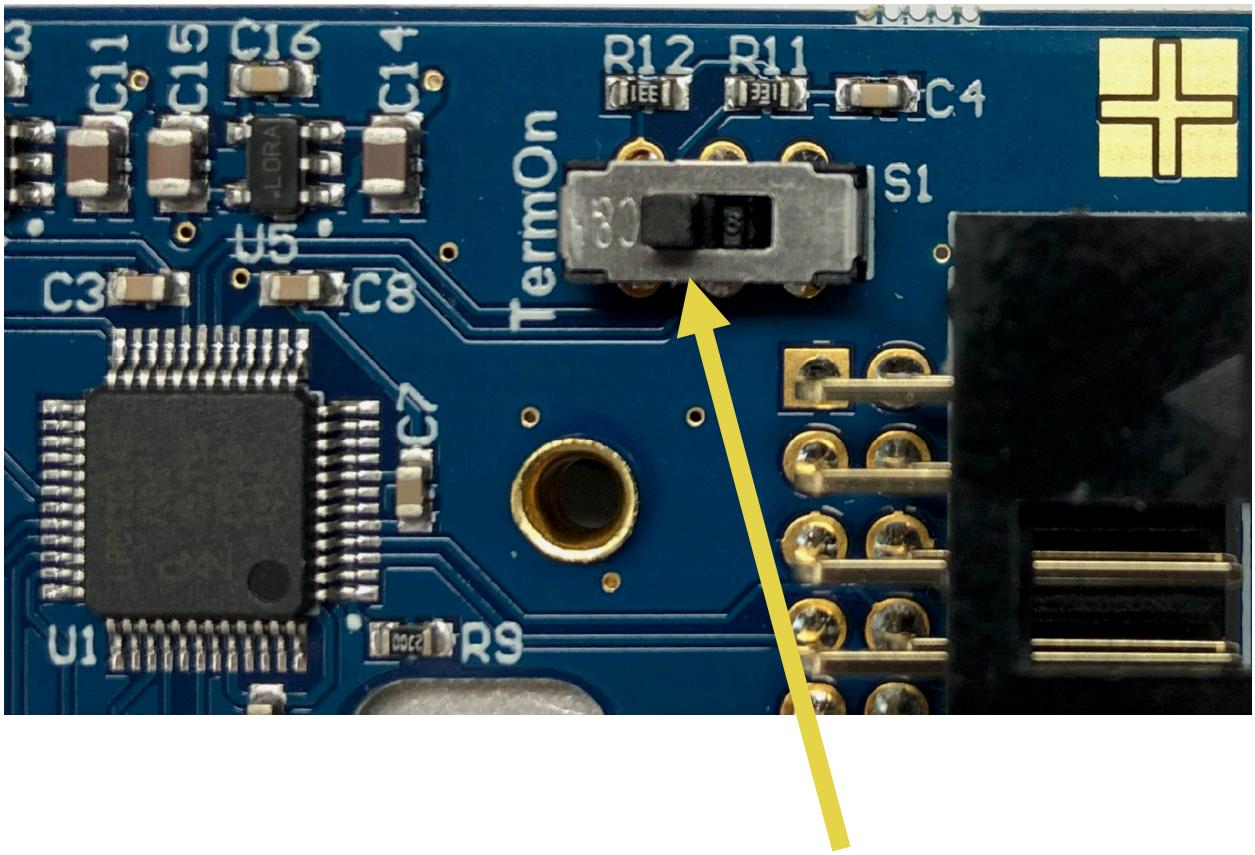
Pedal contact assembly wiring





Switching on the bus termination

All individual sensors have a switch with which the bus cable is terminated with a terminating resistor. This is necessary to avoid interference on the bus cable. On the last sensor (and only on this one!) in the ribbon chain, the switch must be switched to "term. on" (termination) for this purpose.

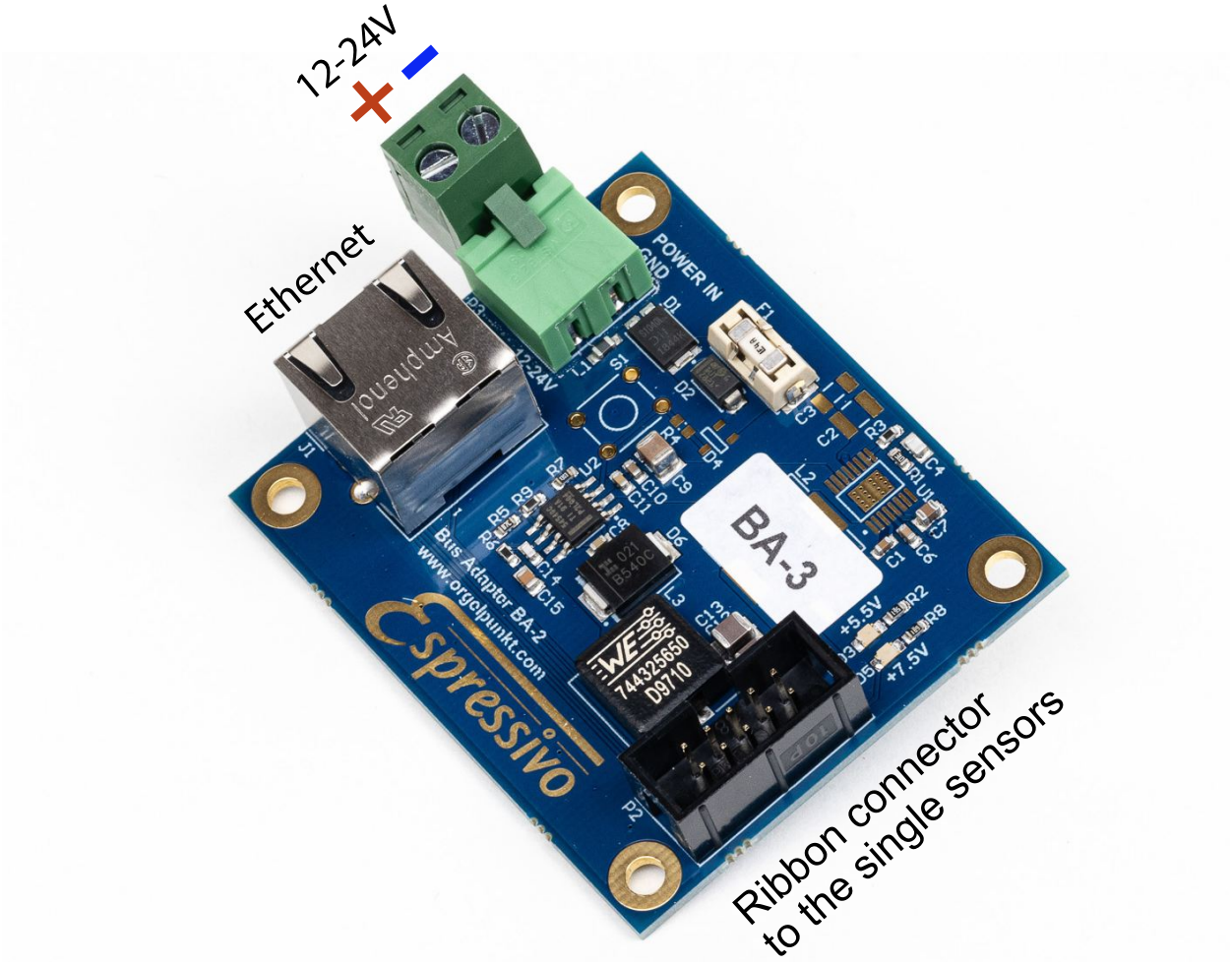


Switch on "Term.On" at the last sensor in the ribbon chain

Connecting the pedal sensors to the Espressivo Master module

The ribbon cable is equipped with 33 plugs. The first plug (with a slightly larger cable spacing) is used to connect to the master module. The bus adapter is required for this.

Up to 32 pedal sensors can be addressed. If you need fewer pedal contacts, please cut off the excess cable end directly at the last connector. An unused longer cable end is a source of interference.



The pedal contact assembly needs its own power supply. Connect the BA-2, BA-3 or BA-4 bus adapter via the power supply terminal to the same power supply unit (12 - 24V) that powers the Espressivo master. Green LEDs indicate the function of the supply electronics on the bus adapter.

Plug the ribbon cable into the appropriate socket (here on the right).

Use an Ethernet cable plugged into the RJ45 socket (left) to connect the assembly to the Espressivo master unit in the same way as the manual keyboards.

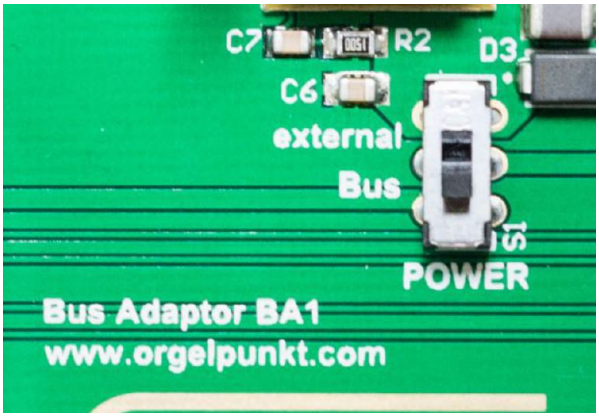
Currently, the BA-4 bus adapter is supplied. This is no longer compatible with older existing systems with green pedal sensor boards. If you need a replacement BA-1 adapter for such a system, please inform your sales partner when ordering.

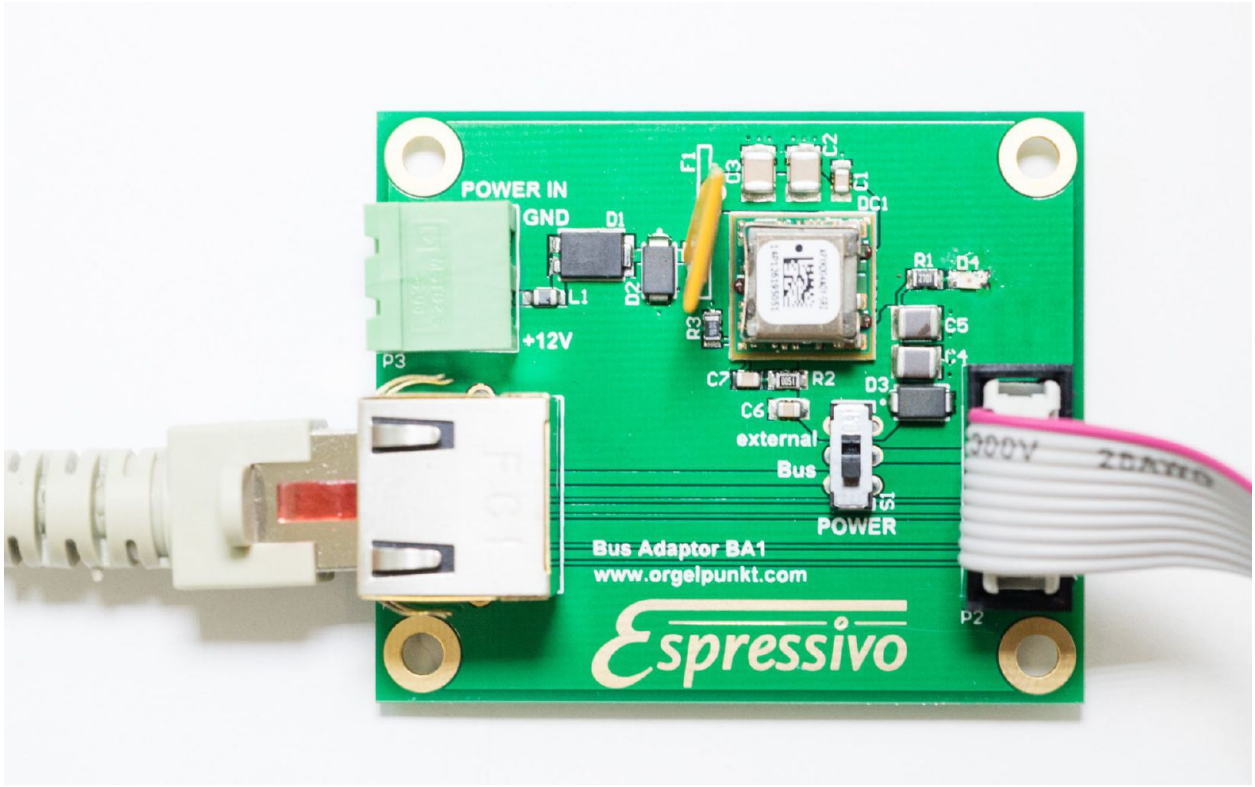
Power supply via the older bus adapter BA-1

The earlier version of the bus adapter BA-1 offered the option of powering the pedal sensors via the bus cable or with an external power supply.

However, only use the external power supply, as the supply via the Ethernet cable has proven to be unreliable. For this purpose, the "Power" switch must be set to "external".

A red LED indicates the presence of the supply voltage.





The BA1 adapter can only be operated with 12V, not with 24V!

If this adapter is used, the entire Espressivo system must be powered from a 12V power supply.

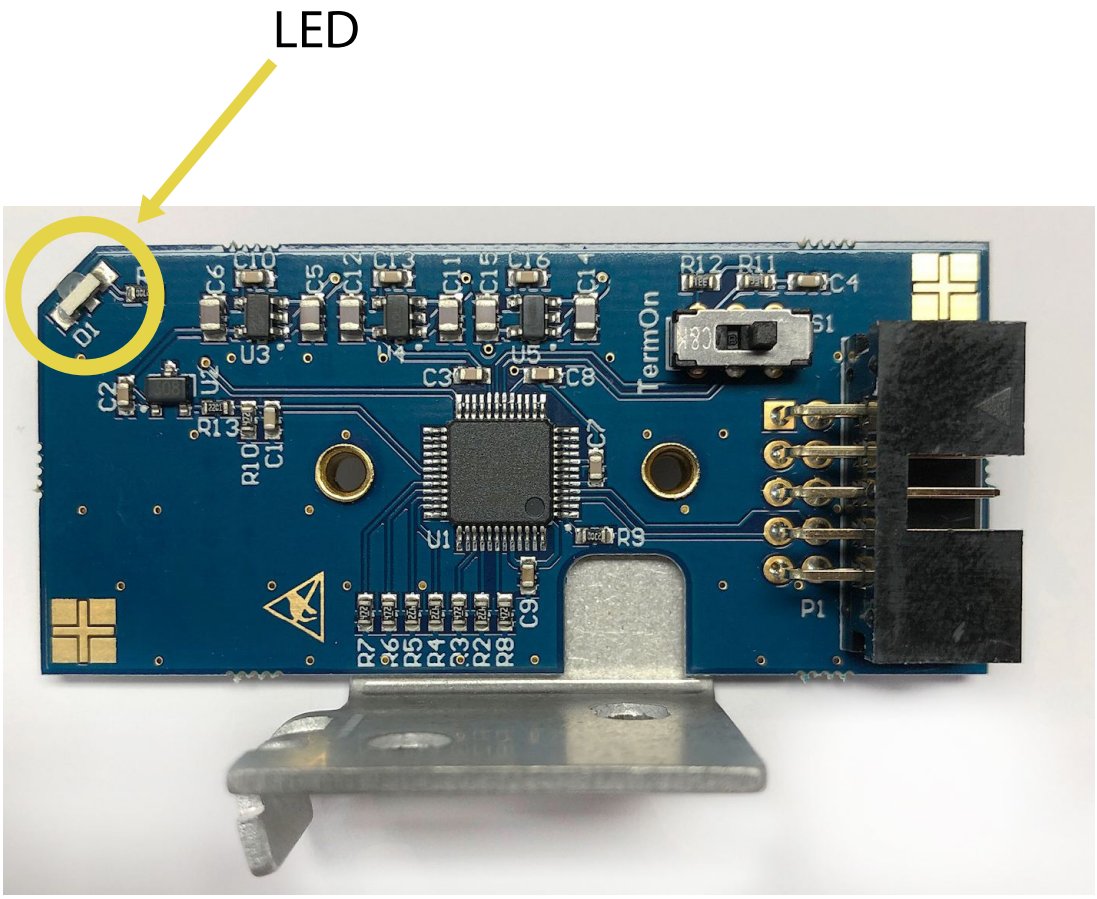
Single sensor LED indicator

Each sensor has an LED indicating its function.

When the system is switched on, all LEDs flash for approx. 1-2s while they are recognized by the master module.

If an LED flashes for longer (approx. 5s), it has not been recognized. Then there is an error in the master configuration or the pedal has not yet been configured.

In normal operation, the LED flashes very briefly when the button is pressed or released.



Configuring manuals and pedal: configuration file

All configuration data of the system are stored on the microSD memory card. Should it be necessary to replace the master module, the memory card can simply be inserted into the new module and the system is ready for operation without any further setting work.

There is a configuration file (orgel.cnf) on the card which is edited using a standard text editor:

 # ======= Espressivo configuration =======

compatible with Espressivo Master Firmware V4.2 or higher
Parameters are defined by keywords written in capital letters starting with a "/", e.g. /CONFIG.
Lines starting with the hash sign are treated as comments and are not scanned for parameters.
This way, settings can be activated or deactivated by deleting or inserting
a "#" at the beginning of a line.

 # --------- Ethernet configuration --

Use the following options to set the IP-Address and related network settings of the
Espressivo master module# as well as the UPD-Port for IPMIDI-messages.

/IPADDRESS 10.0.0.101
/IPADDRESS 10.0.0.102
/IPADDRESS 192.168.1.6
/IPADDRESS 192.168.1.7
/NETMASK 255.255.255.0
/GATEWAY 10.30.0.254
/USEDHCP
/UDPPORT 12345
/MULTICAST

Without explicit settings, the following default parameters are used:
IP 169.254.1.2 (compatible with a Windows-PC in "automatic" network settings without connection
to a DHCP-server).
The subnet mask should only be changed if specific network configurations require it
The gateway address is irrelevant in this case
The DHCP option for setting the IP address of the Espressivo master should only be used as
an exception.
In this scenario the actual address of the master module can change at any time, making it hard
to connect from the PC-configuration software.
Without explicit settings, IPMIDI messages are sent on UDP-Port 21928.
This port is compatible with IPMIDI drivers on the PC https://www.nerds.de/en/ipmidi.html
By default, IPMIDI is sent as a broadcast (target IP 255.255.255.255)
Alternatively, the multicast protocol can be invoked (target IP 225.0.0.37)
All IP settings do not use delimiters like ":"

 # --------- IPMIDI configuration ----------

/MIDIOVERIP
This option enables output of IPMIDI via Ethernet port (normally on).
Outputs single 3-Byte IPMIDI-messages in minimum length Ethernet packages of 60 Bytes.
Fixed package rate of 1/ms
To make use of the high data rates of the Ethernet, please enable "IPLONG" below.

advanced IP-settings available from firmware 4.2
These options reduce the latency on the Ethernet port by more than a factor of 20
Normally, the application software on the receiving side should not be affected by this change
on the network layer.
Test your receiving system for compatibility!

/IPLONG
Will package up to 64 IPMIDI-message into one ethernet packet, 252 Bytes long.
Most efficient use of bandwidth

#/IPFAST
Outputs the same message rate, but uses single message packets.
High packet burst rate may overload receiving buffer!
Inefficient use of bandwidth, may be easier to decode.

 # --------- keyboard configuration ----------

/CONFIG ManualNo: 1 filename: Manual1.txt midichannel: 1
/CONFIG ManualNo: 2 filename: Manual2.txt midichannel: 2
/CONFIG ManualNo: 3 filename: Manual3.txt midichannel: 3
/CONFIG ManualNo: 4 filename: Manual4.txt midichannel: 4
/CONFIG ManualNo: 5 filename: Manual5.txt midichannel: 5
/CONFIG ManualNo: 6 filename: Manual6.txt midichannel: 6

 # --------- pedal configuration ----------

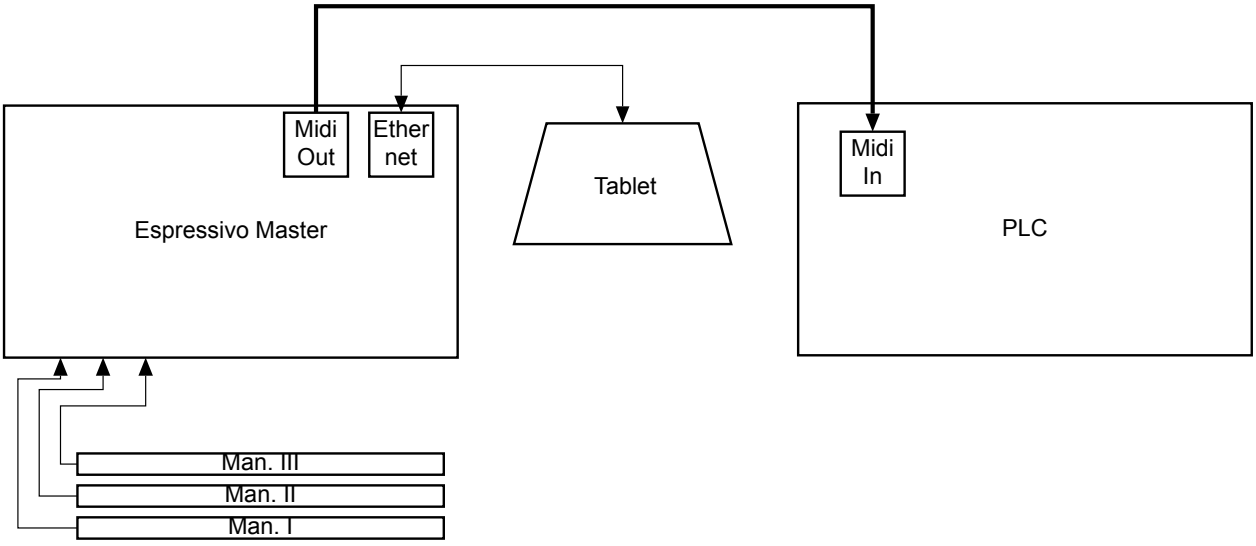
/CONFIGSINGLE PedalNo: 1 filename: Pedal1.txt midichannel: 8
/CONFIGSINGLE PedalNo: 2 filename: Pedal2.txt midichannel: 9

Please don't change any keywords or ":"
If needed, activate manuals 5, 6 by removing the comment sign at the beginning of the line
Change the assignments of MIDI channels to manuals if needed by the receiving system.
Only MIDI channels 1-15 are valid output channels
setting channel to 16 suppresses direct MIDI output
suppressed outputs are activated through couplers only (see below)
e.g. /CONFIG ManualNo: 1 filename: Manual1.txt midichannel: 16

Connecting the Espressivo system to an action system

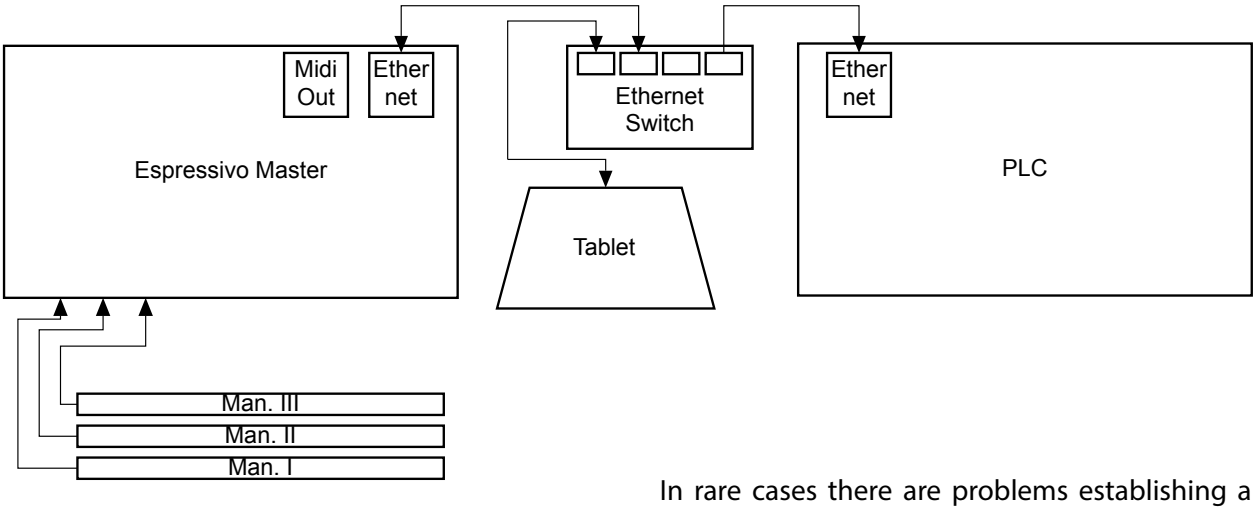
The Espressivo master module has two interfaces through which it can send action data to the organ control system - the MIDI interface and the Ethernet interface.

When you use the MIDI interface, the Ethernet interface remains unused. This allows a Windows PC (preferably a tablet) to be connected to set up and adjust the system if required.



If you use the Ethernet interface to send action data to the organ control system, you should route this connection via an Ethernet switch.

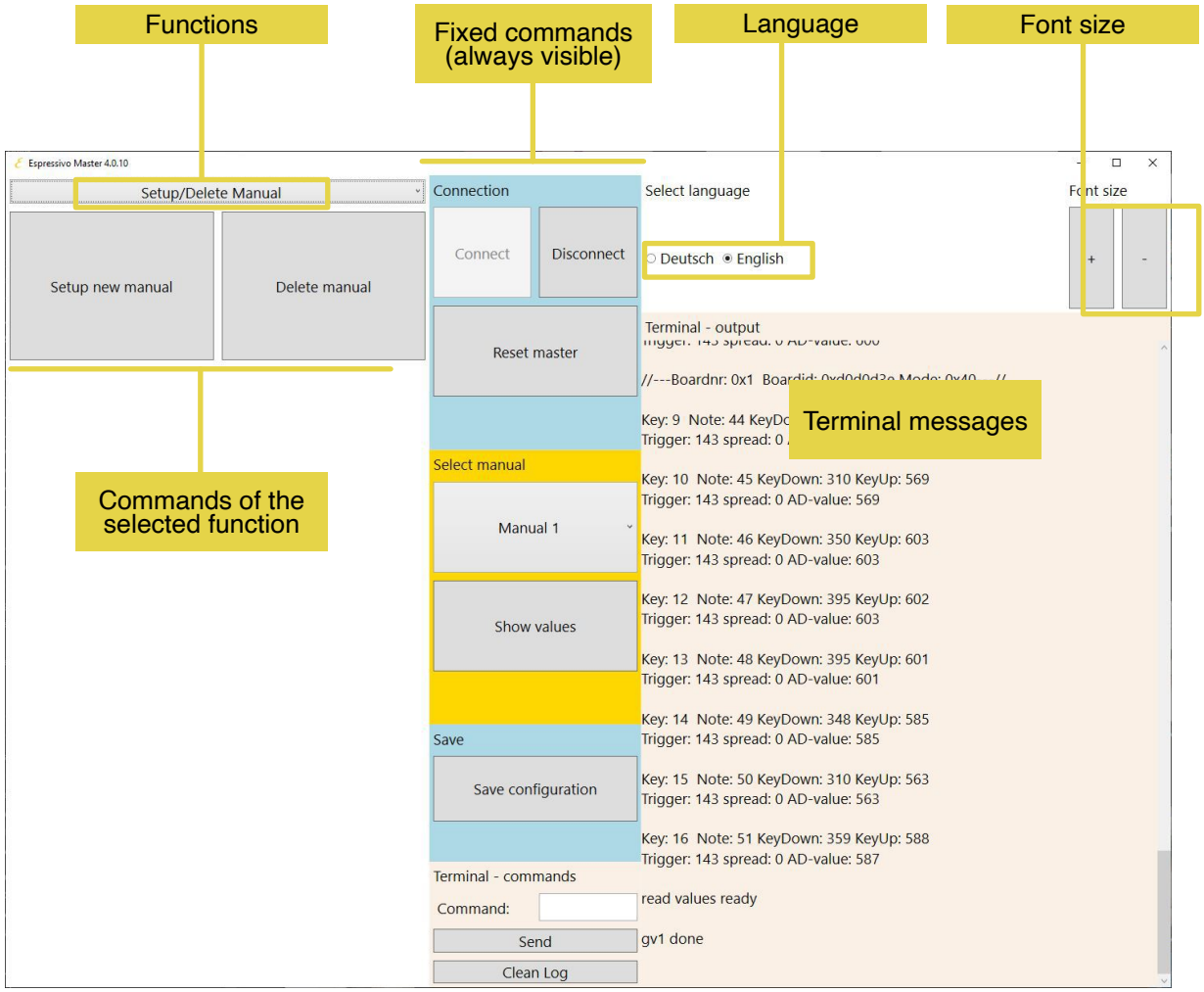
Another interface for the tablet is then available at the switch. This way you can simultaneously play the organ while making adjustments via the tablet in order to check the result acoustically.



In rare cases there are problems establishing a data connection between the tablet and the Espressivo master. The cause usually lies in the IP configuration of the Windows operating system of your tablet.

The configuration software

v



Function:

This pull-down menu allows you to navigate to all the functions described on the following pages

Language:

You can choose between two languages (German and English). After you have selected another language, you need to restart the software.

Font size:

Depending on the screen resolution, the font size of the control elements appears differently. You can adjust the font size individually for optimal readability.

Individual commands:

These are described later in the manual.

Fixed commands:

These commands are always visible. While setting up or calibrating keyboards the buttons cannot be operated.

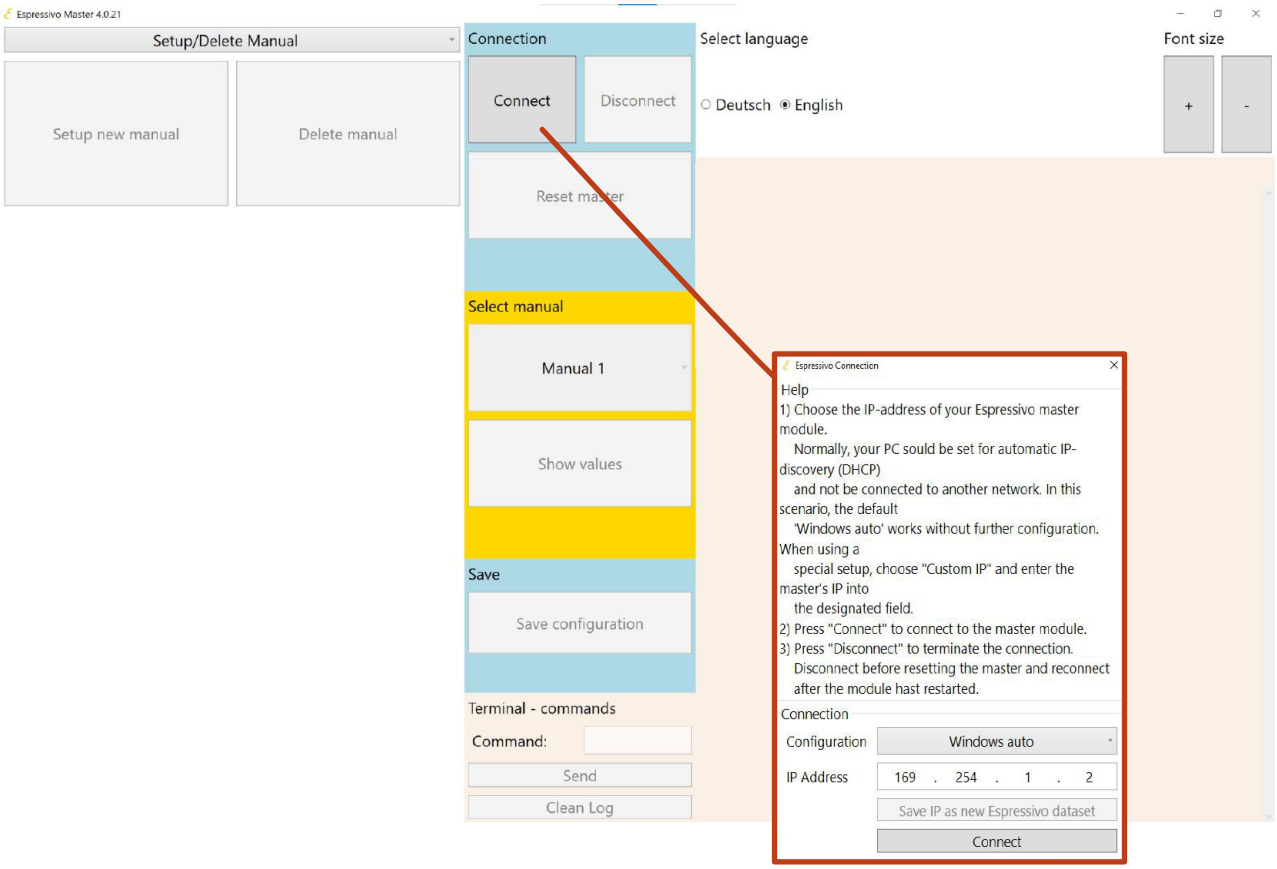
Terminal message:

In addition to chronologically listed system messages, manual values are also displayed here.

Set-up and adjustments

The Espressivo system is set up and adjusted using the associated Windows software.

It can be downloaded free of charge from the Espressivo support area.



Check the IP setting and establish the connection to the master module clicking on the "connect" button:

Select the IP address of your Espressivo master module. Normally your computer is in automatic mode ("DHCP") and is not connected to any other network. Then the basic setting "Windows auto" works.

The pull-down menu contains further, frequently used settings, e.g. the "Sigmatek standard" configurations in the subnet 10.0.0.x, which are used in Laukhuff installations with two consoles or dedicated IP configurations for SSOS systems.

You also have the option of entering the IP address freely if you have stored your own IP in the config file.

Click on "connect" to start the main program.

If you cannot establish a connection to the Espressivo master despite having configured the IP address correctly, press the reset button on the master module and try to establish the connection again a few seconds later.

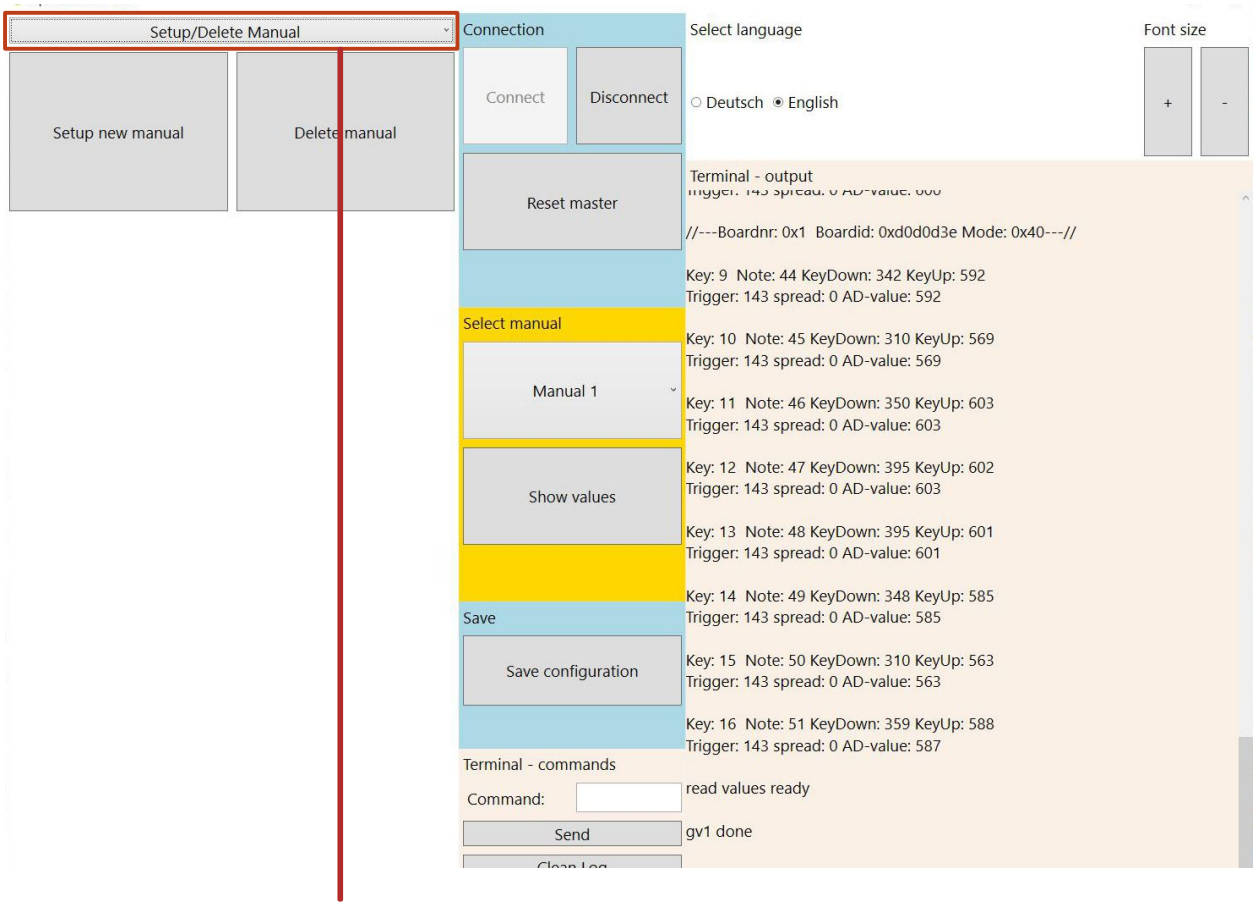
Some Windows systems cannot establish a connection in Auto mode. Change the IP address of your PC manually (to 169.254.1.100).

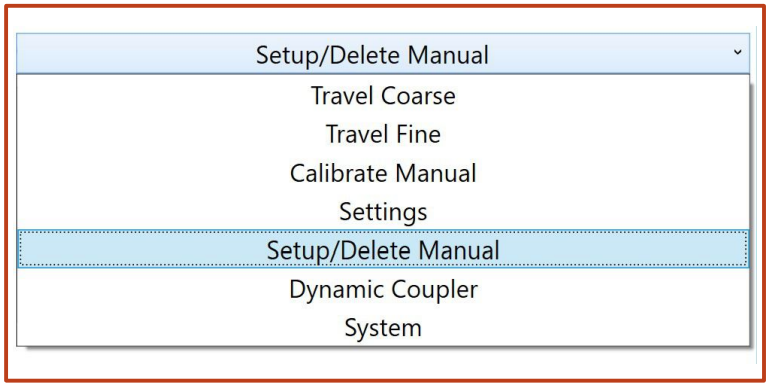
In order to connect to an Espressivo system with a specific IP address (e.g. SSOS systems), your computer's network adapter must be manually configured to an appropriate IP address on the same subnet. If you need help with this, please contact the manufacturer of your organ controll system.

The program now starts on the configuration page.

The various options are selected via the tabs "Setup", "Calibrate", etc. The instruction texts explain how to use the option selected in each case.

Use the "Disconnect" button to terminate the connection to the Espressivo Master. Do this, for example, before you perform a restart with the reset button on the master.

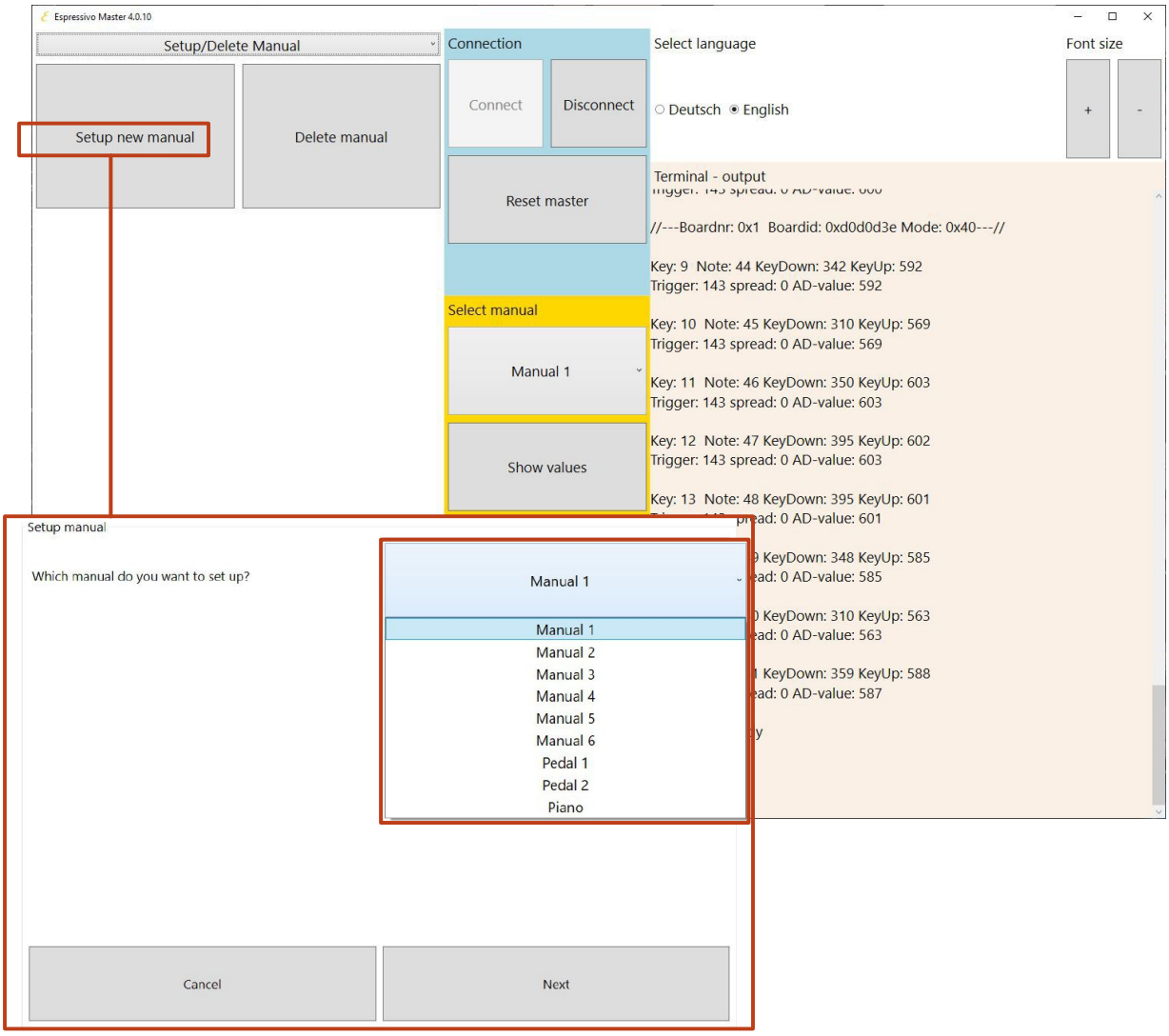




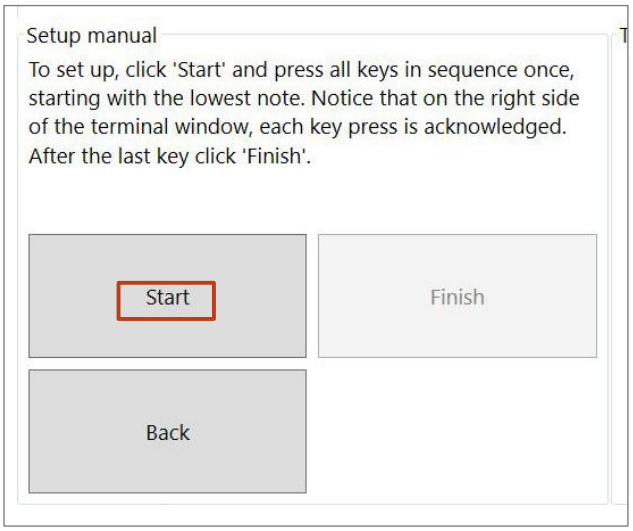
Setting up new manuals

After installing or replacing sensors, these sensors must first be assigned to the corresponding manuals. Since the sensors themselves do not have any coding switches or similar devices and can be arranged in different ways on the keyboard, this assignment is done by playing all keys in each manual once from left to right.

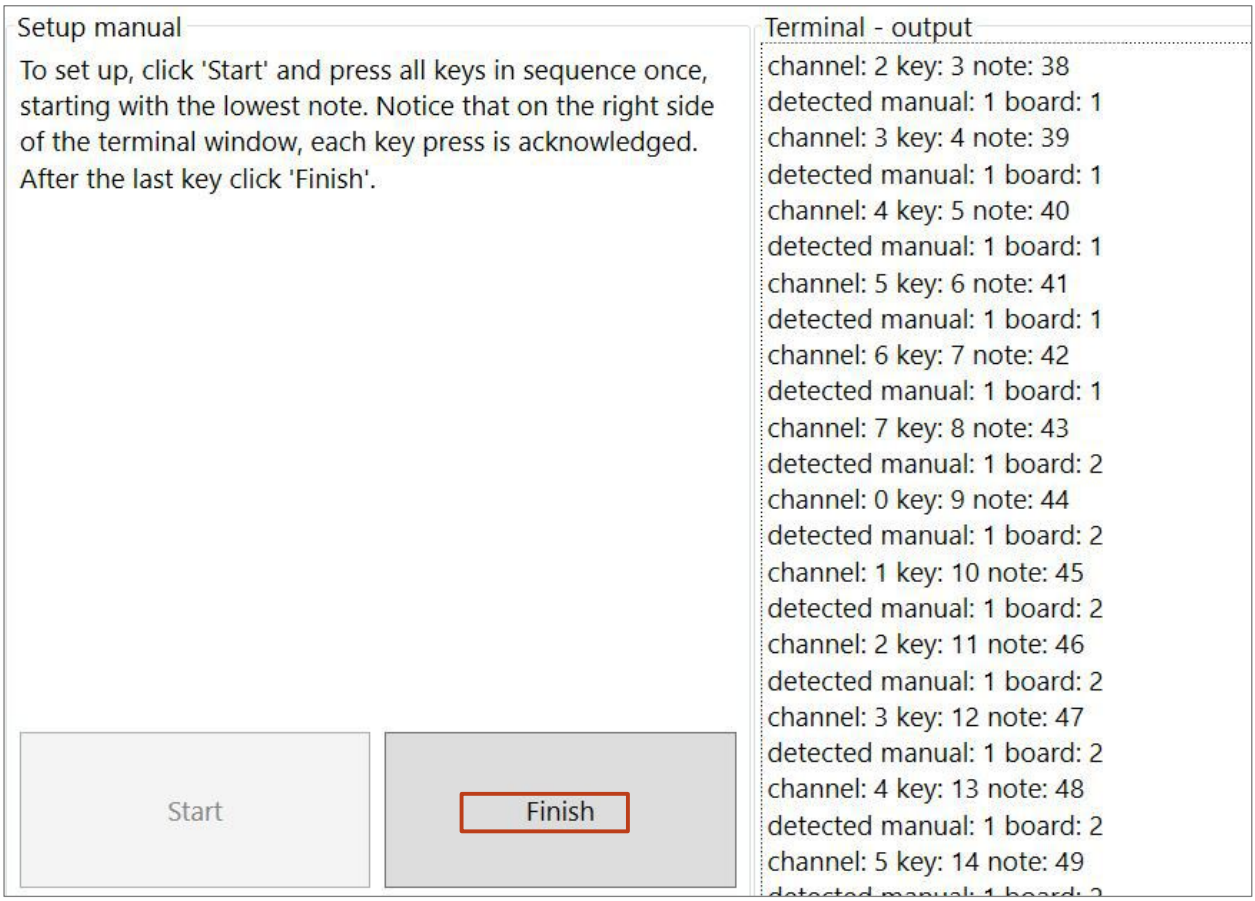
If possible, carry out this setup in the workshop before the console is installed in the organ! In this way you can check that all components are correctly connected and in working order. At this point you can easily remove the sensors again if necessary or correct the position without having to carry out time-consuming disassembly.



1. Click on "Set up new manual".
2. Another window will open to guide you through the setup and calibration of the manual.
3. Select the manual to be set up and click on "Next".



4. Click on "Start".
5. Press each individual key of the manual to be calibrated once in succession from left to right. With each newly recognised key, a message is displayed on the screen counting the number of keys and indicating which sensor on which sensor module has responded.

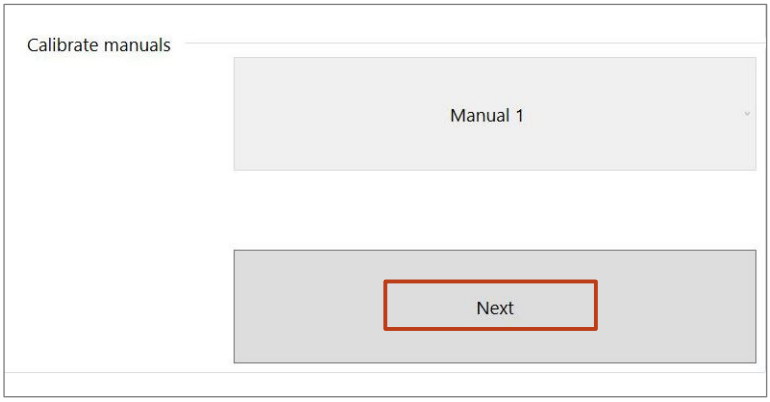


6. Check that the correct number of buttons has been detected.
7. click "Finish".

The manuals only need to be set up once for each manual.

The master module then performs a reset on its own and opens the window for calibrating the manual.

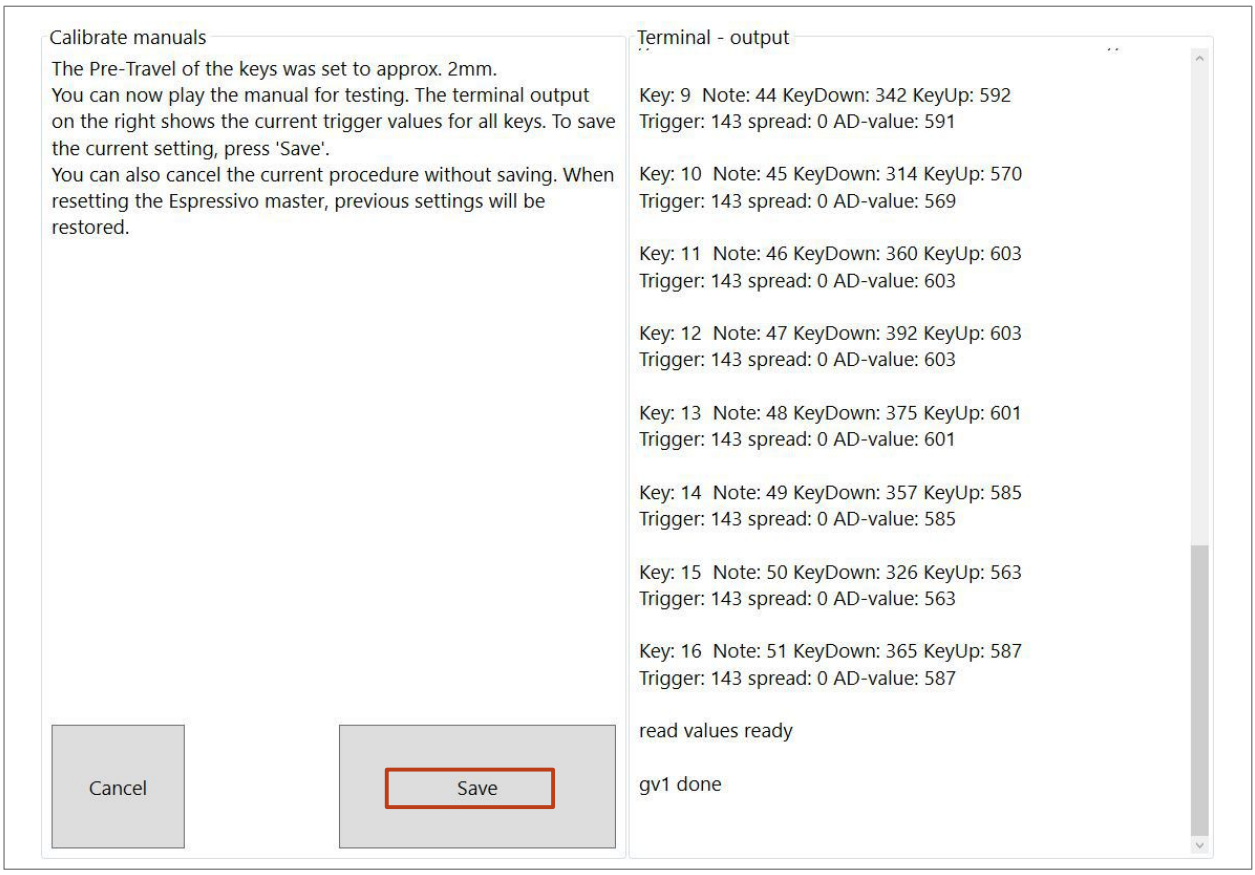
Calibrating a new manual



As the calibration is automatically initiated up after setting up a manual keyboard, the previously set-up manual is already selected.

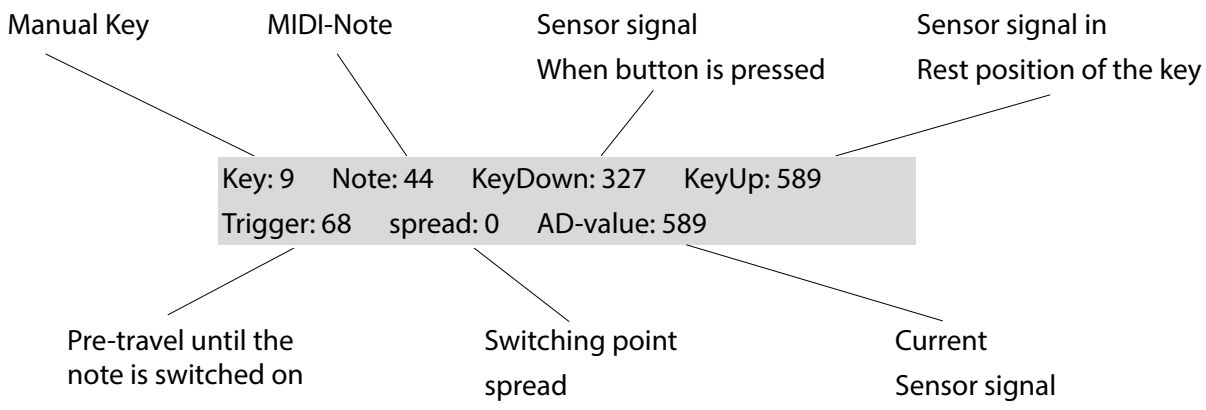
8. Click on "Next“

9. click on "Start
   Now press each key once starting from the rest position all the way down.
10. then click on "Finish".



11. Check the displayed values of each sensor in the log text field on the right.
12. click on "Save" to complete the calibration.

Explanation of the terminal messages:



Reading sensor values

The microcontrollers of the slave modules record analogue voltage values of the Hall sensors on a scale of 0 - 1023. The magnetic field of the key magnets is polarised in such a way that an increase in the field strength causes the sensor signal to decrease. In the "normal" arrangement under the front key arm, key being pressed down therefore corresponds to a lower sensor value.

Typical parameters of a normally mounted (Mode: 0x1) module look like this:

Boardnr: 33 Boardid: 0xd0dec40 NrofChannels: 8 Mode: 0x3

Key: 9	Note: 44	KeyDown: 28	KeyUp: 474	Trigger: 61	spread: 0	AD value: 474
Key: 10	Note: 45	KeyDown: 93	KeyUp: 484	Trigger: 55	spread: 0	AD value: 484
Key: 11	Note: 46	KeyDown: 42	KeyUp: 492	Trigger: 57	spread: 0	AD value: 492
Key: 12	Note: 47	KeyDown: 76	KeyUp: 472	Trigger: 59	spread: 0	AD value: 472
Key: 13	Note: 48	KeyDown: 107	KeyUp: 490	Trigger: 56	spread: 0	AD value: 490
Key: 14	Note: 49	KeyDown: 33	KeyUp: 483	Trigger: 59	spread: 0	AD value: 483
Key: 15	Note: 50	KeyDown: 83	KeyUp: 475	Trigger: 59	spread: 0	AD value: 475
Key: 16	Note: 51	KeyDown: 48	KeyUp: 492	Trigger: 60	spread: 0	AD value: 492

With the inversely mounted module (mode: 0x3), the signal increases when the button is pressed because the magnet moves away:

Boardnr: 33 Boardid: 0xd0dec40 NrofChannels: 8 Mode: 0x3

Key: 13	Note: 48	KeyDown: 584	KeyUp: 311	Trigger: 82	spread: 0	AD value: 311
Key: 12	Note: 47	KeyDown: 594	KeyUp: 312	Trigger: 89	spread: 0	AD value: 312
Key: 11	Note: 46	KeyDown: 601	KeyUp: 267	Trigger: 100	spread: 0	AD value: 267
Key: 10	Note: 45	KeyDown: 571	KeyUp: 263	Trigger: 89	spread: 0	AD value: 263
Key: 9	Note: 44	KeyDown: 576	KeyUp: 210	Trigger: 109	spread: 0	AD value: 210
Key: 8	Note: 43	KeyDown: 593	KeyUp: 308	Trigger: 80	spread: 0	AD value: 308
Key: 7	Note: 42	KeyDown: 602	KeyUp: 270	Trigger: 98	spread: 0	AD value: 270
Key: 6	Note: 41	KeyDown: 573	KeyUp: 255	Trigger: 89	spread: 0	AD value: 255

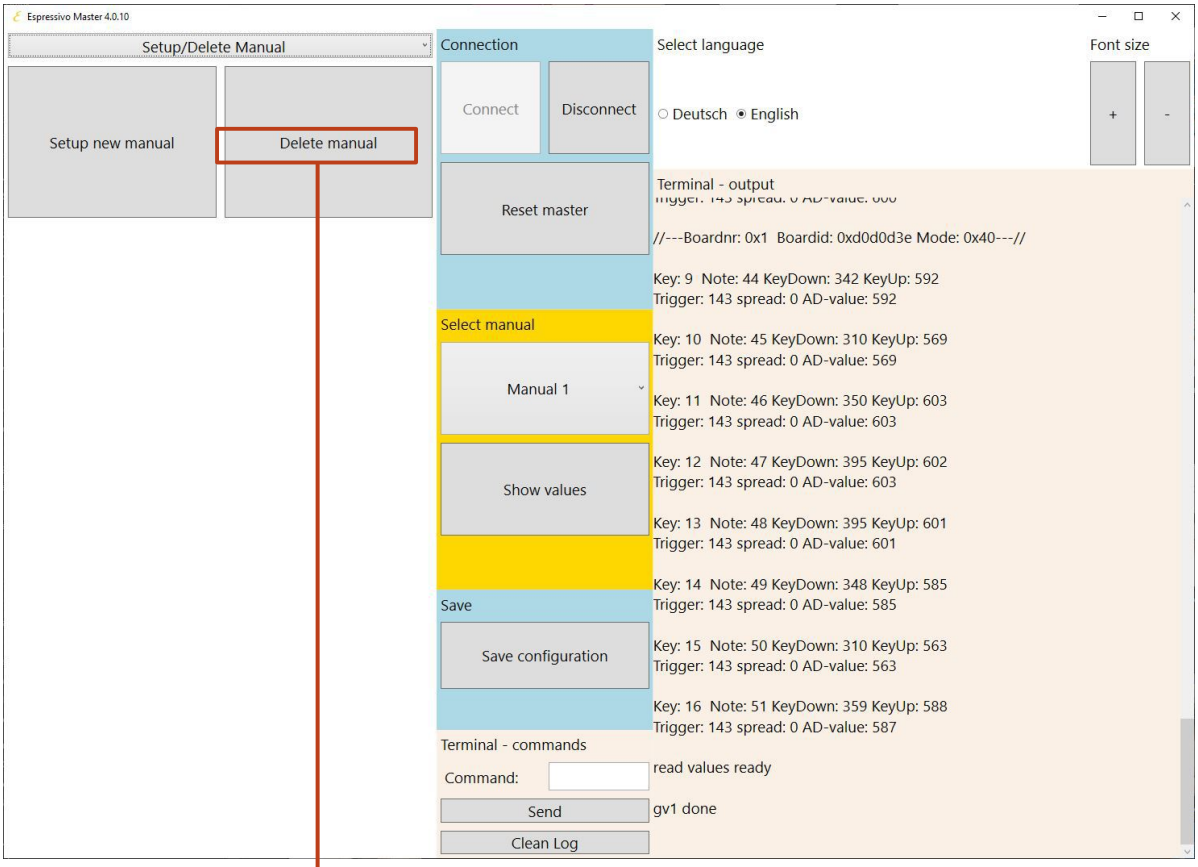
The strength of the keyboard magnets is selected so that the optimum sensor signal is produced when the minimum distance between the button and the sensor strip is about 1.5mm. The minimum signal of the sensors is approx. 30 units (typically 26-28). This means that the sensor is fully saturated and can no longer detect any signal change. With normally mounted modules, this occurs at the bottom of the key.

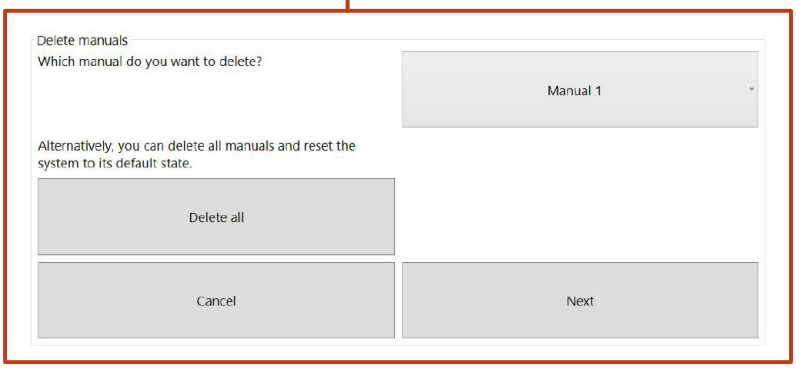
If a few channels show a KeyDown value at the level limit, this is acceptable. If many such values occur, the sensor rail should be mechanically set a little (0.5mm) further away from the keys.

In the case of inversely mounted modules, no key-up value should be around 30, otherwise overdriving may occur in the critical range of pre-travel. If the problem occurs, the sensor bar must be mechanically adjusted to a slightly greater distance.

After each mechanical change of the sensor position, a new calibration (but not the setup) of the manual is necessary.

Deleting manuals





Under certain circumstances, it may be necessary to delete a manual that has already been used and to set it up and calibrate it again completely. This is the case if a manual has previously been set up with another master module.

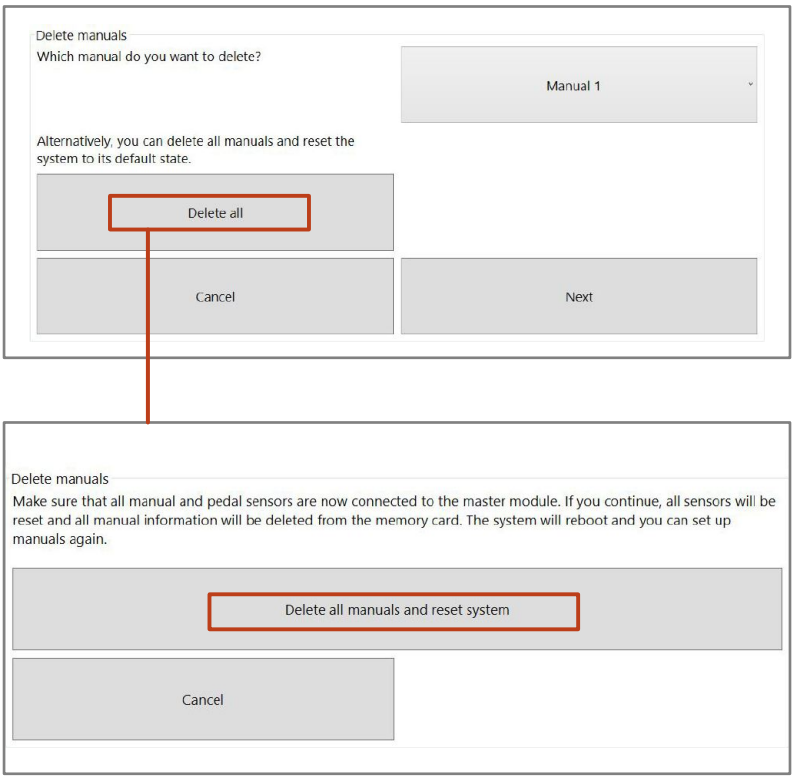
1. Click on "Delete manual".

Here you have two options, which are described further below.

A) Delete all

B) Delete a single manual

A) Delete all manuals / pedal



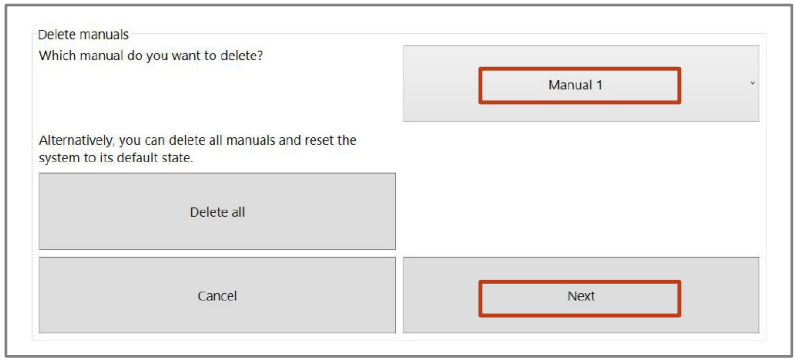
1. Click on "Delete all".

A new window opens to confirm the command.

2. Click on "Reset all manuals and memories".

Note: After this, the organ can no longer be played via the keyboards. The manuals must now be set up and calibrated again.

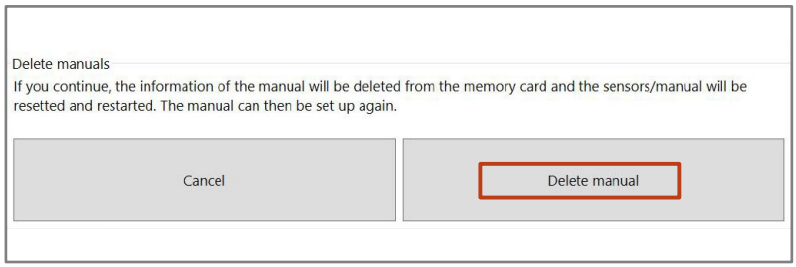
B) Delete specific manual



Select the manual to be deleted from the pull-down menu.

1. Click on "Next

A new window opens to confirm the entry.



2. Click on "Delete manual".

Note: To be able to use the manual again, it must first be set up and calibrated again.

Calibrating a manual

When a new manual is set up, an initial calibration is automatically carried out. The pre-travel set in this way is maintained over a longer period of time because the system recalibrates itself to the current sensor value every time it is switched on. However, if you make mechanical changes, e.g. by readjusting the keyboard or removing and re-installing the sensor strips, you should carry out a new calibration.

Also, if after several years you have the impression that the pre-travel of the keys has become uneven, you should first initiate a calibration of the entire manual before readjusting individual keys.

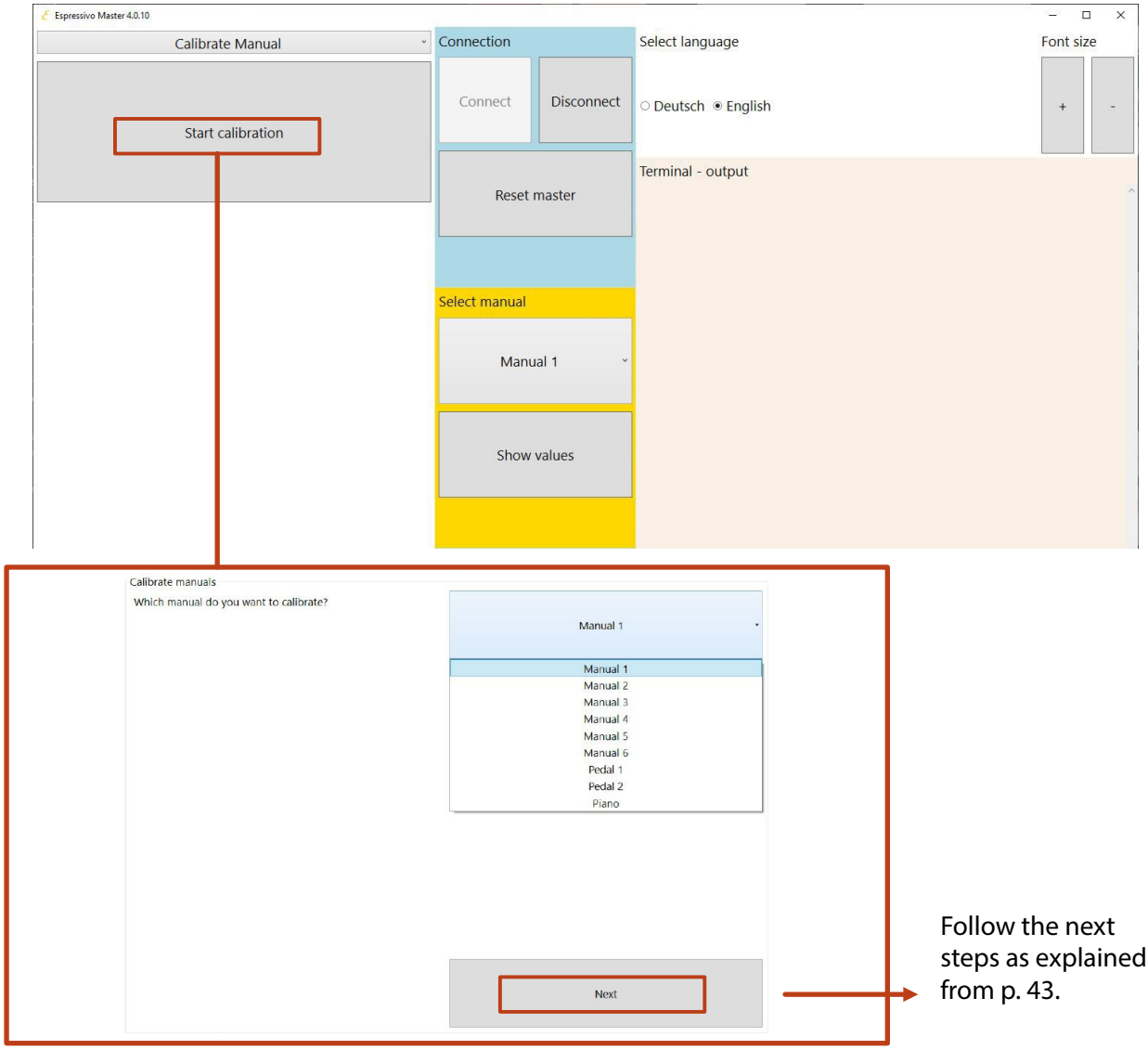
If a mechanical action is equipped with Espressivo sensors for couplers or MIDI output, after the final adjustment of the mechanical action, you should first perform a calibration before you start fine-tuning the electric couplers.

The procedure is the same in all cases:

1. Click on "Start calibration".
2. Select the manual via the pull-down menu and then click on "Start".

Follow the next steps as explained on p. 43.

Do not confuse the new *calibration* with the *set-up procedure* of manuals. A new set-up is only necessary after replacing sensors.

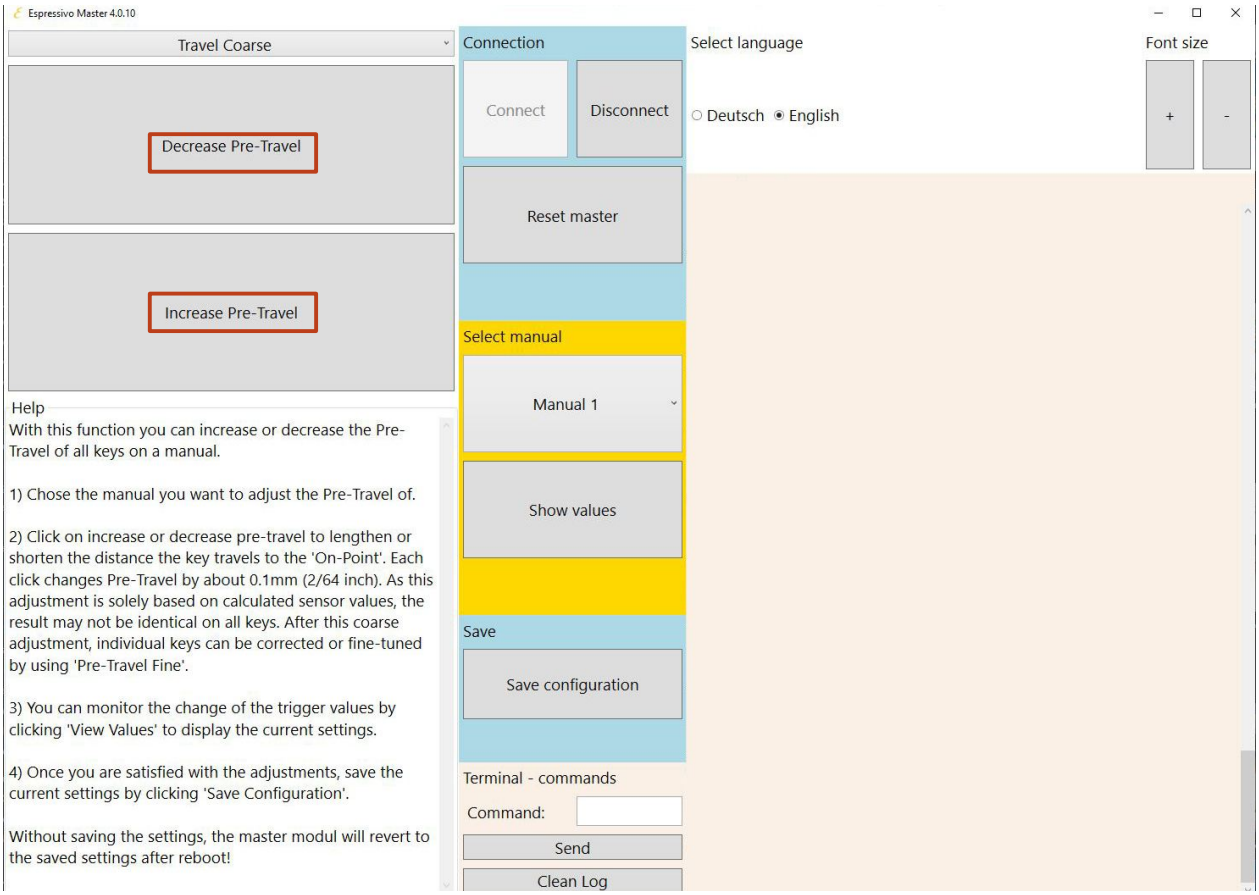


Follow the next steps as explained from p. 43.

Setting pre-travel

The pre-travel can be adjusted in two ways. First, a coarse adjustment of all keys of a manual is recommended.

A) Coarse adjustment



This function allows you to increase or decrease the pre-travel of an entire manual.

1. Select the manual for which you want to adjust pre-travel.

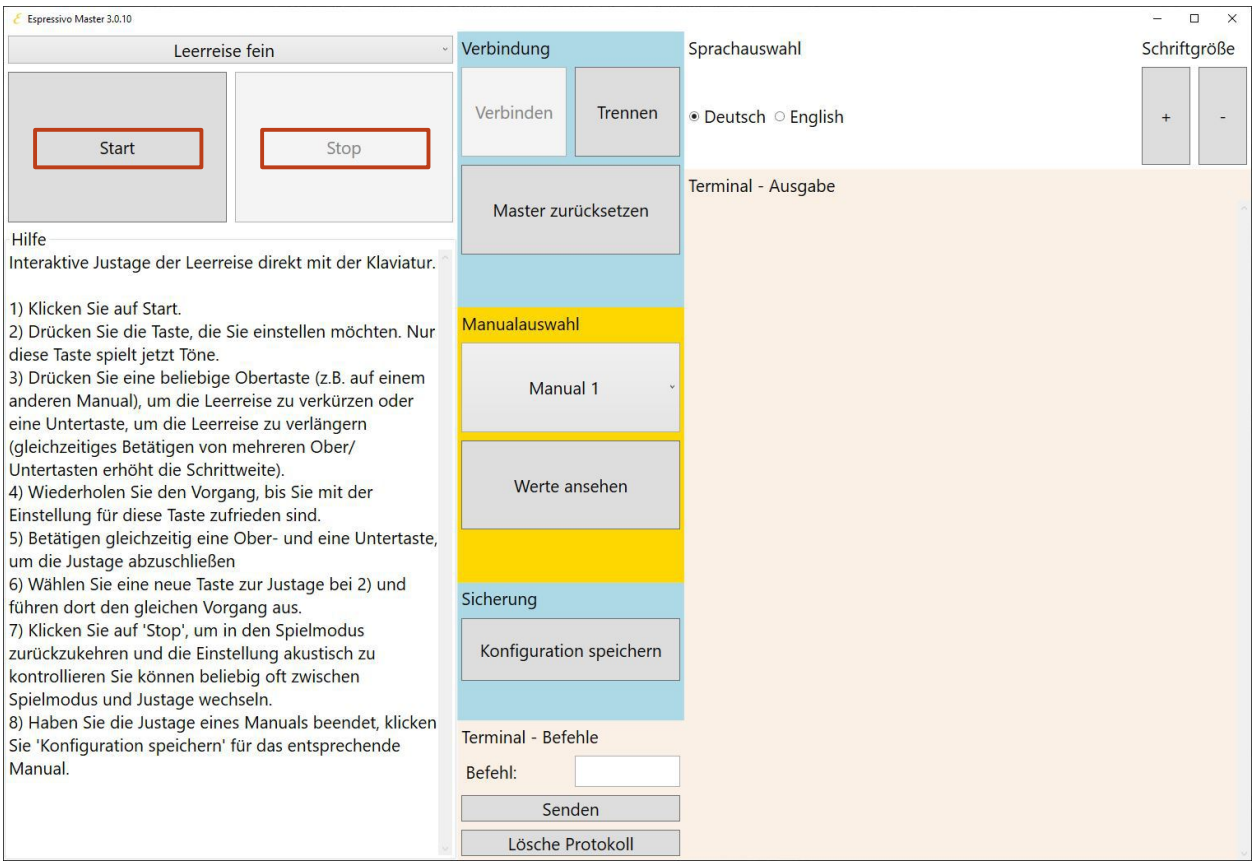
2. Click on Shorten or Lengthen Pre-Travel to change the key travel until the note is played. Each click changes pre-travel by approx. 0.1mm. This function works with calculated values, so the result may not be the same for every key. To adjust or correct individual keys, use the "fine empty travel" function.

3. While you change the setting, you can play the keyboard and thus check the result acoustically.

4. When you are satisfied with the settings, save them with "Save configuration".

Without saving the configuration, the previous values apply again after the next start of the master module!

B) Fine adjustment

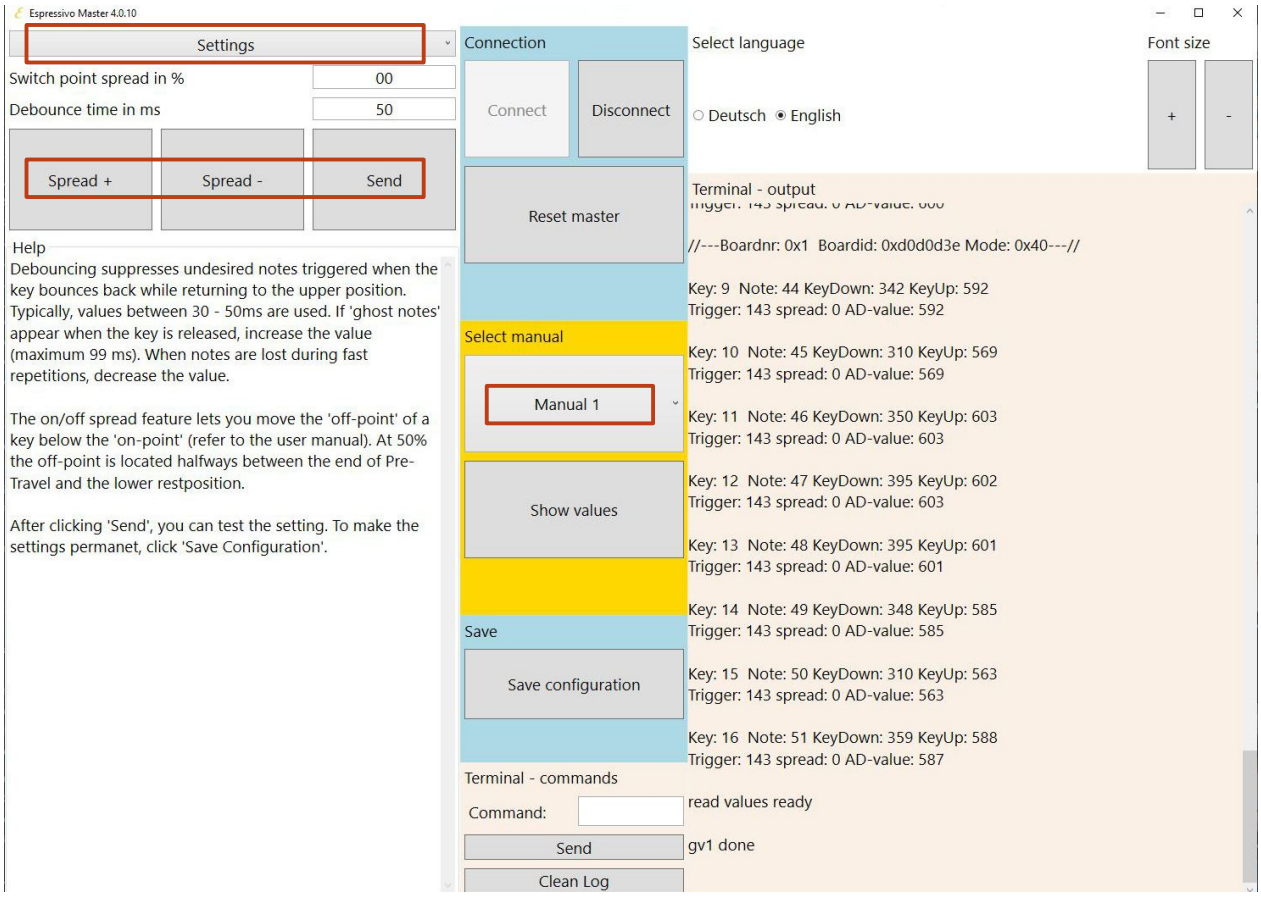


With this function, you can readjust individual keys at any time in the fully installed console under constant acoustic control. In this way, mechanical and electric action can be perfectly synchronised. This is also the preferred mode for making individual adjustments according to feeling and hearing, for example, to adapt the note onset to the feel of a pluck simulation.

Interactive adjustment of the pre-travel directly with the keyboard:

1. Click on Start.
2. press the key you want to adjust. Only this key now plays notes.
3. Press any upper key (e.g. on another manual) to shorten the pre-travel or a lower key to extend pre-travel (pressing several upper/ lower keys at the same time increases the increment).
4. Repeat the process until you are satisfied with the setting for that key.
5. Press an upper and a lower key simultaneously to complete the adjustment.
6. Select a new key for adjustment at 2) and perform the same procedure there.
7. Click on Stop to return to the playing mode and check the adjustment acoustically. You can switch between playing mode and adjustment as often as desired.
8. When you have finished adjusting a keyboards, click on "Save configuration" for the corresponding manual.

Settings for manuals



1. Select the "Settings" function.

2. In the pull-down menu, select the manual that you want to adjust.

Here you can adjust the following parameters for each manual:

a. Debounce time:

   Most keyboards show a "bounce" when a key is released abruptly. The key vibrates when it returns to its rest position and moves downwards for a short time. This deflection is usually not visible to the naked eye, but the Espressivo system is fast enough to detect this process. This may trigger a note again.

   To suppress these unwanted “ghost notes”, the output signal is suppressed for the debounce time after the key is released. The unit of measurement is milliseconds (thousandths of a second).

   The standard time is 30-50ms, i.e. 3-5 hundredths of a second. This means that the key can still be played around 20 times per second when repeating quickly.

   If you find that ghost notes are still audible or you see duplicate notes in your MIDI data, increase the debounce time (maximum 99ms). If you feel that notes are missing during fast repetition, shorten the time.

b. Switch point spread

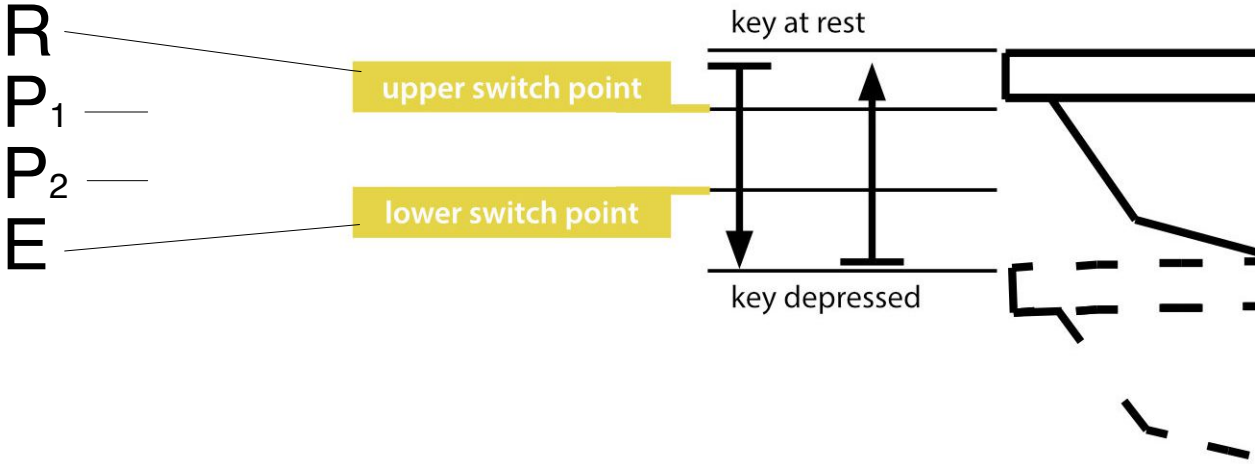
   (see next page) Set the desired value with the "Spread -" and "Spread +" buttons.

After changing a value, press "Send" for the setting to take effect. If the setting is correct, click "Save configuration".

Spread of the switching points

A conventional electric action switches palet magnets on when the key is pressed down to the switching point (P) (the end of the empty travel). Ideally, the sound is also switched off again at the same position when the key moves from the end position (E) upwards back to the rest position (R).

In practice, however, each switch or sensor has a negative "hysteresis" that must be exceeded to change the switching state. Therefore, the sound is only switched off when the button is minimally above the switching point.



This behavior of conventional keyboard contacts makes many organists feel that the action reacts sluggishly. Especially in mechanical instruments, the electric couplers seems to lag behind the direct tracker action. This feeling arises because the sound of the mechanical action already stops before the valve is completely closed, i.e. the key is still below the response position. Delays caused by the unavoidable switching times of the electric action solenoids contribute to the "doughy" feeling when comparing electric and mechanical action.

The Espressivo system features the possibility of spreading the switch-on point (P1) and the switch-off point (P2), thus placing the switch-off point at a lower key position.

This “positive hysteresis” allows the mechanical action and the electric coupling to coincide much better. This early switching off also compensates for additional delays in the electric action.

The spread between on and off postions is set by the parameter "spread". After setting up a manual and adjusting the pre-travel, it is initially set to 0. Adjust the pre-travel first, then try different settings of the spread value.

The spread shifts the switch-off point as a percentage of the distance between the switch-on point (P1) and the key end position (E). With a spread of 50%, the switch-off point is approximately halfway between the pre-travel and the lower end position of the keys.

2-point repetition

The spread of the switching points enables another unique feature of the Espressivo action: accelerated repetition. It is automatically activated when a spread is set for a keyboard.

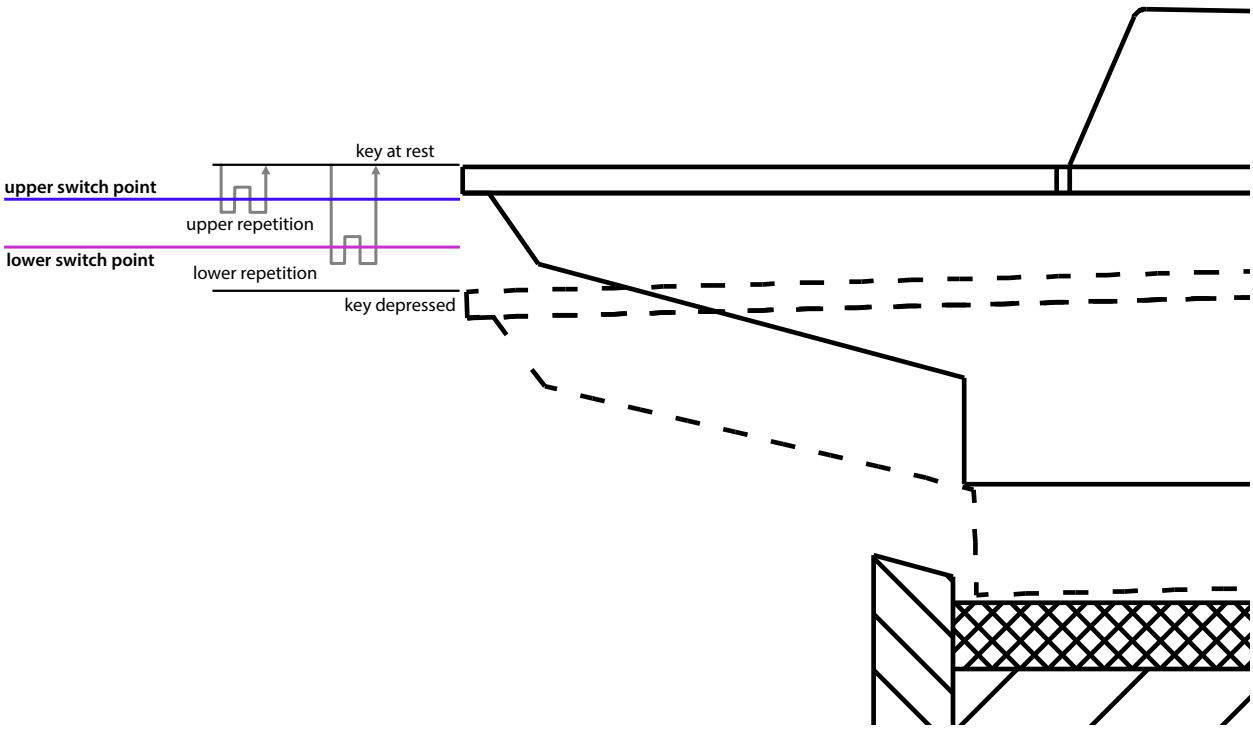
When a key moves back up after being released, the note stops at the lower switching point.

If you do not return the key fully to the rest position, but press it down again immediately, the note will be switched on again right away. This makes it possible to play fast repetitions with only minor key movements. This novel principle makes an appropriately set Espressivo action extremely responsive.

Typical values for a comfortable switching point spread are 20 - 30%.

For a long time, organ builders used to adjust conventional contacts to switch at about half the total key travel. This helps speed up repetition but makes the keys less sensitive due to the large amount of pre-travel. With Espressivo sensors there's no need to compromise: You can have it both ways: Small pre-travel and fast repetition on the same keyboard.

Organists intuitively incorporate this repetition into their playing, since they repeat by ear and are not attuned to a specific key position. They will be positively surprised by the reaction speed of the action without having to get used to a special playing technique.



Couplers

The Espressivo master unit provides 32 couplers that are configured in the orgel.cnf file.

All 32 couplers can be controlled by the signal inputs of an optional DI expansion module (see DI module instructions). Control is via MIDI channel 11 by switching notes 1-32.

The coupling configurations in the **orgel.cnf file** are deactivated on delivery by the comment character "#" at the beginning of the line of the definitions. If necessary, remove this character and enter the desired parameters of the couplings.

```
#---Coupler configuration-----------------------------
# /KOPPEL: 1     Quelle: 1   Ziel: 2   (s)hift/(c)opy: c   Schwelle: 0   Transposition: 0   velocity: 1
# /KOPPEL: 2     Quelle: 1   Ziel: 2   (s)hift/(c)opy: c   Schwelle: 0   Transposition: 0   velocity: 1
# /KOPPEL: 3     Quelle: 1   Ziel: 2   (s)hift/(c)opy: c   Schwelle: 0   Transposition: 0   velocity: 1
```

Source:

Manual on which to play

Target:

Manual on whose MIDI channel the linked notes are output.

(s)hift/(c)opy:

Mode c copies the notes from the source to the destination manual (as in classical organ building). Mode s suppresses the output in the source channel and moves the data to the target channel (only useful with purely electric action).

Threshold:

Velocity value above which the coupler switches. These values are set when using dynamic couplers.

Transposition:

Transposition of the coupled notes in semitones (for sub- or supercoupling).

velocity:

Specifies whether the coupler should send velocity information (1) or not (0).

Coupler definitions in the orgel.cnf-File

 # --------- coupler configuration (English version) ----------

From Master Firmware 4.5 up to 32 couplers can be configured.
Earlier versions support only 8 couplers.
Couplers 1..8 are switched on/off via signals on the ribbon connector on the
Espressivo master module
Couplers 1..32 can be controlled using the optional DI expansion module for 64 contact inputs.
Stop notes 1..32 on MIDI channel 11 always control couplers on the master module (if configured)
Regardless, stop notes are also output as MIDI messages to control e.g. W1 wind chest modules
coupler: numbers 1..32, only configure each coupler number once.
One coupler signal cannot control multiple couplers!

--- coupler definition ---
source: source manual (the one being played on)
dest(ination): destination manual (the one key signals are routed to by the coupler)

Manual numbers 1…6 correspond to the numbers used in the manual configuration above (/CONFIG ManualNo).
Pedals 1 and 2 configured by the statement /CONFIGSINGLE are referred to as
source/dest 7 and 8
example: a coupler with source 7, destination 1 routes notes played on the pedal to the channel of manual 1.
The manual numbers are independent of the associated MIDI channels!
You can e.g. assign manual no. 1 to MIDI channel 5 and manual no. 2 to channel 6.
A coupler with source 1, destination 2 will route the notes played on manual 1 to MIDI channel 6.
Alternatively, you can define the destination MIDI channel directly inside the /KOPPEL-statement.
In this case, use 101…115 as a destination.
This way, the output of a coupler is routed to MIDI channels 1…15, independent of manual channel assignments.

Electrical key contacts connected to a DI extension modules can also be routed through couplers.
In this case, the MIDI channel selected on the DI module defines the source of a couplers.
MIDI messages from DI modules received through channels 1…8 are treated as couplers sources 1…8.
Avoid using the same channels also used as manual numbers by Espressivo sensors.

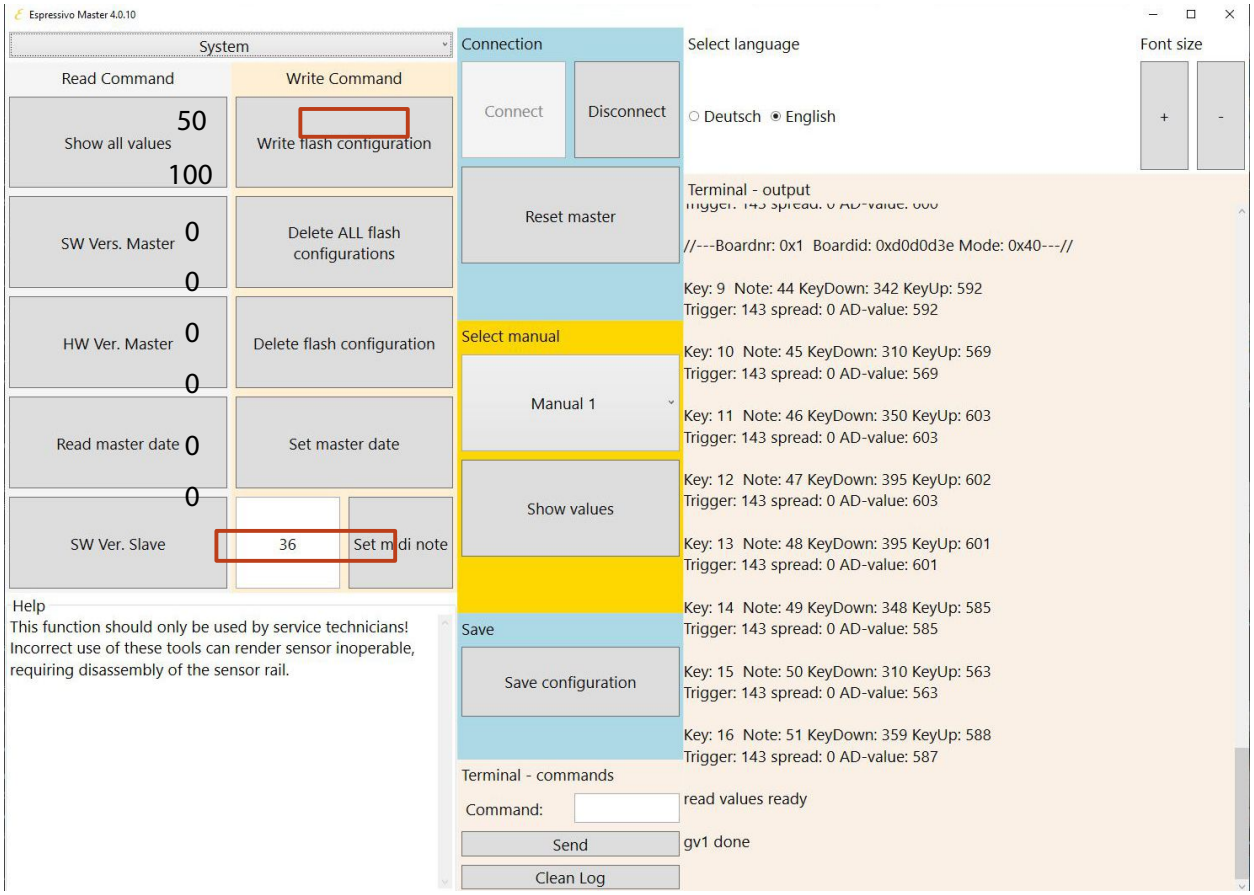
(s)hift/(c)opy: A "copy" coupler behaves like a classical organ coupler
generating a copy of the MIDI message from the source manual channel on the destination
manual channel
a "shift" coupler shifts the MIDI messages from the source channel to the destination channel
Threshold: If this is set to values larger than 0, notes will only be couples if their velocity
is above the threshold
This way, dynamic couplers can be used to accentuate notes played "forte"
transpose: transposes the coupled notes by the specified number of semitones
velocity: 1 (coupler outputs original NoteOn-velocity), 0 (couplers outputs fixed velocity values)

/KOPPEL: 1 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 2 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 3 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 4 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 5 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 6 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 7 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 8 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 9 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 10 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 11 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 12 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 13 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 14 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 15 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 16 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 17 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 18 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 19 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 20 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 21 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 22 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 23 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 24 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 25 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 26 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 27 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 28 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 29 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 30 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 31 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1
/KOPPEL: 32 Source: 1 Dest: 2 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1

Midi output from suppressed manuals (channel 16, see above) can be switched on/off by couplers
setting destination to values 101...115 enables output on channels 1..15
This way, midi output for external sound generators can be toggled or routed
to different channels
by console switches, e.g.:
/CONFIG ManualNo: 1 filename: Manual1.txt midichannel: 16
/KOPPEL: 1 Source: 1 Dest: 101 (s)hift/(c)opy: c Threshold: 0 Transpose: 0 velocity: 1

Dynamic coupling

This coupler is a special feature of the Espressivo system. It makes it possible to play different timbres on one manual depending on the strength of the touch. With a soft touch, the sound is produced as usual in the manual currently in use. With a strong touch, the coupler only works for these notes, as if the manual were coupled. Similar to the piano, it is the **speed** with which the key is struck that is decisive, **not the force** at the end point of the key movement as with the mechanical "second touch" of the cinema organ.



Threshold: Velocity threshold above which which the coupling is effective. The classic coupler is always active with threshold 0. The dynamic coupler is only effective above the specified velocity.

For example, you can play "piano" on Manual II and couple "forte" notes or chords to Manual I or vice versa. The velocity threshold can also be used to activate sub- or super-couplers within or between manuals. In a purely electric action, in addition to the classic "copy" coupling, which adds another manual (i.e. copies the tone information from one manual to the other), a "shift" coupling can also be defined, which outputs the note in the target channel instead of the original channel. In this way, the notes tranfer to another manual, depending on the velocity.

In purely electrically driven instruments, a dynamic coupling in shift mode causes the notes to change between different manuals (works) depending on the velocity of the touch. In mechanical instruments, only the copy mode can be used to play additional stops from another movement for accented notes. A sub- or super-coupler within a manual can also have a dynamic effect.

If your system is set up for dynamic couplings that become active depending on the velocity, you can set the velocity threshold (MIDI Velocity) here. A coupling with threshold value 0 is effective regardless of the velocity.

The maximum velocity value is 127. A threshold around 40 is good to control.

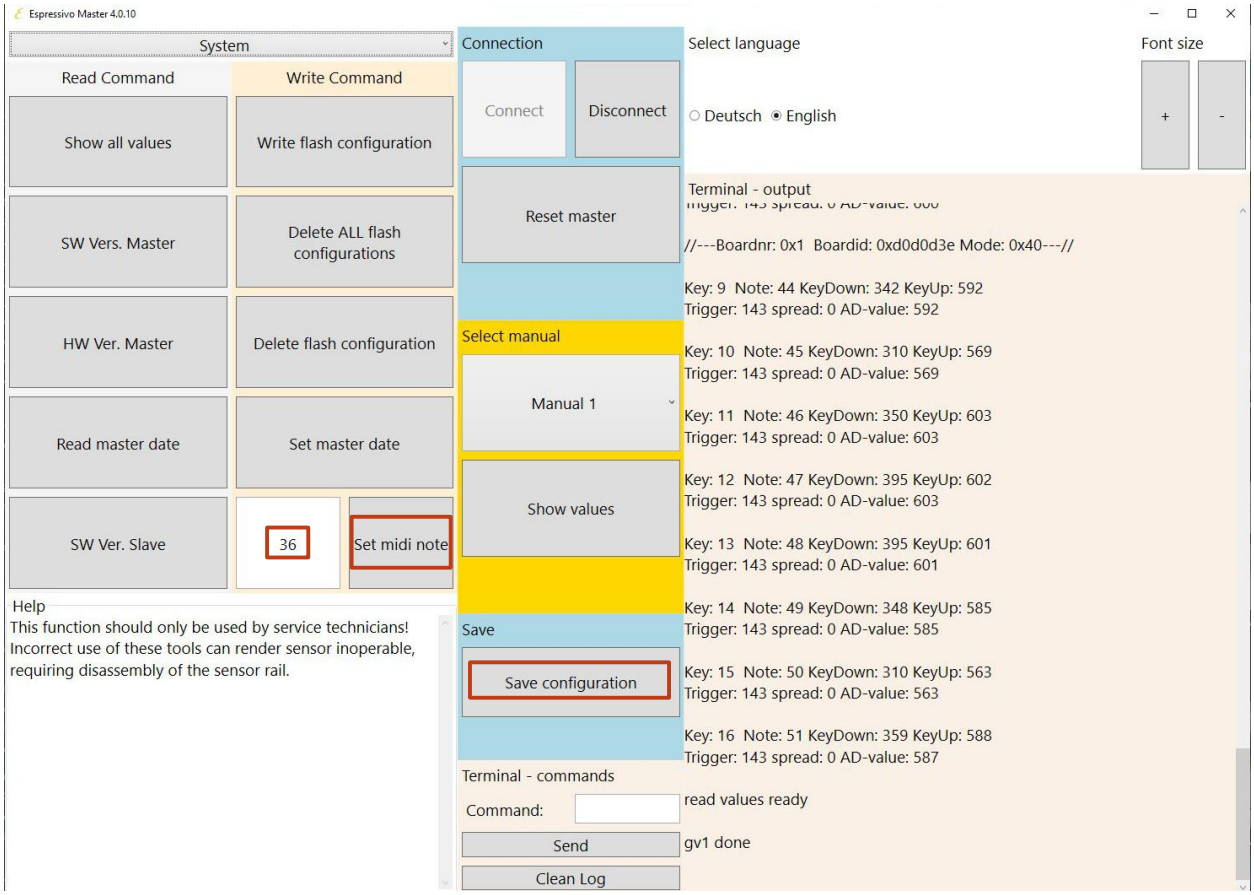
1. activate the coupler at the console

2. Set the threshold value of the corresponding coupler in the Threshold field.

3. Click on "set" to transfer the value.
4. Test the setting on the manual and change the value until the coupler is easy for you to control.

5. click on "save organ.cnf" to save the settings.

System settings



Most of the system setting parameters are only relevant for service technicians. In some cases, however, it may be necessary to use the flash configuration functions. These are described in the next section.

When setting up manuals, in rare cases it may be necessary to change the MIDI start note. By default, when setting up manuals and pedals, the lowest note of a manual is assigned the MIDI note 36 (C). If a keyboard does not begin with a C, or if the connected system expects a different octave position for the lowest C (e.g. 24 or 48), you can set a different start note here and transmit it to the system with "Set Midi Start Note".

To make the change permanent, the configuration must be saved again.

again. The buttons in the left column ("Read command") output information about the system, e.g. the software versions of master and slave (manual sensor 1) or the time of the real-time clock. If the clock deviates roughly from the current time, it can be set to the system time of the connected computer with the button next to it.

Leave the settings for hardware version and firmware update alone. These can only be operated by service technicians with the necessary tools.

If any MIDI settings are changed (Start note via system settings or channels via editing the orgel.cnf file) after a manual has already been set up, you need to delete the corrsponding flash configurations of the sensor moduls (see next page) for the changes to take effect!

Deleting sensor data ("Flash configurations")

When you set up a manual, the configuration data is stored in two places:

- On the memory card in the Espressivo master module.
- In the internal memory of the sensors ("flash memory").

The fully configured sensors contain all the information on MIDI channels, pre-travel, etc. and can send MIDI data to the master module directly after switching on. This shortens the boot time of the system.

For sensors without data in their own flash memory, the master module first reads all parameters from its memory card and sends them to the sensors. This procedure, which takes a few seconds, was standard before firmware version 3. Currently it is no longer used.

In certain situations, however, the flash configurations must be deleted from the sensors to enable the transmission of new data:

- If the MIDI channels of the manuals have been changed in the orgel.cnf file.
- If in special (e.g. non-chromatic) key arrangements the MIDI notes in the manual.txt file have been changed.

The setting software offers two possibilities for this:

1. Deleting the flash data of a manual. The procedure can only be used if the desired manual is already set up and functional, because only then are the addresses of the associated sensors known to the master.

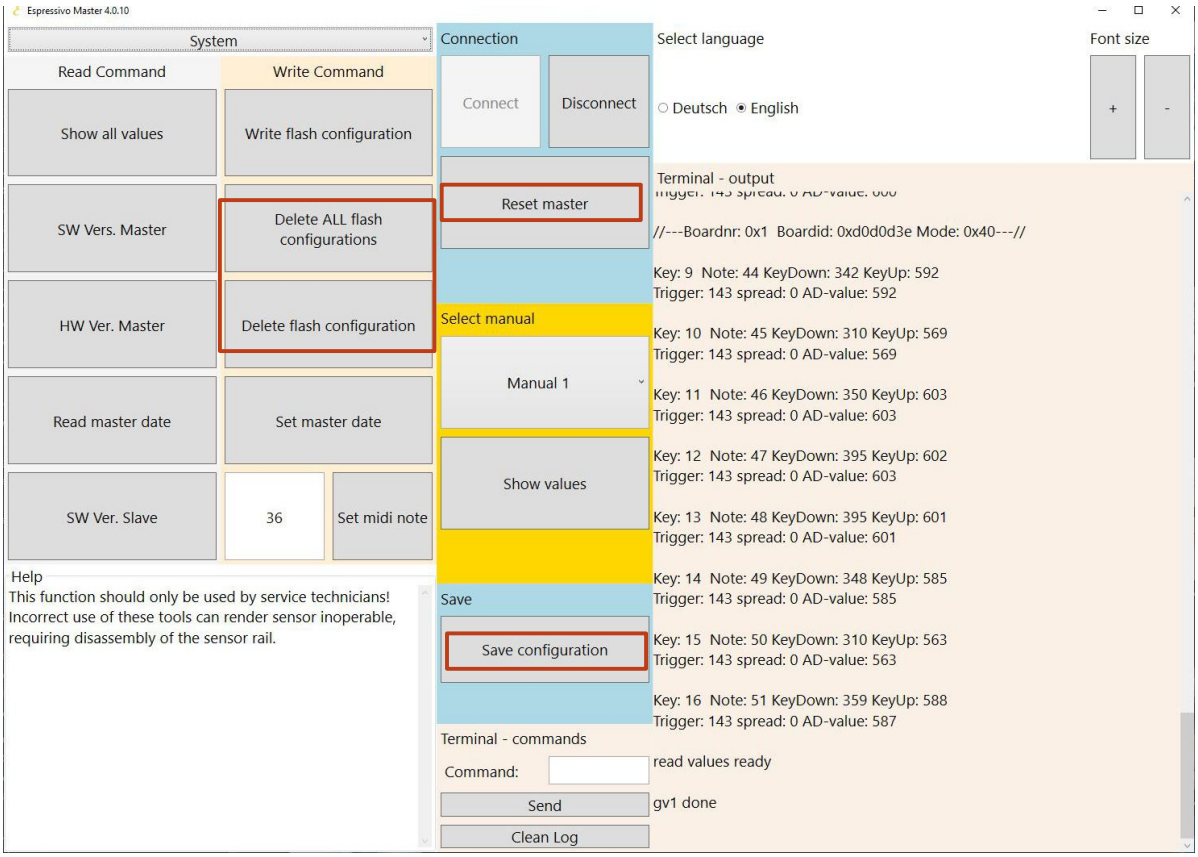
b. Erasing all flash data. This function sends a special command to all sensors that are connected to the master at that moment. This procedure must be used if sensors are connected that have previously been used on another system or if there are no associated manual.txt files on the SD card.

After deleting flash data, restart the system. **In a functionally set up system, flash deletion does not result in any loss of data.**

Sensors that were already set up will receive updated data from the master module after the restart. If you then execute the function "Save configuration" for the respective manual, the data will also be saved on the sensors again.

If you have used the "delete all flash configurations" function to delete the data of sensors that were not previously connected to this system, the manual must first be set up again so that it is functional.

The "Delete all" function described above in the Manual Setup section restores the entire system to its default state. It deletes all manual data from the memory card as well as all flash data from the sensors. Afterwards, all manuals can (and must) be set up again.



Deleting the flash configurations is accessible via the "System" function.

Decide whether you want to delete the flash configuration of the selected manual or the configurations of all connected manuals.

Then restart the system.

If the deletion only served to update the configurations (after changes of MIDI channels or start notes), then save the data for each manual again under "Save configuration".

If you have used the command "all flash configurations" to initialise sensors that were not yet in operation on this system, continue with setting up the manuals (p. 40).

Connecting key contacts and stop switches (DI module)

The Espressivo system is usually installed to take advantage of the contactless sensors. In many situations, however, it also makes sense to integrate classic electrical contacts into the system.

For example, it is often desired to convert the keyboards of an existing electric console to Espressivo, but replacing the existing pedal contacts would be difficult to implement mechanically. Some installed devices are also in such good condition that replacement would incur unnecessary costs.

With the DI add-on module (Digital Input) you can also connect electrical contacts to the Espressivo Master. The DI has 64 inputs (plus-switching 12-24V) and is connected like a manual to one of the manual sockets of the master module. The signals of the inputs are output via MIDI and Ethernet interface just like the sensor signals. Of course, velocity sensitive playing or digital setting of the empty trip is not possible here.

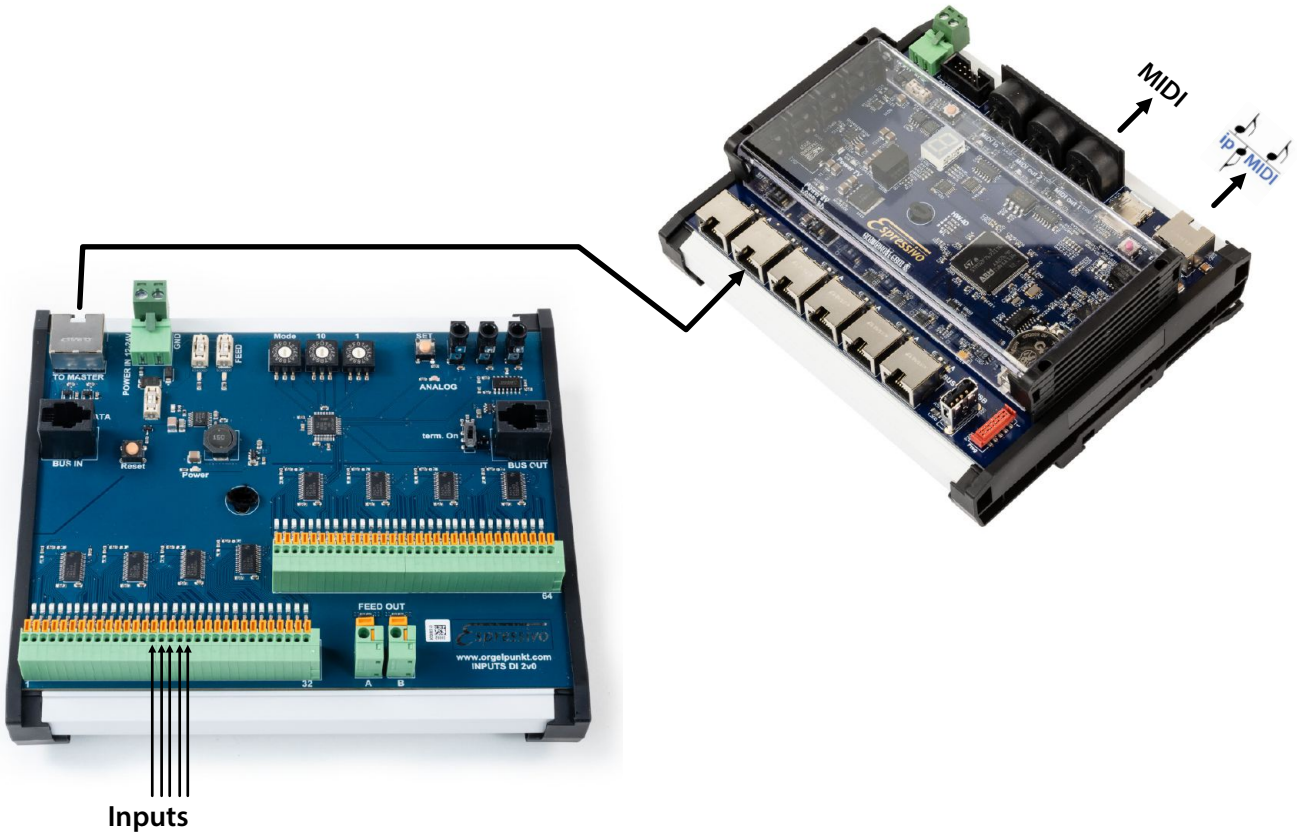
The DI module has various settings for defining the MIDI channel and the note range (see next page). Keyboards are usually output from MIDI note 36 (C).

The DI module is also used to read in control signals for stop and coupler switches. For this, the stops are coded from MIDI note 1 on a fixed control channel. Notes 1-32 on channel 11 are used to set the 32 couplers that the Espressivo master module can provide.

If more than 64 inputs are required, any number of DI modules can be connected together as desired.

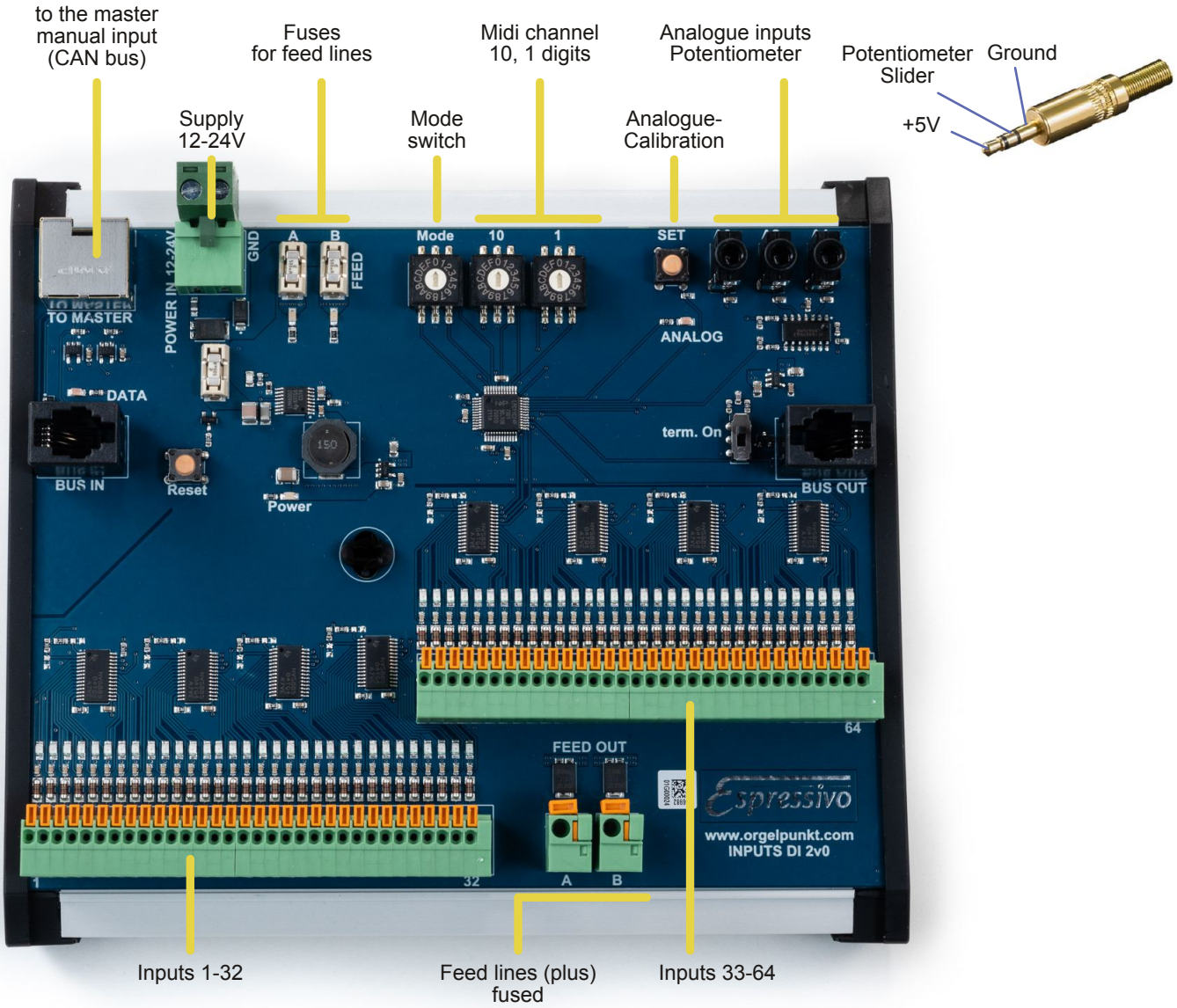
The stop notes are transmitted to the organ network, where they can be used, for example, to control the key action of Espressivo windchest modules.

In addition, the DI module has three analog inputs for connecting potentiometers. These values are translated into MIDI controller data and can be used to control swell drivers.



The Espressivo DI module

Extension module for digital inputs 12-24V



Mode

1 stops switches MIDI notes 1-64 on set channel

2 stops switches MIDI notes 65-126 on set channel (inputs 63, 64 without function)

3 keyboard, 64 notes from MIDI note 24 on set channel

4 keyboard, 64 notes from MIDI note 36 on set channel (Espressivo Standard)

5 inputs 1-32: pedal, 32 notes from MIDI note 36 on set channel
inputs 33-64: stops or coupler switches, MIDI notes 1-32 on channel 11

Analogue inputs

A1-A3 send controller 7, 8, 9 on the set MIDI channel (mode 1-4), in mode 5 on channel 11

Calibration:

Set all potentiometers to minimum position (controller value 0, e.g. swell closed).

Press SET button for 2s, LED flashes.

Set all potentiometers to maximum (controller value 127, e.g. swell open).

Press the SET button until the LED turns off.

The controller values are now calibrated to the mechanical travel of the potentiometers.

Technical appendix: Log files

The master module creates log files on the micro SD card, which save the most important parameters of the sensor modules at every start-up. In this way, defective modules, unstable connections or fluctuating values due to mechanical defects of the keyboard can be detected.

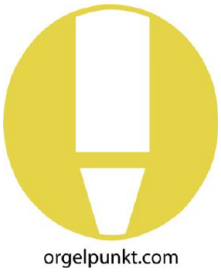
In the "LOGS" directory, files with the current date are created for each day of operation, e.g. "20140507.LOG" (of 7 May 2014). In such a file, every switch-on of the respective day is logged. The signal of the keys in rest position (keyup) is stored. The comparison with the corresponding value in the Manual.txt file shows deviations from the installation status. Small deviations do not affect the function, because the startup value is automatically used as the start value for a recalibration. Individual larger outliers, however, indicate defects.

Changes over a longer period of time may indicate mechanical problems. Some modules may be equipped with temperature sensors that can give indications of climatic influences. Sensors that are not fitted record temperature as 0.

```
lnetd IINFORMATIONI Client 10.30.0.200:8384 connected
telnetd IINFORMATIONI Successful authentification "root" from 10.30.0.200:8384
telnetd client @10.30.0.200:8384 IINFORMATIONI Connection accepted
telnetd IINFORMATIONI ***Up and running at port 23***
lwip IINFORMATIONI Network interface is up, ip = 10.30.0.24, gw = 10.30.0.254, mask
=255.255.255.0
EspressivoMaster IINFORMATIONI Boot from 2014-05-15 at 16:31
EspressivoMaster IINFORMATIONI Manual 1 board 1 temp: 25.06 °C
EspressivoMaster IINFORMATIONI Manual 1 board 1 keyup:
EspressivoMaster IINFORMATIONI channel 0 value 460
EspressivoMaster IINFORMATIONI channel 1 value 496
EspressivoMaster IINFORMATIONI channel 2 value 528
EspressivoMaster IINFORMATIONI channel 3 value 516
EspressivoMaster IINFORMATIONI channel 4 value 485
EspressivoMaster IINFORMATIONI channel 5 value 521
EspressivoMaster IINFORMATIONI channel 6 value 525
EspressivoMaster IINFORMATIONI channel 7 value 490
EspressivoMaster IINFORMATIONI Manual 1 board 2 temp: 25.19 °C
EspressivoMaster IINFORMATIONI Manual 1 board 2 keyup:
EspressivoMaster IINFORMATIONI channel 0 value 478
EspressivoMaster IINFORMATIONI channel 1 value 491
EspressivoMaster IINFORMATIONI channel 2 value 501
EspressivoMaster IINFORMATIONI channel 3 value 480
EspressivoMaster IINFORMATIONI channel 4 value 494
EspressivoMaster IINFORMATIONI channel 5 value 486
EspressivoMaster IINFORMATIONI channel 6 value 481
EspressivoMaster IINFORMATIONI channel 7 value 498
EspressivoMaster IINFORMATIONI Manual 1 board 3 temp: 24.87 °C
...
EspressivoMaster IERRORI Manual 3 board 1 missing.
EspressivoMaster IERRORI Manual 3 board 2 missing.
EspressivoMaster IERRORI Manual 3 board 3 missing.
EspressivoMaster IERRORI Manual 3 board 4 missing.
EspressivoMaster IERRORI Manual 3 board 5 missing.
EspressivoMaster IERRORI Manual 3 board 6 missing.
EspressivoMaster IERRORI Manual 3 board 7 missing.
EspressivoMaster IERRORI Manual 3 board 8 missing.
```

MIDI note numbers and ranges

MidiNote	Midi-Octave (SPN)	Tone	Octave					organ key	Piano key
0-11	-1	C-3 - H-3							
12-20	0	C-2 - G#-2	sub-contra						
21	0	A-2							1
22	0	A#-2							2
23	0	H-2							3
24	1	C-1	contra						4
25	1	C#-1							5
26	1	D-1							6
27	1	D#-1							7
28	1	E-1							8
29	1	F-1							9
30	1	F#-1							10
31	1	G-1							11
32	1	G#-1							12
33	1	A-1							13
34	1	A#-1							14
35	1	H-1							15
36	2	C	major	Ped.	Man.	Man.	Man.	1	16
37	2	C#		30	56	58	61	2	17
38	2	D						3	18
39	2	D#						4	19
40	2	E						5	20
41	2	F						6	21
42	2	F#						7	22
43	2	G						8	23
44	2	G#						9	24
45	2	A						10	25
46	2	A#						11	26
47	2	H						12	27
48	3	c	minor					13	28
49	3	c#						14	29
50	3	d						15	30
51	3	d#						16	31
52	3	e						17	32
53	3	f						18	33
54	3	f#						19	34
55	3	g						20	35
56	3	g#						21	36
57	3	a						22	37
58	3	a#						23	38
59	3	h						24	39
60	4	c'	1-strike					25	40
61	4	c#'						26	41
62	4	d'						27	42
63	4	d#'						28	43
64	4	e'						29	44
65	4	f'						30	45
66	4	f#'						31	46
67	4	g'						32	47
68	4	g#'						33	48
69	4	a'						34	49
70	4	a#'						35	50
71	4	h'						36	51
72	5	c''						37	52
73	5	c#''						38	53
74	5	d''						39	54
75	5	d#''						40	55
76	5	e''						41	56
77	5	f''						42	57
78	5	f#''						43	58
79	5	g''						44	59
80	5	g#''						45	60
81	5	a''						46	61
82	5	a#''						47	62
83	5	h''						48	63
84	6	c'''						49	64
85	6	c#'''						50	65
86	6	d'''						51	66
87	6	d#'''						52	67
88	6	e'''						53	68
89	6	f'''						54	69
90	6	f#'''						55	70
91	6	g'''						56	71
92	6	g#'''						57	72
93	6	a'''						58	73
94	6	a#'''						59	74
95	6	h'''						60	75
96	7	c''''						61	76
97	7	c#''''						62	77
98	7	d''''						63	78
99	7	d#''''						64	79
100	7	e''''							80
101	7	f''''							81
102	7	f#''''							82
103	7	g''''							83
104	7	g#''''							84
105	7	a''''							85
106	7	a#''''							86
107	7	h''''							87
108	8	c5							88
109 - 119		c#5 - h5							
120 - 127	9	c6 - g6							



Standardised MIDI assignments in organ building

Channel	Typ	Value range	Assignment	alternative
1	Note	21-108 (88 Keys, Piano) 36-91 (56 Keys, organ) 36-93 (58 Keys, organ) 36-96 (61 Keys, organ)	**Manual I**	
2	Note	dto.	**Manual II**	
3	Note	dto.	**Manual III**	
4	Note	dto.	**Manual IV**	
5	Note	dto.	**Manual V**	console 2, Manual I
6	Note	dto.	(Manual VI)	console 2, Manual II
7	Note	dto.	(Manual VII)	console 2, Manual III
8	Note	36-65 (67)	**Pedal**	
9	Note	36-65 (67)	not used	console 2, Pedal
10	*Not used, as MIDI sound generators often play percussion sounds here.*			
11	Note	1-126	**Stop 1-126**	
	Controller	0-127	**Controller 7: Swell 1**	
			Controller 8: Swell 2	
			Controller 9: Swell 3	
12	Note	1-126	**Stop 127-252**	console 2
	Controller	0-127	Controller 7: Swell 4	Controller 7: Swell 1
			Controller 8: Swell 5	Controller 8: Swell 2
			Controller 9: Swell 6	Controller 9: Swell 3
13	Note	1-126	**Stop 253-378**	
14	Note	1-126	**Stop 379-504**	
15	Note	1-126	**Stop 505-630**	
16	Note	various	Switching functions, e.g. sequencer	
	Controller	various		
	Sysex	in Discussion	System- or manufacturer-specific control data, e.g. starting of certain combinations	
equal	Controller	Controller 123	AllNotesOff	
			Reset all active tones and registers (optionally adjustable)	

Usual UDP port usage:

ipMIDI-Port	UDP-Port	Application
1	21928	Console 1 -> SPS
2	21929	Console 2 -> SPS
3	21930	opt. Tuning system -> PLC / console 3 -> PLC
4	21931	opt. external MIDI-In -> PLC
5	21932	PLC -> action outputs or ext. MIDI-out

Classification of MIDI implementations in organ building

MIDI Level	Features	Applications
0	The system outputs the data of the **key action**.	The playing can be recorded, e.g. to generate notes from it or to listen to it on home sound generators. With restrictions, it is also possible to control the action externally by feeding in action-compatible data and the organ reacts as if the notes were played live on the manuals.
1	The system outputs the data from **tone and stop action**.	see above with addition of the register data, which enables the control of sound generators with suitable external devices.
2 	The system outputs the data from **tone and stop action** and can also **receive** this data.	This provides a **bidirectional interface** through which an external recorder can record and play back the game in its entirety. In addition, all data in ipMidi format is available in the network, which can later be used to control extensions without interfering with the original control system. can be controlled (external consoles, auxiliary movements, etc.). Limitations exist if the control system controls internal processing with hard-wired switches, e.g. transpositeur, sostenuto and the like. However, one can essentially control all organ functions from the outside.
3 	All action and control signals are **openly communicated in ipMIDI format on the organ network.**	This means that individual control components can be replaced at any time, **regardless of the manufacturer**. For example, windchest modules could be replaced by Wago islands, or a decentrally controlled remote control system could be replaced by a new one. Signals can be read from future control components and, if necessary, modified and forwarded. For example, an external CPU in the network can read data and send modified data via another UDP port or MIDI channel, to which new plant parts then react.