



ASTROMI.CH

MBox Manual

MBox Manual

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Introduction

Thank you for purchasing MBox (short for MeteoBox), a small, self-contained weather sensing device that delivers barometric pressure, temperature, humidity and dew point information with high accuracy.

Sophisticated telescope mounts usually allow the creation of models to minimize inaccuracies in pointing and tracking that can result from mechanical tolerances, atmospheric refraction and other factors. In order for this model to be of the highest quality, the mount computer or controlling software can use the data that MBox provides and thus improve the accuracy in their calculations.

Because of the small size of MBox, it can be used in both mobile astronomy as well as stationary setups inside an observatory.

MBox is CE conform according to EN 61326-1 Class B
MBox is also ROHS compliant.

System Requirements

MBox was tested on WindowsXP, Windows 7 and Windows 10 in a mix of 32-bit and 64-bit versions. It is assumed that the Windows OS is updated to the latest patches and updates.

General Requirements

Windows Operating Systems

- Windows 10
- Windows 8 / 8.1
- Windows 7
 - No further requirements, in case the FTDI Driver is missing or overwritten by the Windows update process, please reinstall the one from the FTDI website (<http://www.ftdichip.com/Drivers/VCP.htm>)
- WindowsXP
 - Service Pack 3
 - .Net Framework 4.0
 - FTDI Driver (<http://www.ftdichip.com/Drivers/VCP.htm>)

Other Operating Systems

Although untested, MBox should work on Mac or Linux operating Systems. It may be necessary to install the proper driver that is available from FTDI (see link above). For a description of the command protocol please refer to Section [Application Interface](#).

ASCOM Connections

For connections thru ASCOM the following needs to be installed:

- ASCOM Platform 6.2 or later
- Astromi.ch MBox Driver

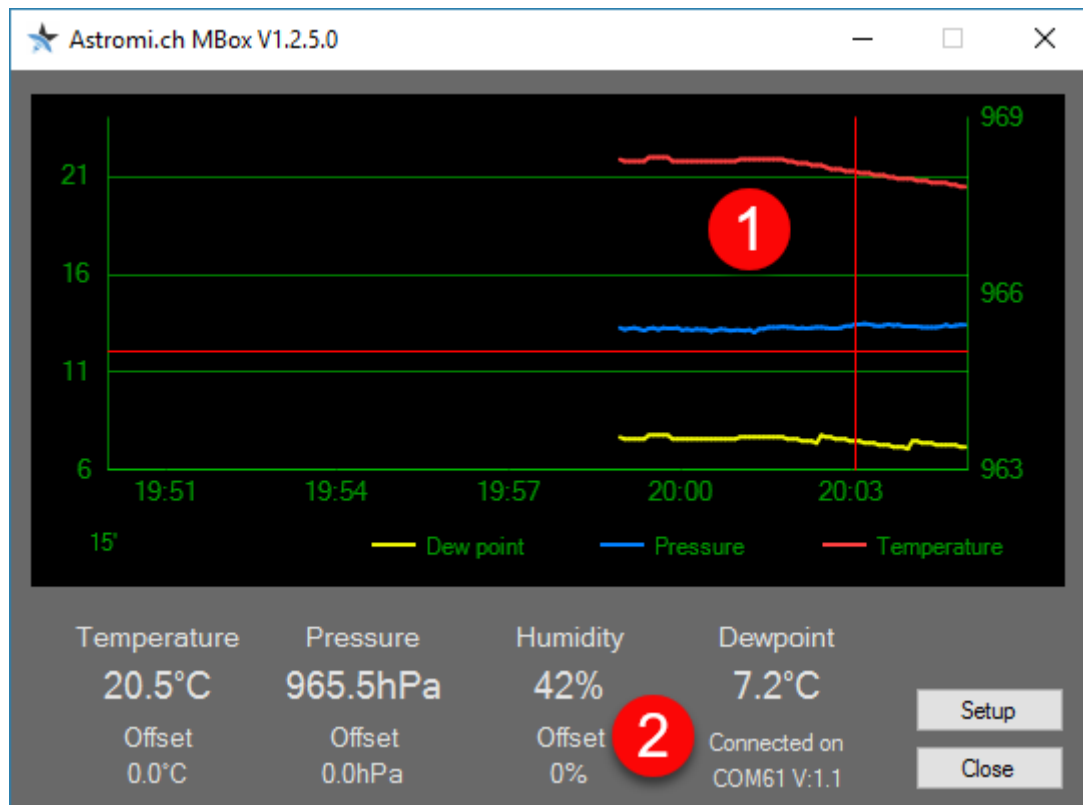
MBox usage

Using MBox is as easy as connecting it with your computer using the optional USB-Cable and launching the application. Upon insertion Windows will recognize MBox as a new Com-Port and make it available to the system.

On older Windows Versions or other Operating Systems it might be necessary to install the proper FTDI Driver before the device becomes available.

Windows Application

The Software that is provided together with MBox collects the data from the hardware and displays it in a small graphical user interface that can be split up into two main sections, which are described below. The application also writes a file called “10micronRefraction.txt” to your temp folder at periodic intervals. If you own a 10Micron mount and use Per Frejvall's ASCOM Driver for the mount, the driver will read this file and send the atmospheric information to your mount.



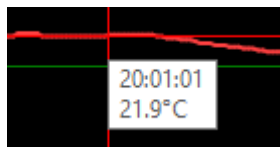
Temperature, Pressure and Dew point Chart

As soon as MBox is connected by the application the chart region (1) will begin to be populated with data. The Chart features a temperature scale on the left side that is used for temperature and dew point, and a pressure scale on the right side used to indicate current relative air pressure. The scale at the bottom indicates a timeline, with the actual time and data displayed on the right side of the graph.

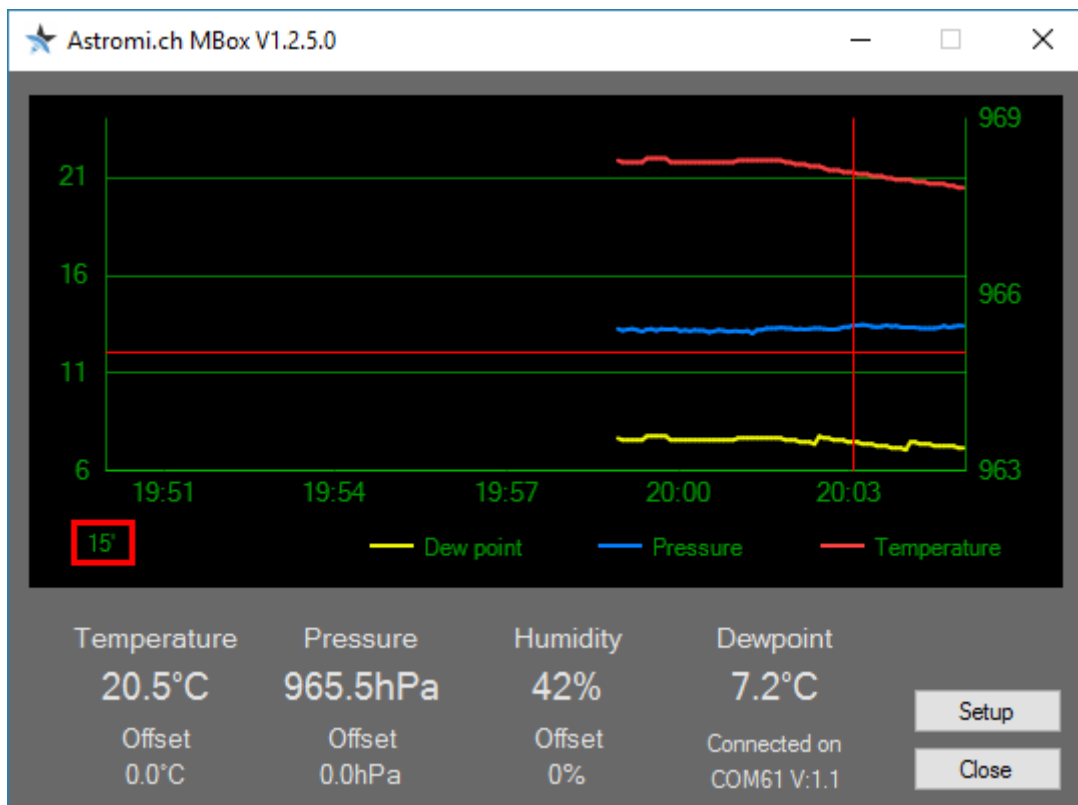
Below the chart the current measurements are displayed as clear text (2), along with information about configured offsets, the port used for communication and firmware version of MBox.

Chart Details

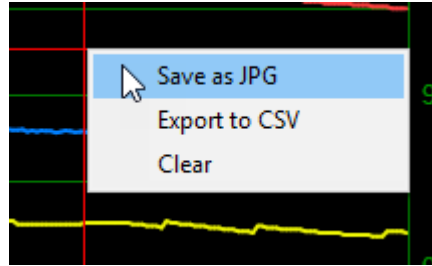
Moving the mouse pointer inside the chart area will change it to a crosshair that provides detailed information about a certain point on the chart when hovered over a line.



On the bottom left of the chart is the current range index of the chart displayed. Scrolling with the mouse wheel acts as zoom into or out of the graphic and will change the time range that is displayed on the chart.



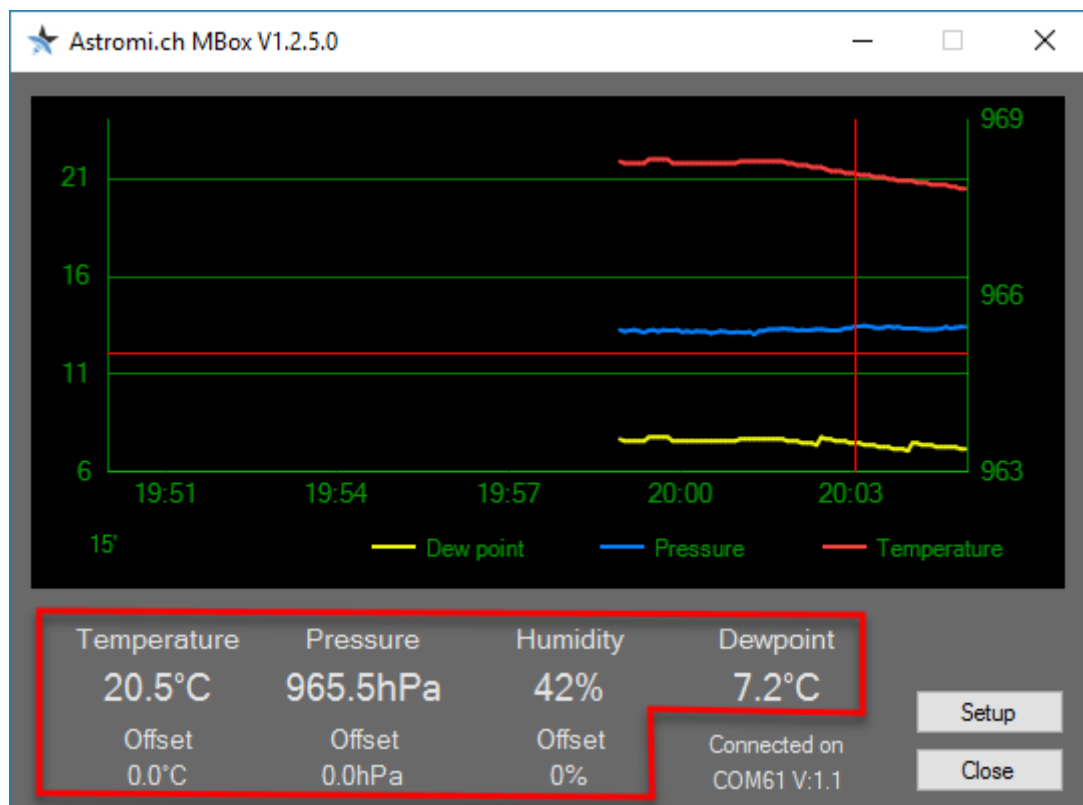
Clicking onto the chart with the right mouse button brings up a context menu as shown in the next figure.



- Save as JPG
 - Saves the currently displayed chart in a picture on your computer.
- Export to CSV
 - Exports all data points available into a CSV file that can later be used with 3rd party Software (e.g. Excel) to recreate the graphs.
- Clear
 - Clears the current graph and removes all data points

Temperature, Pressure and Dew point values

In addition to the chart, the current values are displayed in a numeric format for easier readability.

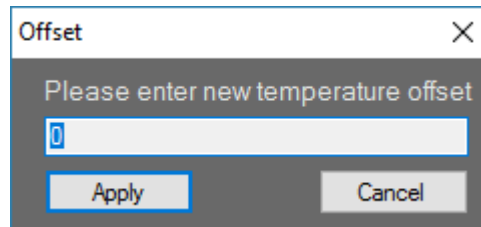


Offsets

Should you find your MBox to not be accurate enough in either temperature, pressure or humidity, you can apply a linear offset. Double clicking either the offset label or the numeric value for the offset in question will bring up a small window asking for a new offset to be applied.

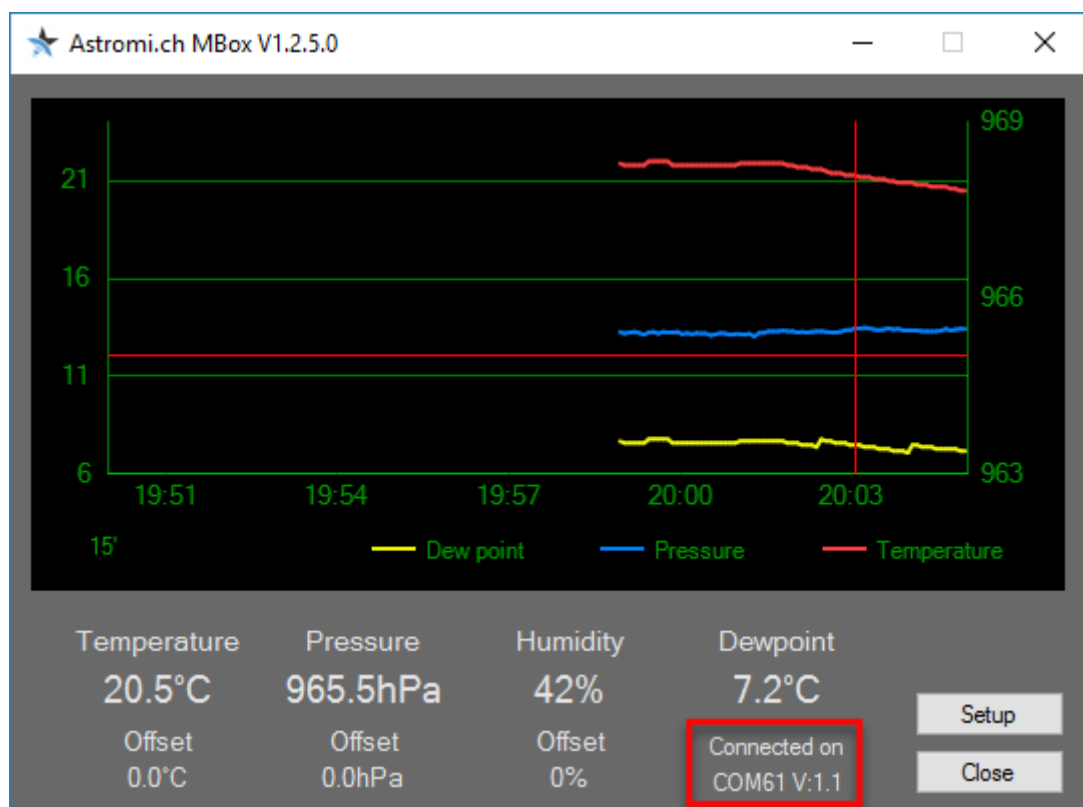
Offset values are stored inside the EEPROM and are therefore unique to the device and transferred to all systems that you use this particular MBox on.

Note: Dew point is calculated by MBox and is based on current temperature and current humidity. Applying an offset to either of these two values will automatically be reflected in the dew point reading as well.



Connection indicator

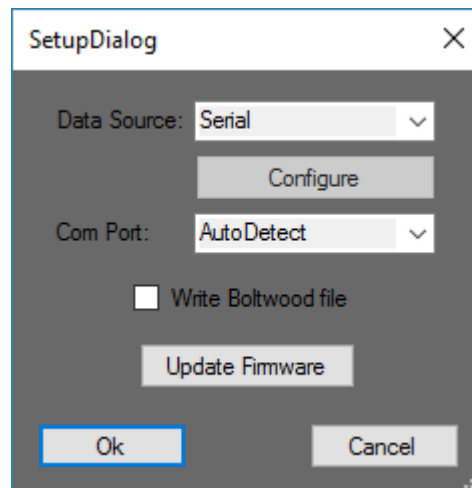
Below the dew point information the connection status is displayed. If no MBox is detected by the software "Waiting for MBox" is displayed. Once a connection has been established the Com-Port used for the connection along with the Firmware-Version of the connected MBox is displayed.



Setup and Close buttons

Setup

You can configure behavior of the software as well as perform firmware updates should they become necessary.



- Data Source
 - Specify if the application should connect to MBox thru the available ASCOM Driver, or directly to the serial port. If ASCOM is selected, the setting for the Com Port is grayed out.
 - The Application supports “Hot-Plugging” when using serial connections to the device, meaning you can connect or disconnect MBox at any time and the application will either connect or disconnect automatically.
- Configure
 - Configure ASCOM Driver settings. The settings will be stored and the application tries to connect to MBox automatically on the next startup
- Com Port
 - AutoDetect is the default setting. In this configuration the application will periodically “scan” all available com-ports on your system for a MBox. It does so by connecting to the port, “listening” to the data coming from the port and deciding whether the data looks valid or not. If no MBox is detected, the application will try again after a short delay. Once MBox has been found, the search is ended and a permanent connection to MBox is established.
 - If the AutoDetect routine described above is not wanted or causes undesirable side-effects to other devices connected to your PC, you can manually select which port the application should “listen” on.
- Write Boltwood file
 - If this checkbox is selected, the application generates a text file in your “My Documents” Folder named “boltwood.txt”. This file is compatible with the structure as generated by Boltwood weather stations and can be used by Software such as CCD Autopilot.
NOTE: If making use of this feature be aware that only the timestamp and the data that MBox provides are valid! The values e.g. for wind or rain shall not be used as the data is not “real”!
- Update Firmware

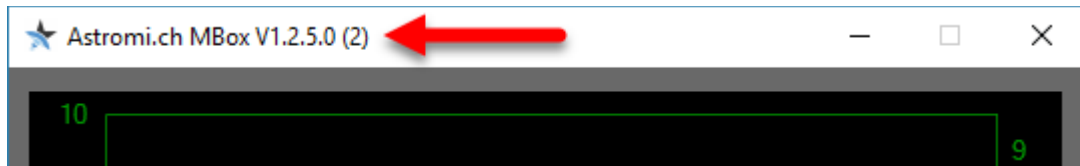
- Should newer Firmware versions become available you can use this button to update your MBox to the newest version. During the update process various Windows may pop up. Please ignore them and do not interrupt the update process.
- The Firmware can only be updated if connected via Serial Port
- **NOTE 1:** When connecting thru ASCOM, “Hot-plugging” of MBox is not supported. MBox needs to be connected to the PC and the Com Port available on startup of the application.
- **NOTE 2:** Because of “issues” with Serial Ports in the .Net Framework, the application needs to be restarted when switching from ASCOM to Serial connection.

Close button

Closes the application.

Running multiple Instances of the application

It is possible to run multiple instances of the MBox application. The instance number is displayed in the title bar of the application the second and each subsequent instance that is launched. Please note that each MBox sensor can only be connected to one instance of the application at a time.



Hardware information

MBox uses a Bosch Sensortec BME280 Sensor that delivers pressure, temperature and Humidity with very high accuracy. The following is an excerpt from the specifications of the sensor depicting its tolerances and operating limits:

Pressure Sensor

Parameter	Min	Typical	Max	Unit
Operating temperature range	-40	25	+85	°C
Operating pressure range	300		1100	hPa
Absolute accuracy pressure		+/- 1.0		hPa
Relative accuracy pressure		+/-0.12		hPa

Temperature Sensor

Parameter	Min	Typical	Max	Unit
Operating range	-40	25	+85	°C
Absolute accuracy temperature		+/- 1.0		°C

Humidity Sensor

Parameter	Min	Typical	Max	Unit
Operating Temperature Range	-40	25	+85	+C
Absolute accuracy tolerance		+/- 3.0		%RH

Microprocessor

The “heart” of MBox is an Atmel ATmega328P microprocessor that interfaces with the Sensor over the I²C protocol. It features 32KB of flash memory, 1KB of EEPROM and 23 general purpose I/O lines.

In order to reduce circuit complexity and part count, the ATmega328P is configured to use its internal oscillator running at 8MHz.

Application Interface

This section provides information about how to interface with MBox from your own application or script.

Serial Port settings

Use the following settings to connect to MBox and start receiving data:

Baud: 38400
Data-Bits: 8
Parity: None

Protocol

MBox uses, for compatibility reasons, the NMEA 0183 Protocol that is used by various navigation devices.

MBox sends data from the sensor in the following format:

\$PXDR,P,96276.0,P,0,C,31.8,C,1,H,40.8,P,2,C,16.8,C,3,1.1*31<cr><lf>

This breaks down into the following, more readable format:

\$	Start of sentence
P	Proprietary sentence
XDR	Transducer type
P	Sensor type, pressure
96276.0	Sensor value
P	Sensor units, pascal
0	Sensor ID
C	Sensor type, temperature
31.8	Sensor value
C	Sensor units, °C
1	Sensor ID
H	Sensor type, humidity
40.8	Sensor value
P	Sensor units, percent
2	Sensor ID
C	Sensor type, temperature
16.8	Sensor value
C	Sensor units, °C
3	Sensor ID
1.1	MBox firmware version
*31	Checksum

Additionally, MBox can also send information about calibration values stored in the EEPROM:
\$PCAL,P,20,T,50,H,-10*79

\$	Start of sentence
P	Proprietary sentence
CAL	Calibration data
P	Sensor type, pressure
20	Calibration value multiplied by 10, e.g. 2.0 hPa
T	Sensor type, temperature
50	Calibration value multiplied by 10, e.g. 5.0 °C
H	Sensory type, humidity
-10	Calibration value multiplied by 10, e.g. -1.0 %RH
*79	Checksum

Setting, resetting and receiving Calibration data

In order to set, reset or query calibration data from the MBox, similar formatted sentences can be sent to the device:

Setting pressure calibration

:calp,50*

:calp	Set calibration value for pressure
50	Calibration value multiplied by 10, e.g. 5.0 °C
*	End of message indicator

Setting temperature calibration

:calt,22*

:calt	Set calibration value for temperature
22	Calibration value multiplied by 10, e.g. 2.2 hPa
*	End of message indicator

Setting humidity calibration

:calh,50*

:calh	Set calibration value for pressure
50	Calibration value multiplied by 10, e.g. 5.0°C
*	End of message indicator

Resetting calibration values

:calreset*

:calreset	Resets all calibration values
*	End of message indicator

Getting calibration values

:calget*

:calget	Resets all calibration values
*	End of message indicator

Troubleshooting

If your MBox does not work as expected, please check the following:

- Verify in Device Manager the FTDI Serial Port shows up. Install / reinstall the driver if necessary (<http://www.ftdichip.com/Drivers/VCP.htm>)
- If configuring ASCOM Connection and it appears that nothing happens when you click the “Configure” button, look in your task bar for an additional window. Sometimes the ASCOM Setup-Dialog ends up behind the other windows and is therefore not apparently visible.