KODA MBC-1U
MIDI BREATH CONTROLLER

USER MANUAL

Version EN 1.0, January 2014
Firmware 1.05

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Introduction

MIDI Breath Controller KODA MBC-1U is a device which purpose is the generated sound parameters control through the changes of the pressure of the air being blown into the mouthpiece. The air pressure changes are being converted into the appropriate MIDI messages which can define the parameters of the sound generated in the sound module, synthesizer or software instrument installed on PC, MAC, iPad/iPhone. Playing the instrument together with the breath controller allows for close to reality reproduction of complex wind instruments sounds. Due to the flexibility of MBC-1U configuration and features of modern, advanced electronic instruments, the use of the breath controller does not have to be bound to the wind instruments. Each electronic instrument capable of continuous control of its parameters via MIDI messages can be augmented with MBC-1U breath controller.

Technical Description

Design and Operational Principles

MIDI Breath Controller KODA MBC-1U set is composed of the following components:

1. Interface module (Fig. 1) - the microprocessor module responsible for the pressure changes electric signal into MIDI messages conversion. Additionally the interface module is MIDI-USB converter. The interface module communicates with the host computer and the configuration software.

2. Sensor module (Fig. 2) - the device responsible for converting the air pressure in the mouthpiece into the proportional electric signal. The sensor module can be worn around the user's neck (Fig. 3), while the mouthpiece is located at the end of the goose-neck tubing which is also the pressure channel. It is bendable allowing for stable, but still very comfortable mouthpiece hold during the play.

3. Signal cable - interconnects the interface and sensor modules.

4. USB cable - interconnects the interface module and PC/MAC computer.

5. MIDI cables (optional) - interconnect the interface module and electronic instrument or sound module.

The interface module has aluminum housing (natural silver or anodized black color) with aluminum front and rear plates (black anodized). On the front plate there is 3.5 mm jack connector and 4 LED diodes informing about the device status. On the rear plate there are USB, MIDI IN and MIDI OUT connectors.

Sensor module has been manufactured with the use of the following technologies:

- a part surrounding the musician neck and the sensor housing are 3d printed of ABS plastic,

- the pressure channel is made of metal still very flexibe gooseneck,

- the mouthpiece consists of the ABS plastic housing and removable (for the hygienic reasons) mouthpiece, which is made of CNC machined polycarbonate.

Fig. 1 Interface module

Fig. 2 Sensor module

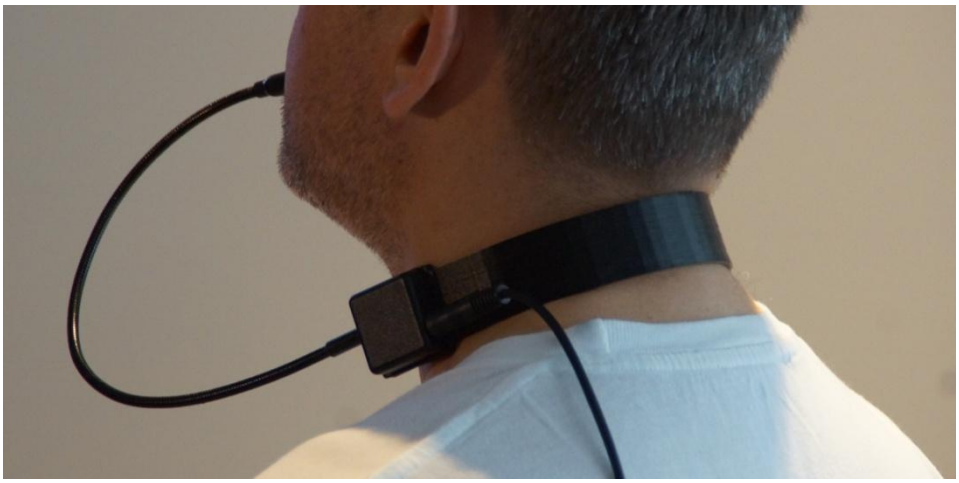


Fig. 3 How to use the sensor module

The breath controller continuously measures the pressure of the air being blown into the mouthpiece. The mouthpiece itself is designed this way, that allows to modes of operation, depending on the musicians preferences or the music style to be played:

- blow-through - the air is being blown through the mouthpiece,

- blow-in - the air is being pressurized by blowing into the mouthpiece without being released outside.

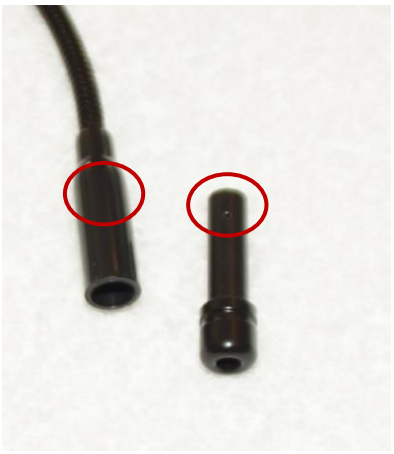


Fig. 4 Holes in the mouthpiece and mouthpiece housing - facilitates the air flow through the mouthpiece

The selection of the operational mode is being done by rotating the mouthpiece inside the housing. If the holes in the mouthpiece and its housing are aligned, then the air can be blown through (Fig. 4). If the holes are misaligned, then the air is being kept and pressurized inside the mouthpiece. Partial alignment allows for the precise adjustment of the blow-through ratio.

The pressure in the mouthpiece, using sophisticated signal processing, is being converted into the appropriate MIDI messages. In the simplest case, the value coded in the MIDI message can proportionally correspond to the air pressure. MBC-1U breath controller allows

for defining more complex dependencies. Due to the 11-point response curve, user definable, it is possible to adjust the sensor response according to the exact instrument nature, music style or the musician preferences (Fig. 5). For example, it is possible to set such a response curve enabling very delicate and precise output signal control while blowing gently still having the full output potential with the stronger blow (exponential curve). Alternatively, as on (Fig. 5) one can set more aggressive curve with amplifying even very small amount of the pressure in the mouthpiece.

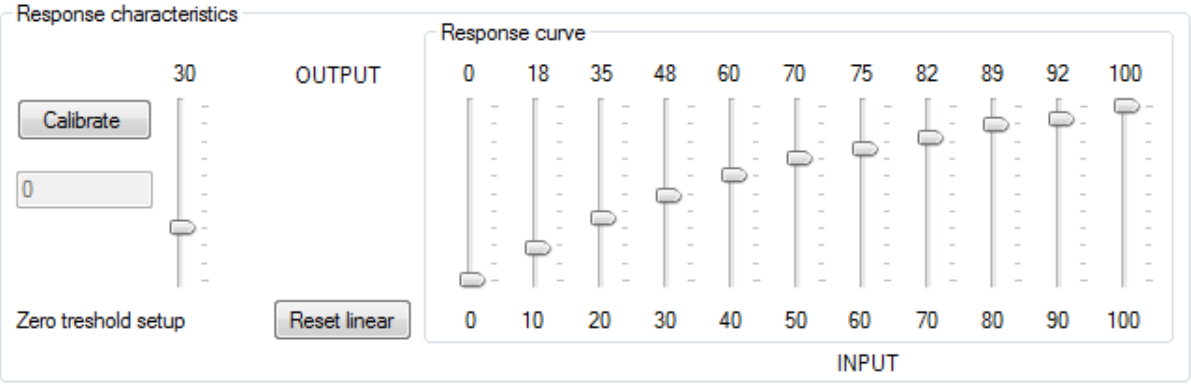


Fig. 5 Configuration software - 11-point response curve

KODA MIDI breath controller MBC-1U features very low latency between the pressure measurement and the MIDI message being ready on the device's output (lower than 1ms). It gives the musician very responsive feeling of the breath controller, and as a result, rigid control over the sounds being generated.

The configuration software provides the user with the tool to change the following settings:

- 11-point response curve,
- pressure threshold level connected with the calibration procedure,
- front panel LEDs intensity,
- definition of the function each LED represents (input, output, both signals, none),
- definition of the MIDI channel on which the Control Change messages related to the breath control are going to be sent,
- definition of the number of particular Control Change MIDI message related to the breath control; the default value is 2 *Breath Controller* but the user can change it to any other controller, for example 7 *Volume* or 11 *Expression*, etc.

The parameters set with the configuration software and sent to the device are stored in its non volatile internal memory. For the backup, the configuration values can be stored as well in the disk file in the host computer.

CAUTION: For the time being, the configuration software works only on PC (Windows: Vista, 7, 8). The Mac OS X version is under development.

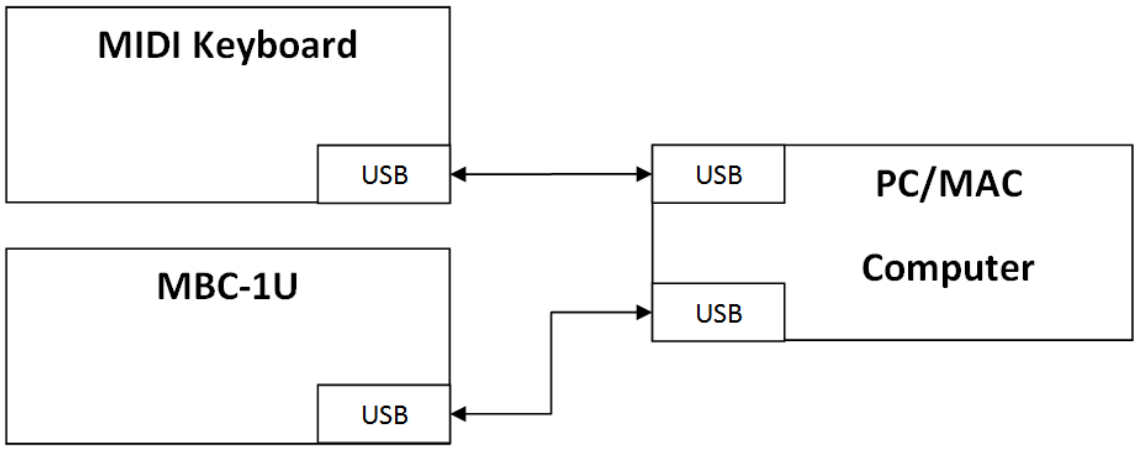
During regular operation (playing music) MBC-1U breath controller can work with the following hosts:

- PC computer, MS Windows based, as it complies with USB Audio 1.0 Device Class,
- MAC (OS X) computer, as it complies with Core Audio,
- iPad/iPhone (iOS), as it complies with Core Audio, additional interface is required (so called "camera connection kit" allowing for connection with regular USB device).

Connectivity options

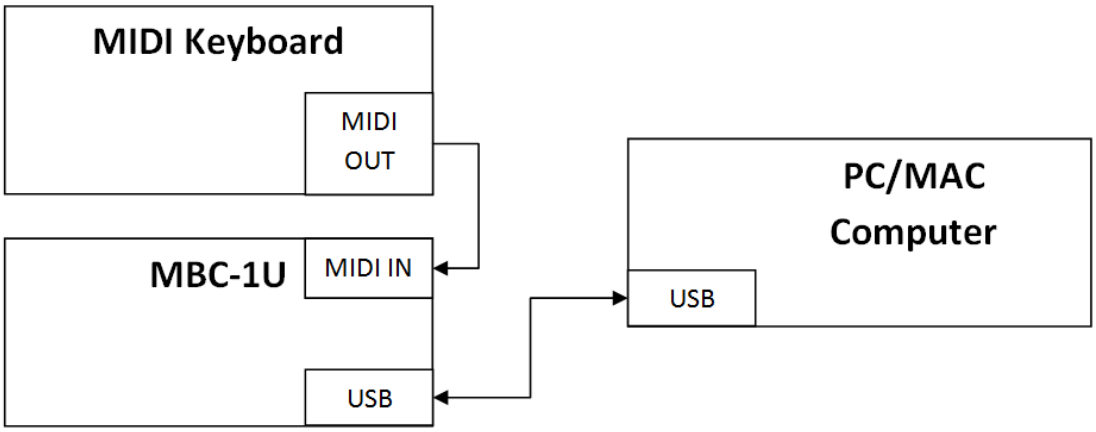
MIDI breath controller KODA MBC-1U is equipped with MIDI USB interface (USB type B connector) and regular MIDI IN/OUT interface (DIN connector). MIDI messages related to the breath controller (air pressure) are being sent to both, MIDI OUT and USB interfaces. As MBC-1U is also MIDI-USB interface, several connectivity options are possible. The next paragraphs describe some of these modes to give the user the basic ideas. There are many other possibilities depending on the devices set and user's creativity.

Option 1



The breath controller is connected to the host computer (PC or MAC) with the USB connector. The host computer detects the device as KODA MBC-1U (IN and OUT respectively). This mode of connectivity is recommended in cooperation with the software instruments (eg. KONTAKT by Native Instruments or Wind Instruments by Samplemodelling). This way of connecting the controller to host computer is recommended during the configuration and firmware update procedures.

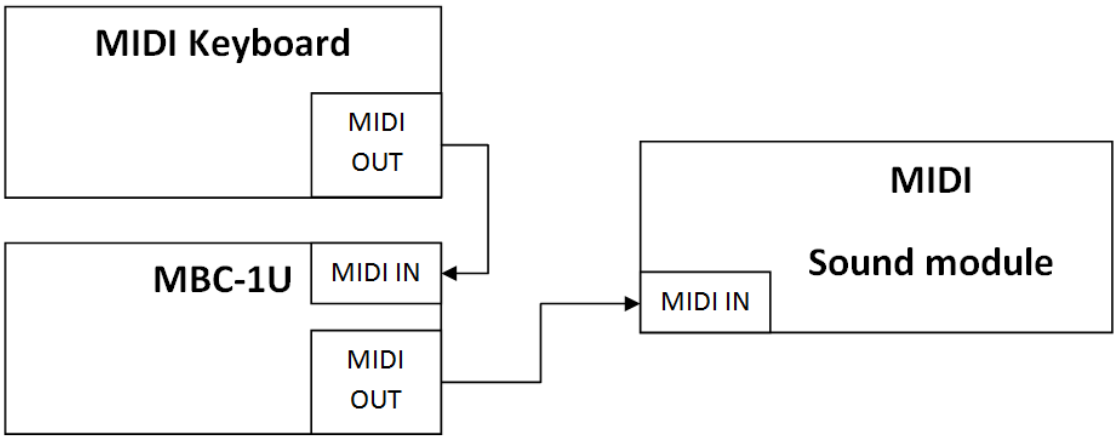
Option 2



The breath controller is connected to the host computer (PC or MAC) with the USB connector. In addition, to the MIDI IN port of the breath controller there is connected the MIDI keyboard with regular MIDI cable. The MBC-1U breath controller sends on its USB output the copy of the MIDI messages received from the MIDI keyboard. The MIDI messages being the result of the pressure change are being interleaved with the keyboard messages. Such a combined messages are delivered to the host computer.

Keyboard and breath controller messages can be sent on the independent MIDI channels.

Option 3



The breath controller is connected to the MIDI enabled device such as sound module, synthesizer, MPC, guitar effect, etc. In addition, to the MIDI IN port of the breath controller there is connected the MIDI keyboard with regular MIDI cable. The MBC-1U breath controller sends on its MIDI OUT port the copy of the MIDI messages received from the MIDI keyboard. The MIDI messages being the result of the pressure change are being interleaved with the keyboard messages. Such a combined messages are delivered to the host device.

Cables & Connectors Assembly and Preparation for Use

The breath controller is powered via USB connector. The supplied USB A-B cable should be plugged in this connector. The other end of the cable should be connected to the host computer or USB power supply (most USB chargers will do the job).

CAUTION: Every other cable connection should be done first before powering the unit.

Before turning on the controller the cable between interface and sensor modules has to be connected. This is the cable terminated on both ends with 3.5mm jack.

CAUTION: Plugging-in the cable connecting sensor and interface modules, while the interface module is connected to the host computer, may cause the damage to the interface module and the host computer.

Before turning on the controller the MIDI cables (assuming it is required by the setup) should be plugged into DIN sockets.

After the power being supplied to the interface module, the internal test procedure is commenced. After successful procedure, the front panel LEDs signalize the initial configuration of the device:

- all diodes blink 3 times - internal tests OK,
- "MIDI" LED blinks *n* times, where *n* corresponds to the MIDI channel number, which is assigned to the breath related messages. CAUTION: The notation of the channel numbers assumes 1 - 16 range which is mapped to native MIDI messages notation 0 - 15. The default channel number is #0.
- "USB" LED blinks *n* times, where *n* corresponds to the Control Change number, related to the breath messages. CAUTION: if the CC number is higher than 16 the LED blinks only 16 times. The default setting is CC#2 Breath Controller.

Software Installation

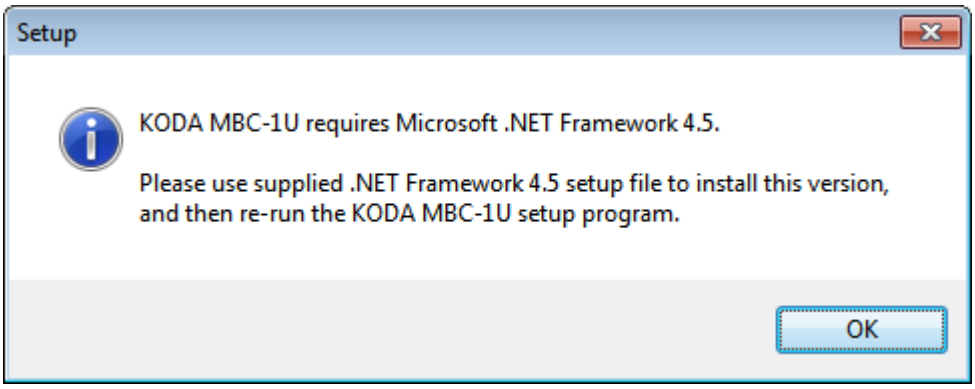
The configuration software allows to control the parameters of MBC-1U Breath Controller. The installation versions of the software can be found on the CD-ROM attached or on http://www.midibc.com where the updates will be available as well. The configuration software can be installed on the following system types:

- Mac OS X,
- Windows Vista,
- Windows 7,
- Windows 8,
- any other Windows version, which allows for installation of Microsoft .NET Framework 4.5.

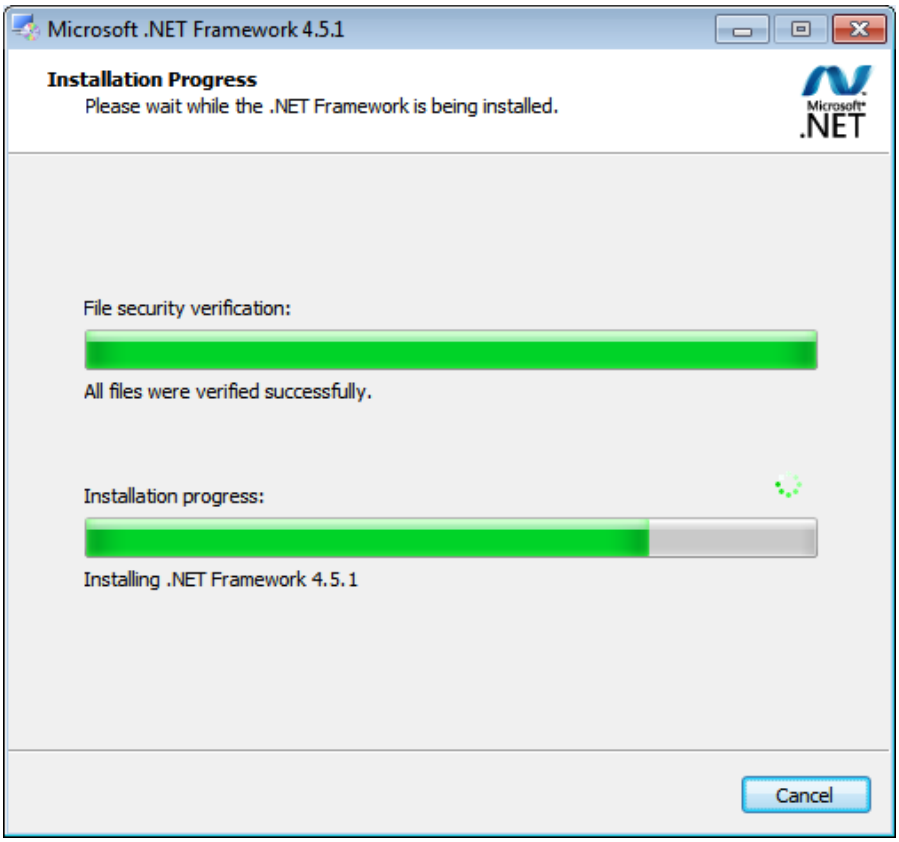
The Windows installation procedure is straightforward and consists of the following steps:

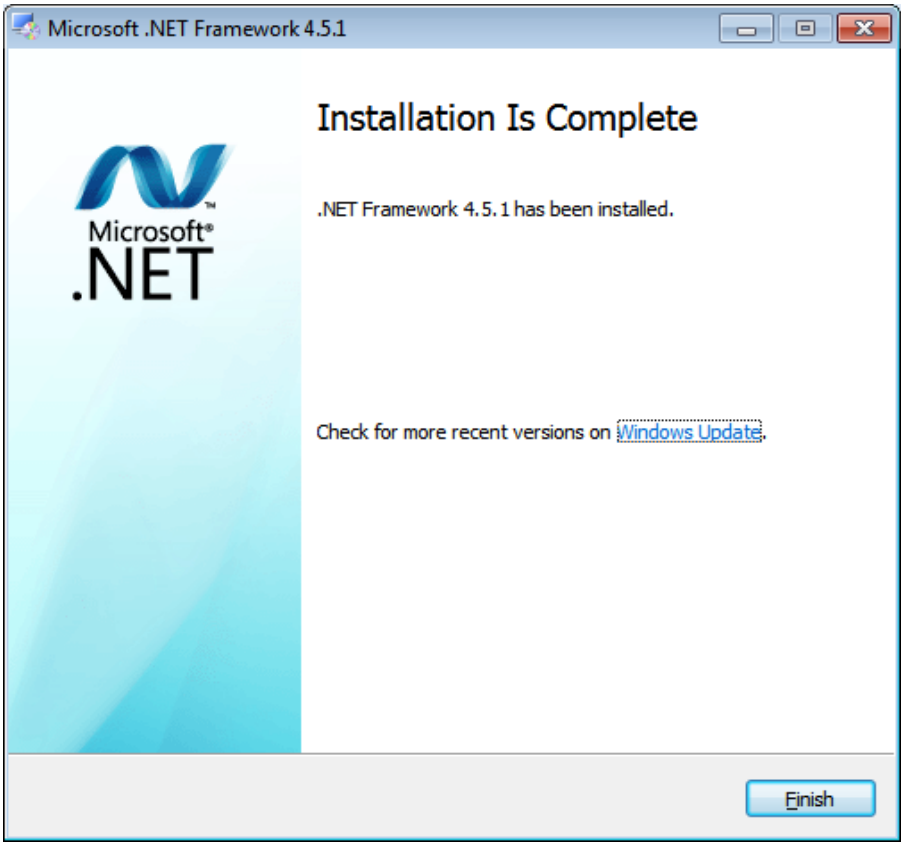
Run the "setup.exe" file and follow the installation wizard guidelines.

CAUTION: The Windows version requires prior Microsoft .NET Framework 4.5 installation. If, during the installation the following message appears, it means that .NET is not present in the system.

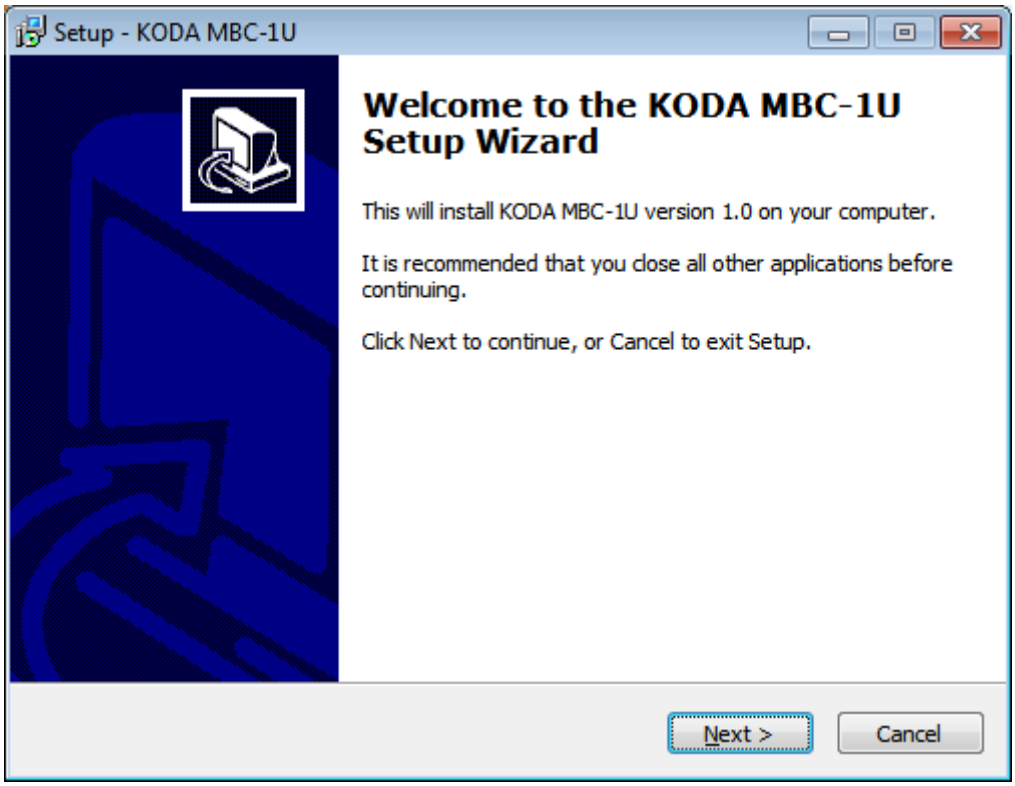


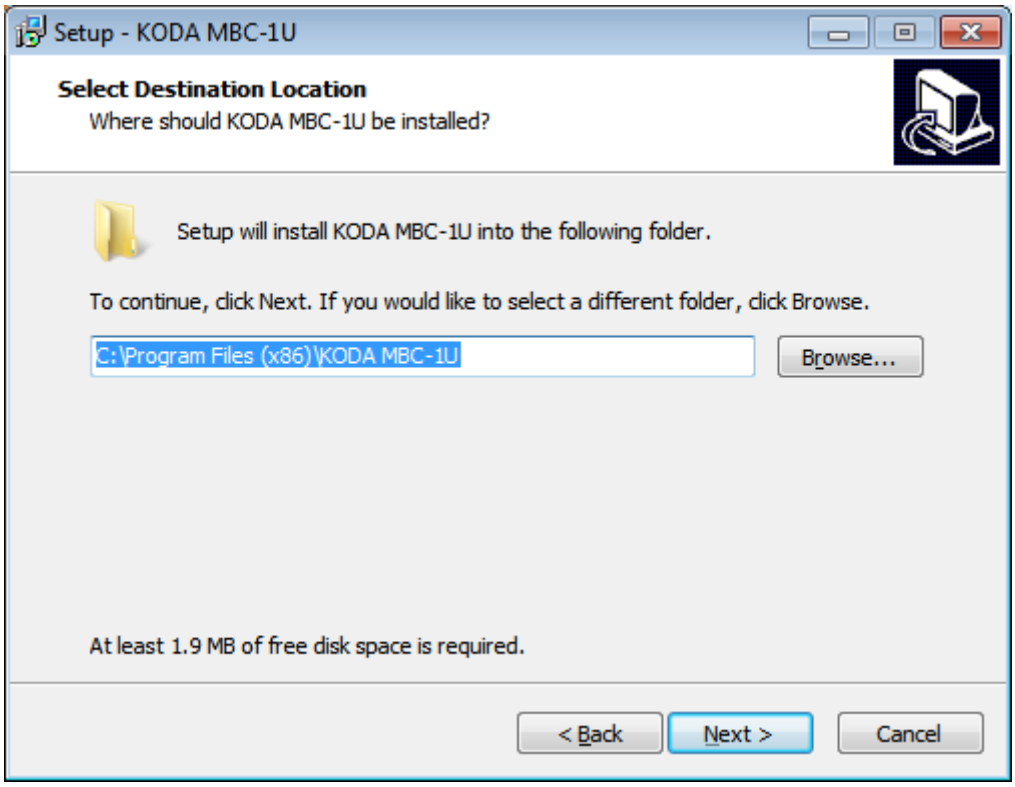
In that case, pressing "OK" button will terminate the installation. Microsoft .NET Framework 4.5. must be installed. The appropriate installation version can be found on the CD-ROM attached (file "dotnetfx45.exe") or can be downloaded from Microsoft website: http://www.microsoft.com/en-us/download/details.aspx?id=30653. Please follow the installation wizard guidelines.

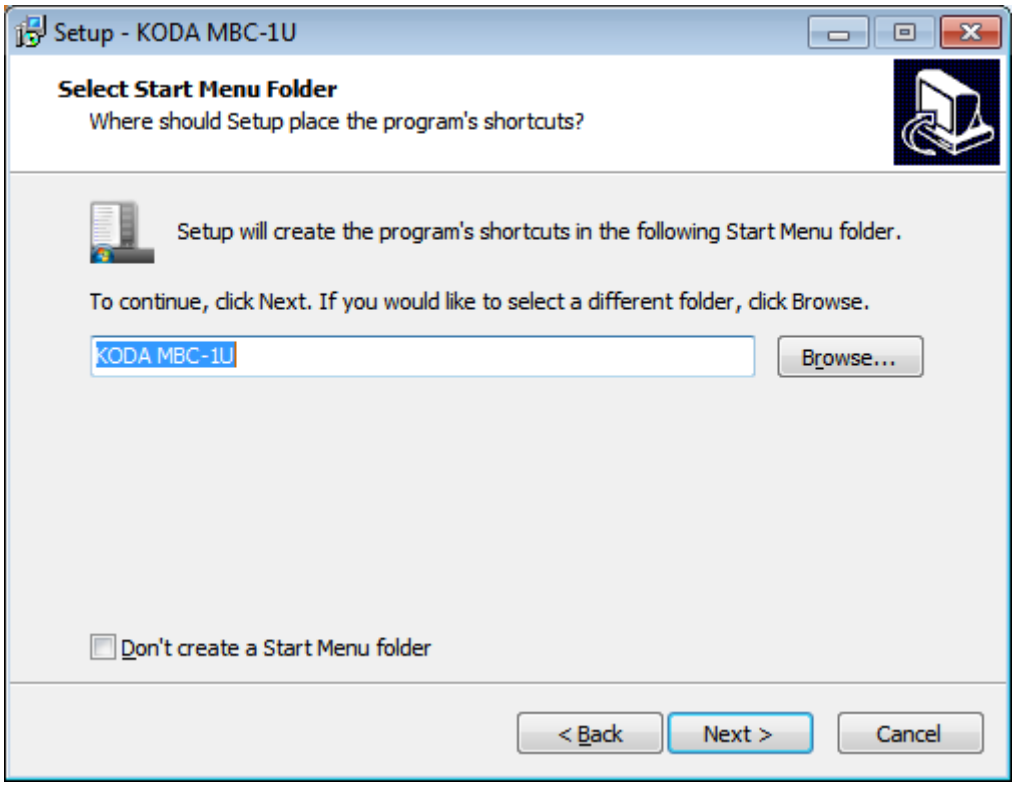


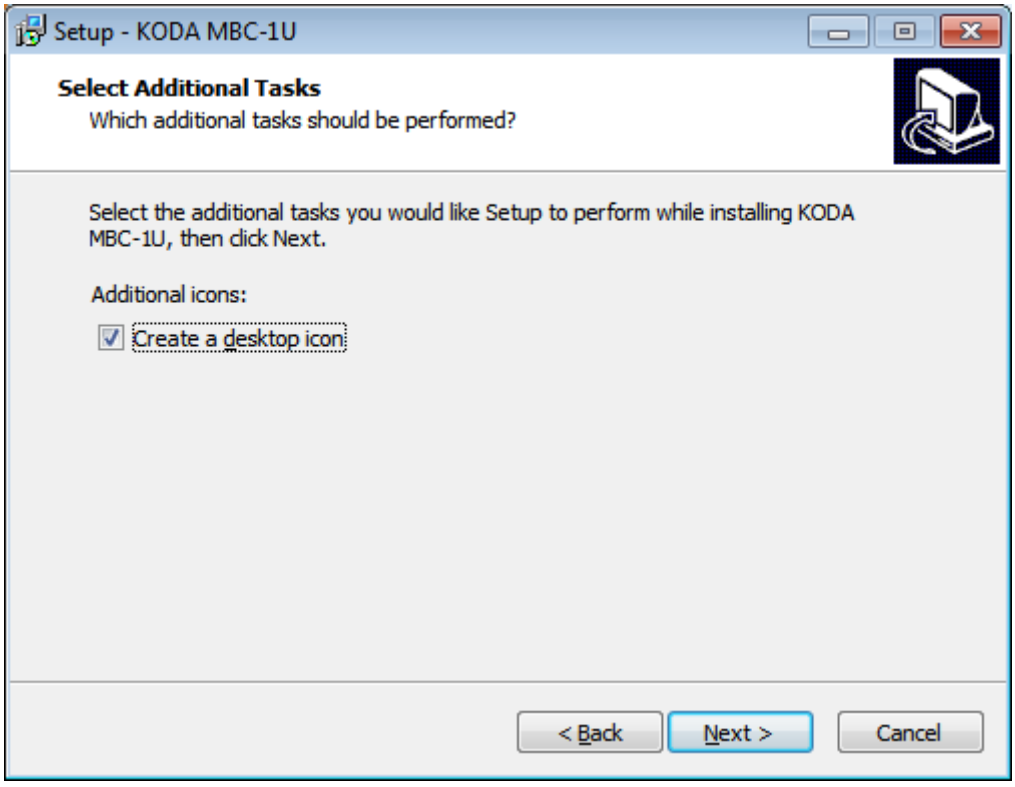


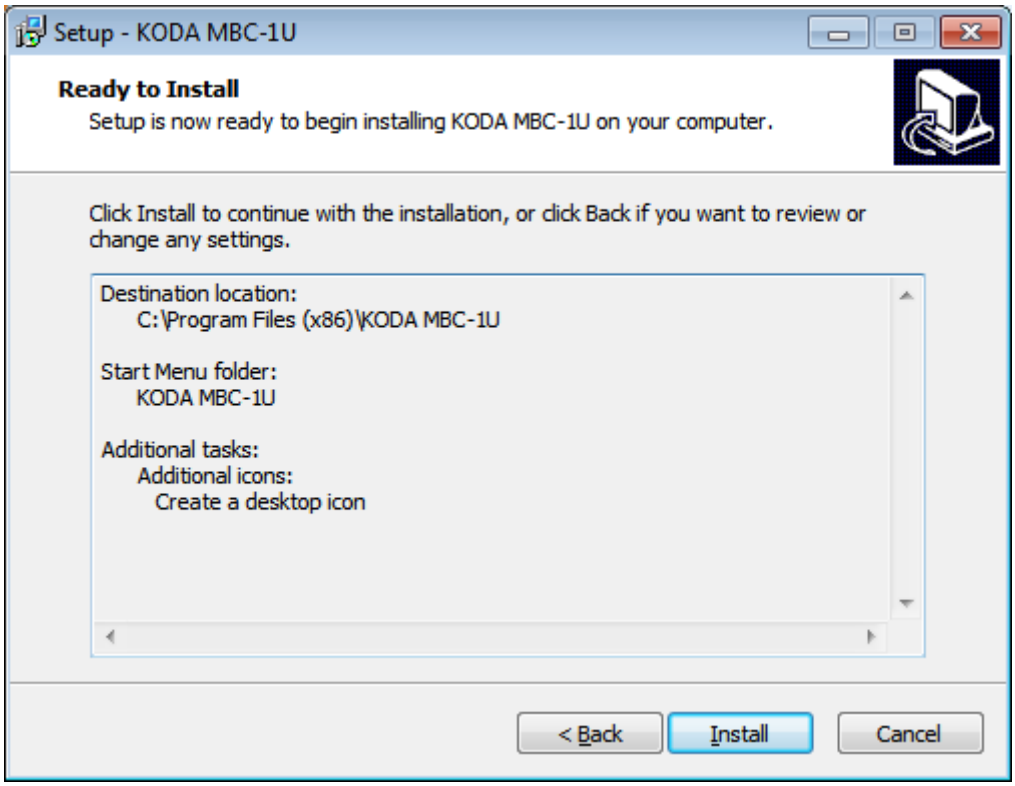
After succesful Microsoft .NET Framework 4.5 installation, the breath controller setup software can be resumed.


Setup - KODA MBC-1U
Welcome to the KODA MBC-1U Setup Wizard
This will install KODA MBC-1U version 1.0 on your computer.
It is recommended that you close all other applications before continuing.
Click Next to continue, or Cancel to exit Setup.
Next >
Cancel


Setup - KODA MBC-1U
Select Destination Location
Where should KODA MBC-1U be installed?
Setup will install KODA MBC-1U into the following folder.
To continue, click Next. If you would like to select a different folder, click Browse.
C:\Program Files (x86)\KODA MBC-1U
Browse...
At least 1.9 MB of free disk space is required.
< Back
Next >
Cancel


Setup - KODA MBC-1U
Select Start Menu Folder
Where should Setup place the program's shortcuts?
Setup will create the program's shortcuts in the following Start Menu folder.
To continue, click Next. If you would like to select a different folder, click Browse.
KODA MBC-1U
Browse...
Don't create a Start Menu folder
< Back
Next >
Cancel


Setup - KODA MBC-1U
Select Additional Tasks
Which additional tasks should be performed?
Select the additional tasks you would like Setup to perform while installing KODA MBC-1U, then click Next.
Additional icons:
Create a desktop icon
< Back
Next >
Cancel



When the installation procedure is finished, the application can be run. The breath controller should be attached to the host computer before running the application.

Software Application for Breath Controller Setup

After starting the application, the appropriate MIDI interfaces should be selected from drop down menu (Fig. 6). In the *MIDI Connect* panel in both fields the interface KODA MBC-1U should be selected. In the next step it is recommended to receive the setup from the device in order to have the reference point for the changes to be done (Receive Setup button).

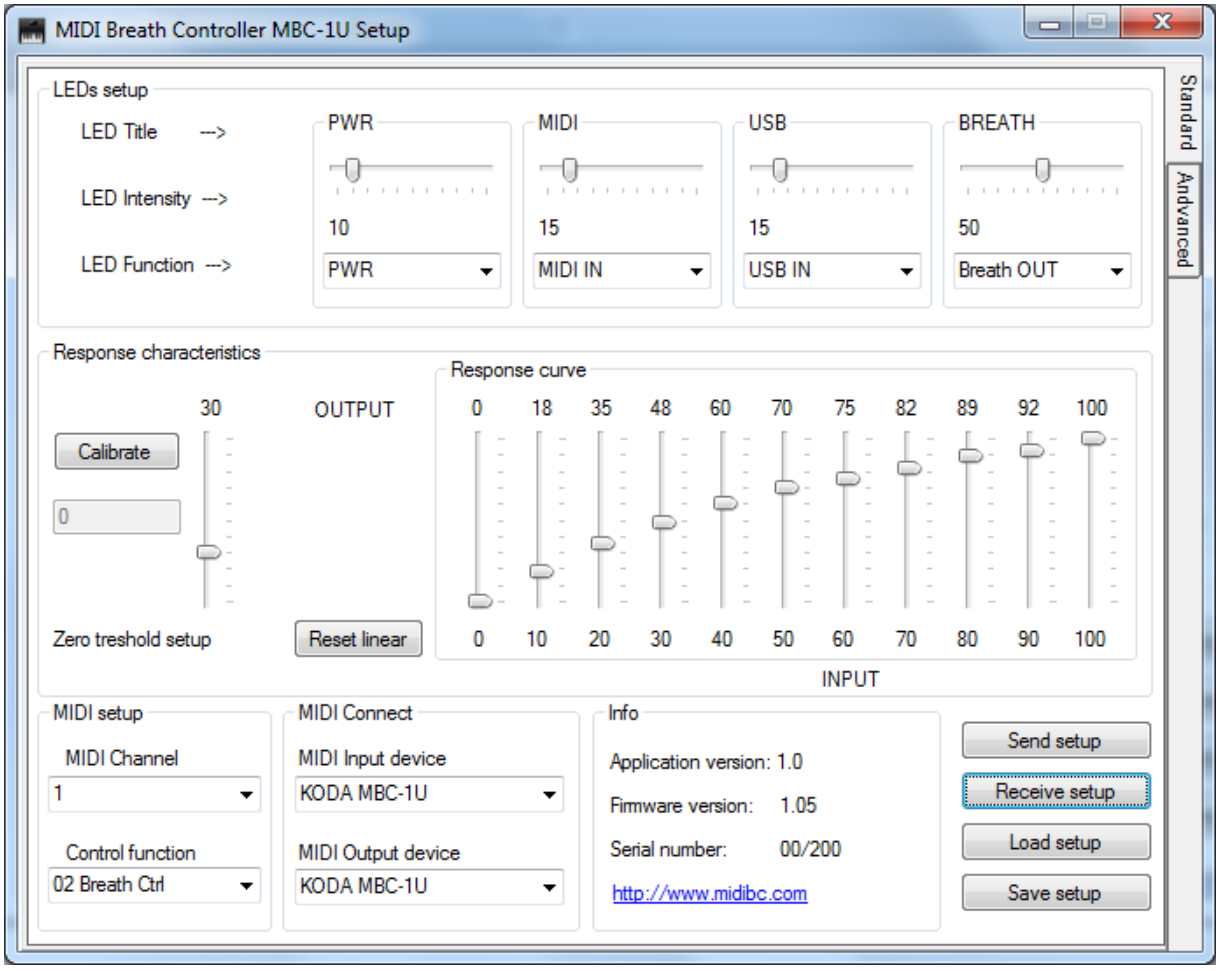


Fig. 6 Accessing the interfaces of MIDI KODA MBC-1U and reading back the stored settings

In the next step it is recommended to calibrate the sensor. Depending on the surrounding air (temperature, pressure, humidity) conditions, the sensor generates some noise signal without the air being intentionally blown into the mouthpiece. In order to get rid of that noise the device should be calibrated. After pressing the Calibrate button, the internal calibration procedure is being commenced in the interface module. It takes about 2 seconds and results with the readout in the field below Calibrate button. Let's assume, the result is 30. It means the threshold value, above which only the intentional blowing will be valid in terms of MIDI messages. To set the threshold one should move the slider right to the Calibrate button. The recommended value is between 2 and 4 units above the calibration readout (Fig. 7).

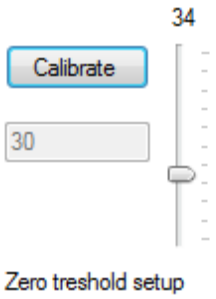


Fig. 7 Pressure sensor calibration

After setting the zero threshold, the value should be sent to the device. It will be applied by pressing the Send setup button. The zero threshold value will be saved in non volatile memory.

In the next step the LEDs light intensity and function can be configured (Fig. 8).

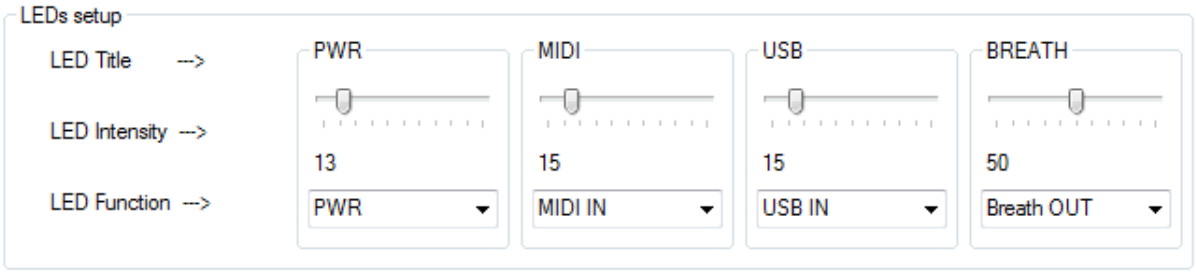


Fig. 8 LED diodes intensity and functions setup

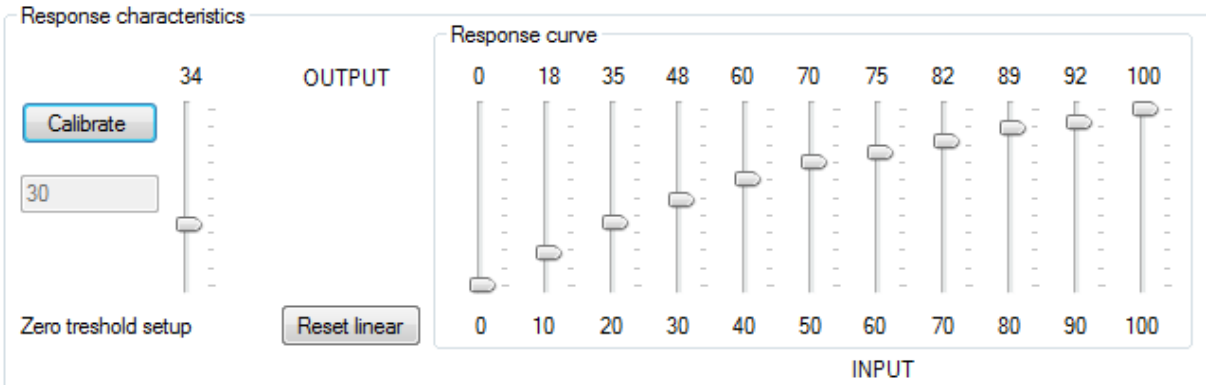


Fig. 9 Response curve setup

In the next step, the controller response to the breath strength can be configured. The response curve allows for manipulating the character of the response in the MIDI messages for the blow ratio in the mouthpiece. The relation between these two values does not have to be linear (which is the simplest scenario achievable by pressing Reset linear button, Fig. 9).

The MIDI channel on which the breath related messages are generated can be configured with drop down list MIDI Channel (Fig. 10).

KODA MIDI Breath Controller MBC-1U generates breath related MIDI Control Change messages. There are 120 controller types to chose from (the default value is CC#2 Breath Controller). The user can change the default controller into any other according to the needs in MIDI Setup, Control function drop down field (Fig. 10).

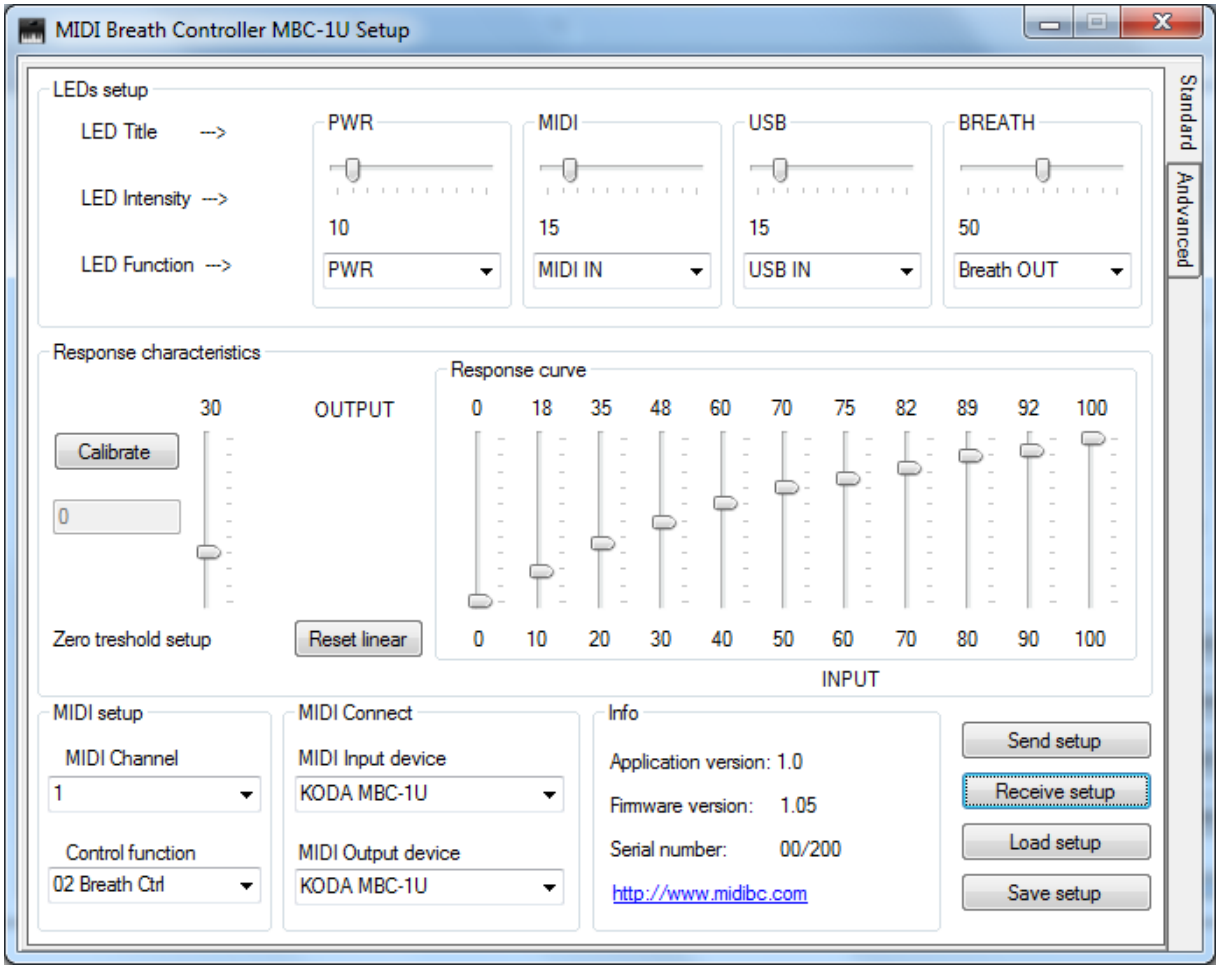


Fig. 10 MIDI Channel and Control Function setup

CAUTION: In order for the changes to have effect, they should be sent to the device by pressing Send setup button. The changes will be stored in non-volatile memory and will remain effective other changes will be introduced.

The setups can be also stored in the computer file (Save setup button) and restored (Load setup button). The files have .set extension and can be used to prepare the collection of setup profiles facilitating the fast setup upload.

Firmware Update Procedure

The embedded software running on the processor inside the interface unit (firmware) is responsible for the proper operation of the breath controller. The software can be, in the

future, enriched with some new features, that is why, there is a procedure for the firmware update by the user.

CAUTION: The firmware update is a risky operation. It consists of erasing the previous firmware and uploading the new one. If, by the chance, the power is switched off during the procedure, the device will be damaged. It is recommended to perform the procedure only when the real need occurs and it is requested to do it exactly as written in the next paragraphs.

New firmware versions will be issued and published on http://www.midibc.com website. The procedure described below applies to the Windows version of the application. After downloading the firmware file, it should be saved exactly in the same directory, where the configuration application is stored (Fig. 15). It is not allowed to change the name of the firmware file.

The procedure should be initiated by connecting the interface module to the host computer (via USB), running the configuration application and selecting the right interfaces in the MIDI Connect panel. The correctness can be checked by pressing the Receive setup button. If the setup has been passed to the host computer it means everything is properly connected. In the next step the Advanced tab should be selected (Fig. 11) and Prepare load button pressed.

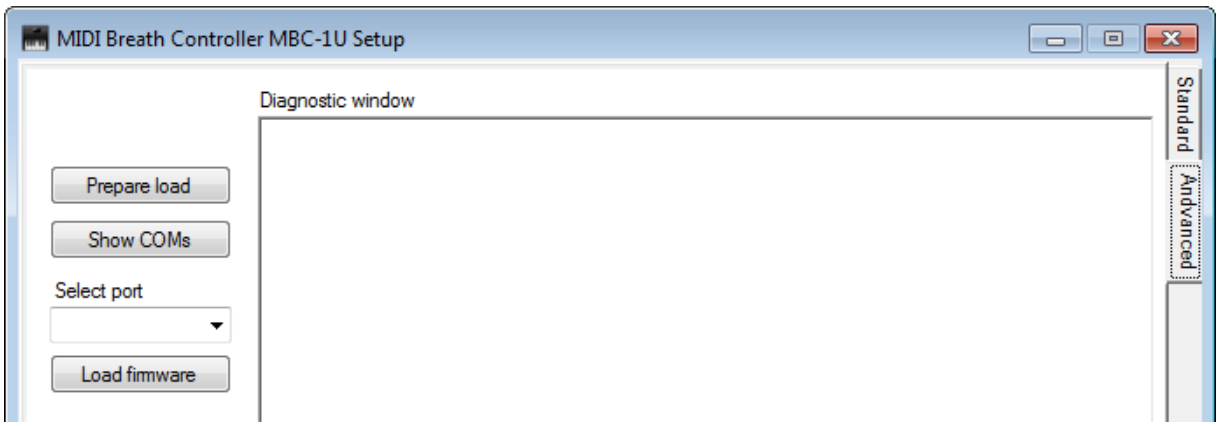


Fig. 11 Preparation of the firmware upload

As a result, the device will be switched into the service mode. It will be discovered by the operating system as a AVR CDC Bootloader, what can be monitored in *Device Manager* (Fig. 12).

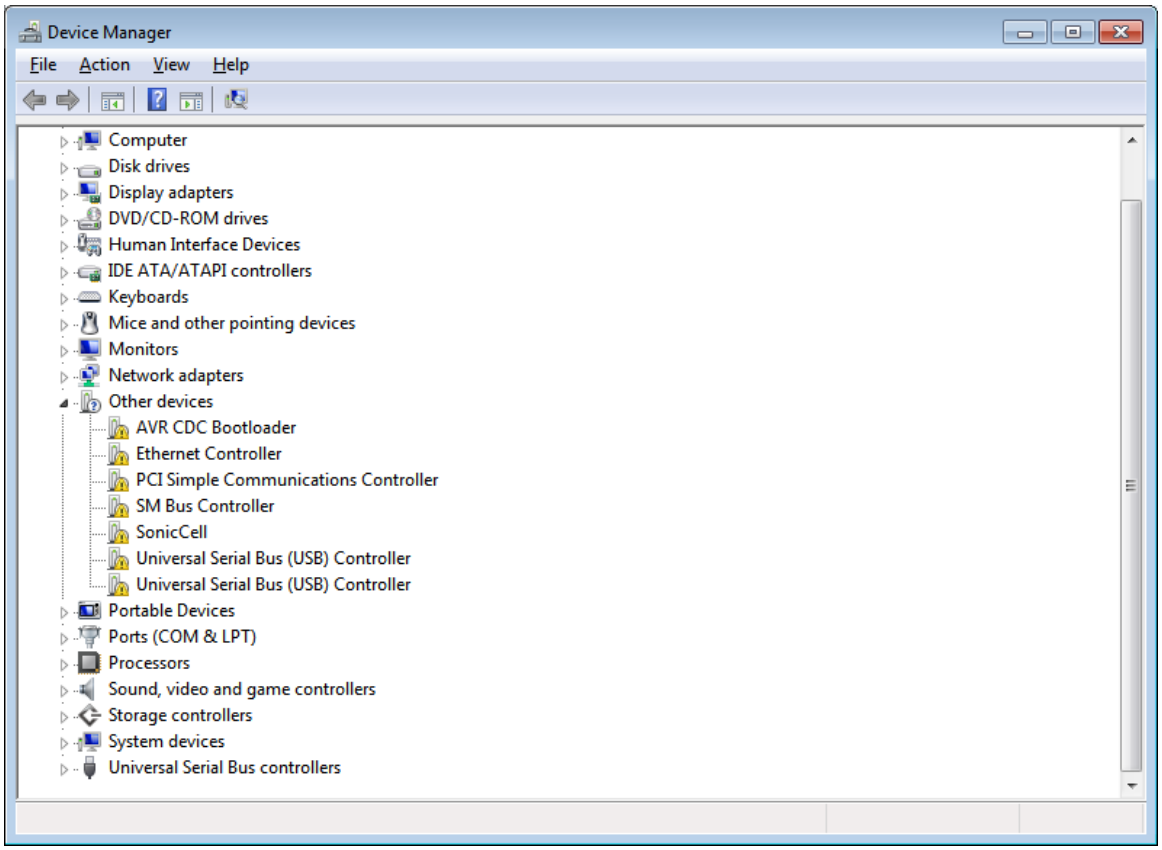


Fig. 12 Device discovery in the service mode (*AVR CDC Bootloader*)

The device in the service mode will require the driver installation. The property card of the AVR CDC Bootloader should be open and the Update Driver option selected (Fig. 13).

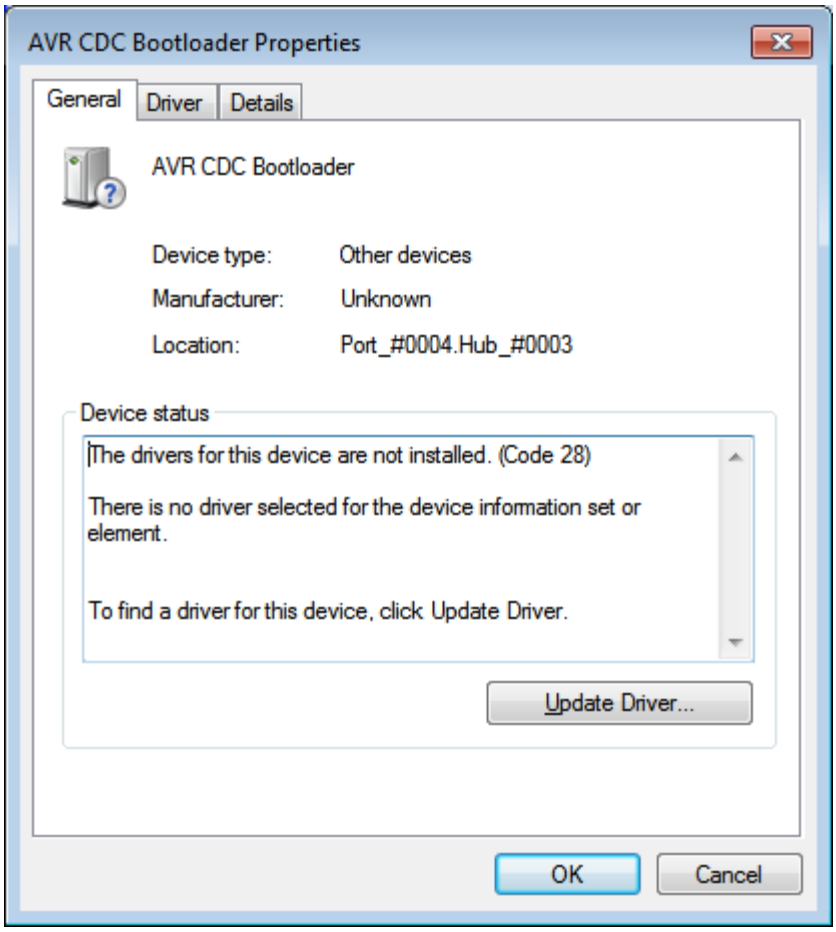


Fig. 13 Properties card of AVR CDC Bootloader

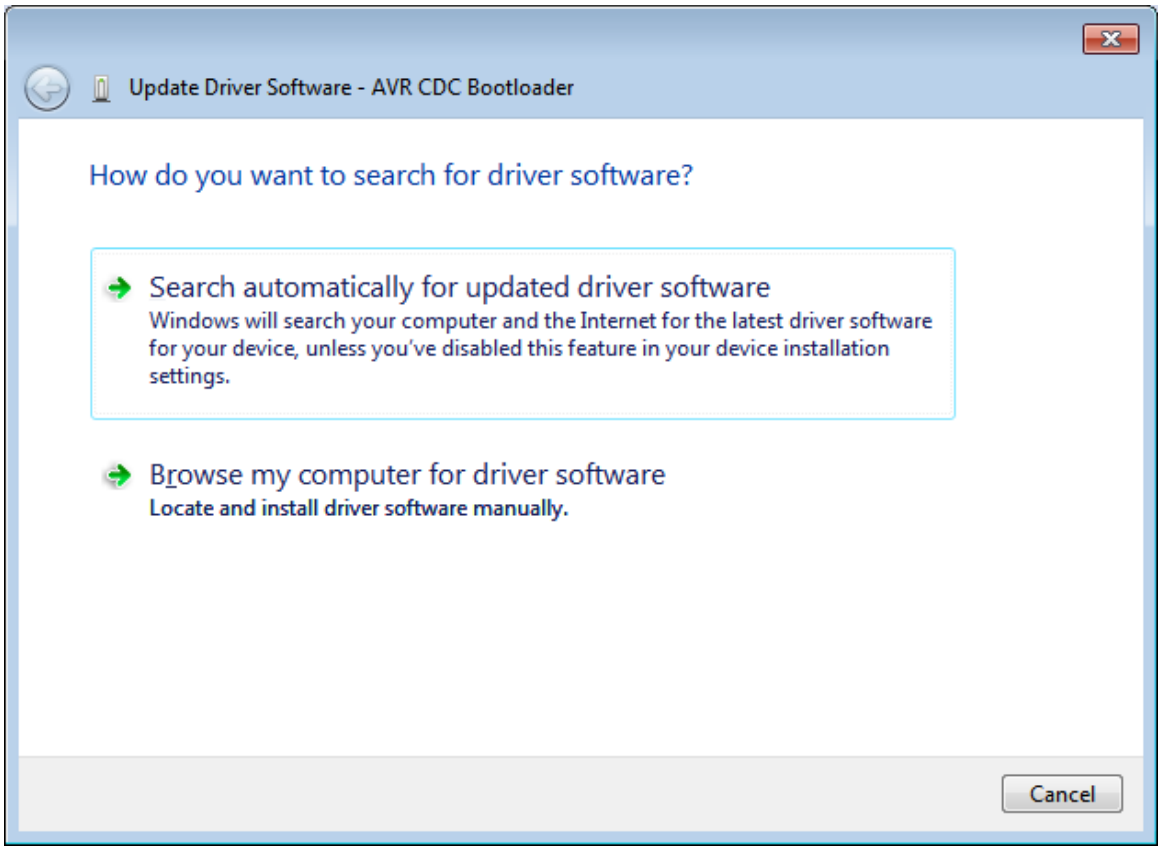


Fig. 14 Selection of the way the device driver will be searched

In the next step the manual mode of locating the driver should be selected (Fig. 14). The driver itself is located in the same directory as the configuration application was previously installed (Fig. 15).

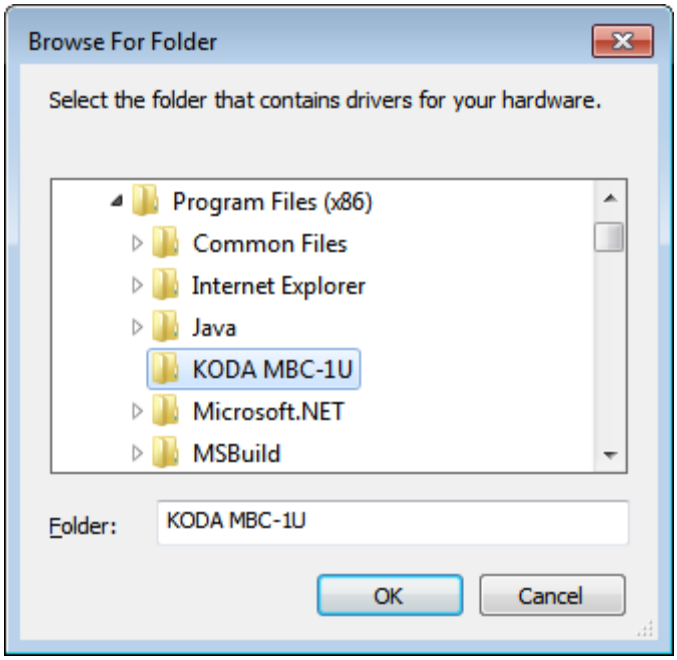


Fig. 15 Selecting the driver folder

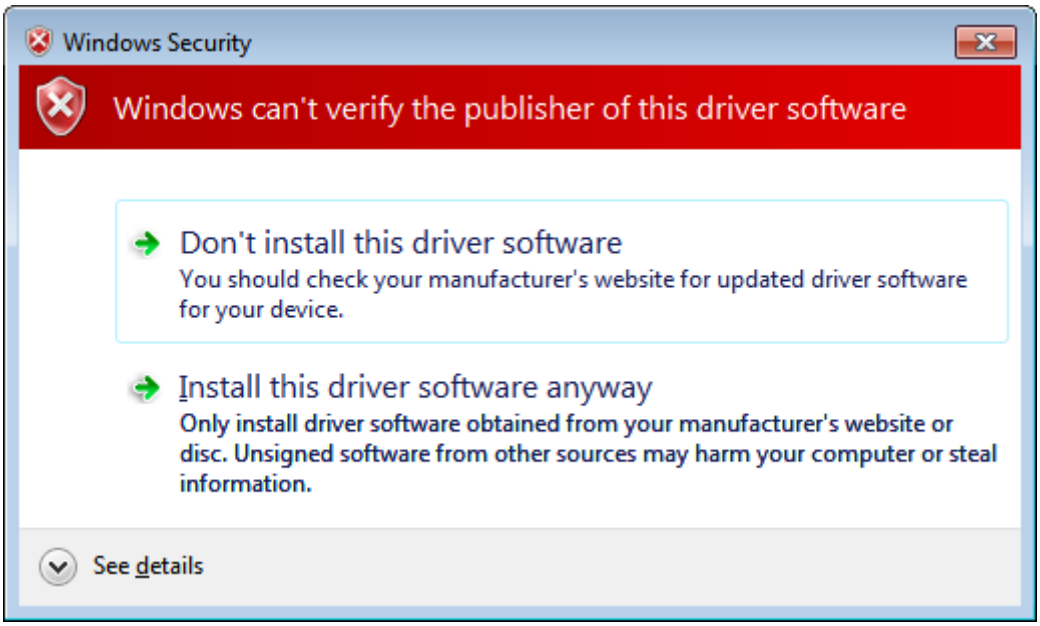


Fig. 16 Warning during the driver installation (*Install this driver software anyway*)

Depending on the operating system setup, the warning can appear (Fig. 16). The option to install the driver anyway should be selected.

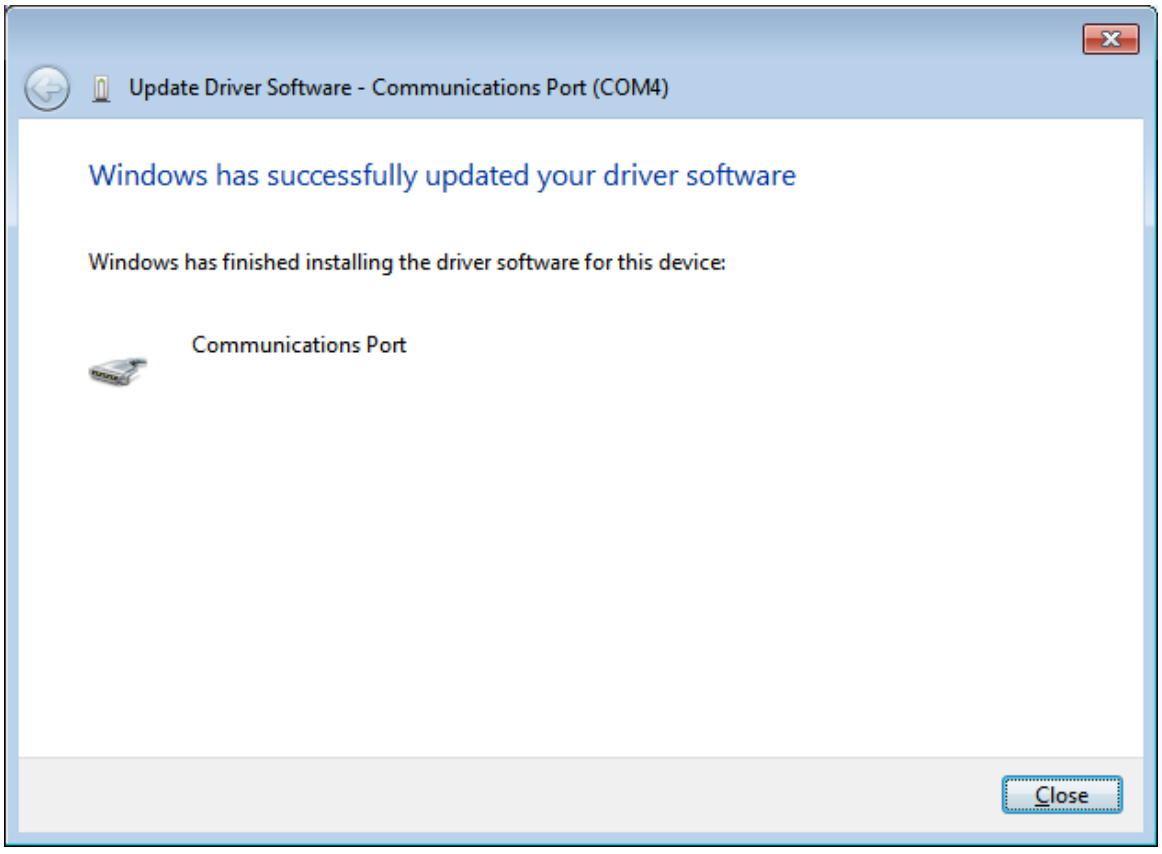


Fig. 17 Confirmation of the installed driver

As a result, a new communication port will be installed in the system. It will be marked with COMx, where x is the number of the consecutive serial port applied by the operating system. The number should be noted for the future reference(Fig. 18).

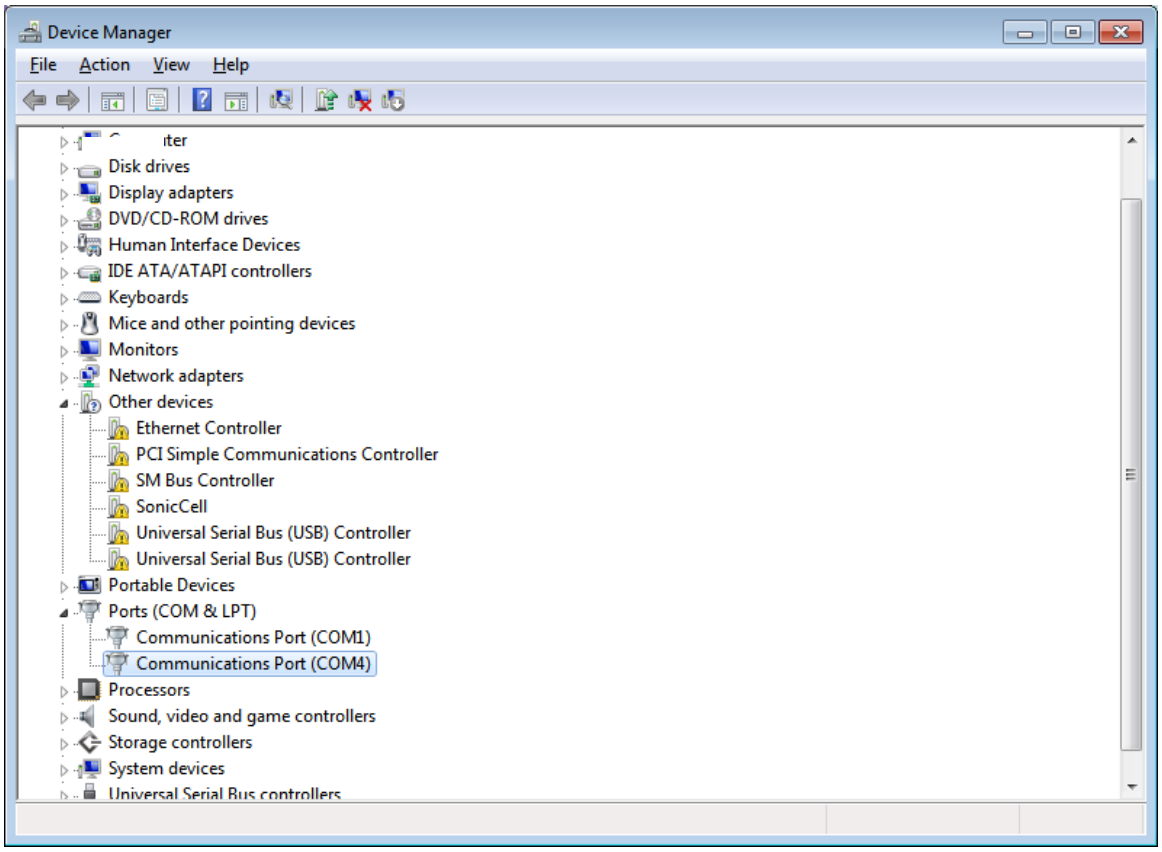


Fig. 18 Device installed as a *Communications Port*

After the driver installation, the firmware upload can be continued. In the configuration application the appropriate, previously installed port number should be selected. The selection will be acknowledged in the diagnostic window (Fig. 19).

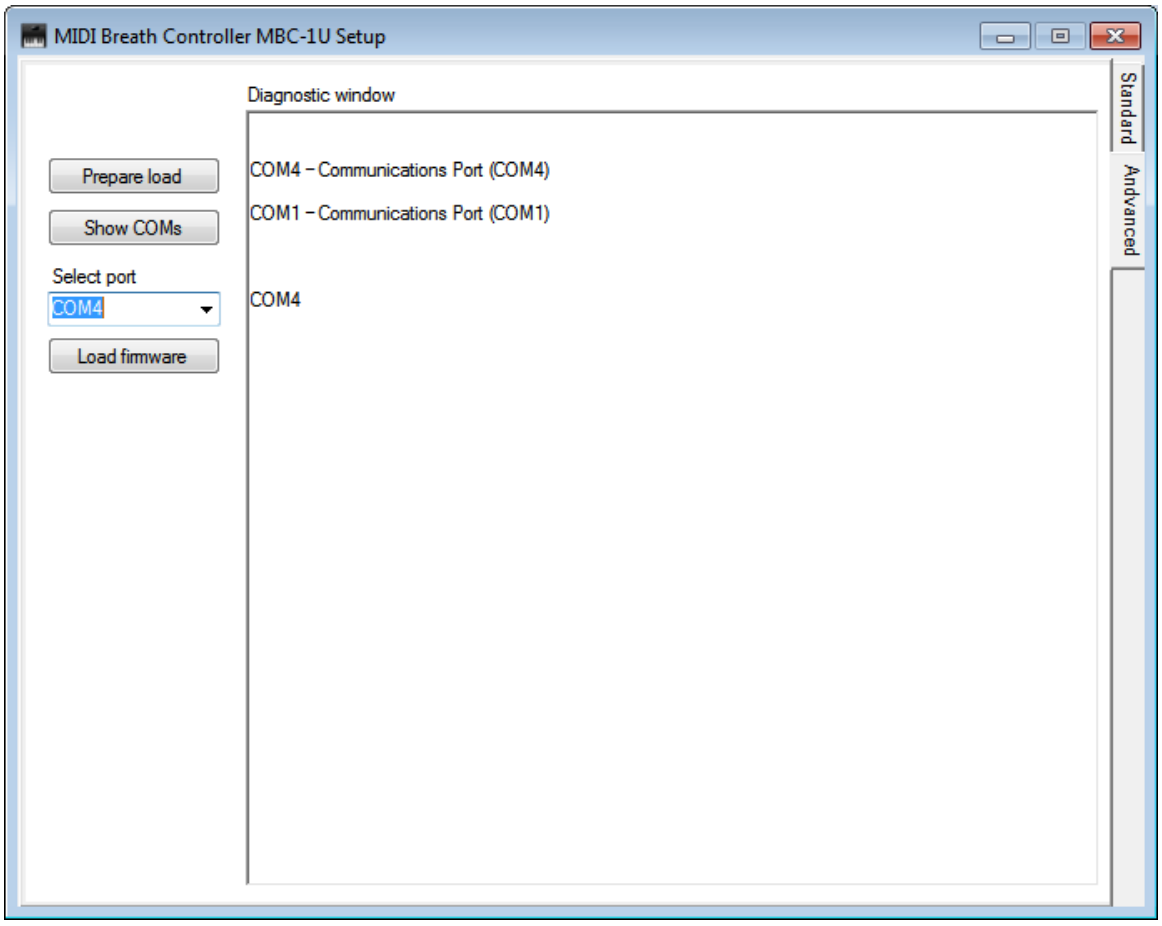


Fig. 19 Selecting the COM port

In the next step, Load firmware button should be pressed. If the firmware upload was successful the diagnostic window should look like on Fig. 20.

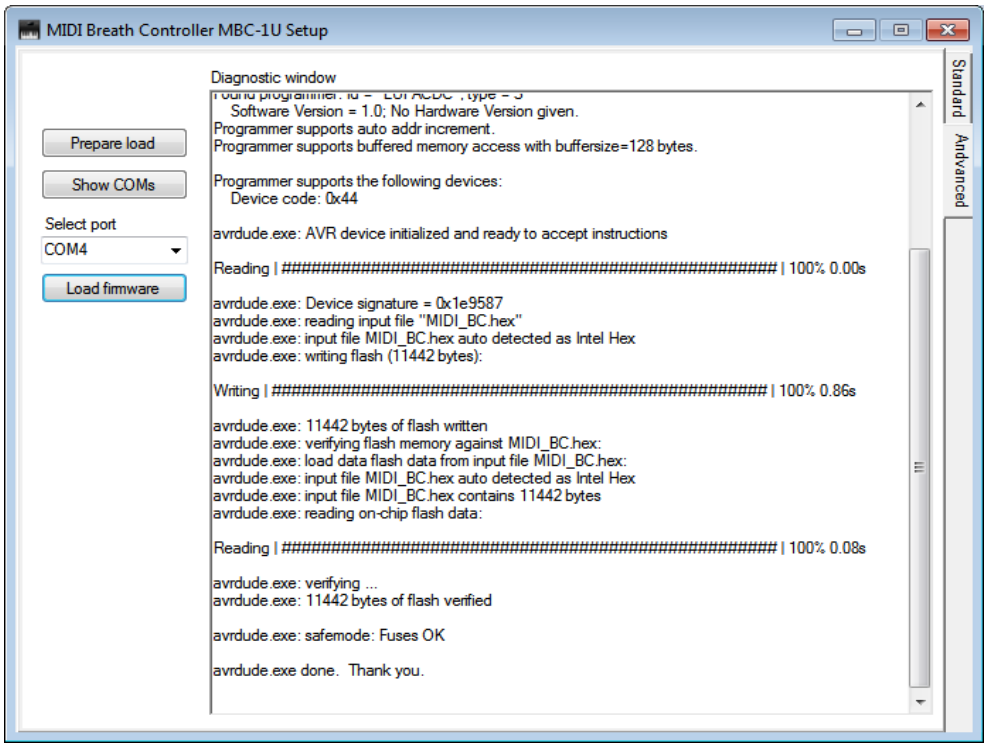


Fig. 20 Properly uploaded firmware summary

After uploading the new firmware, the breath controller should restart. Disconnect the USB cable and connect it again. The device is ready for use. The new firmware number can be verified in the Info panel.

Maintenance and storage

The breath controller should be stored in the temperatures 0 - 50 degrees Celcius and the relative humidity not higher than 90%. It is allowed for the short periods of time to use the device in lower temperatures and higher humidity.

Due to the device character, the sensor unit and the mouthpiece are resistant to the higher humidity. Due to the hygienic reasons, the mouthpiece is removable in order to clean it from time to time. The mouthpiece can be cleaned with the water or rubbing alcohol.

Guarantee

The product is guaranteed to work properly during the period of 12 months from purchase date.

The guarantee does not cover the mechanical damages being the result of the improper use of the device.

The guarantee does not cover the damages to the device itself or other connected devices done by the use of the breath controller in the way other than described in the user manual.

Serial number:

.....

Purchase date:

.....

Producer signature:

.....

Open Source Technologies in Product Design

This breath controller was designed with the use of the following open source technologies:

- LUFA Lightweight USB AVR Framework,
- ECLIPSE
- AVRDUDE