Operating Manual

Vers. 3.0 (Master Firmware 3.06, Slave Firmware 3.0)

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Contents

Special features of the Espressivo-system

The Espressivo system doesn't use any contacts in the conventional sense. Using magnetic sensors, it continuously monitors the position of each key. Determining when a note should be played or stopped, is determined by comparing the sensor signal to variable threshold values, rather than by mechanical adjustments, such as a contact spring or a photo interruptor.

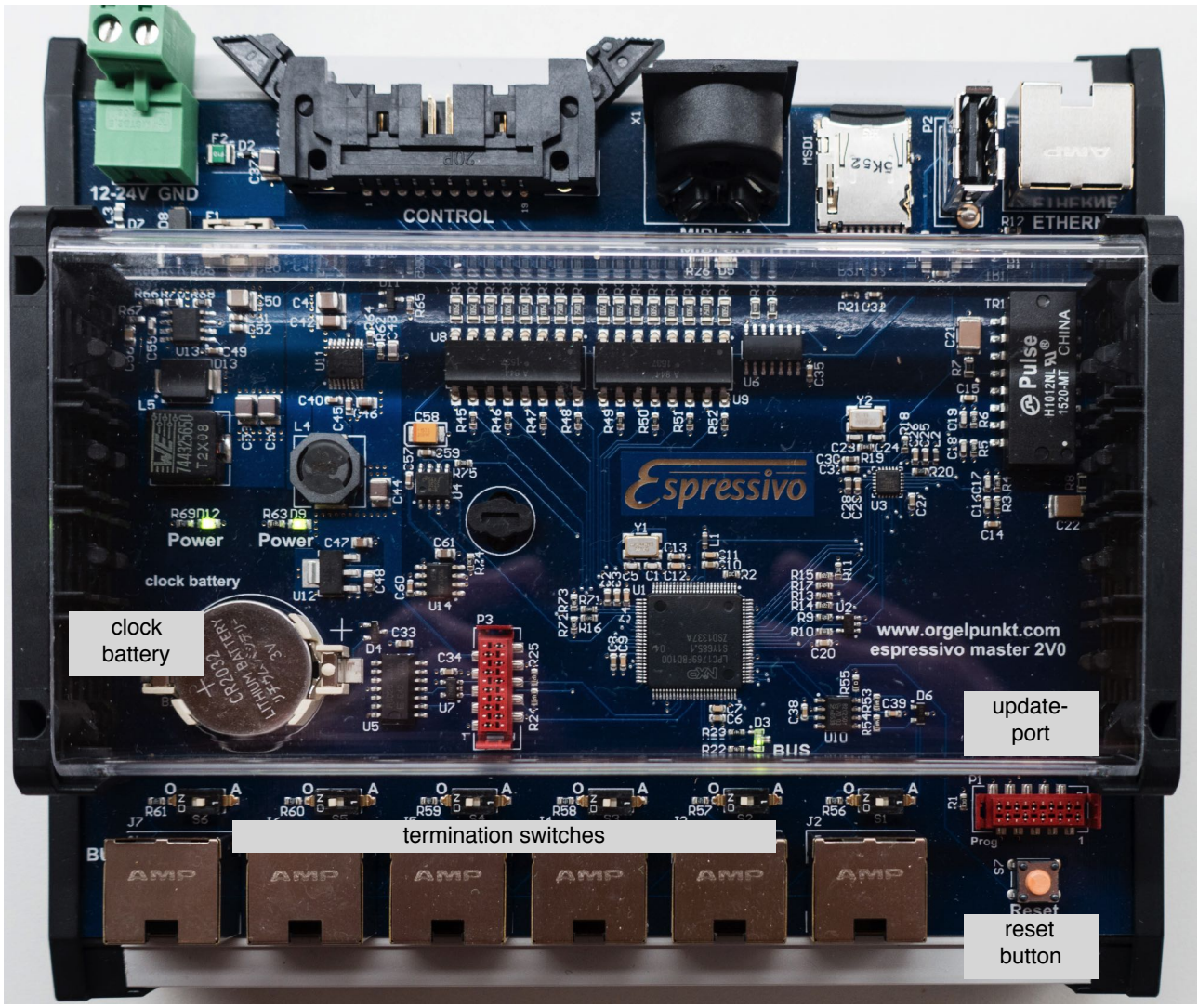
This method enables features which are unattainable with any conventional contact:

- adjusting pre-travel (firing point) without mechanical access to the contacts
- spreading of on- and off-point
- 2-point repetition for playing fast repetitions with small key movement
- output of Midi-velocity data for dynamic playing of external sound devices
- dynamic couplers activated by different playing styles

The pre-travel of the keys before the firing point can be adjusted with a precision of about 0.1mm (1/256 inch). This high accuracy is possible, because the sensor rail is typically mounted at the most stable structure of the keyboard, the balance rail. In addition, the system measures the current rest position of each key on start-up and adjusts the trigger values accordingly.

When calibrating initial positions, the system also scans for keys which would cause ciphers due to technical problems and subsequently mutes those keys. This method will also mute keys which are depressed when switching on the organ. Please advise the organist to refrain from touching the keyboard or stepping on the pedals when switching on the organ. While a conventional action will ignore this sloppy habit as long as no stops are drawn, the Espressivo action will mute the key until the organ has been turned off and on again.

The Master module



Up to six sensor rails or bus chains with individual sensors (up to two chains) can be connected to the Master module. The Master module powers the sensor modules, analyzes the data and generates the Midi signals that control the electric key action or other tone generators.

Power is applied via a plug-in terminal. **The Master hardware version 1v1 (green circuit board) can only be run on 12V DC. Hardware version 2 (blue circuit board) can be connected to 12 – 24V DC.**

The Espressivo system should not be run on the same power supply line as the other components of the organ action. Smooth and trouble-free operation is guaranteed by an **autonomous** power supply delivering 5 amps (e.g. a rail-mounted switching power supply). The power supply has be switched on/off together with the organ, as the system re-calibrates the key sensors automatically each time it is started up.

Plug/unplug the manuals only if there is no voltage supplied to the Master module.

Do not connect the manual bus ports to any PC Ethernet interface! Although the cables are the same, they differ in their terminal assignments. Any mix-up of connections may damage your PC and Espressivo Master.

Do not connect PC equipment to the USB-port. This port is reserved for use with accessories like Bluetooth transmitters (currently not supported).

Use Ethernet cables to connect the manuals to the six manual bus ports on the Master module. Use high quality cable to ensure reliable power supply of the sensors. The cable length between manual and Master module must not exceed 5 m (16 feet). The Master module itself should be placed as close as possible to the manuals in the console. This setup is also very practical, as there is only one Ethernet cable to install for the longer distance to the organ control system.

All bus ports are identical, special assignments of manuals is not required.

The termination switches of occupied manual ports must be switched to "A" (active), those of unoccupied ports to "0" (inactive).

The note control signals are output via the standard Midi interface (DIN socket). In addition, the data can be sent as standard "MidiOverIP" via the Ethernet interface (see configuration) via UDP data packets. This interface runs about 300 times as fast as the Midi standard. It is supported by various manufactures of organ control systems, such as Laukhuff, Heuss and Sinua. We also provide drivers for Macintosh and Windows PCs which enable the direct data exchange, i.e. no detour via Midi interface.

The coin cell battery powers the integrated real-time clock used for the log file functions. The battery should last significantly longer than 5 years. A depleted battery does not affect normal operation of the unit, as the clock is only used for logging functions.

Control elements and displays

The Espressivo Master module has no control elements for normal operation; all settings are carried out via Telnet commands sent through the Ethernet interface. These commands are sent from the graphical user interface provided by the free Espressivo Windows software or the Espressivo starter kit comprising a dedicated tablet PC as described in a later section.

The reset button is used for system restart after keyboard setup. The following LEDs provide a basic function diagnosis:

POWER: two LEDs indicate that Master CPU and sensor rails are supplied voltage. They are lit when the system is running.

BUS: the LED is yellow during the initialization phase. Once all configured modules have been recognized, the LED changes from yellow to green (normal operation). If the system fails to recognize all sensor modules, the BUS LED turns red. This can, for example, happen if a previously configured manual is unplugged or a single module is defective or not connected correctly to the flat sensor strip cable.

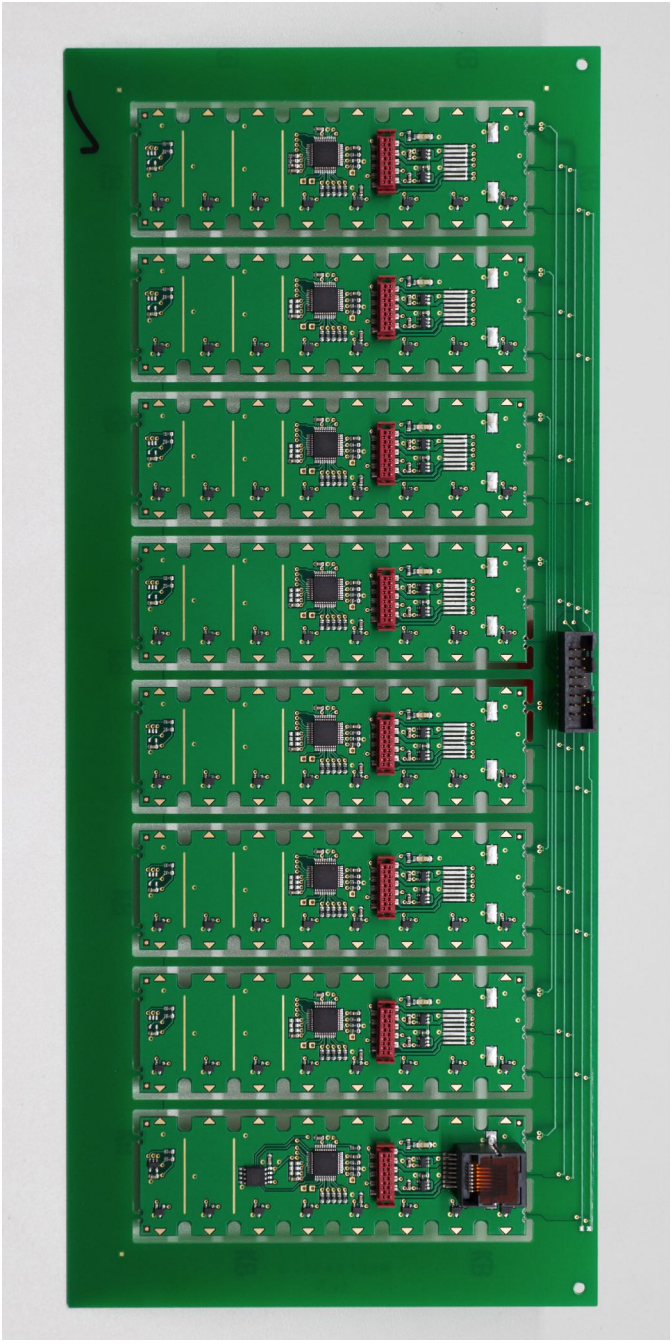
MIDI: indicates the transmission of Midi data. After successful manual configuration, the LED flashes briefly whenever a key is pressed or released.

ETHERNET: lit if the Ethernet port is connected to an operative counterpart (PC or Laukhuff Sigmatec System). From hardware version 2 (blue circuit board) the LED flickers to indicate any data traffic on the network.

The sensor modules

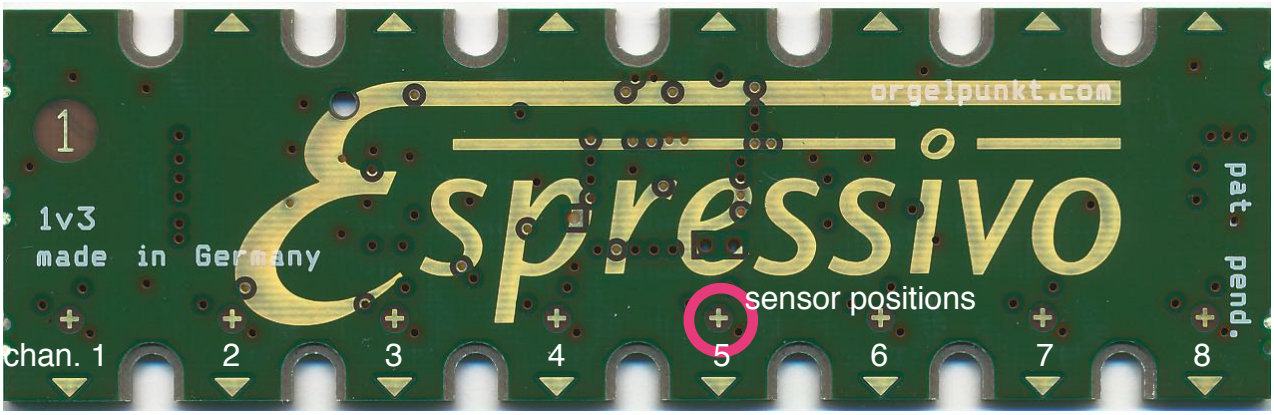
The Espressivo system provides up to 8 sensor modules for a total of 64 keys. Each module of the system serves 8 keys. Larger manuals of more than 64 keys can be accommodated by additional modules which are treated as supplementary manuals but can be configured so that the compass links up seamlessly.

The modules come in frames. The thin bars holding the single modules can be easily severed with a side cutter.



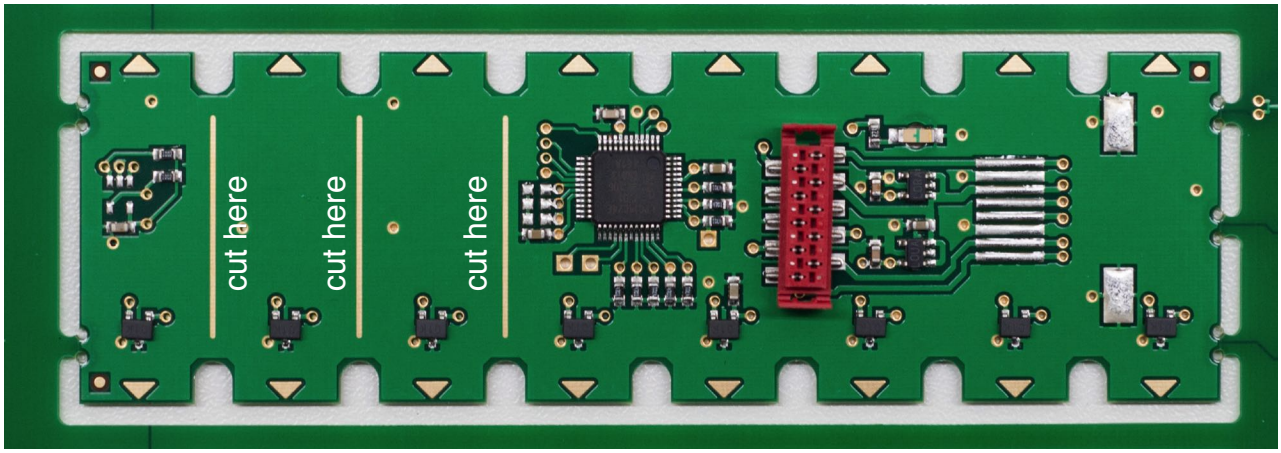
The modules must not be connected to the Master module in their frame! The internal connections to the programming adapter on the frame cause short circuits in the voltage supply.

Sensor module:



To fit different manual compasses, the sensor board(s) can be sawn off along the gold line ("cut here"). The cut lines should be as smooth as possible (file smooth) to prevent short circuits on the separated PCB tracks.

Do not use a grinder to clean up the edges. This will heat up the board and deform the copper of the conducting layers, thereby increasing the likelihood of short circuits.



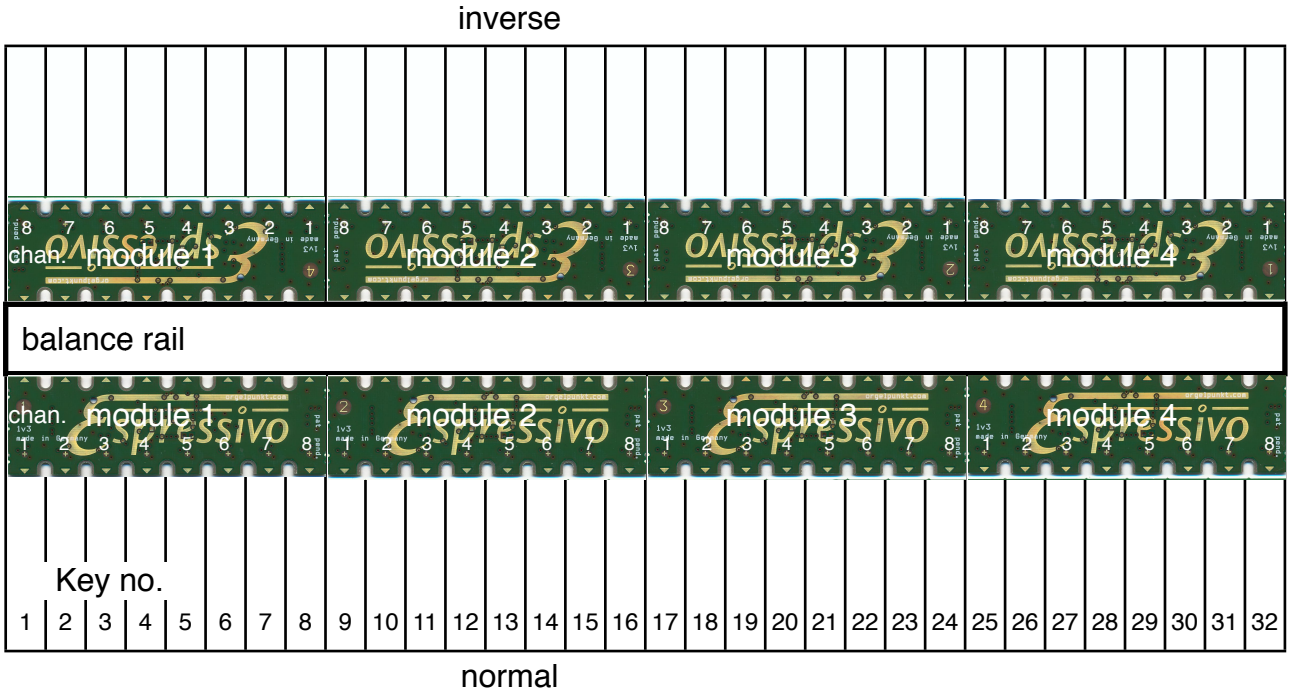
Normal and inverse sensor arrangement

The modules can be arranged in different positions

a) “normal”: when the key is depressed, the key magnet moves towards the sensor module. Here, the rail is mounted on the front arm underneath the keyboard or on the rear arm above the keyboard.

b) “inverse”: when the key is depressed, the key magnet moves away from the sensor module. Here the rail is mounted underneath the keyboard on the rear arm of a balanced keyboard or if suspended above the front arm of the keyboard.

The sensor position is always on the far side from the balancing bar. Therefore, in “normal” assembly, the circuit board numbered 1 is on the left of the console; “inverse” assemblies have the module on the right.



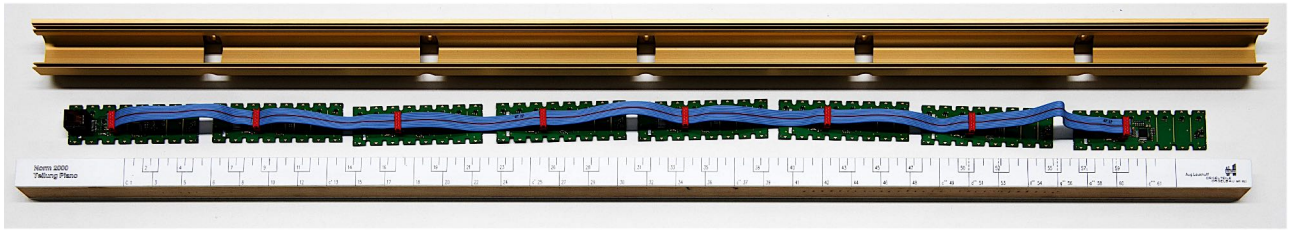
The system automatically identifies the type of assembly. The modules are always numbered consecutively from left to right. In case of inverse assemblies, however, the key sequence is opposite to the module numbers.

The channels of each module are numbered consecutively from left to right. In case of inverse assemblies, the key assignment to the channels is therefore opposed on each module section.

Preparing the sensor rail

The Espressivo sensor modules are mounted in a special aluminum profile which allows the modules to be moved along the manual compass so that the sensor positions can be easily adapted to all standard manual scales.

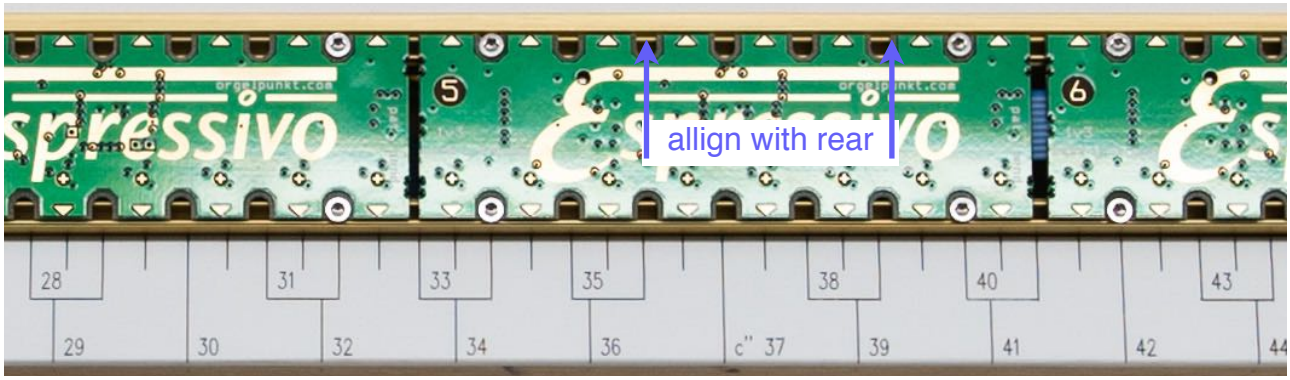
The assembly profile is 100 cm long (approx. 39 inch). To fit the manual width, cut off the excess equally on both the right and left so that the pre-stamped mounting holes are distributed uniformly across the keyboard. Interconnect the modules via the flat cable included in the kit, and insert them into the rail.



Align the gold triangle markers on the module edges to the manual scale and fasten each module to the profile with four screws. The modules should be flush with the rear profile edge.

Only use the special screws supplied with the kit. They can be easily screwed into the profile groove at any position (no pre-drilling or punching required).

The screws are self-tapping and comply with DIN 7500, ISO 14581 M2.5x6 or M2.5x5 (e.g. Würth item no. 0209722506). Use a Torx screwdriver TX8 for fastening.

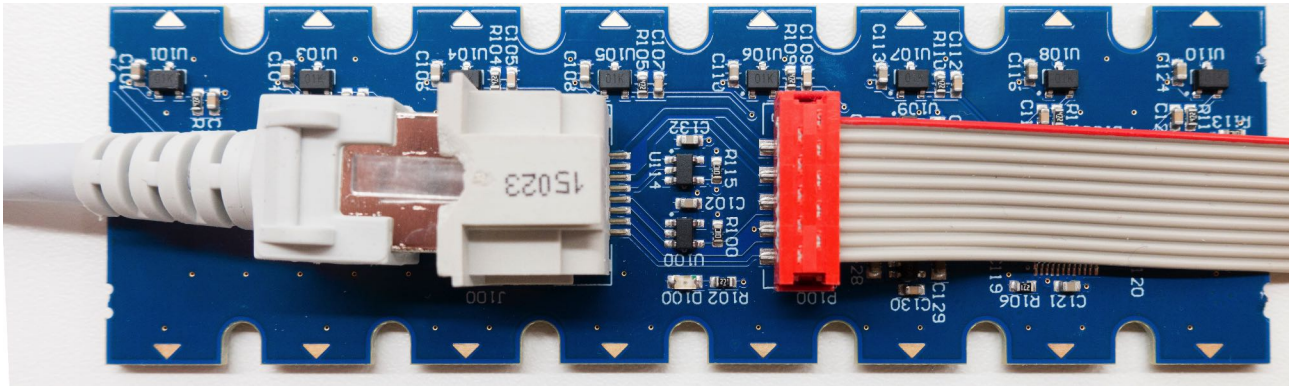


Connecting the sensor rails

The slave modules have the same electronics and can therefore be arranged in any order. The numbers on the boards serve as identification only.

All modules except module 8 can be placed at random. Module 8, however, must always be the last member on the ribbon cable.

If fewer than 8 modules are used, module number 8 must occupy the last position.



Module 1 integrates the RJ45 connector (Ethernet cable) that connects to the Master. assembly is easiest at the end of the sensor rail so that the connecting cable can be plugged in at any time in the mounted condition. If that is not possible, i.e. if the keyboard frame is in the way, the module can also be placed in position 2 of the ribbon cable. In that case, the RJ45 cable needs to be inserted into the aluminum rail during board assembly. The cable cannot be removed afterwards but has a significantly lower cross section at the end of the rail which allows for easier routing through narrow spaces on the keyboard sides.

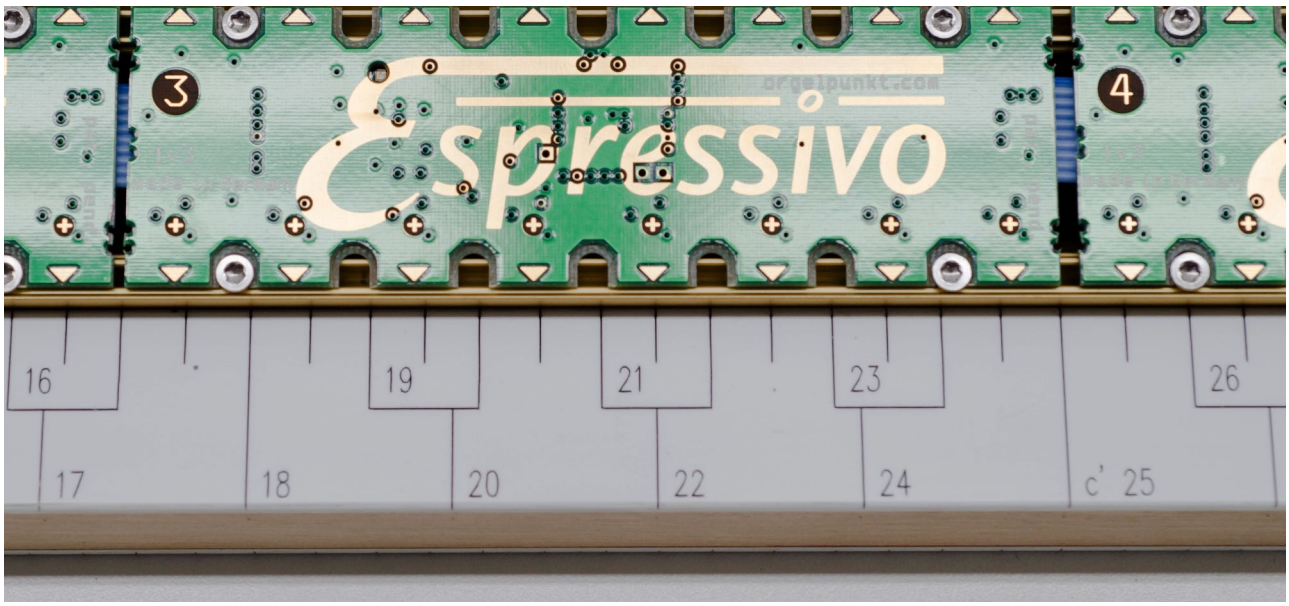
From hardware version 2 (blue circuit boards) the RJ45-connector has been moved so far inwards that most cables will not protrude outside the rail. Thus, module 1 can almost always be mounted on the first position on the rail.

Only use high quality and highly flexible cable to connect the rails to the Master module (e.g. Dätwyler CU 7702 4P flex).
As the sensors also get their power supply via the bus link, low-quality connectors will affect reliability. Stiff standard cables are difficult to route through the keyboard frame and will put mechanical stress on the connector.

Fitting the rail to the keyboard scale

Since the sensor spacing is the same on each board, small deviations from the manual scale are normal within a module. When aligning board and scale, try to limit the maximum deviation to no more than 1 mm in each direction.

The deviation becomes particularly obvious in scales with varying spacing. Piano scales, for example, show major deviations in module no. 3 on the left board edge in positive direction, and on the right board edge in negative direction. The system functions are not affected in any way by these deviations; you should, however, make sure to distribute the misalignment evenly.

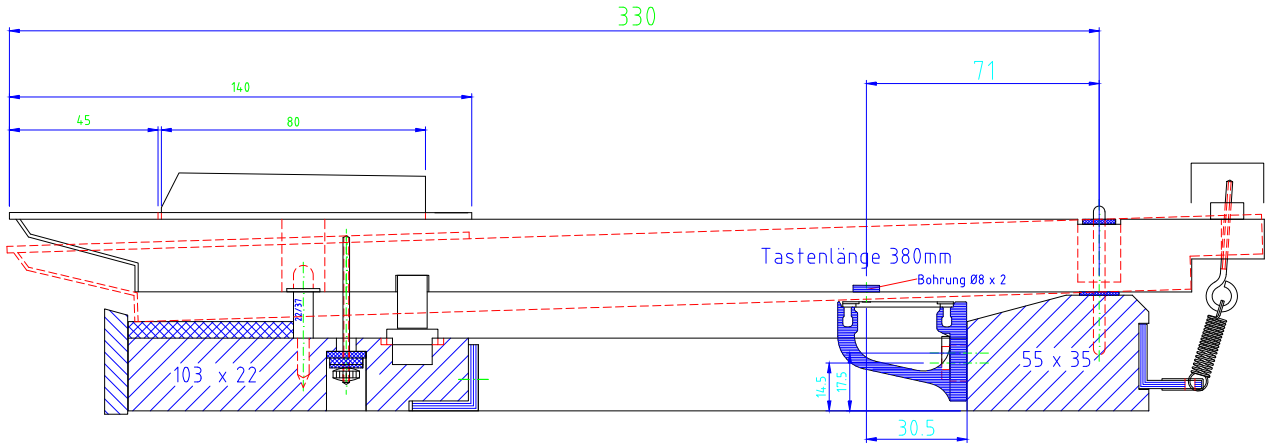


Assembled sensor rail:

The sensor rail can now be tested: Connect the rail to the Master module (see below) and switch on the system. The LEDs of the modules (in the capital Espressivo E) flash for about one second after activation. If you approach a sensor position with a key magnet (ensure correct polarity) or a test pin (yellow tip), the LED of the respective sensor module lights up briefly.

Installation on the keyboard

The Espressivo system has been designed for a 2 to 4 mm key travel. The sensor rail should therefore be mounted directly on the balance rail. The illustration shows the typical dimensions of an electrical keyboard and the lever arm ratio that achieve the best key travel results on the sensor.



Always use the screws, washers and spring lock washers included in the packaging for fastening on the balance rail in order to guarantee permanent and stable connection between sensor strip and key frame. Unstable joints impair the switching precision when metal profile and wood move against each other.

The distance between sensor rail and key bottom should not be too large when the key is depressed. The optimum distance is about 1 mm (1/32 inch). Use a common credit or customer card (standard thickness is 0.7 mm) as a gauge.

Attaching the key magnets

The Espressivo sensors detect key movement by the changing field strength of the magnets attached to the keys. The distance between sensors and sensor strip mounting surface is 30.5 mm (see drawing on the previous page). Correct positioning of the magnets on the keys is paramount.

To guarantee maximum precision, the keys should be manufactured with an 8 x 2 mm blind hole. For retrofitting, the magnet can be easily glued to the bottom surface of the keys. The centers of magnet and sensor should be aligned within a tolerance of about 1 mm.

Use the magnets supplied with the Espressivo system only. Their strength has been attuned to the distances and the key travel in order to achieve an optimum sensor modulation level and thus the required precision..

The magnets have two poles: North (marked red) and South (marked green).

The Espressivo sensors responds only if the **South pole points towards the sensor module**.

The correct magnet position can be easily checked with the positioning pin (red tip). The pin tip has a magnetic North Pole. As opposing poles attract one another, the key magnet attaches to the pin's South pole.

Put the magnet on a non-magnetic surface and touch it with the positioning pin. Contact between pin and magnet is made only if the magnet surface has the correct pole. If the magnet lies upside down, turn it around carefully with the pin.

Lift the magnet with the pin and place it into the previously prepared recess in the key. Remove the pin sideways.

The magnets should be glued in place with a high-viscosity acrylate glue (superglue), e.g. Toolcraft Ropid 200

Common “superglues” with water-like low viscosity usually do not bond well to rough wood surfaces, especially in drilled holes.

Use fresh glue!
Acrylate glue starts to age, once the seal of the bottle has been broken. Adhesive joints made with older glue tend to become brittle over the course of several months. This may cause magnets to fall off the keys.

Observe the glue safety information! Wear gloves to press the magnet into the key recess after positioning.

Individual sensors for pedal keyboards

Although designed for the pedal keyboard, the individual Espressivo sensors can easily be used elsewhere in the action system.

The sensors are installed on the side of the pedal squares. The respective 4 x 12 mm magnet is glued into a bore hole on the square and moves past the sensor side.

The module is attached to an aluminum bracket which is fastened to the bearing elbow of the standard Laukhuff square.

For easy positioning, the mounting bracket is equipped with a guide lug that perfectly fits the Laukhuff bearing. If the guide lug impedes installation on other bearings, it can easily be broken off along its breaking line.

In horizontal position, the maximum detectable pedal lever travel on the front end is +/- 15 mm (3/5 inch).

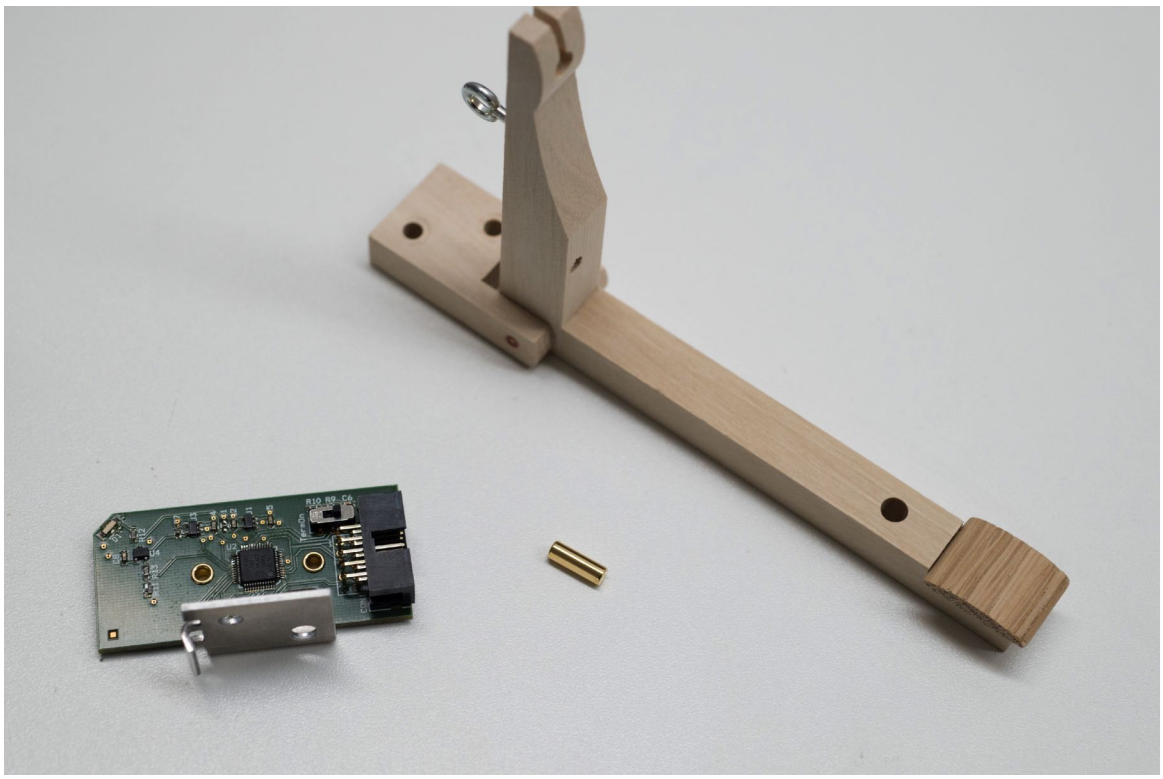
The pedal keyboard sensors are interconnected via the prefabricated flat cable. An adapter PCB connects the standard RJ 45 bus connector (Ethernet) with the Espressivo Master.

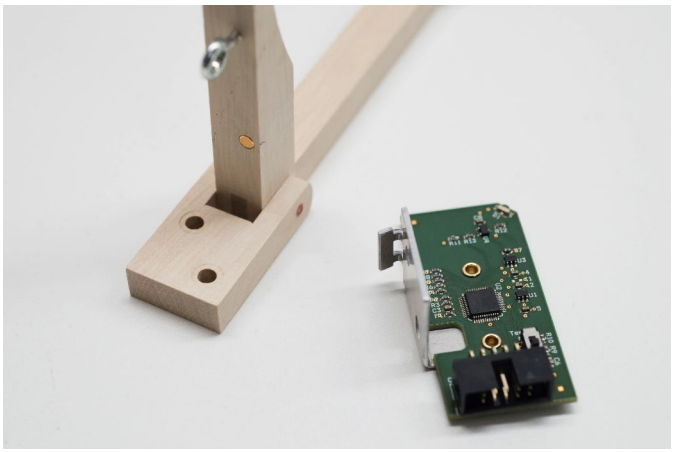
All Espressivo functions described in the operating manual (settings for pre-travel, switchpoint stretching etc.) are also available for the pedal.

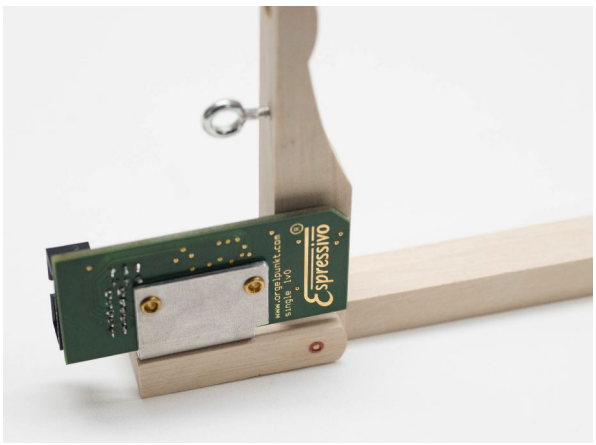
Note:

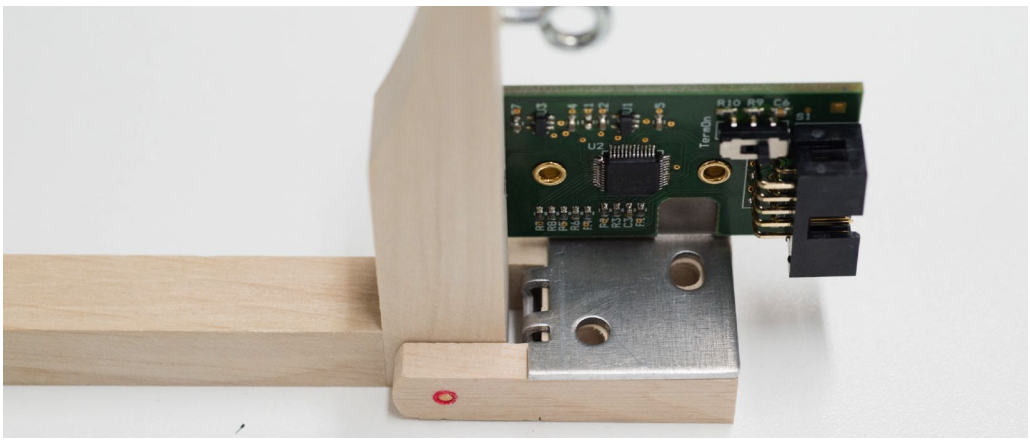
Due to their mechanical design, the pedal contact assembly has a different ON/OFF behavior than the manual sensors. To ensure reliable triggering, the pedal contacts should be set to a switch-point spread of at least 10% during set-up (see page 36)

Sensor installation on the pedal square







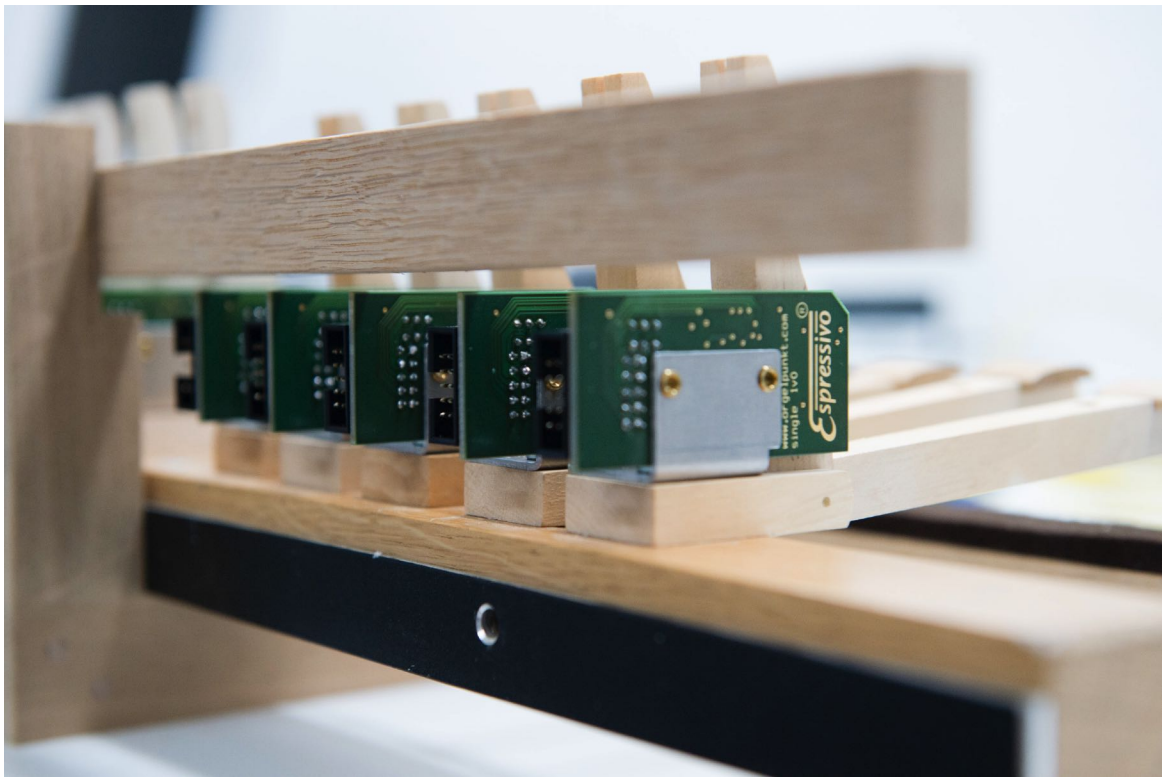


Single Espressivo sensor with mounting bracket, magnet and square

Positioning the sensors at the square

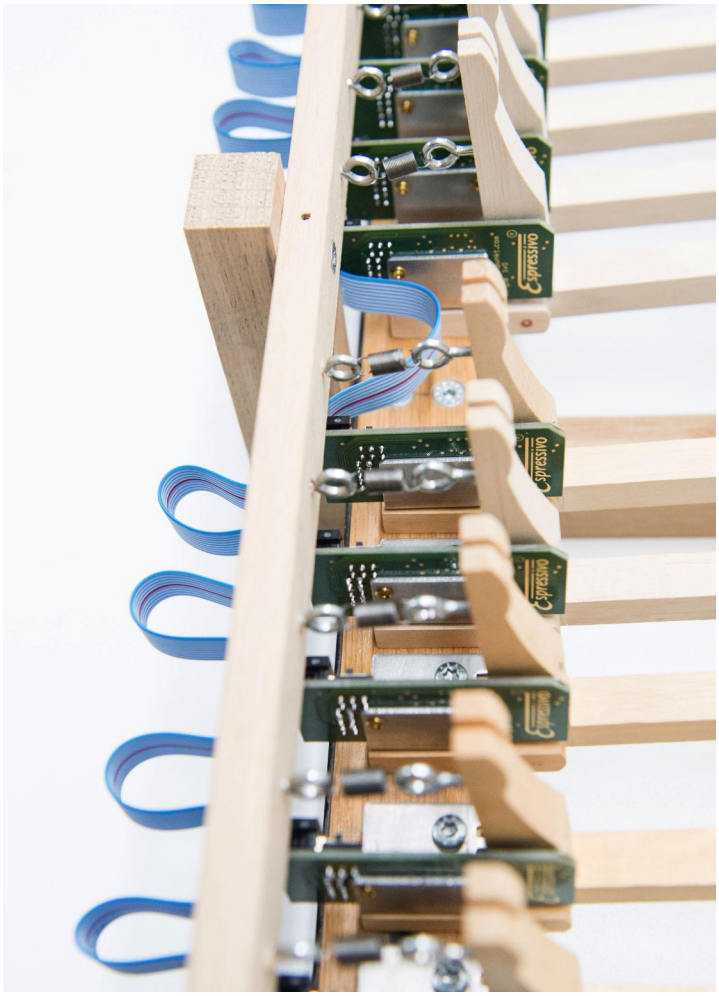
With this sensor type, the polarity of the magnets is not important. It is recognized automatically when setting up the sensors.

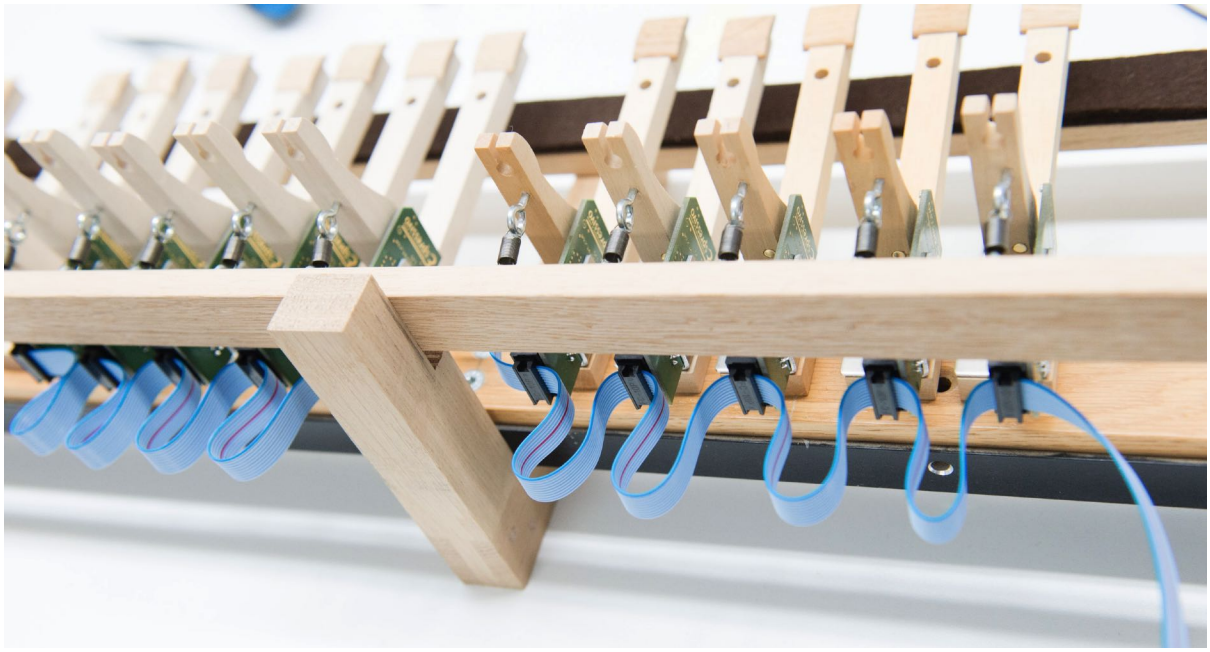
Assembling a pedal contact board



(Shown here with stop rails and retaining spring for action simulation)

Pedal keyboard cabling

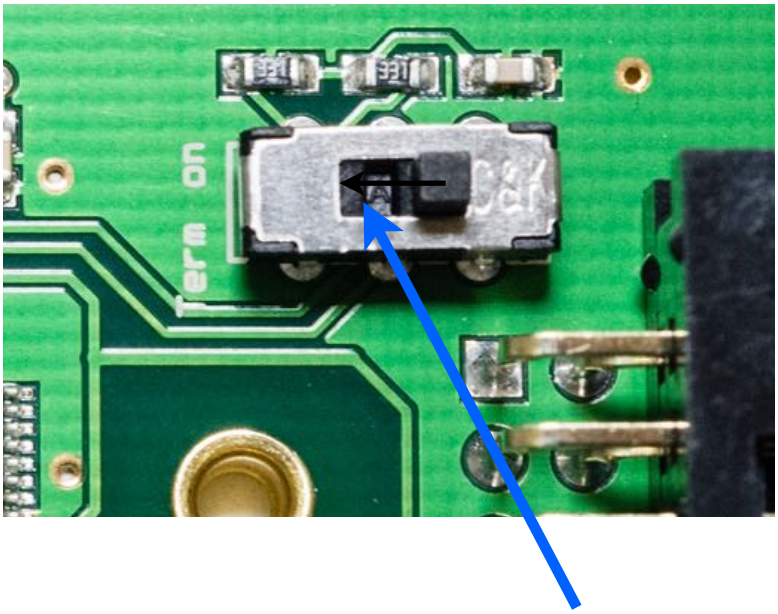




Setting the bus terminating resistor

All individual sensors are equipped with a bus terminating resistor. This is necessary to prevent interference on the bus cable.

The switch on the last sensor module in the flat cable chain needs to be activated for termination (do not activate any of the switches on the other modules).

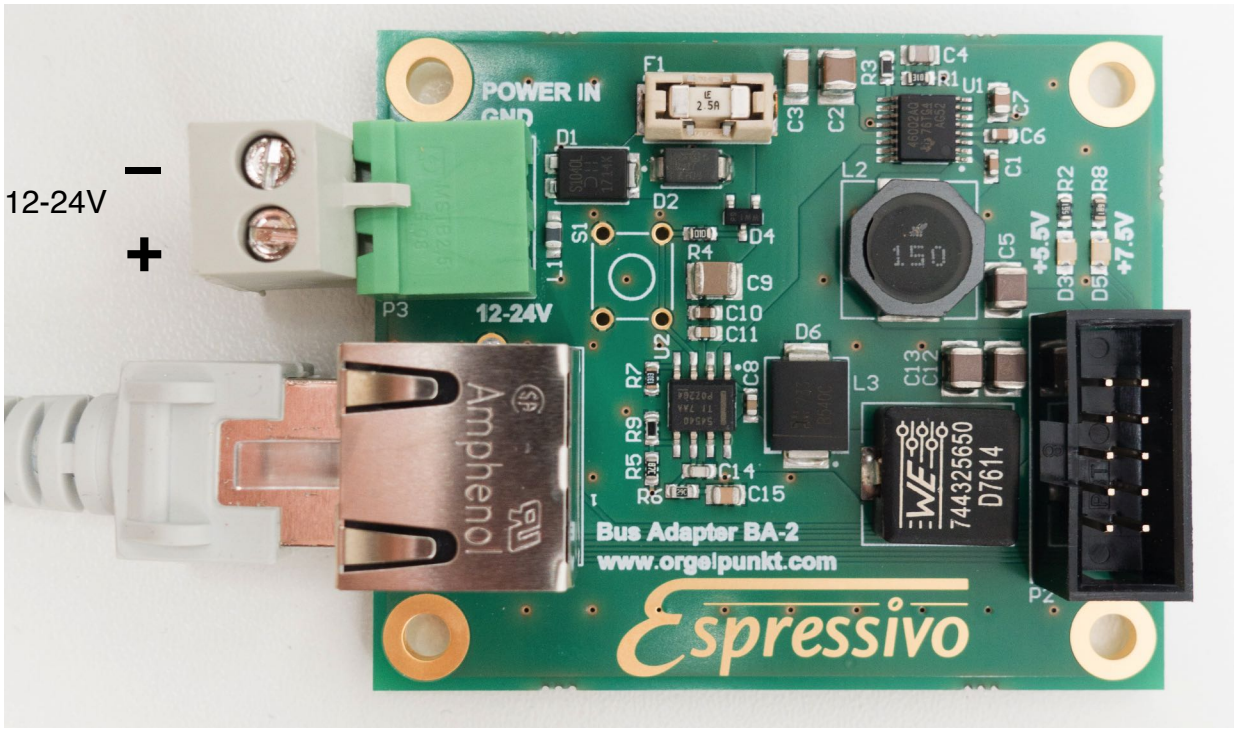


“Term. on”
switch on at the last sensor board on the ribbon cable chain

Connecting the single sensors to the Espressivo Master module

The ribbon cable is equipped with 33 connectors. The first connector (with a longer length of cable) is used for connection to the Master module using the bus adaptor.

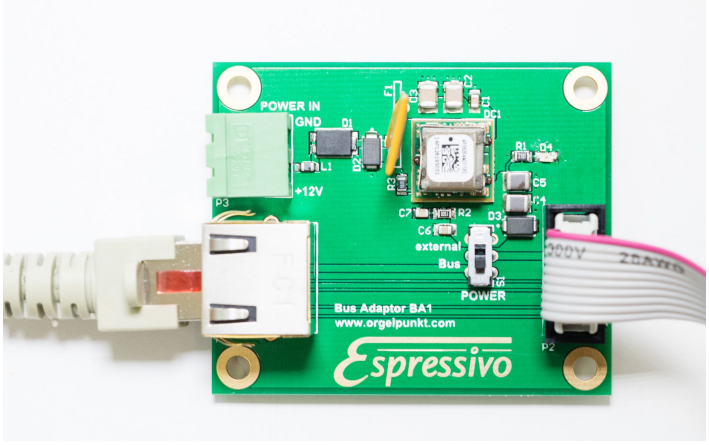
Up to 32 pedal contacts can be connected. If you need fewer contacts, please cut off the unused ribbon cable at the last used connector. Unused cable at the end of the bus chain will only pick up electric interference.



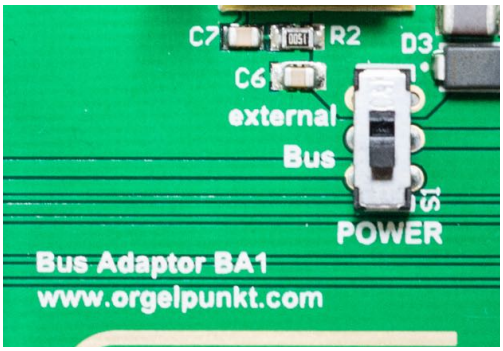
The pedal contact stock needs an additional power supply. Connect the bus adapter BA-2 to the same power supply (12 – 24V DC) used for the Master module (see p. 5). Two green LEDs signal the operation of the power supply circuitry of the BA-2.

Connect the flat cable as shown above (right), connect a standard Ethernet cable to the RJ45 port and connect to the Espressivo Master unit as described for the manuals.

Using the bus adapter BA-1



The earlier version of the bus adapter, BA-1, allowed for powering the pedal contact stock via the bus cable or external supply, alternatively. Always use the external power supply option. Tests have shown the power supply via bus cable to be unreliable depending on the cable brand. Make sure the “Power” switch is set to “external”. A red LED signals the presence of external power.



The BA-1 adapter can only be used with 12V supply voltage, not 24V!

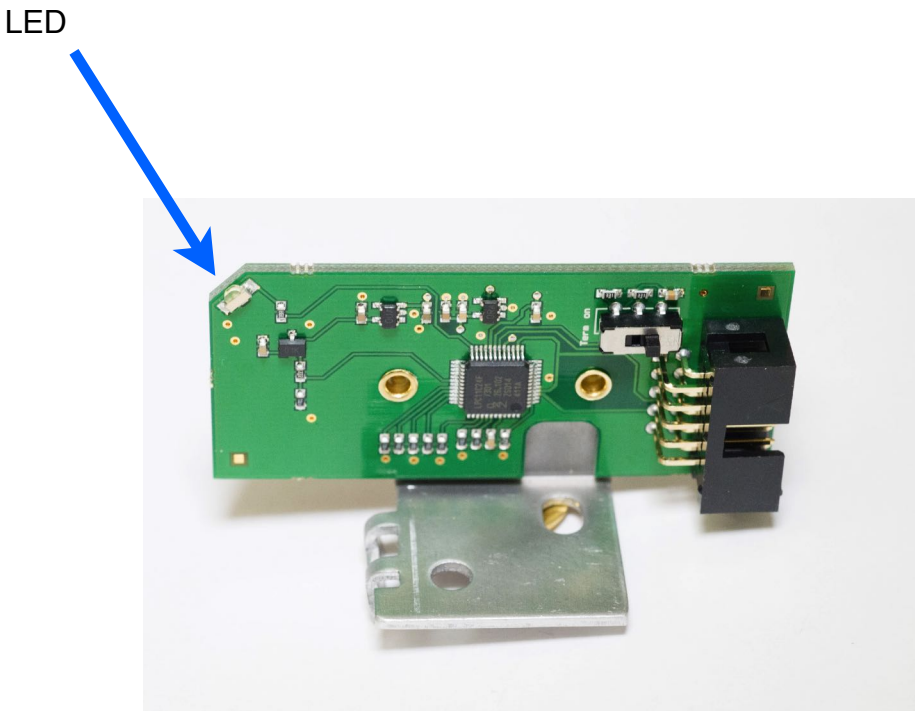
If you use the BA-1 adaptor, the whole Espressivo system needs to be powered by a 12V power supply.

Sensor LEDs

Each sensor has an LED for status indication.

When the system is switched on, all LEDs flash for 1 to 2 seconds until the Master module has identified all of them. If an LED flashes longer (approx. 5 seconds), it was not recognized by the Master. In that case, the Master configuration must be checked and/or the modules assigned anew.

In normal operation, the LED flashes briefly when the key is actuated or released.



Manual and pedal configuration files

All system config files are stored on the Micro SD memory card. If the Master module needs to be replaced, the memory card can be inserted into the new one and the system is immediately ready for operation.

The card features two types of configuration files.

a) The orgel.cnf file

The configuration file on the micro SD memory card describes the manual organization and is therefore **absolutely necessary**. Without the config file, the module would not start up. The configuration file - a text file - is named "**orgel.cnf**" and structured as follows:

#---organ configuration

/LOWSPEED

/MIDIOVERIP

/CONFIG manual no: 1 filename: Manual1.txt midichannel: 1

/CONFIG manual no: 2 filename: Manual2.txt midichannel: 2

/CONFIG manual no: 3 filename: Manual3.txt midichannel: 3

/CONFIGSINGLE manual no: 1 filename: Pedal1.txt midichannel: 8

"#" adds comment lines which are ignored.

The key words need to be in capital letters.

/LOWSPEED downgrades the bus rate from high-speed mode (1MBit/s) to 500 kBit/s. This setting is necessary when the firmware needs to be updated via the bus. In normal operation, this line is deactivated with the comment line "#".

/MIDIOVERIP outputs the Midi commands as UDP packets via Midi interface as well as via the Ethernet interface. This operating mode is required to activate the Laukhuff Sigmatec System. The drivers available for Windows and Macintosh systems allow activation via PC without extra Midi interface.

/IPONLY deactivates the Midi interface and outputs the data via Ethernet interface only. This allows maximum speed but is usually not required.

/CONFIG starts a keyboard description. The descriptive key words end with a colon which is followed by the parameter.

Each one of the up to six manuals is defined by its manual number, preferably the same number as in the console. The name of the corresponding parameter file created during system setup is usually named “Manual<no>.txt. You can use any other name. The Midi channel indicates the channel the manual is to use.

/CONFIGSINGLE manual no: 1 filename: Pedal1.txt midichannel: 8

/CONFIGSINGLE manual no: 2 filename: Pedal2.txt midichannel: 9

These statements define up to 2 manuals with single sensors.

Each physically present organ manual must be configured (configuration file). Additional virtual manuals can be created as well. They are used to define Midi channels which output notes via couplers only (see below).

IP configuration

The Espressivo system allows a variety of Ethernet interface configurations.

In standard applications, the module has IP address 169.254.1.2. As soon as a Windows PC with automatic network configuration is connected to the Master and **all other network PC network connections** (e.g. WLAN) **are deactivated,** the PC reverts to an address that can communicate with the Master.

The Midi data can be received by all PCs connected to the network.

Changes in the orgel.cnf file allows for user-specific network configurations.
A short overview below:

```
#------IP section default 169.254.1.2   255.255.0.0
#/IPADDRESS 10.30.0.24
#       IPAddress of the master                         important
#/GATEWAY  10.30.0.254                                  unimportant
#       Gateway address to other subnets
#/NETMASK  255.255.255.0                                important
#       filter of the subnet IP range
#/DNS  10.30.0.106                                      unimportant
#       Domain Name Server Address
#/USEDHCP
#       Get IP address from DHCP server
#       do not use this option unless you have no other choice
#       as you do not know the Master IP address and therefore cannot
#       connect to it via telnet.

#/UDPPORT 12345
#       set the UDP Port to parameter.  default 21928
#/MULTICAST
#       use udp in multicast mode (IP:=225.0.0.37)
#               default broadcast (255.255.255.255)
# !! Attention for all IP Keywords DO NOT use a ":"
```

b) The manual .txt files

The system generates parameter files for the single manuals during setup. They contain the serial numbers of the detected sensor modules as well as the adjustment parameters, i.e. the sensor voltage values of an actuated (key down) and non-actuated (key up) key as well as the voltage change when the tone is triggered. The assignments of keys to Midi notes are also saved to the manual.txt file.

Manual1.txt:

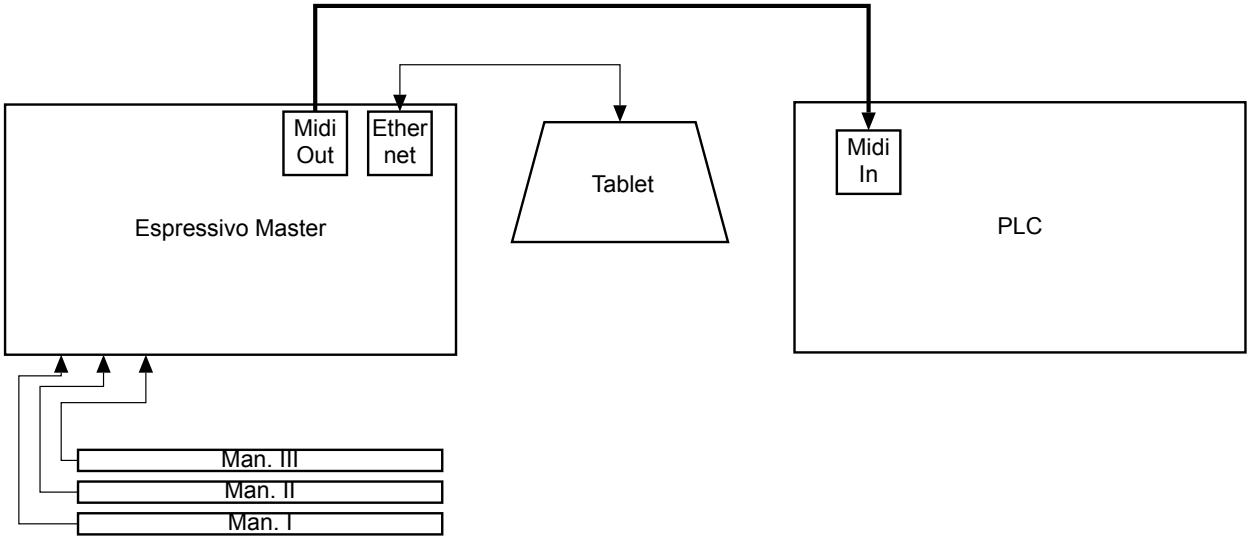
```
#date: 2014-05-15 (setup date)
NofBoards: 8 (number of modules in the manual)
NofKeys: 0 (currently unused parameter)
#-------------------------------------------------
Boardno: 0 BoardID: 0xd0dfa33 NofChannels: 8 Mode: 0x0
#temperature: 24.75 °C (temperature during calibration if sensor is connected)
Key: 1  Note: 36  KeyDown: 83 KeyUp: 460 Trigger: 50 spread: 50
Key: 2  Note: 37  KeyDown: 80 KeyUp: 496 Trigger: 67 spread: 50
Key: 3  Note: 38  KeyDown: 183 KeyUp: 528 Trigger: 45 spread: 50
Key: 4  Note: 39  KeyDown: 129 KeyUp: 516 Trigger: 52 spread: 50
Key: 5  Note: 40  KeyDown: 80 KeyUp: 484 Trigger: 54 spread: 50
Key: 6  Note: 41  KeyDown: 172 KeyUp: 523 Trigger: 44 spread: 50
Key: 7  Note: 42  KeyDown: 104 KeyUp: 525 Trigger: 51 spread: 50
Key: 8  Note: 43  KeyDown: 81 KeyUp: 490 Trigger: 57 spread: 50
#-------------------------------------------------
Boardno: 1 BoardID: 0xd0df533 NofChannels: 8 Mode: 0x0
#temperature: 24.81 °C
Key: 9  Note: 44  KeyDown: 28 KeyUp: 476 Trigger: 61 spread: 50
Key: 10  Note: 45  KeyDown: 93 KeyUp: 491 Trigger: 55 spread: 50
Key: 11  Note: 46  KeyDown: 42 KeyUp: 501 Trigger: 57 spread: 50
Key: 12  Note: 47  KeyDown: 76 KeyUp: 480 Trigger: 59 spread: 50
Key: 13  Note: 48  KeyDown: 107 KeyUp: 494 Trigger: 56 spread: 50
Key: 14  Note: 49  KeyDown: 33 KeyUp: 486 Trigger: 59 spread: 50
Key: 15  Note: 50  KeyDown: 83 KeyUp: 480 Trigger: 59 spread: 50
Key: 16  Note: 51  KeyDown: 48 KeyUp: 495 Trigger: 60 spread: 50
```

... and so on ...

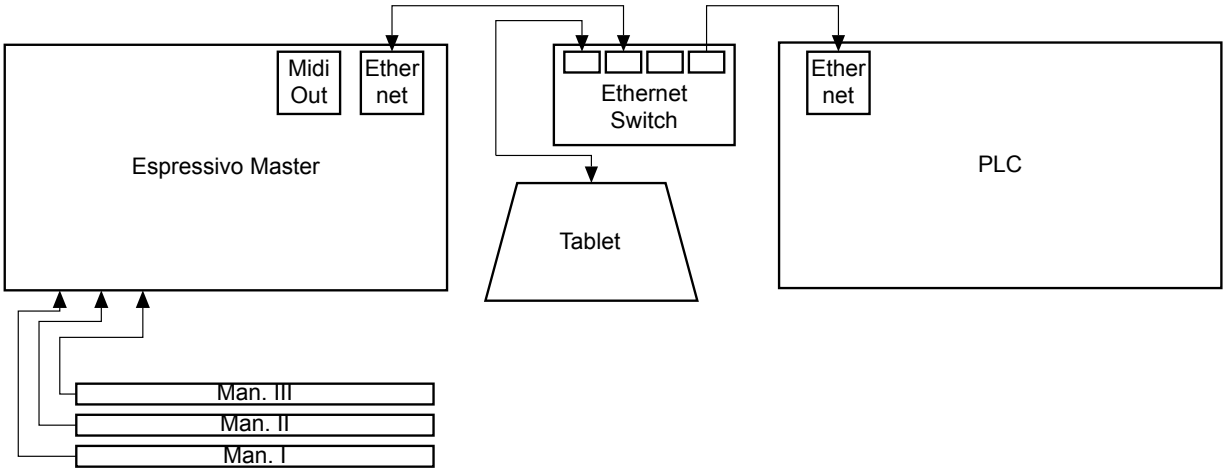
In standard sensor assemblies (mode: 0x1), the KeyUp value is higher than the KeyDown value. In inverse sensor assemblies (mode: 0x3), the KeyUp value is lower than the KeyDown value.

Connecting the Espressivo to an action system

The Espressivo Master module has two interfaces which can be used to connect it to an electronic action system – the Midi and the Ethernet interface. If you use the Midi interface, the Ethernet connection is available to connect a Windows PC (preferably a tablet) if needed, to set up or adjust the system.



If you use the Ethernet interface to send keying data to the action, you should use an Ethernet switch in that circuit. A spare port on that device can be used to connect the tablet at any time. This way, you can play the organ while adjusting the system, helping you to check the acoustic results immediately.

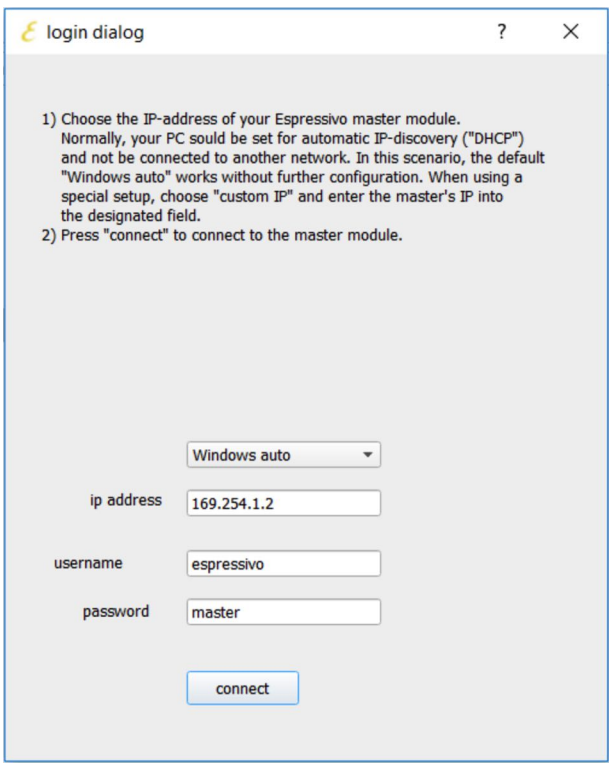


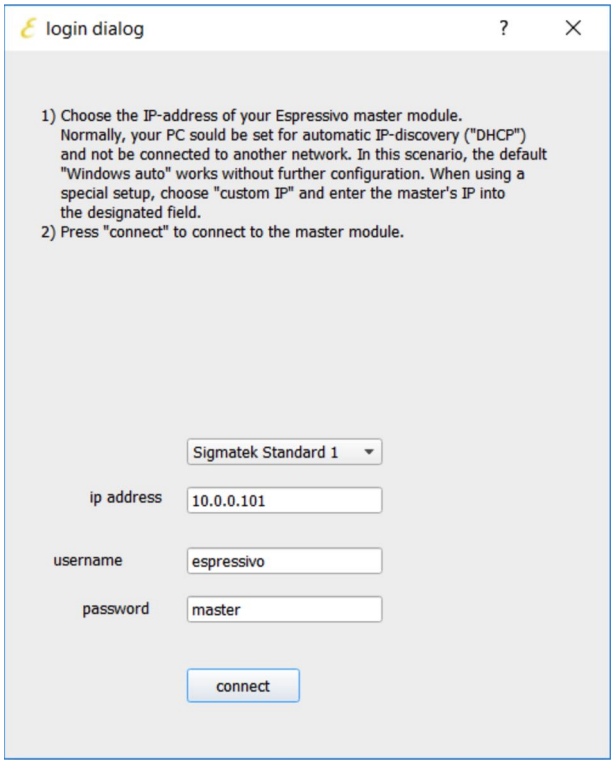
Setup and configuration of the Espressivo system

For easy and convenient setup of your Espressivo system use the special Windows software, which is also pre-installed on the tablet PC included with the Espressivo starter kit.

All functions (and special settings) can also be entered as text commands in the Telnet command field. This option, however, is not necessary during normal operation and is not described in detail here.

Start screen after Espressivo software start-up:





Check the IP settings and click on the "Connect" button to establish the connection to the Master module.

1) Select the IP address of your Espressivo Master module.
   If your computer is in automatic mode (DHCP) and not connected to any network (standard), basic setting "Windows auto" now establishes the connection.
   If a special configuration is used instead, select "custom IP"
   and enter the Master module IP address in the IP field

   The pull-down menu has common presets, like the “Sigmatek” configurations in the subnet 10.0.0.x used by Laukhuff setups with two consoles.

   You can also enter a specific IP address numerically if you configured such an address in the config file.

2) Click on “connect” to start the main program.

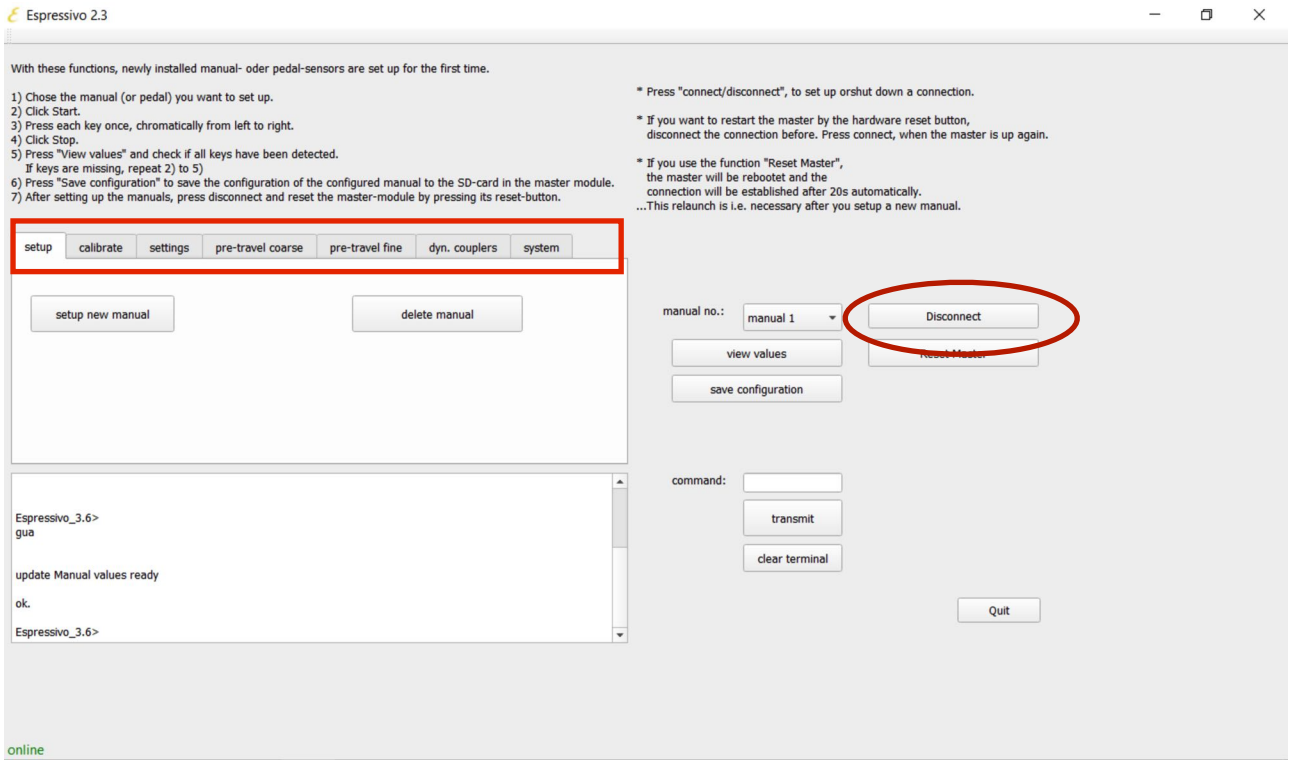
Note: To connect to the Espressivo Master configured with a non-standard IP, the network adapter of your PC has to be configured manually to a matching address in the same subnet.

If you cannot connect to the Espressivo Master even though your addresses are configured correctly, press the reset-button on the Master module and try connecting again after several seconds.

The program starts with the setup-tab open.

The different options “setup”, “calibrate”, etc., can be chosen using the tabs. Help notes on the top of the window will explain the use of the option.

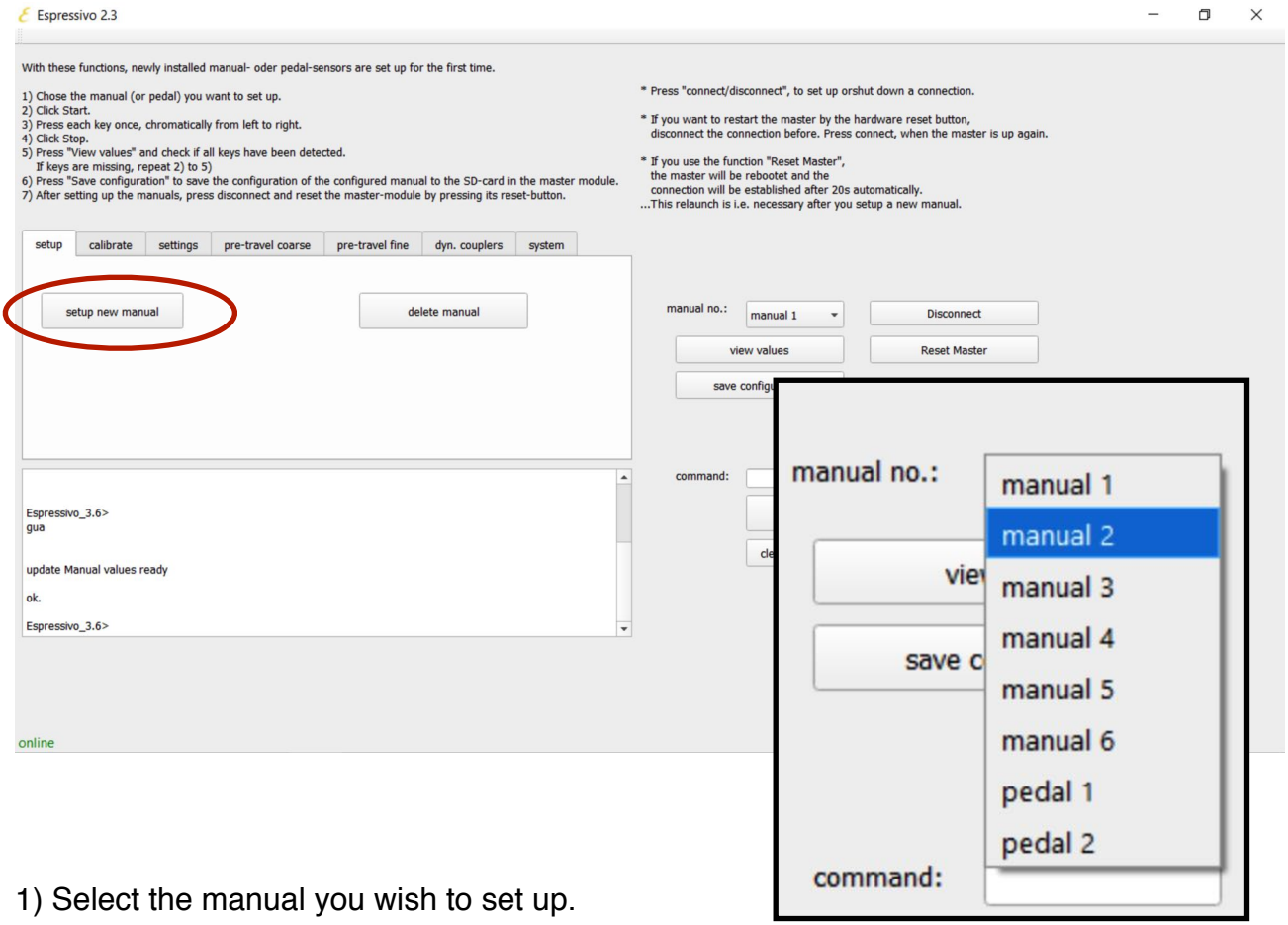
The “disconnect” button terminates the connection to the Espressivo Master. Use it prior to resetting the Master with its reset-button.



Setting up newly installed manuals

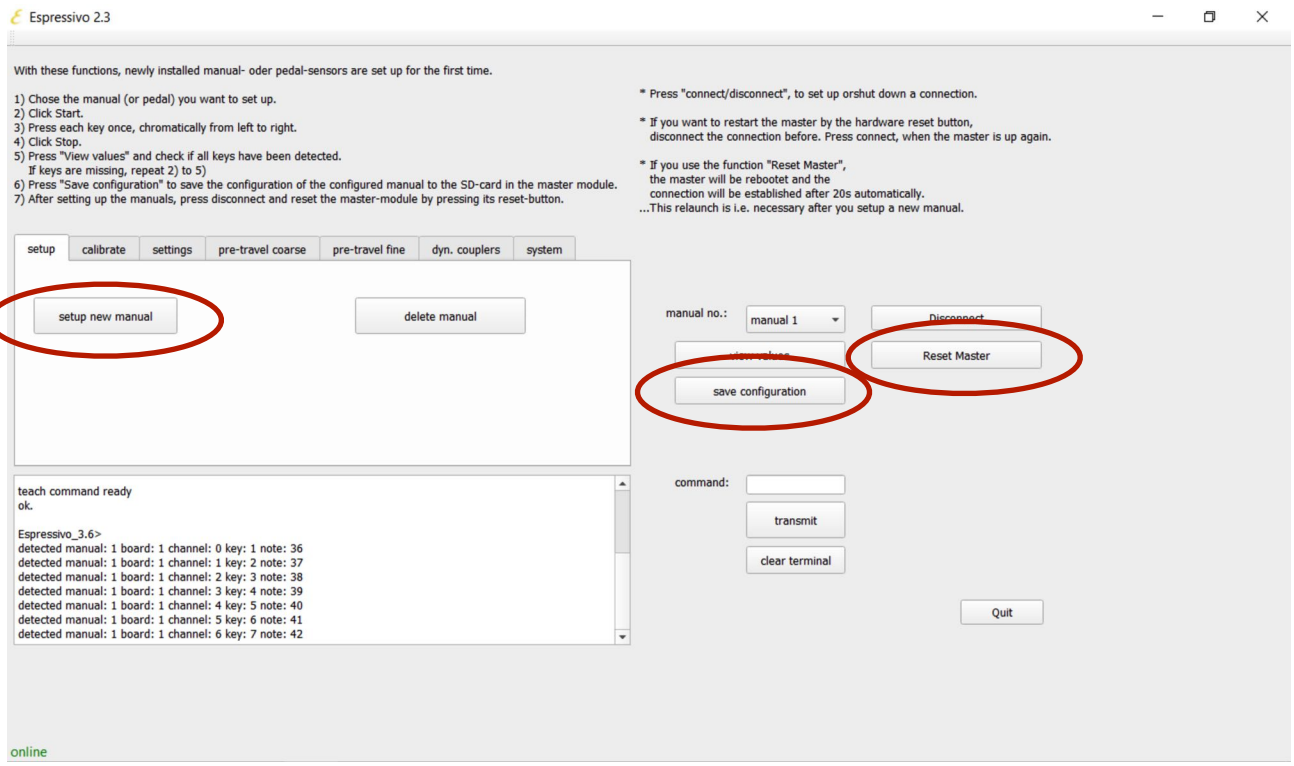
After installation or exchange of sensors, the new sensors need to be assigned to their manuals. The assignment routine is described below.

We recommend setting up the manuals before the console is installed in the organ. In the workshop condition, it is easier to check the functions and correct connections of components. Sensors can be removed or repositioned without time-consuming disassembly.



1) Select the manual you wish to set up.

2) Click on “setup new manual”.



3) From right to left, press each key once.
   With each key, a message is displayed in the terminal window, counting the number of detected keys, indicating which sensor on which module has been activated.

4) Click on “finish setup”.

5) Verify if the correct number of keys has been detected.

6) Click “save configuration” to save the keyboard data.

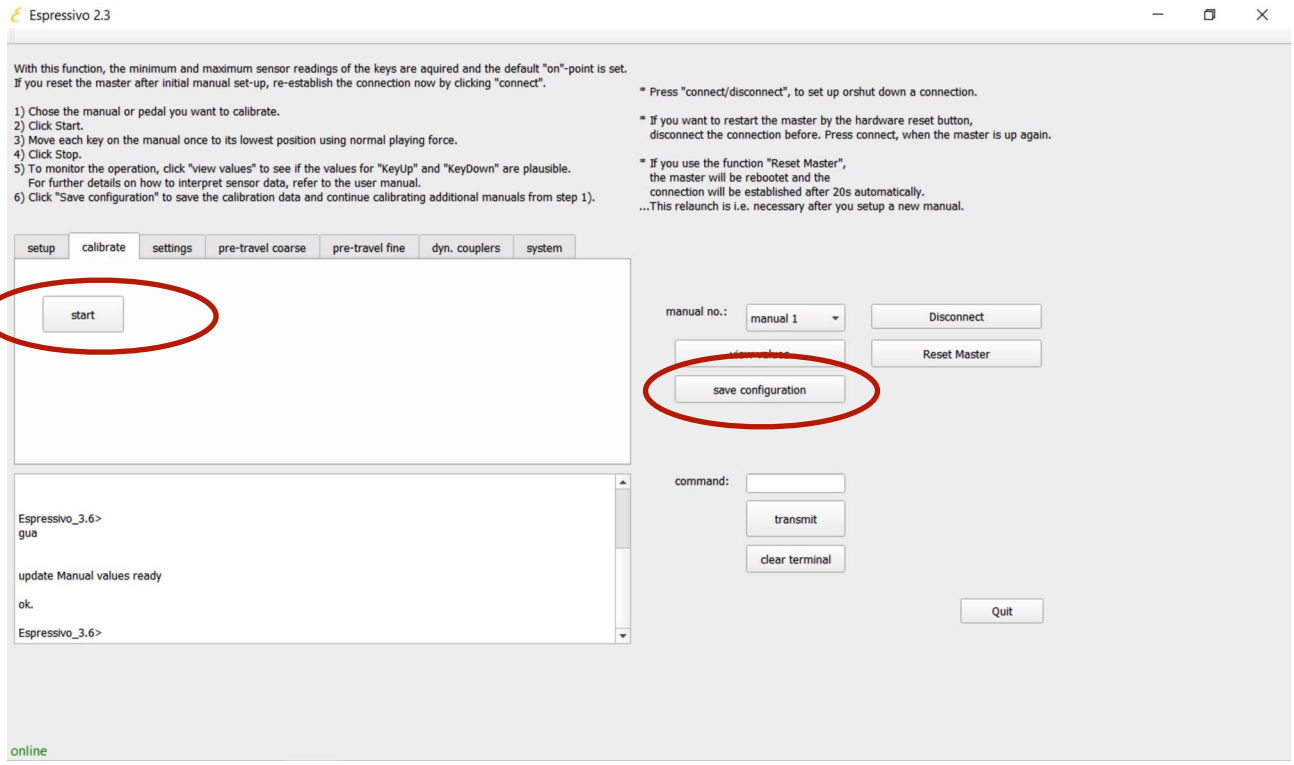
7) Reboot the system by clicking on “Reset Master”. In the lower left of the window, a countdown of 20 seconds will be displayed before the program automatically reconnects to the Master module.

The reboot is essential before you can proceed to the next step, calibrating the newly installed manual.

Setup is necessary only once. However, new calibration is required if the distance between key and sensor changes, e.g. when the sensor rail had to be removed.

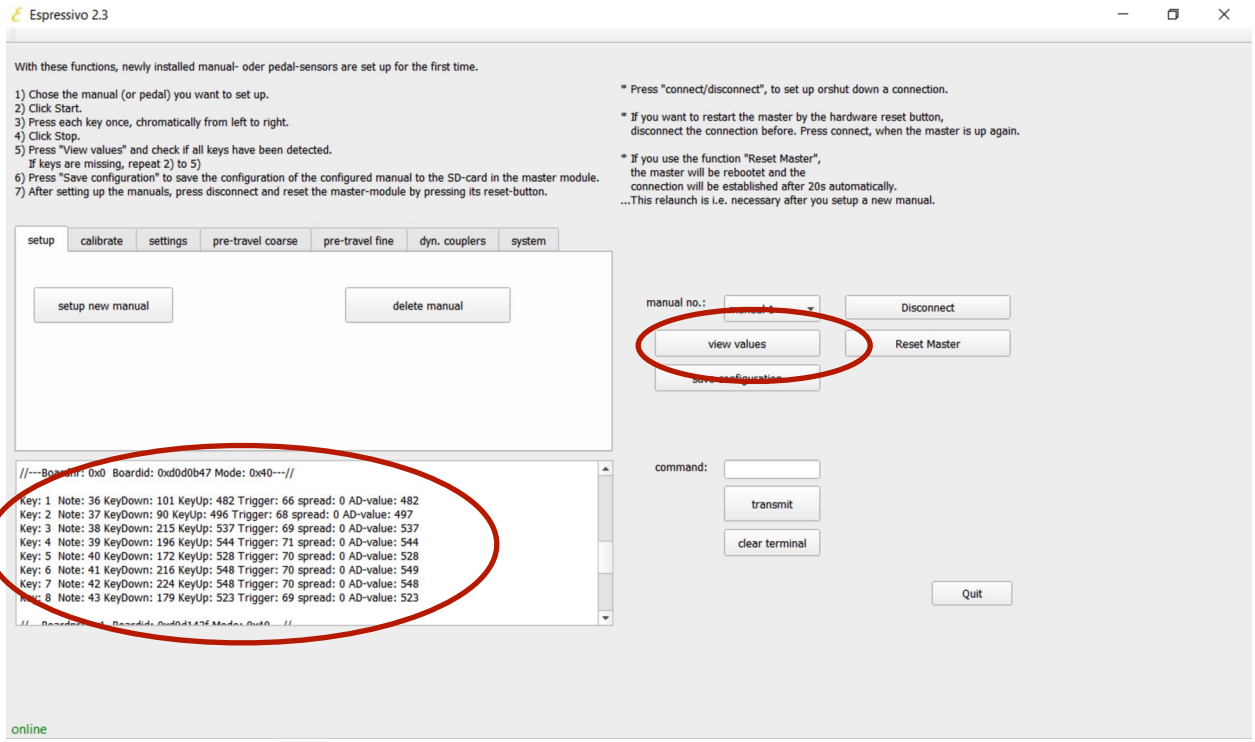
Also, if a mechanical action is equipped with Espressivo sensors for coupling or Midi data output, we recommend a recalibration after final action adjustment.

Calibrating manuals



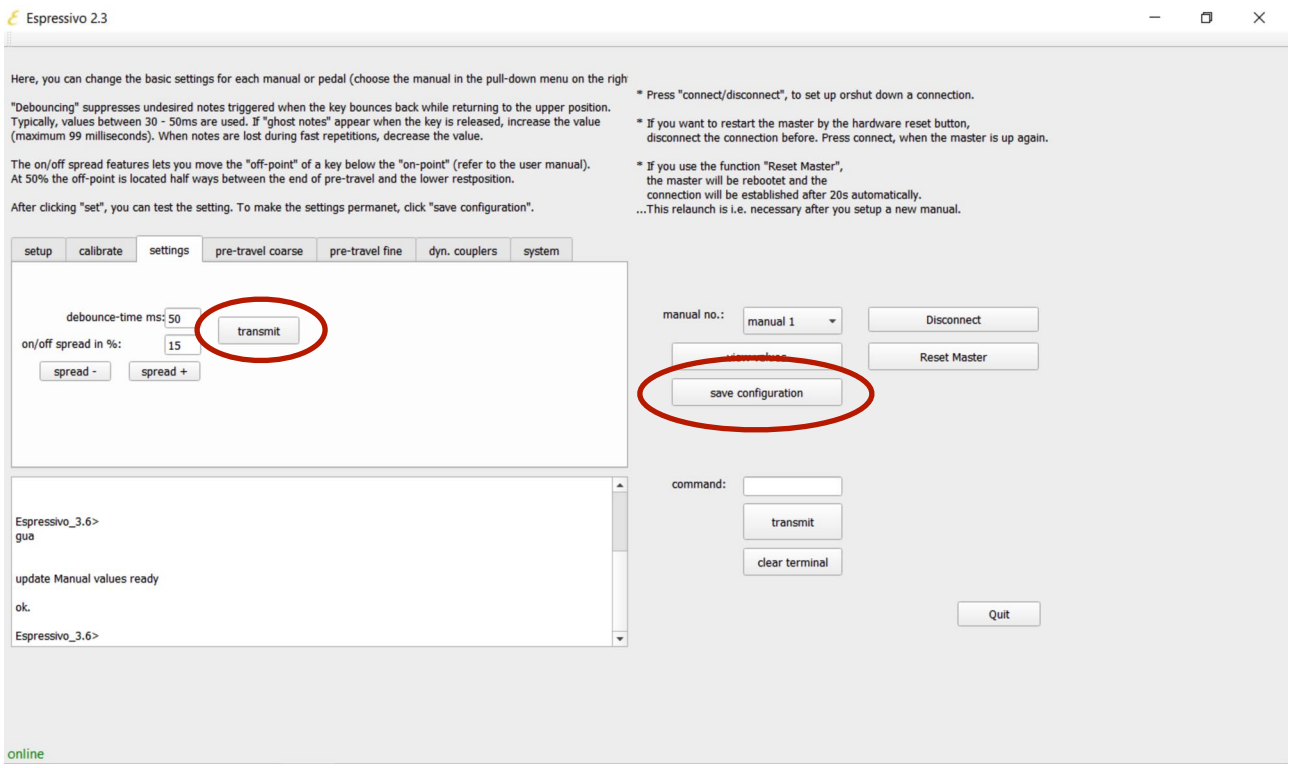
With this function you acquire minimum/maximum sensor values and set the pre-travel to default values.

1) Select the manual or pedal you wish to work on.
2) Click on Start.
3) Depress each manual key once all the way to the lower rest position (normal pressure, not too strong).
4) Click on Stop.
5) To check the values, click on "View values" and verify the "KeyUp" and "KeyDown" parameters (for detailed information see the technical appendix at the end of the documentation).
6) Click on "Save configuration" and calibrate the other manuals (steps 1 to 6).



Display of sensor values in the terminal window

Keyboard settings



Select the manual you wish to set up from the pulldown menu.

The following parameters can be defined:

1) Debounce time: Most keyboards "bounce" when one of the keys is released very suddenly. The key vibrates when it returns to home position and makes a very short move downwards. This process is invisible to the eye but easily recognized by the Espressivo system. This brief downward movement generates a sound. To suppress these unwanted sounds, the note output is suppressed for the debounce time after the key is released. The debounce time is measured in milliseconds. Standard debounce time is 30 to 50 ms. This feature still allows fast key repetition of as many as 20 times a second. If you notice that these "ghost" sounds are still audible or you see two sets of notes in your Midi data, extend the debounce time (maximum 99 ms). If you feel that notes are missing during fast repetitions, shorten the time.

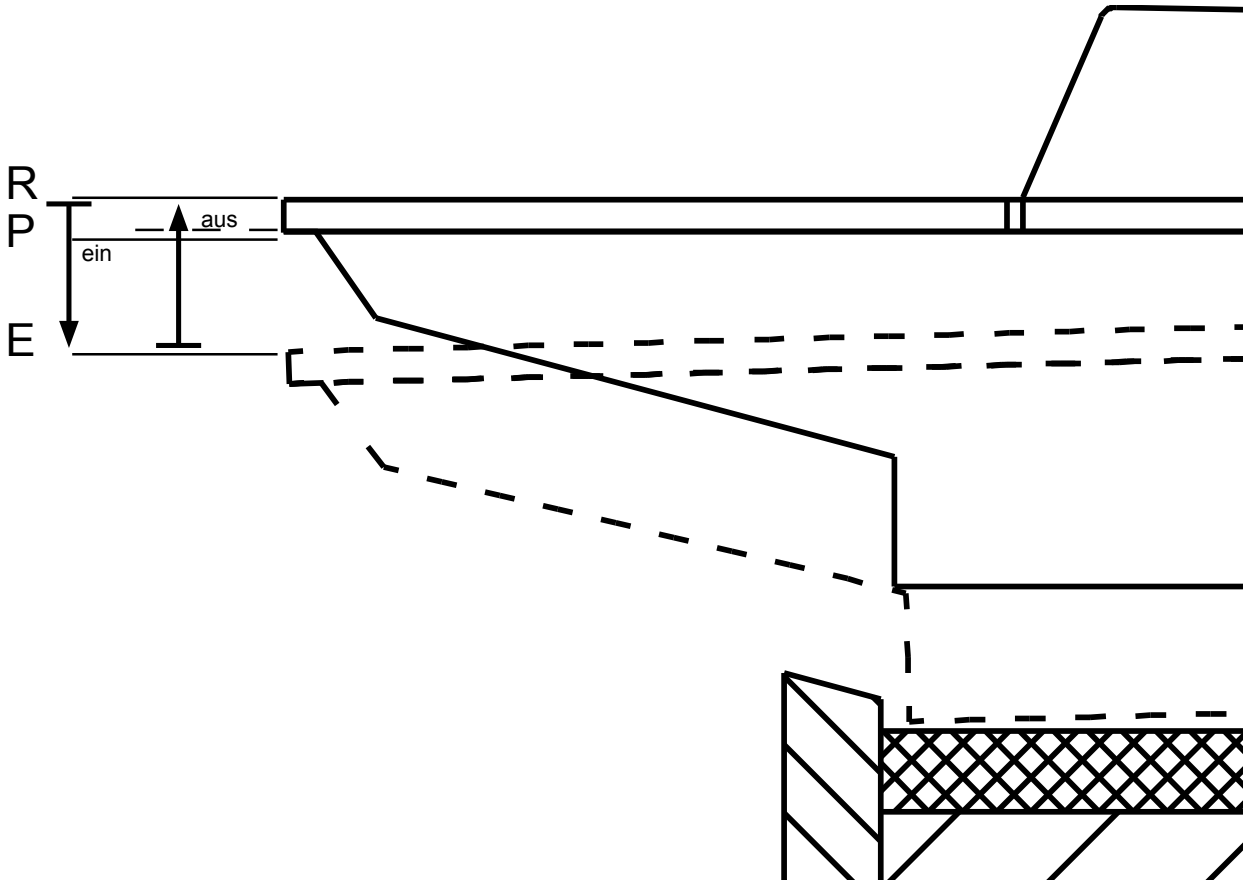
2) Switchpoint spreading (see next page)

Click on “transmit” to transmit the new setting to the Master module and test the new value by playing on the keyboard.

If you are satisfied with your setting, click on "Save configuration”.

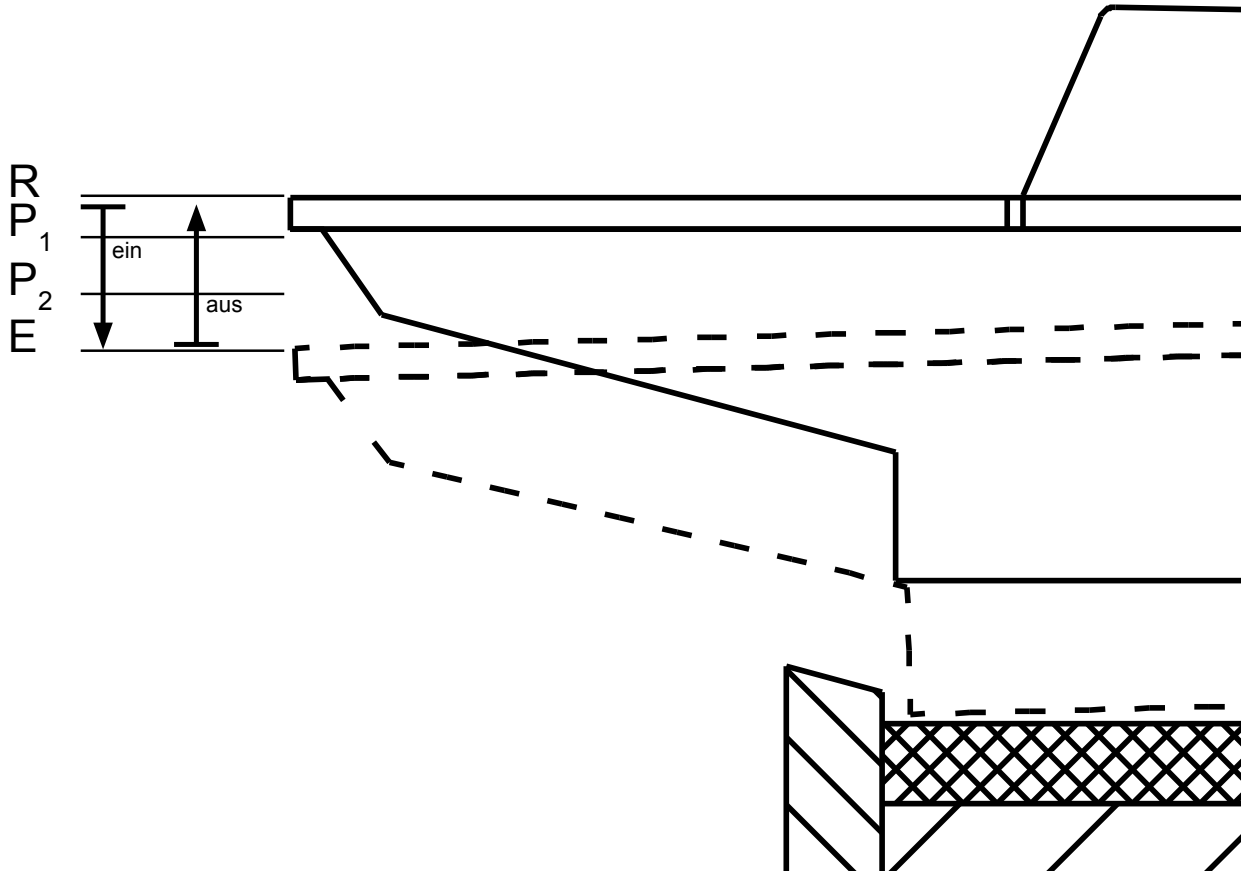
Spreading the switchpoints

Standard electrical action systems switch the tone on when the key is depressed until it reaches the switchpoint (P), i.e. the end of the pre-travel. Ideally, the tone is switched off at the same position, i.e. when the key moves from end position (E) back up into rest position (R). In reality, however, each switch or sensor has a negative hysteresis which must be traversed to toggle the state. For this reason, the tone is deactivated only after the key has risen above the switchpoint.



This behavior often gives the impression of a slow and lethargic action response. Especially in instruments with mechanical action, electric coupling seems to lag behind the mechanical tracker. This impression is caused because the airflow to the pipe is actually interrupted before the mechanically-actuated valve is completely closed, i.e. the key is still below the response position. Delays due to the unavoidable switching times of the action magnets reinforce the sluggish feel of the electrical action.

The Espressivo system provides the possibility to spread the switch-on (P1) and switch-off (P2) points, and to shift the switch-off point to a deeper key position.



This positive hysteresis allows for a much better synchronization of mechanical and electrical action. In addition, any electrical action delays are compensated by premature switch-off.

The spread values are adjusted by the "Spread" parameter. Standard setting is "0" after manual and pre-travel adjustment. Spread value input makes sense only after pre-travel is adjusted.

The spread parameter moves the switch-off point as a percentage of the distance between switch-on point (P_1) and final key position (E). If the spread value is 50%, the switch-off point is situated half way between pre-travel and final position.

Switchpoint spreading also allows for accelerated repetition (2-point repetition):

The tone stops at point P_2 when the depressed key moves back up. If you depress the same key again instead of allowing it to reach its rest position, the tone is immediately reactivated. This allows for fast repetitions with minimum key movement. This novel principle makes the Espressivo action extremely agile.

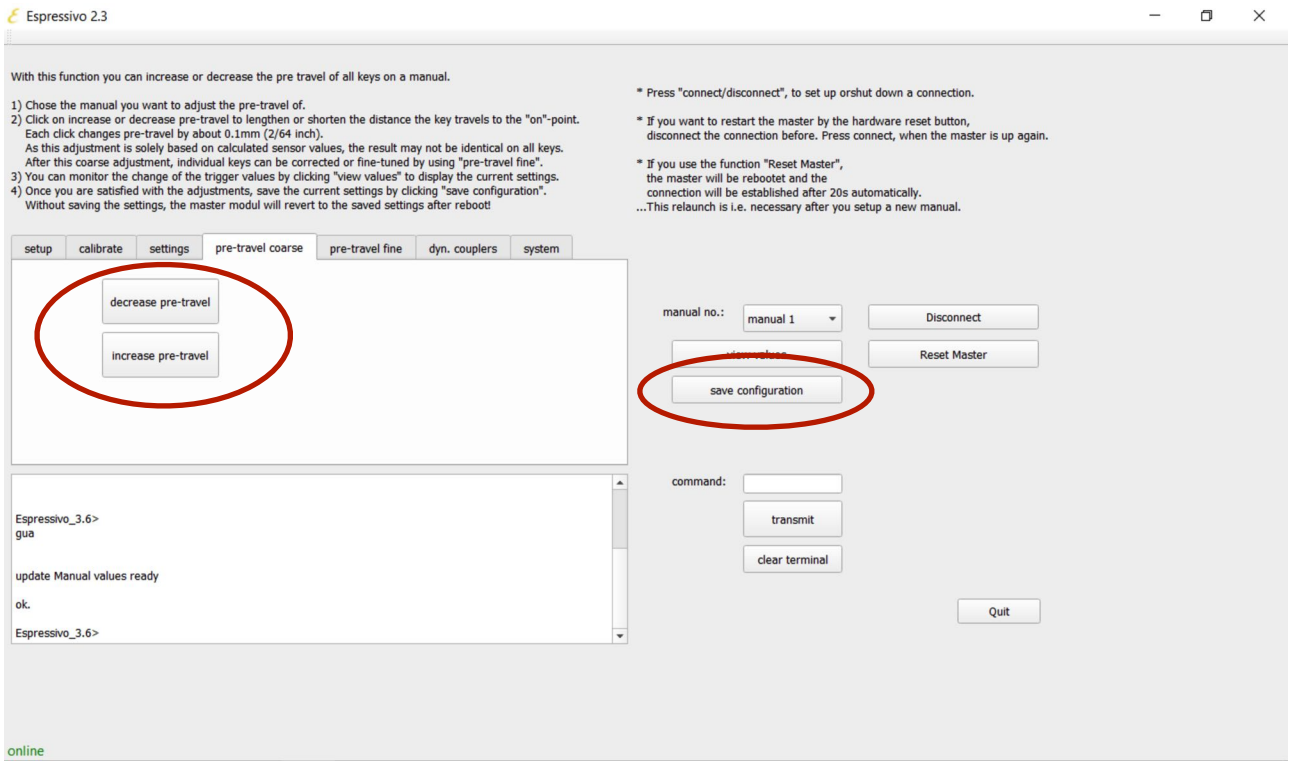
Typical spread values liked by organists are about 20 – 30%.

Setting the pre-travel

Pre-travel can be set in two ways.

First, a coarse adjustment of all keys of a manual is recommended.

a) Coarse adjustment

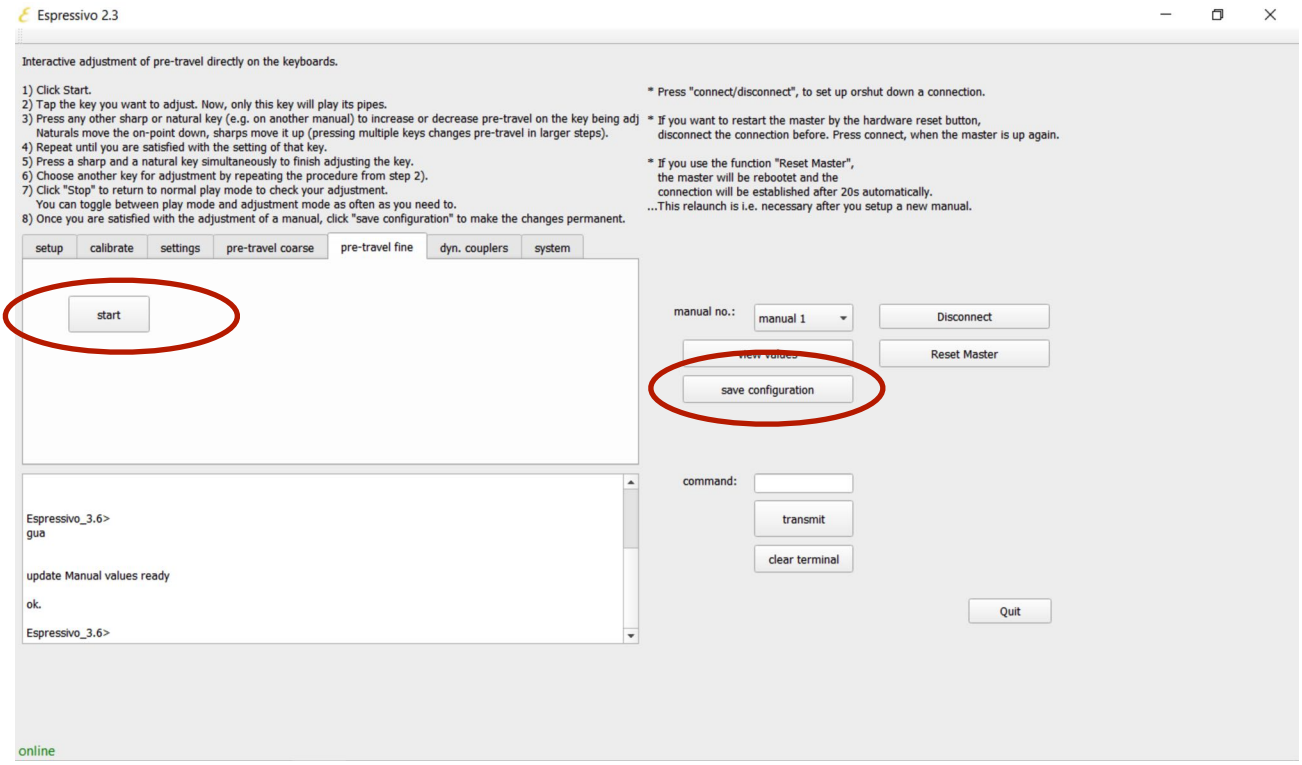


This function allows you to increase and decrease pre-travel of the entire manual.

1) Select the manual for adjustment.
2) Click on "increase" or "decrease" pre-travel to adjust the key travel before the note starts playing. Each click changes the pre-travel by approx. 0.1 mm (1/256 inch).This function works with calculated sensor values, i.e. the result may not be the same for all keys.To correct and fine-tune single keys, use the "Fine adjust" function.
3) To check the trigger values, click on "View values".
4) Save the settings by clicking on "Save configuration".

If the new values are not saved, the previous values are used at the next start of the Master module.

b) Fine adjustment



This function allows you to fine-tune and, at the same time, sound-check single keys on a fully assembled console. Mechanical and electrical action can thus be perfectly synchronized. This mode is recommended when individual settings need to made by feel and ear, for example, to adapt the onset of the tone to the feel of a pressure point simulation.

Interactive pre-travel adjustment directly at the keyboard:

1) Click on Start.

2) Depress the key you wish to set. Only this key sounds.

3) Depress any sharp (e.g. on another manual) to decrease the pre-travel, or a natural to increase it (simultaneous actuation of several sharps/naturals increases the increment).

4) Repeat the procedure until you are satisfied with the key settings.

5) Depress a sharp and a natural at the same time to complete adjustment.

6) Select a new key for adjustment (step 2) and repeat the routine.

7) Click on Stop to return to play mode and to check the settings acoustically. You can switch between play mode and adjustment mode at any time and as often as you wish.

8) After manual adjustment, click on "Save configuration".

Couplers

The Espressivo Master module can internally process up to eight couplers which are configured by editing the orgel.cnf file on the SD memory card. The couplers are activated by applying a voltage to the respective control input.

The couplers are configured line by line, marked by the German keyword “/KOPPEL”:

```
#---coupler configuration----------------------------
/KOPPEL switch: 1 SourceMan: 1 DestMan: 2  (s)hift/(c)opy: c Threshold: 0 offset: 0 velocity: 1
/KOPPEL switch: 2 SourceMan: 1 DestMan: 2  (s)hift/(c)opy: c Threshold: 100 offset: 0 velocity: 1
/KOPPEL switch: 3 SourceMan: 1 DestMan: 2  (s)hift/(c)opy: s Threshold: 100 offset: 12 velocity: 1
```

The couplers become active, if a control voltage is applied to the corresponding “switch”-input (see technical appendix):

SourceMan: the manual being played on

DestMan: destination manual, i.e. the manual on which Midi channel the couples notes are output on

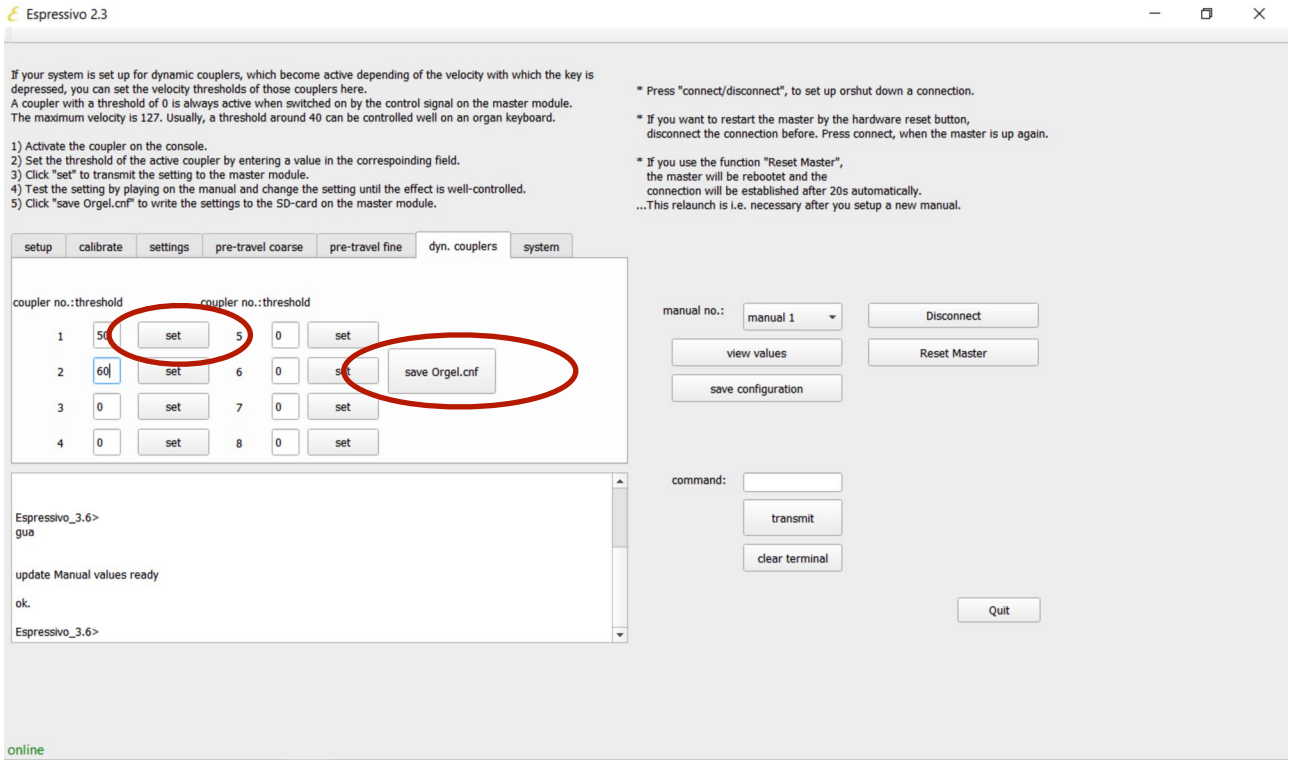
(s)hift/(c)opy: a coupler set for copy mode will output a copy of the source-manual’s Midi data on the destination-manual’s Midi channel. This is what happens in a classical electric coupler connecting the second manual in parallel to the first. The shift mode suppresses the original Midi-data of the source manual, effectively “shifting” the data to the destination manual’s channel (usable in purely electric actions only).

offset: transposition of the coupled notes in semi-tones (to set up sub- or super-couplers)

velocity: determines if the coupled notes carry the original Midi velocity (1) or not (0)

Dynamic coupling

One of the innovative features of the Espressivo system is the ability to vary the organ's tone color in dependence of the velocity. The system measures the **speed** (not the force, like using a “second-touch” keyboard) at which the key is actuated and outputs this information as Midi velocity. The Espressivo Master module allows for setting a velocity threshold above which the couplers come into effect.



Threshold: Velocity threshold above which the coupler becomes active. A threshold zero coupler is active independent of the key velocity. A dynamic coupler only acts on notes played with velocities above the threshold.

You can, e.g. play soft stops (“piano”) on the second manual couple accentuated notes of chords on to a fully voiced manual I. You can also configure dynamic sub or super couplers acting on the same manual or between manuals.

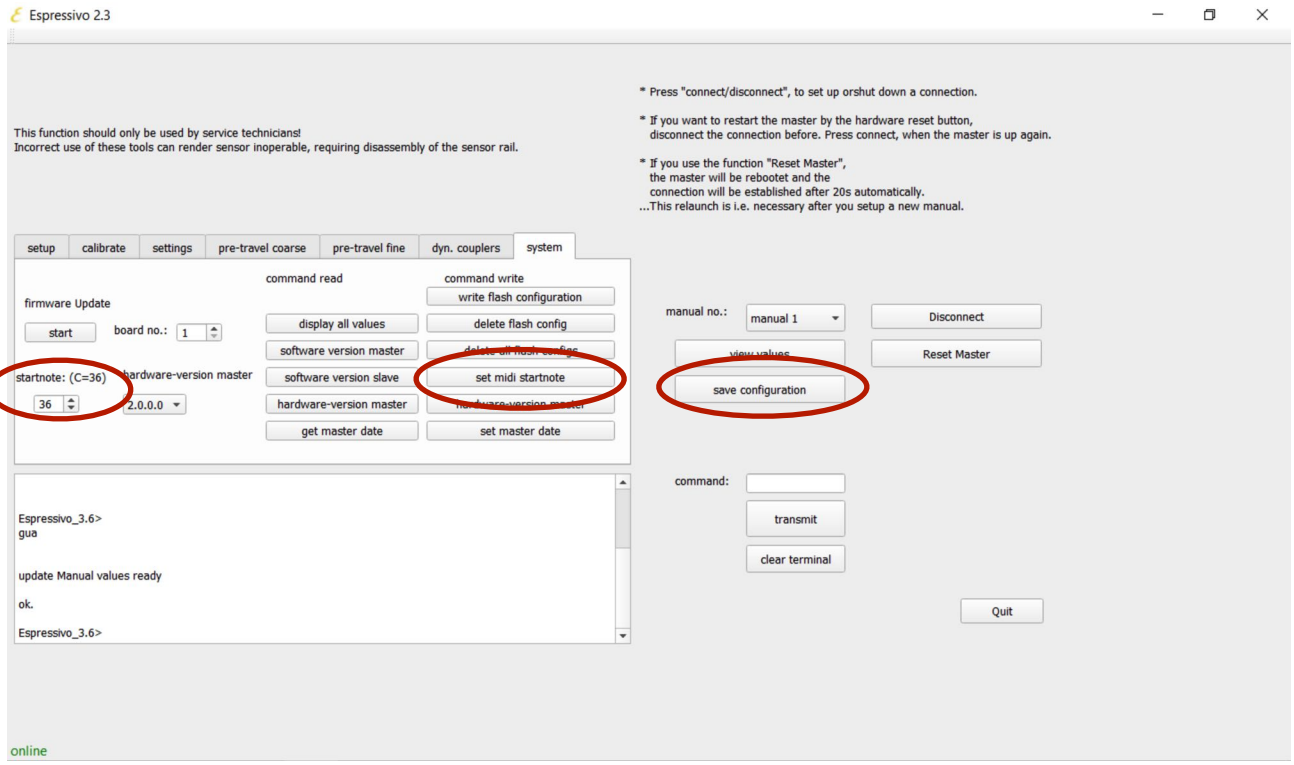
In purely electrical actions, it makes sense to experiment with “shift” couplers which make notes or chords play on different divisions of the organ depending on how quickly you hit the keys. In organs with mechanical action, you can only use the copy mode to add electrically coupled divisions to the division played via mechanical action.

If your system is set up for dynamic couplers that switch on in dependence of the key depression velocity, you can modify the velocity threshold (Midi velocity) of each coupler.

The maximum speed value is 127. Values around 40 are usually well controllable on an organ keyboard.

1) Activate the coupler on the console.
2) Set the threshold value of the respective coupler in the "Threshold" field.
3) Click on "Set" to transfer the value.
4) Test the settings on the manual and change the value until the coupler is easy for you to control.
5) Click on "Save orgel.cnf" to save the settings.

System-settings



Most of the parameters in the system settings tab are only relevant for service technicians. In some cases it can be necessary to use the functions for “flash configuration” which will be explained in the next section.

When setting up manuals, it may be necessary in rare cases to modify the Midi start note. By default, manuals and pedal are set up to start with a low C, assigned to Midi note number 36. If you happen to have a keyboard which does not have a C as the lowest note or your Midi device demands a different octave to work correctly (e.g. note number 24 or 48), you can set a different start note for each manual.

To make the change permanent, click on “save configuration”.

The buttons in the left column (“command read”) are used to display various system info, such as the software versions of the Master module and sensor-slaves or the Master’s real time clock. If the clock should deviate significantly from true time, it can be set to the PC’s system time with the adjoining button.

Keep away from settings for hardware version and firmware update. Those options can only be operated by technicians equipped with the necessary tools.

Important new feature in firmware 3.0

Firmware versions 1 and 2 store the assignment of sensors to manuals and the sensor calibration values inside the manual.txt files on the micro SD-card of the Master module (see page 28). When the system boots, the sensor modules report to the Master module. Subsequently, the Master initializes the sensors, transmitting the parameters for Midi note assignment as well as calibrations data (e.g. pre-travel) for each sensor.

From firmware version 3, when saving a keyboard configuration, this data is stored in the manual.txt files as well as inside the sensor modules themselves, in so-called flash memory. This way, the assignment of Midi notes is already known to the sensors without lengthy initialization on start-up. The system is therefore more robust against interference, such as voltage fluctuations. For example, in the event of a spurious loss of power, the sensor will keep sending Midi data without the need for being re-initialized.

In some cases, it is necessary to clear the flash data stored in the sensor modules:

• If sensors are to be set up, which have already been used in a different manual or in a different position of the manual.

• If the Midi channel of a manual has been changed in the orgel.cnf file

• If a manual has an exotic key configuration (e.g. non-chromatic) which needs to be mapped by editing the manual.txt file.

The system tab offers two methods to deal with these issues:

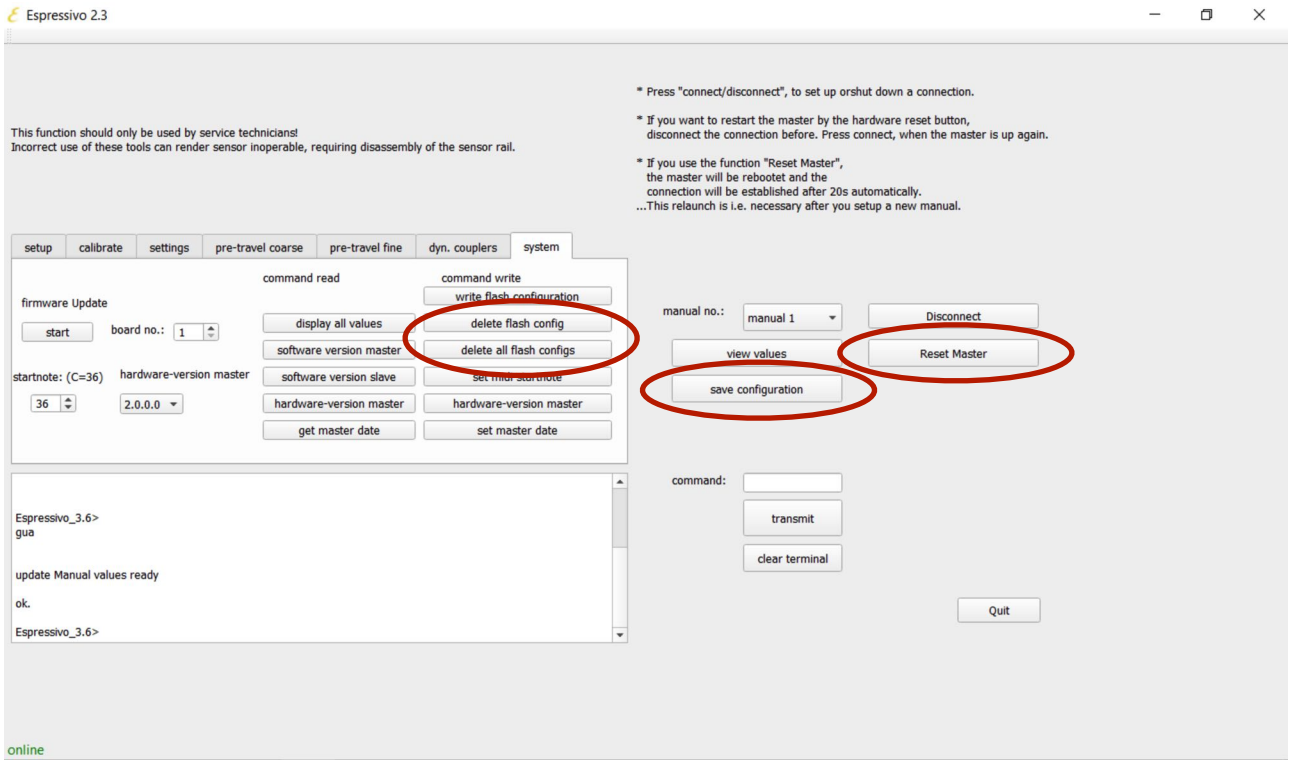
a) Deleting the flash configuration of a specific manual.
This function addresses the sensors of the manual or pedal selected in the pull-down menu. This method can only be applied, if the desired manual is fully set up and working, as it requires the Master to know the address of each sensor.

b) Deleting all flash configurations
This function sends out a special command to all sensors presently connected. This method needs to be used, if sensors are connected which were previously set-up in another system, or if no matching manual.txt file exists on the SD card. To delete flash data on only some of the keyboards, disconnect all other sensors before executing this command.

Restart the system after deleting flash data. In a completely set-up system, no data loss will occur by deleting flash data.

After reboot, the sensors will report to the Master, and will be initialized using identical data from the manual.txt files. The system can also be operated in this fashion. If you want to write the data to the sensors' flash memory again, simply save the manual configuration again. In the process, the data will also be written to flash.

If you need to repeat the setup of a manual, e.g. because some keys were skipped during the first attempt, you first need to delete the flash configuration of that manual and restart the system. Otherwise, the sensors will not be detected when setting up the manual from scratch.



buttons for deleting flash configurations

Technical appendix

Control signal input pinout for couplers

Pin	Signal
1	Input 1 a
2	Input 1 b
3	Input 2 a
4	Input 2 b
5	Input 3 a
6	Input 3 b
7	Input 4 a
8	Input 4 b
9	Input 5 a
10	Input 5 b
11	Input 6 a
12	Input 6 b
13	Input 7 a
14	Input 7 b
15	Input 8 a
16	Input 8 b
17	+ 5V
18	+ 5V
19	ground
20	ground

Each single input is decoupled via optocouplers. The input is activated when direct current (any polarity between 5 and 24 V) is applied to the respective a and b lines. Pins 17 to 20 are not connected.

In the absence of external control voltages, potential-free contacts can be used. In this case, the 5V output at 17/18 and 19/20 are switched to the desired inputs.

Interpreting sensor values

The Slave modules' microcontrollers record the analog Hall effect sensor voltage values on a scale of 0 to 1023. The magnetic field of the key magnets is poled in such a way that a field strength increase reduces the sensor signal. In "normal" arrangement under the front key arm, depressing a key results in a lower sensor value.

Typical parameters of a module in a standard arrangement (mode: 0x1) look like this:

Boardno: 1 BoardID: 0xd0df533 NofChannels: 8 Mode: 0x1

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

In inverse module assemblies (mode: 0x3) the signal increases when the key is actuated because the magnet moves away:

Boardno: 33 BoardID: 0xd0dec40 NofChannels: 8 Mode: 0x3

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

The key magnets are chosen to yield an optimum sensor signal if the minimum distance between key and sensor strip is no more than 1 mm.

The minimum sensor signal is approx. 30 units (typically 26 - 28). At these values, the sensor is fully saturated and cannot detect any further signal changes. In standard module assemblies, this occurs at the lowest key position. It is acceptable that some (not many!) channels have a keyDown value at the saturation limit. In case of a large number of such values, the rail should be mechanically moved away from the keys (approx. 0.5mm).

In inverse module assemblies, no keyUp value should be 30; otherwise, overload may occur in the critical pre-travel range. If this problem does occur, the sensor rail must be mechanically set to a larger distance.

Each mechanical sensor position adjustment requires a new manual calibration (New teaching is not necessary).