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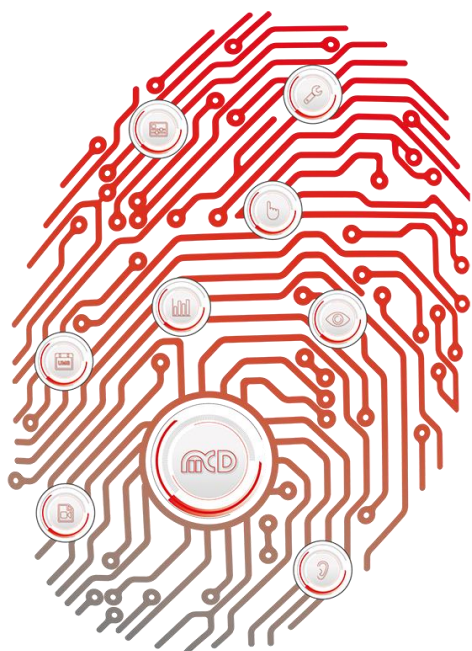
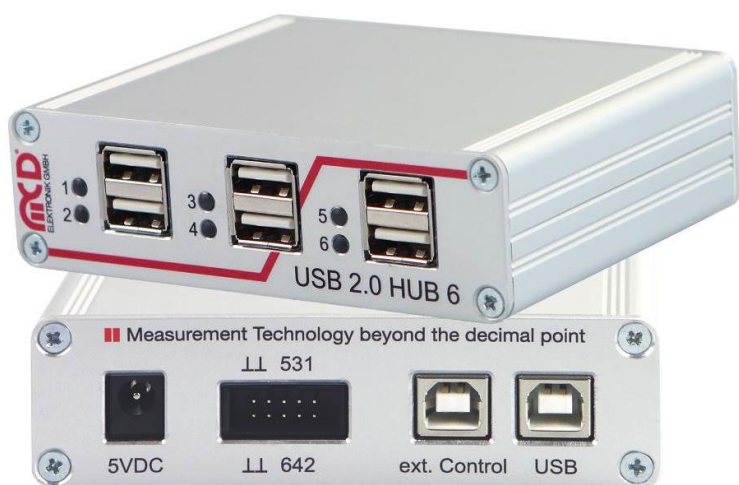
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# Manual

## USB hub 2.0 6-Port, Switchable, 2 Control Inputs



GET IN **touch**  
WITH SENSITIVE TESTING

- Softline \_\_\_\_\_
- Modline \_\_\_\_\_
- Conline** \_\_\_\_\_
- Boardline \_\_\_\_\_
- Avidline \_\_\_\_\_
- Pixline \_\_\_\_\_
- Application \_\_\_\_\_

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## 1. General

The USB hub can be operated only on the USB host (bus - powered) or with the use of a 5 VDC power supply with an output power of at least 17 W or an output current of at least 3.3 A (self - powered), which is enough for 500 mA output current on each USB port. For the maximum output current of 5 A, a 5.2 A (26 W) power supply is needed. The device automatically detects and switches between bus - powered and self - powered modes. The USB hub is re - enumerated when the external power supply is connected or disconnected.

This USB hub has six USB 2.0 downstream ports that can be turned on and off individually via USB. When switching it off, the supply voltage (+ 5 V) and the data lines on the semiconductor switches are separated. Control is provided by the Toolmonitor USB hub 6 (PC software). Whether or not and which ports are active after switching on the hubs can be configured and stored.

The USB 2.0 host connection is usually also used to control the USB hub. Alternatively, however, control can also be provided from another host using the additional USB 2.0 connection on the back. In addition to this control via USB, ports can alternatively also be turned on and off via external control inputs.

Whether or not and which ports are active after switching on the USB hub (for example to have access to the mouse or keyboard) can be stored in non - volatile memory.

A number, that can be stored in the device, can be used to distinguish between multiple USB hub 6-Port units on one PC.

The USB hub is controlled through a virtual serial interface with simple text commands (see chapter 9). This makes it possible to use the USB hub under Linux as well. If the operating system does not already provide native support for USB serial converters from FTDI, Linux drivers can be found at <http://www.ftdichip.com/Drivers/VCP.htm>.

The Toolmonitor USB hub 6-Port can also be installed, which provides a user interface for the control and configuration of the USB hub. It communicates with the USB hub through the virtual serial interface and in turn offers an interface for remote control. External software can be used to control the Toolmonitor USB hub 6-Port completely remotely. COM / DCOM or a .Net assembly can be used as the interface. This allows the Toolmonitor USB hub 6-Port to be integrated into many different applications (MCD TestManager CE, LabView®, Microsoft Visual Studio® (C#, C++, Visual Basic), Microsoft Office® (for example Excel®), Open Office®). There is also a command line tool available.

**Order number:** # 122536

## 2. Scope of Delivery

- 1 x USB hub 2.0, 6-Port, switchable (two control inputs)
- 1 x USB storage card with installation software
- 1 x USB - A to USB - B connector cable 0.8 m

## 3. Safety Instructions

The USB hub 6-Port is intended for use indoor. It may not be exposed to moisture. The device has no parts that can be replaced by the user. Any repair must be carried out by a trained technician. Before opening the housing, all cables must be disconnected from the device.

## 4. Installation of Software, Drivers and Hardware

### 4.1. Installation of Software

On the USB storage card included, the “*Drive:\Software\Installer*” directory contains the installation file for the Toolmonitor. To install it, start the file “*USBHub6Install.msi*” and follow the instructions of the installation dialog.

### 4.2. Installation of Drivers

The drivers for the USB hub are integrated into the operating system. For the controller, the driver under Windows® (starting with Windows® 7) is automatically downloaded from Windows® Update. For older Windows® version (starting with Windows® XP) or if no Internet connection is available, the driver can be installed manually. The installation file for this driver is on the USB storage card included, in the “*Drive:\Software\Drivers*” directory”. Start the file “*CDMxxxxx\_Setup.exe*” file located there (xxxxx is a number denoting the version number). After installation, it will take another few seconds before the USB hub is ready to use.



The USB storage card provided cannot be operated on the USB hub without a power supply. Please connect a suitable power supply to the USB hub or plug the USB storage card into a USB connector on your PC.

### 4.3. Connecting the Hardware

The USB hub can be operated alone on the USB host (bus - powered) or additionally with a 5 VDC power supply (self - powered) with at least 17 W output power, or 3.3 A output current, which is sufficient for 500 mA output current on each USB port, including the power supply to the USB hub. For the maximum output current of 5 A, a 5.2 A (26 W) power supply is needed. Weaker power supplies can lead to functional problems due to overload.



Weaker power supplies can be used. However, it is then the user's responsibility to ensure that they are not overloaded. Signs of overload are dropped connections and error messages related to excess USB current.

Connecting or disconnecting the external power supply logs the USB hub out of the operating system and logs it back in with the changed power supply (bus - powered / self - powered). The ports shut off during this and switch back to their original state after reconnection. Without a power supply, the USB hub must be connected to a PC USB connection or an active hub. Then each port has at most 100 mA available with a sum total of 400 mA, since the USB hub itself requires 100 mA in this situation. The deciding factor here is the required current which the connected devices registered and not the (possibly lower) actual current consumption.

The connection for the external power supply is a DC connector with either a 2.1 mm or a 2.5 mm inner diameter and at most 6 mm outer diameter. The polarity is arbitrary (as long as it is not AC!)

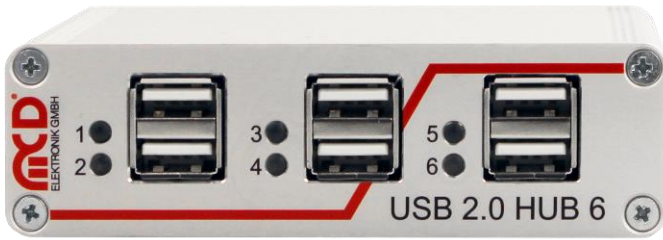


Figure 1: Front View of the USB hub

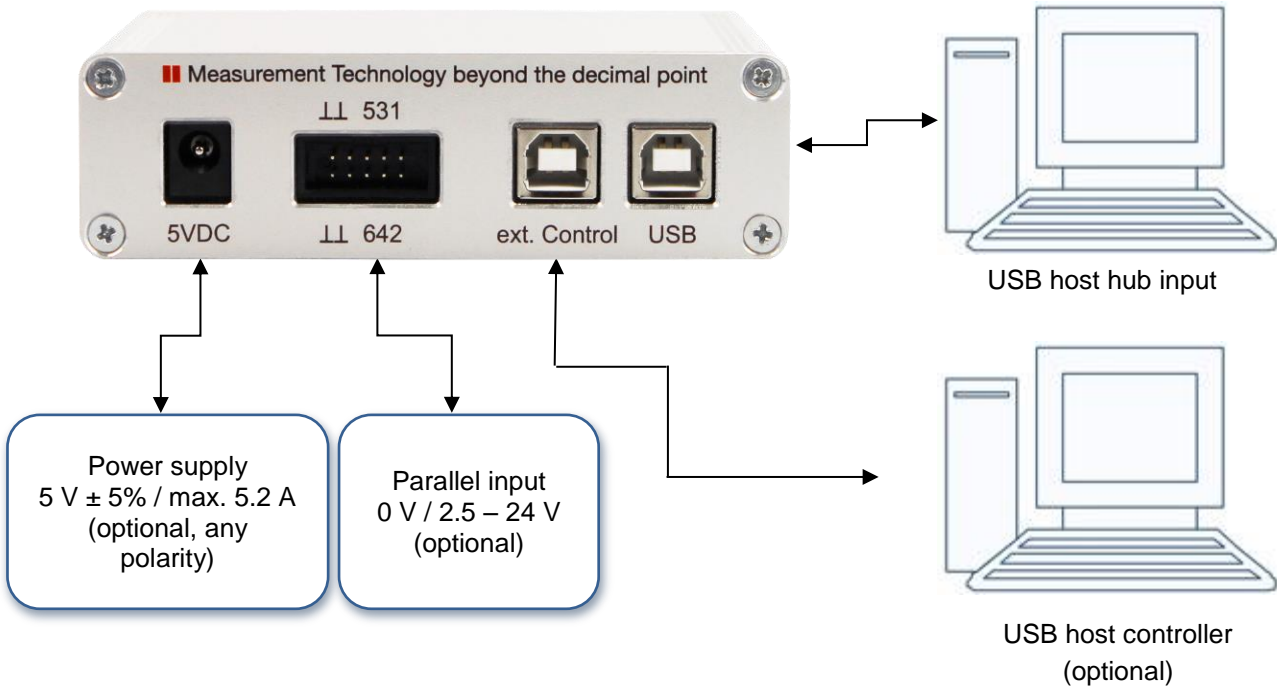


Figure 2: Connecting the USB hub to your PC

The USB hub can be controlled either through the hub input ("USB", on the right) or an external control ("ext. control", on the left). If the external USB control input is connected to another host, control is carried out through it and only the pure USB hub functionality will remain on the hub input. Alternatively, if configured correctly the USB ports can also be turned on and off from the parallel input.

**!** If no USB host is connected to the USB hub input ("USB", on the right), then all USB ports are turned off or remain off. The exception to this rule are pure charging ports (DCP or charger - emulation), if a power supply is connected. Once a USB host is connected and as long as it stays connected, the ports will be turned on as configured.



## 5. Hardware Manual

### 5.1. Features

- **USB downstream ports**
  - 6 ports, individually switchable with up to 2.5 A per port; total output current up to 5 A
  - Each port is protected by a resettable overload breaker
  - Current limitation adjustable
    - ⇒ Connected devices are protected from excess current by the adjusted shutoff limit
  - Adjustable charger emulation for many mobile devices (such as CDP, DCP, etc.)
    - ⇒ An automatic mode tries different profiles
  - Detection of whether a device has been connected to a port
    - ⇒ Detection when devices are connected that are not USB devices (such as USB fans, USB reading lights, etc.)
  - Current measurement for every port (resolution about 10 mA)
    - ⇒ Detection of defects (e.g. current consumption too high / too low)
    - ⇒ Measurement of the current consumption of connected devices
  - Display for port / channel: on / off / excess current / charge / charge complete / no device connected
    - ⇒ Mode always visible from outside
- **Host connection**
  - Control via the USB hub connection or an additional USB control connection
    - ⇒ Hub functionality and control of the USB hub with just one cable
    - ⇒ Alternatively supports connection of the USB hub to a host (e.g. an embedded host) with simultaneous control from another host (e.g. a PC)
  - Host notification can be disabled
    - ⇒ Permits automated power - on after an overload on a USB port without user intervention
- **Parallel control input with internal pull - up resistors**
  - Permits control via external control elements like switches, relays, open collector outputs, and control voltages from 0 V (low) and 2.5 - 24 V (high)
    - ⇒ Polarity (active low / active high) and priority (parallel input / control via USB) individually configurable for each port individually
- **Other**
  - Automatic polarity correction of the connected power supply (no polarity reversal possible)
  - Regeneration protection from the power supply to the USB host
    - ⇒ Protects the USB port of the PC when it is turned off
  - Robust, compact metal housing
  - Operating state on power - on (e.g. active USB ports and relay channels) can be specified and stored
    - ⇒ With appropriate configuration, can also act as a USB charger without a USB host
    - ⇒ Defined operating state on power - on appropriate to any application
  - User - defined labeling of the USB hub to distinguish it from other USB hubs on the controlling host
  - USB - compliant renumbering of the USB hub and connected devices when the power supply is connected or disconnected
  - Remote control with any operating system or programming language
  - Installation package with all programming interfaces

### 5.2. Construction

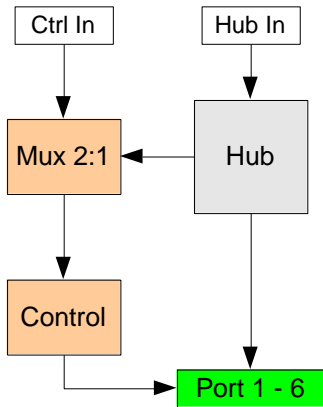


Figure 3: Construction of the USB hub

### 5.3. Display

	USB port turned off
	USB port turned on, but no device connected. This function can be disabled.
	USB port turned on
	Charging active (bright) Only if there is no standard port (SDP).
	Charging complete (dark) Only if there is no standard port (SDP).

### 5.4. Pin Assignments on Parallel Input

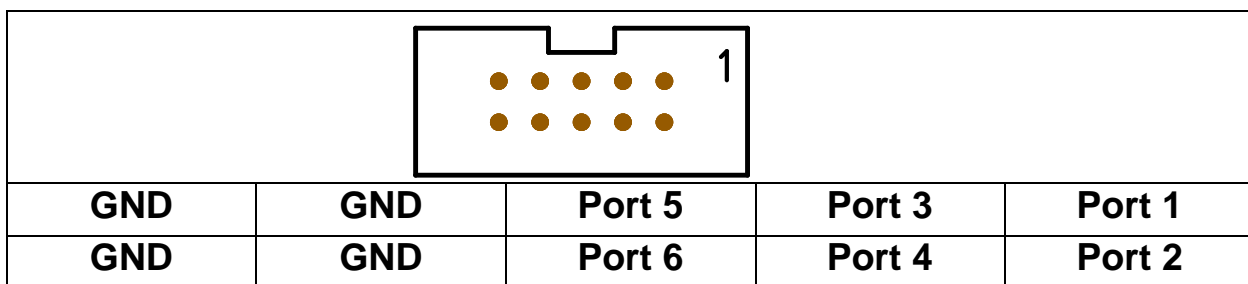
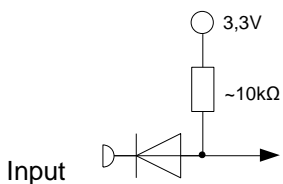


Figure 4: Pin Assignment on Parallel Input

Connecting an input pin to positive voltage (high level) or leaving it open has the same effect. The signal only changes when connected to GND potential (low level). Whether the port turns on at the high or the low level can be configured.






## 5.5. Function of the USB Ports

### 5.5.1. Operating Modes


The USB hub provides six high - speed - capable USB 2.0 ports. Each port can be configured to one of four modes. These four modes are:

1. Standard port (SDP):  
If the maximum current is exceeded, the port shuts off.
2. Charge - capable port (CDP):  
Like a standard port, but it announces itself to the connected USB device as a charge - capable USB port according to the USB battery charging specification V1.2 (USB-IF BC1.2 CDP).
3. Dedicated charging port (DCP BC1.2)  
The port announces itself to the connected USB device as a dedicated charging port according to the USB battery charging specification V1.2 (USB-IF BC1.2 DCP).  
The current is limited to the maximum possible value.  
In this mode, no USB communication is possible with the connected device!
4. Charger emulation  
The port attempts to negotiate a charging protocol with the connected device. To do this, it tries different variants one after the other, including YD/T-1591 (2009) and variants compatible with many portable devices from Apple® and RIM®.  
The current is limited to the maximum possible value.  
In this mode, no USB communication is possible with the connected device!

 Dedicated charging port connection and charger emulation can also be active without a host connected (operation as a standalone charger).  
Due to the many charging schemes - some of which are manufacturer - specific - there can be no guarantee that battery charging will succeed with a particular mobile device and that no damage can result!  
For operation as a charging port or a charger, it is necessary to connect a power supply.

### 5.5.2. Connection Detection

The USB ports have a function to detect when a USB device is connected. This also works for connected devices that only use the power from the connection (e.g. USB fans or reading lights). Connection detection can be disabled individually for each port if the small test current should lead to unexpected problems.

 In CDP mode, it may be that the connection detects a device, but does not detect when it is disconnected. This has no effect on the other functions of the USB hub. Connecting a normal USB device or turning the port on and off will reset connection detection again.


### 5.5.3. Current Measurement

Each USB port has a mechanism to measure the current, with a resolution of about 10 mA. This permits the actual current consumption of the connected device to be measured and monitored. This applies to both operating currents of USB devices and non - USB devices as well as charging currents.

### 5.5.4. Current Limitation

The switching threshold for current limitation can be configured individually for each USB port in steps of 500 mA to up 2500 mA. Current limitation is in principle configurable regardless of use, but the following limits are recommended:


<i>Mode</i>	<i>Current limitation</i>
Standard port (SDP)	500 mA
Charge - capable data connection (CDP)	1500 mA - 1800 mA
BC 1.2 dedicated charging port (DCP)	2000 mA - 2500 mA
Charger emulation	2000 mA - 2500 mA

 Most USB connectors are specified at 1.5 A to 1.9 A. So in general, a current limitation of no more than 2000 mA should be configured.

The total output current can be no greater than 5000 mA. If an attempt is made to configure a higher limit, an error message will occur. The power supply connected must be able to provide the output current and the operating power for the USB hub (see technical data, chapter 8) at a stable voltage of 5 V.

### 5.5.5. Host Notification

If too much current is drawn from a USB port, it shuts off and the operating system is notified. User intervention is then required to restore the USB port to operation. In automated systems, this may be undesired. For this purpose, host notification can be disabled for certain USB ports or for all of them. A restart is then carried out via the controlling application. To do this, the port in question must first be specifically turned off and then back on.

 The response of the operating system to overload events may differ from the behavior described above, depending on the version and the driver used.


Port 5 and Port 6 cannot generate host notifications!

### 5.5.6. Connection Type

It can be specified for each individual port whether it has established a USB 2.0 connection. The connection to the host (PC) can also be queried in the same way.

### 5.5.7. Polarity of Data Lines

For special applications, the D+ and D- data lines can be individually swapped for each port. This function is normally not used.

 The USB hub will restart after this command is executed. All connected devices will temporarily be disconnected from operating power.

## 5.6. Power Supply

### 5.6.1. With an External Power Supply

The USB hub detects an external power supply when a voltage of more than 4.8 V is connected to the DC connector. If the voltage drops to about 4.7 V, the power supply is considered to have been disconnected. So the power supply should have a voltage of at least 5 V, and no greater than 5.25 V. The polarity of the connected voltage is corrected internally to the device. The power requirement depends on the devices connected and the current limits configured. The voltage may not be less than 4.7 V or greater than 5.25 V over the entire power range. The USB hub prevents current from flowing from the power supply through the USB cable to the power supply as long as the operating conditions are observed.



Excessive power supply voltages risk damage to the USB hub and the devices connected to it!

### 5.6.2. Via the USB Host

The power supply of the USB hub and the devices connected to it can also be provided through the USB host connection. In this case, the total current for the USB hub and devices may not be more than 500 mA. A port on the USB hub can then provide at most 100 mA. If these restrictions are not followed, error messages, connection drops, and other malfunctions may result. Thus in this case, devices should only be connected which have their own power supply or need only a little power from the USB connection (such as a keyboard).

## 6. Software Manual

### 6.1. Programming Interface

After the Toolmonitor starts, the interface looks like this:

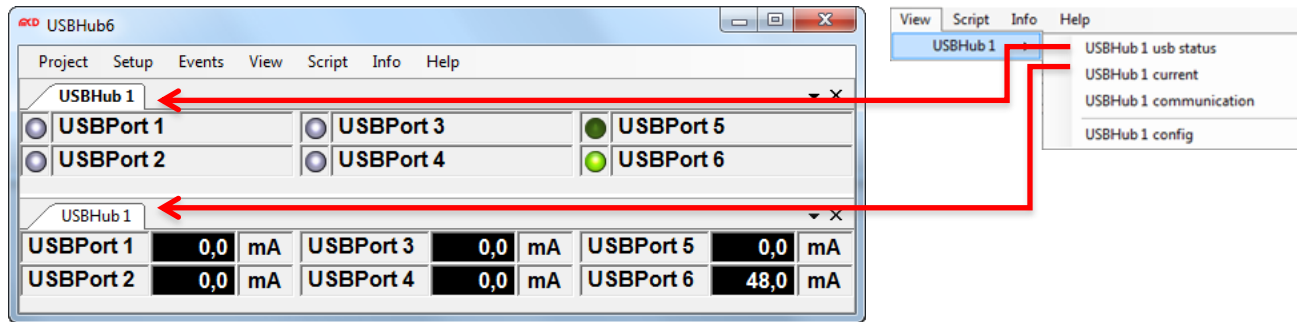


Figure 5: Starting Interface of the Toolmonitor

The switching state of each port and the current flow from each port is shown.

	Port turned off
	Port turned on; no connected device detected
	Port turned on; connected device detected or detection function turned off
	Port is off although it should be turned on Possible cause: <ul style="list-style-type: none"> <li>Excess current shutoff</li> <li>Connected device feeds current back into the USB hub</li> <li>The USB hub is supplied by a power supply and missing USB connection on the USB hub connection (back right) and USB cable connected to the USB control connection.</li> </ul>

The program help provides further information.

The following are the main features:

### 6.2. Program Settings

Basic settings are configured under *Setup* → *Options*. The default settings are sufficient for an initial commissioning.

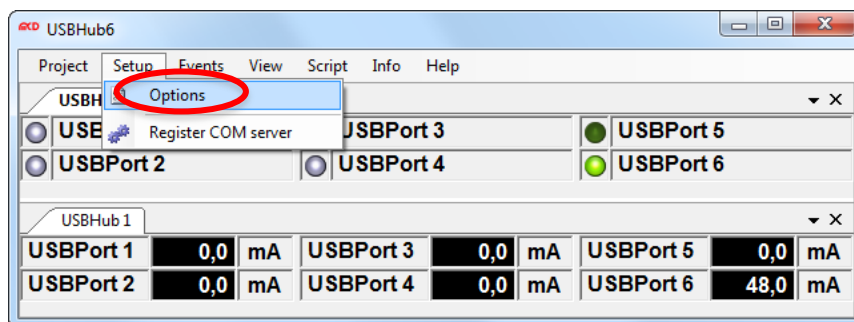


Figure 6: Enter Program Settings

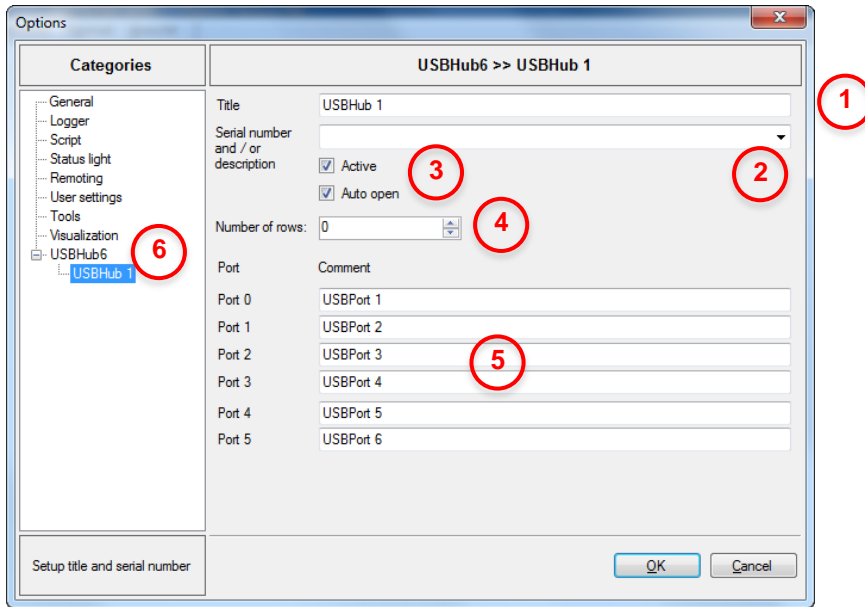


Figure 7: Menu Options

1	A name can be given to the USB hub here.
2	If multiple USB hubs are connected, here you can select which of the names specified above should be controlled.
3	These two checkboxes should always be set.
4	Determines the number of lines on which USB hubs are shown. If this is zero, it is automatically set depending on the size of the window.
5	Here, USB ports can be given names, e.g. the names of the connected devices.
6	In "USBHub6", the number of USB hubs to be controlled can be configured. New USB hubs are given the name "USBHub" with an incrementing number.

The USB hub can be configured using the configuration dialog. This is located in the standard settings under *View → USBHub 1 → USBHub 1 config*:

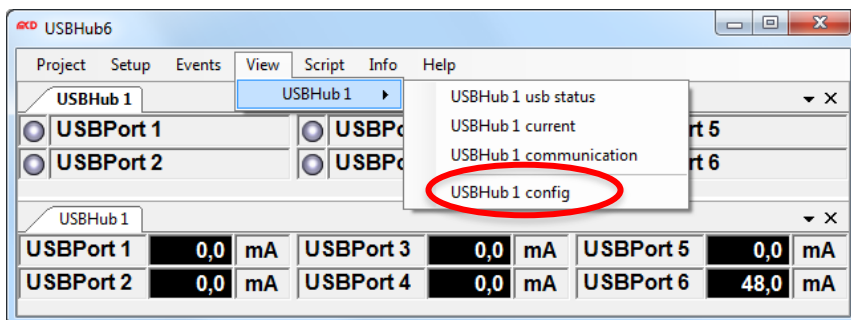


Figure 8: Configuration Dialog

### 6.3. USB Hub Configuration

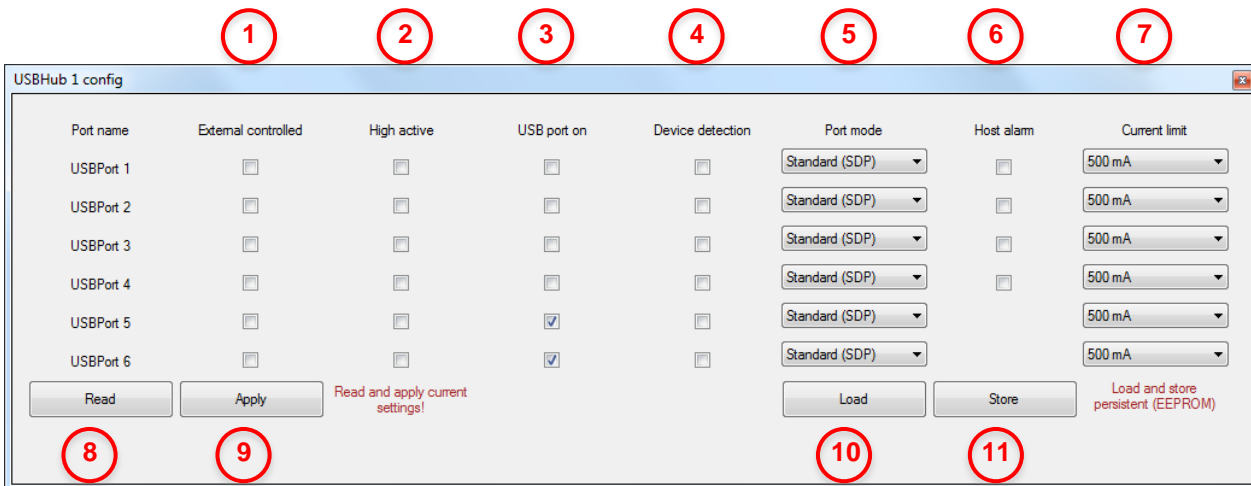


Figure 9: USB hub Configuration

1	A checked box in this column causes the corresponding USB port no longer to be turned on and off via USB, but rather from the corresponding signal on the parallel input.
2	This setting only has an effect if the corresponding port is set to parallel port control ("External controlled"). If this checkbox is checked, the USB port is turned on for a high level on the corresponding parallel input; otherwise, for a low level. An open parallel port input corresponds to a high level.
3	This setting only has an effect if the corresponding port is <u>not</u> set to parallel port control ("External controlled"). Turns the corresponding USB port on when the box is checked.
4	Turns device detection on. In DCP mode and charger emulation, device detection is necessary for correct functioning. Devices that consume less than 1 mA from the USB port are frequently not detected and the port is then not released. For this case, device detection can be turned off.
5	Places the corresponding port into SDP, CDP, DCP, or charger emulation mode.
6	This function reports an excess current event to the operating system and leaves further handling to it. Without this function, the port will turn back on as soon as the overload is removed. Host notification is available only for the first four ports.
7	Sets the current limitation per port. In total, at most 5000 mA can be set. Without a power supply, at most 100 mA per port is permitted (500 mA total).
8	Reads out the current configuration.
9	Applies the configuration set in the dialog. It will be lost when the power supply to the USB hub is lost.
10	Reads out the configuration currently stored.
11	Saves the configuration set up in the dialog, but does not apply it. This configuration is restored by the USB hub after uninterrupted power supply is restored.



### 6.4. USB hub Command Line

Under *View* → *USBHub 1* → *USBHub 1 communication*, a window can be opened for direct communication with the controller in the USB hub:

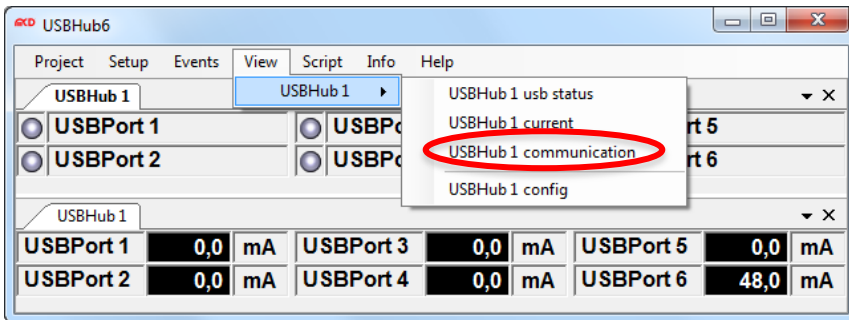


Figure 10: USB hub Command Line

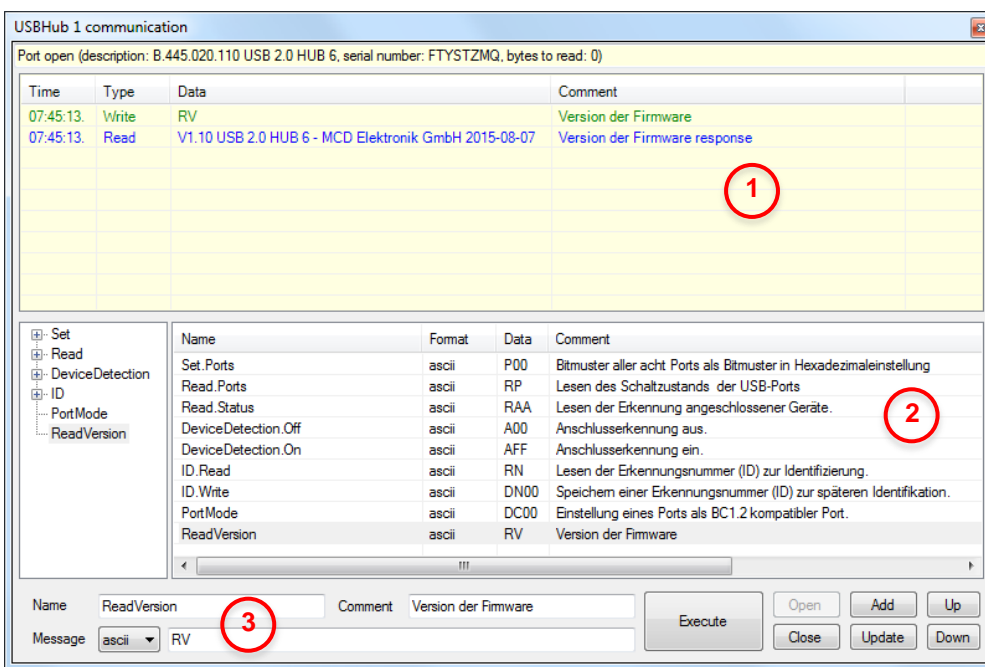


Figure 11: Interface Communications

1	Here, the data traffic between the Toolmonitor and the control unit of the USB hub can be viewed directly.
2	A list of commands that can be extended and changed.
3	Commands can be sent directly to the USB hub here (see chapter 9) to be able to include the command in the list, it must be assigned a name. The comment is optional.
4	When this button is pressed, the command is executed.
5	Opens or closes the control interface to the USB hub. When the interface is closed, the hub is released and other applications can access the USB hub.
6	These buttons can be used to add the command entered on the left into the list, or edit the command.
7	These buttons sort the command currently selected in the list up or down.

## 6.5. Command Line Tool

'USBHubCom.exe' is a small tool which allows communicating with the hub via the command line. This tool may be used in conjunction with batch files.

The syntax is USBHubCom <COM-Port> <command>.

Example: USBHubCom COM3 P03

This switches the first two USB ports of the hub at the virtual COM port 3 on and all other USB ports off. You can find a documentation of all possible commands in chapter 8.

## 7. Technical Data

<b>Electrical Characteristics</b>		
<b>Operating voltage</b>	4.8 V - 5.25 V	Polarity is corrected internally to the device
<b>Power consumption during operation</b>	Typically 150 mA	When not supplying power to connected devices
<b>Connection power</b>	Max. 26 W	Including power supply to connected devices via USB
<b>Output current limitation on USB ports (5 V)</b>	Configurable in steps: from 500 mA / port to 2500 mA / port	480 mA - 500 mA 2370 mA - 2500 mA
<b>Current Measurement</b>	Resolution: better than 10 mA Precision: 2 %	Typically 9,8 mA Current limit not exceeded
<b>Pull - up resistors on parallel input</b>	10 kOhm - 20 kOhm / 3.3 V	
<b>Input voltage on parallel input</b>	0 V - 0.2 V (low level) 2.5 V - 24 V (high level)	Reference level is GND (pins 7 to 10) Open input corresponds to high level
<b>Mechanical Characteristics</b>		
<b>Dimensions (L x W x H)</b>	85 mm x 105 mm x 30 mm	Without connectors or supporting feet
<b>Fastening holes (circuit board)</b>	70 mm x 90 mm	Diameter 3.1 mm
<b>Connections</b>	2 x USB - B	Upstream to host Optional additional control input
	6 x USB - A	Downstream to USB devices Port 1 is at the top left, Port 6 at the bottom right (front view)
	Male shroud connector, 10 pins Grid dimension: 2,54 mm	Parallel control input
	DC connector (hollow plug) Inner diameter: 2.1 mm or 2.5 mm; Outer diam.: max. 6 mm	Optional external power supply
<b>Other Characteristics</b>		
<b>USB version</b>	USB 2.0	Requires a USB 2.0 host high speed / full speed / low speed
<b>Control</b>	Via USB	
<b>Display</b>	6 x green LEDs	For active USB ports
<b>Control interface</b>	Virtual serial port via USB	19200 baud 1 start bit 1 stop bit No handshake
<b>Ambient temperature</b>	0 - 40 °C (32 °F - 104 °F)	

## 8. Interface Description

The command line interface uses simple ASCII strings. Recognized valid commands are acknowledged with the string "ok" if the command is a configuration command. For a read command, the corresponding data is sent. An unrecognized command is answered with "???". In ready mode, all configuration commands are answered with "off". A prefix "D" changes no current settings, but rather specifies a write or read access to the non - volatile memory from which the configuration will be taken when the USB hub is turned on. All strings are terminated with a CR (ASCII 13).

<b>Command</b>	<b>Parameter</b>	<b>Response value</b>	<b>Comment</b>	<b>With prefix "D"</b>
<b>Switching</b>				
P	00 - 3F	ok	Bit mask of all six ports in hexadecimal. A set bit corresponds to an active USB port. Thus if the lowest bit is set, then Port 1 is active, if the third highest bit is set, Port 6 is active. The two top bits are unused.	X
R	P	00 – 3F	Read the switching state (set state) of the USB port	X
R	PP	00 – 3F	Read the switching state (actual state) of the USB port	
R	PO	00 – 3F	Read the error shutoff of the USB port	
R	U	0 – 3	Read which USB connection is active <ul style="list-style-type: none"> <li>• 0 = no connection</li> <li>• 2 = USB 2.0 connection</li> </ul> Port to be read <ul style="list-style-type: none"> <li>• 0 - 5 = downstream port 1 to 6</li> <li>• U= upstream port (host)</li> </ul>	
	0 – 5   U			
Z	00 - 3F	ok	Reverse the polarity of ports (D+ and D-)	X
R	Z	00 – 3F	Read which ports have reversed polarity	X

<b>Command</b>	<b>Parameter</b>	<b>Response value</b>	<b>Comment</b>	<b>With prefix "D"</b>
<b>Port Functionality</b>				
A	00 – 3F	ok	Connection detection on	X
R	A	00 – 3F	Read active connection detection	X
R	AA	00 – 3F	Read the detection of connected devices	
C	0 – 5 0 – 3	ok	USB port to be configured Mode: <ul style="list-style-type: none"> <li>• 0 = standard port (SDP)</li> <li>• 1 = USB-IF BC1.2 charge-capable port (CDP)</li> <li>• 2 = charger emulation (sense should always be active for this!)</li> <li>• 3 = USB-IF BC1.2 dedicated charging port (DCP)</li> </ul>	X
R	C 0 – 5	0 – 3	Read the mode (0 – 3; see above) Port to be read	X
R	B 0 – 5	0 – 9	Read the charger emulation currently in use Port to be read	
L	0 – 5 0 – 5	ok	USB port to be configured Current limitation (see table below) If a total of 5000 mA over all ports is exceeded, an error message ("ILim > 5000 mA") will be emitted and the command ignored.	X
R	L 0 – 5	0 – 7	Read current limitation (see table below) Port to be read	X
H	00 - 0F	ok	Host notification on USB port overload on Port 5 and Port 6 cannot have host notification	X
R	H	00 – 0F	Read active host notification	X
R	I 0 – 5	0000 – 61A8	Read actual current in 0.1 mA steps Port to be read	

<b>Command</b>	<b>Parameter</b>	<b>Response value</b>	<b>Comment</b>	<b>With prefix "D"</b>
<b>Special</b>				
SC	A   E   H	ok	Control connection is selected automatically, always via the external connection or always via the USB hub connection	X
N	00 - FF	ok	Store an ID number for later identification; only with prefix "D"!	X
X	00 – 3F	ok	Bit mask for priority of parallel inputs: <ul style="list-style-type: none"> <li>• 0 = port is turned on and off via USB</li> <li>• 1 = port is turned on and off via the parallel port</li> </ul>	X
Y	00 – 3F	ok	Bit mask for polarity of parallel inputs: <ul style="list-style-type: none"> <li>• 0 = active on low level</li> <li>• 1 = active on high level or open input</li> </ul>	X
R	SC	A   E   H	Read the selection of the control connection	X
R	N	00 – FF	Read the ID for identification	X
R	V	String	Version of the firmware	
R	X	00 – 3F	Read the priority of the parallel inputs	X
R	Y	00 – 3F	Read the polarity of the parallel inputs	X

Table: Parameters for Current Limitation

<b>Parameter</b>	<b>Nominal value of current limitation</b>	<b>Typical</b>	<b>Maximum</b>
0	500 mA	480 mA	500 mA
1	900 mA	850 mA	900 mA
2	1000 mA	950 mA	1000 mA
3	1200 mA	1130 mA	1200 mA
4	1500 mA	1400 mA	1500 mA
5	1800 mA	1720 mA	1800 mA
6	2000 mA	1910 mA	2000 mA
7	2500 mA	2370 mA	2500 mA