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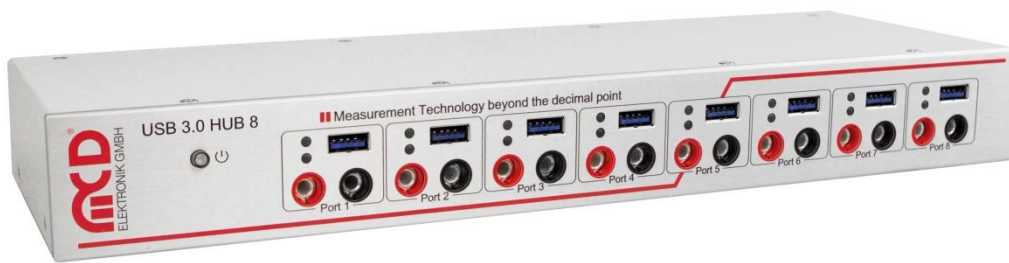
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Manual

USB hub 3.0 8-Port, Switchable



GET IN **touch**
WITH SENSITIVE TESTING

- Softline _____
- Modline _____
- Conline** _____
- Boardline _____
- Avidline _____
- Pixline _____

- Application _____

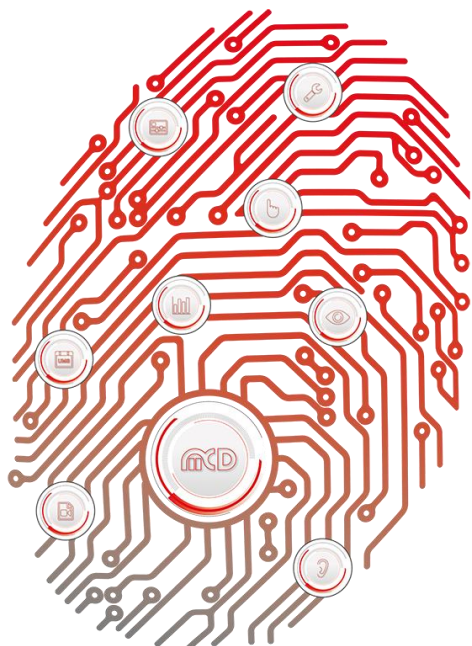


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1. General

This USB hub provides eight USB 3.0 downstream ports, which 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. The control is via ASCII commands or the Toolmonitor USB hub (PC software). Whether or not and which ports are active after switching on the hubs can be stored in non - volatile memory.

Each USB port can be used as standard port (SDP), load - in line (CDP) or as a charger connection (DCP) and provides the connected device up to 2.5 A.

Optionally, sending commands through the USB 3.0 host connection or the additionally available USB 2.0 port is possible. Additionally to the USB ports, the USB hub still has a 8 - channel relay multiplexer, with a centrally supplied voltage individually on each port (max. 30 V) and independently switchable, e.g. device supply with a voltage other than 5 V. The input connection is made via binding posts on the back side while the output connection is made via 4 mm banana plugs on the front side.

Via a button on the device, one can temporarily shut down all ports or restore the previous switching state of all ports. A storable number in the device helps distinguish multiple USB hubs on a PC.

For third - party software, the Toolmonitor USB hub can be completely remote controlled. COM / DCOM or .Net – Assembly is used as an interface. This allows the Toolmonitor USB hub to be integrated in a large number of applications (MCD TestManager CE, LabView[®], Microsoft Visual Studio[®] (C#, C++, Visual Basic), Microsoft Office[®] (e.g. Excel[®]), OpenOffice[®]). There is also a command line tool available. This USB hub 3.0 8-Port can also be implemented for Linux operating systems, if required.

Order number: # 122204

2. Extent of Delivery

1x USB hub 3.0 8-Port
1x USB storage card with installation software
1x USB 3.0 connection cable 2 m
1x power cord 1.8 m

3. Safety Instructions

The USB hub 3.0 8-Port is intended for indoor use only. It must not be exposed to moisture. If the unit is moved from a cold to a warm environment, it must remain untouched and unplugged from all power cords and other cables for at least one hour so that all condensation moisture can dry up.

The unit contains no user serviceable parts. A possible repair must be produced by a trained professional. Before opening the housing, the plug must be pulled out and left alone for about a minute before being serviced.

4. Connection and Installation

4.1. Connecting the Hardware

The USB hub 3.0 8-Port can be powered at an 110 V or 230 V power grid. When turning on the device with the power switch on the back, the front left button lights up. In the default state of the device, all relays are turned on and all USB ports are off, as indicated by the respective signal LEDs. The startup behavior can be changed later.

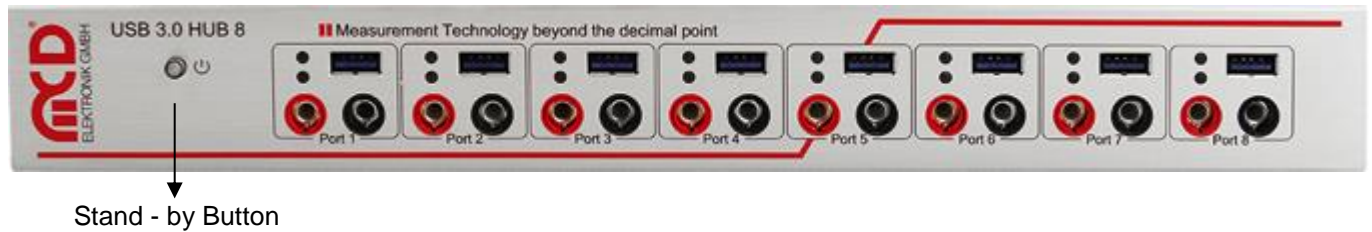


Figure 1: Front Side of the USB hub

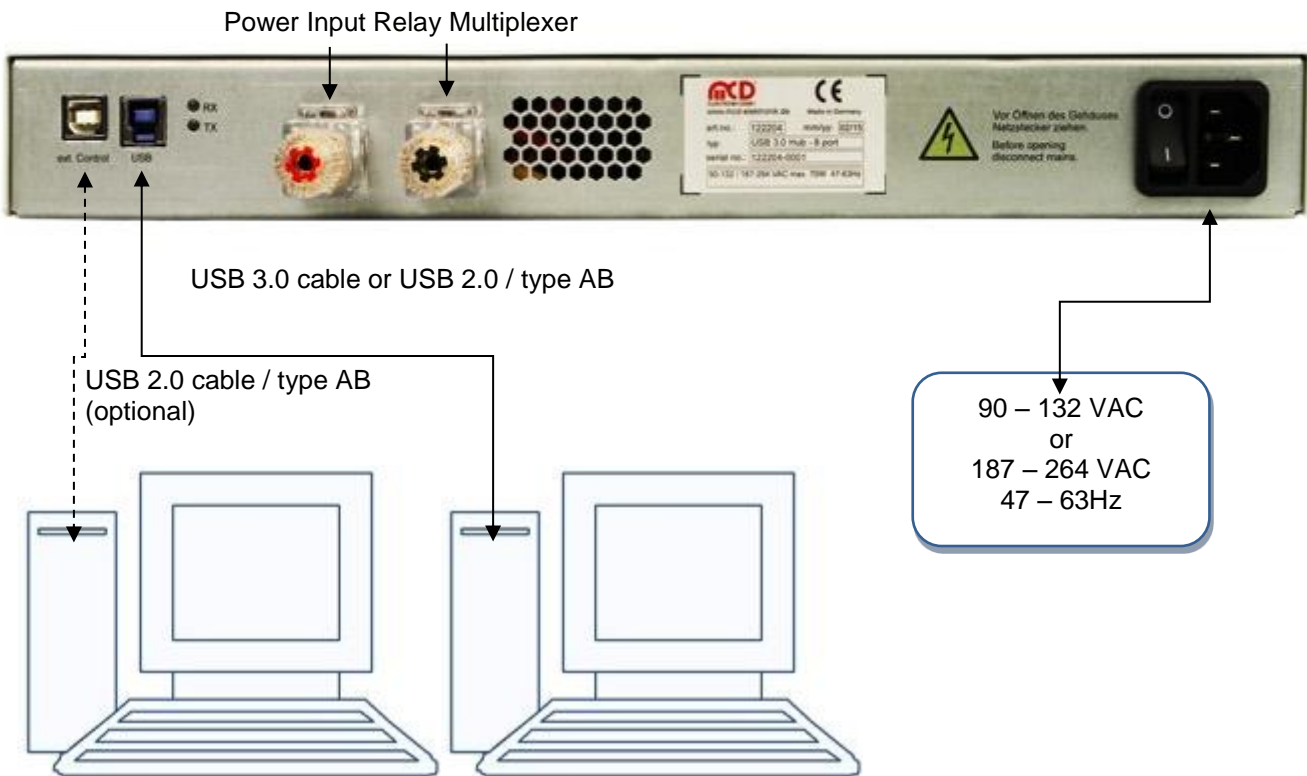


Figure 2: Connecting USB hub to Your PC

4.2. Installing Drivers

Connect USB hub 3.0 8-Port to a free USB port and switch it on at the backside. The actual hub will be automatically detected by Windows® and appropriate drivers will be installed. For the control component an additional driver is needed. For this you have following options:

- 1) With internet access Windows® will automatically download and install the driver.
- 2) You can also download the driver from <http://www.ftdichip.com/Drivers/VCP.htm>.
For simple installation please choose "setup executable".
- 3) If you got the "MCD USBHub8Monitor", then the driver is in the sub directory "USB Driver" of the installation folder. The default installation directory is:

<drive name>:\MCD Elektronik GmbH\MCD USBHub8Monitor\USB Driver

4.3. Installing Toolmonitor USB Hub8

The USB hub 3.0 8-Port can be completely controlled by text commands (see chapter 11 on p. 20). Optionally the Toolmonitor USB Hub8 can be installed as a graphical user interface as well as an interface for other applications. For this, execute the "USBHub8Install" installer (EXE - or MSI file) and follow the installation dialog. After successful installation the Toolmonitor can be started via the Launchpad.

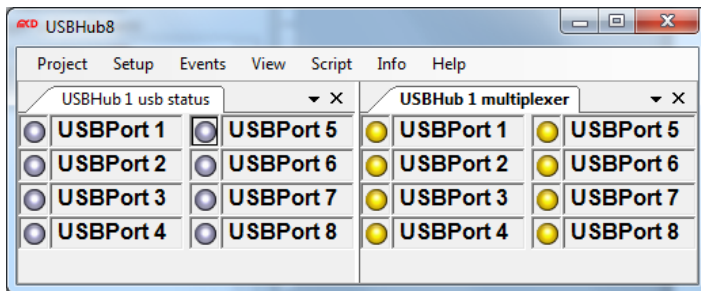


Figure 3: Toolmonitor Interface

In the menu **Setup** → **Register COM Server** the Toolmonitor can be registered and can be controlled remotely by other applications.

5. Introduction

5.1. Properties

- **Relay multiplexer**
 - 8 channels, separately switchable
 - Up to 30 VDC / 5 A per channel resistive load
 - Each channel is provided with a resettable overcurrent protection
 - Indications for channel on, off or overcurrent
- **USB - Downstream ports**
 - 8 Ports, separately switchable; up to 2.5 A per port
 - Each port is provided with a resettable overcurrent protection
 - Adjustable overcurrent protection
 - ⇒ Protection of connected devices by customized overcurrent limits
 - Configurable charger emulation for many mobile devices (z. B. CDP, DCP, etc.)
 - ⇒ An automatic mode applies several charging profiles in order to find a fitting profile
 - Detection when a device is plugged in
 - ⇒ Also detects non - USB devices (for example USB ventilator, reading lamp etc.)
 - Current measurement for each port (resolution app. 10 mA)
 - ⇒ Detection of faults (such as current consumption too high or too low).
 - ⇒ Measurement of current consumption of connected devices
 - Indicators for port on / off / overcurrent / charging / charging complete / no device connected
 - ⇒ Operating status is always visible
- **USB - Upstream port (Host)**
 - Control via USB hub connection or USB control connection
 - ⇒ Hub functionality and controlling the hub over a single connection
 - ⇒ Makes it possible to connect the hub to an embedded device as a host (for example a multimedia device) and control the hub via another host (for example a PC)
 - Disengageable Host notification
 - ⇒ An USB port can automatically be reactivated after an overcurrent event without user intervention
- **Push Button**
 - Indicates current operating status: On / Standby
 - Switches earlier defined or all USB ports and relay channels off
 - ⇒ Possible functionality of a manual Emergency Off
 - ⇒ Switches off specific devices while for example mouse and keyboard stay active
- **Other**
 - Operation on power up (for example active USB ports and relay channels) can be defined and saved
 - ⇒ With the right configuration the hub can function as a stand - alone charging device without any USB host
 - ⇒ Customized and defined operating state after power up
 - User defined tagging of the hub to differentiate several hubs at one PC

5.2. Internal Construction

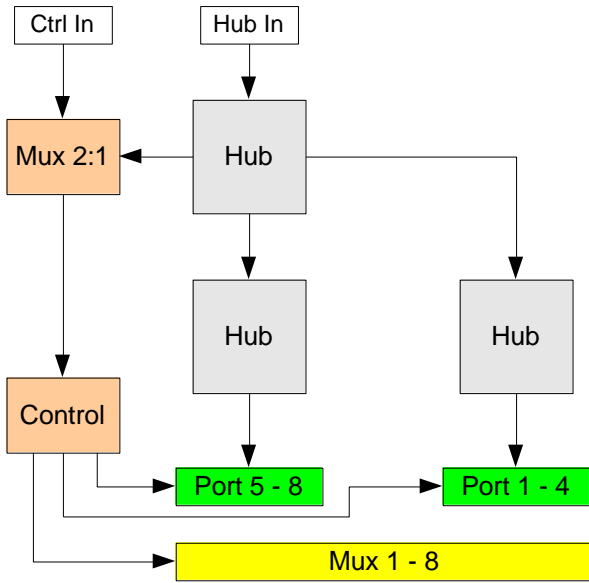


Figure 4: Construction of the USB hub

5.3. Display

○ ○	Relay off
○ ●	Relay on
○ ⊙	Relay off with overcurrent event (fast blinking)
○ ○ ○	USB port off
⊙ ○ ○	USB port on, but no device is connected
● ○ ○	USB port on

Indicators of USB ports configured as charging ports are dimmed when the charging has finished.

5.4. Push Button

○	Device off
● ⊙	In Stand - by mode (depending on production batch: illuminated red or blinking green)
●	In Operation mode

6. Function of the USB Ports

6.1. Operation Modes

The USB hub provides eight super - speed capable USB 3.0 ports. Each port can be placed in one of four modes. These four modes are:

1. Standard port (SDP):
If the maximum current is exceeded, the port is turned off.
2. Charging capable port (CDP):
Like the Standard port, but is detectible as a loading enabled USB port on the connected USB device according to USB Battery Charging Specification V1.2 (USB-IF BC1.2 CDP).
The current is limited to the configured value.
3. Dedicated Charging Port (DCP BC1.2)
The port is detectible as a dedicated charger connected USB device according to USB Battery Charging Specification V1.2 (USB-IF BC1.2 DCP).The current is limited to the configured value.
In this mode, USB communication with the connected device is not possible!
4. Charger Emulation Port
The port reconciles with the connected device on a charging protocol. In addition, different variants are tested sequentially, including BC1.2 DCP, YD/T-1591 (2009) and variants compatible with many portable devices from Apple® and RIM®. The current is limited to the configured value.
In this mode, USB communication with the connected device is not possible!



DCP ports no longer appear in the device manager of Windows®. But they can be active even without a connected host.



Because of the variety - even custom specific - charging schemes, there can be no assurance that the battery charge is achieved with a particular mobile unit and no damage will occur!

6.2. Attach Detection

The USB ports have a feature to detect when a USB device is attached. This also works for attached devices using only the power from the port (e.g. USB fans, or reading lamps). The attach detection can be switched off individually for each port, if the small testing current should lead to unexpected problems.



In the CDP mode it is possible that the connection of such a device is recognized, but its removal is undetected. But this has no effect on the other functions of the USB hub. The connection of a normal USB device or the switching on and off of the port resets the attach detection.

6.3. Current Measurement

The output current of each USB port can be measured with a resolution of 10 mA. This makes it possible to measure and monitor the current consumption or charging current of each connected device. This affects both operating currents of USB devices and non - USB devices as well as charging currents.

6.4. Current Limiting

The current limit for each port can be configured in steps from 500 mA up to 2500 mA for each port separately. Principally, the configuration of the current limit is independent of the operation mode of the port. However, these are the recommended current limits for the several modes:

<i>Operation mode</i>	<i>Current limit</i>
Standard port (SDP)	900 mA – 1000 mA
Charging data port (CDP)	1500 mA – 1800 mA
Dedicated charging port (DCP BC 1.2)	2000 mA – 2500 mA
Charger emulation port	2000 mA – 2500 mA



Most USB connectors are rated for currents of 1.5 A to 1.9 A. Because of this, the current should not be higher than 2000 mA.

6.5. Host Notification

If the current limit is tripped, the operating system is notified about this event. The port switched off and user action in the operating system is required to switch the port back on. This might be undesirable behavior in automated systems. For this purpose host notification to assigned ports or all ports can be turned off. To switch a port without host notification back on, the concerned port has to be purposefully switched off and back on.



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

6.6. USB Connectivity

The USB connectivity for each device as well to the host can be identified to differentiate between a USB 3.0 (super speed) connection and a USB 2.0 connection. This is especially useful for determining if a USB 3.0 connection has been made or if the connection has fallen back to USB 2.0. The connection to the host (PC) can also be queried in this way.

7. Function of the Relay Multiplexer

The relay multiplexer allows outputting an externally supplied voltage for up to eight outputs. Thus, for example, USB devices, which are not operated by USB power supply, can be operated.

The multiplexer can be switched independently from the USB ports. The infeed takes place on the back at the local terminal posts. The consumers are connected on the front side via 4mm banana plugs.

The multiplexers are equipped with a fast overcurrent circuit. In case of an overcurrent event this overcurrent detection switches the regarding output off. Outputs which were switched off because of overcurrent have to be purposefully switched off and back on.

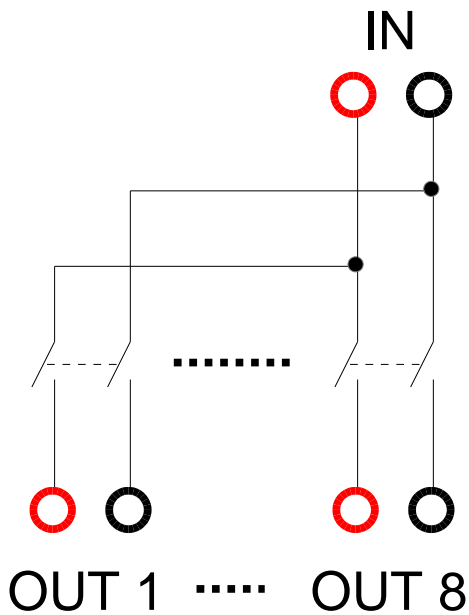


Figure 5: Relay Multiplexer

! Paying attention on a sufficient cross section and good contact of the attractive conductors is essential!

! Overloading the outputs in frequent intervals may result in failure. The current through the red output connectors is monitored and in case of an overload of a corresponding relay switched off. Large currents flowing through the black sockets can destroy the multiplexer! Sourcing power into the output connectors is also not allowed. Also, the currents from several red output connectors must not be returned to one black connector. Sourcing power into the output connectors is also not allowed.

8. Function of the Hub

8.1. Control Input

In delivery condition the control input is chosen automatically. If only the host input is connected, control is done through this connection. If the external control input is also connected, control is ensured through that connection. It is also possible to fix one of the host inputs as control input.

8.2. Startup Behavior

This enables the setting whether the USB hub after startup goes into normal operation or initially goes into the standby mode. If the USB hub goes into normal operation - as previously configured - the ports and multiplexers are connected. If the hub has not yet been enumerated from the host, all communication ports (SDP and CDP) remain off until the enumeration takes place and will only then be switched on. In standby mode the hub will act as if it were transferred in it immediately after the startup (see the following section). Ports for which no exception has been defined are not switched on.

8.3. Standby Mode Behavior

With the button on the front the hub can be offset from the normal mode to the standby mode and back. In standby mode normally all ports and multiplexers are switched off, however, exceptions can be defined for devices, which are not to be switched off (e.g. for mouse / keyboard or for charge ports). Already disconnected ports or multiplexers are not turned back on in standby mode, even if an exception has been defined for them. The hub will reject any command in standby mode for configuration or locating the ports and multiplexer from a PC. Reading accesses will continue to operate. This prevents that by the manual intervention, switched off devices can be inadvertently turned on by the PC again.

8.4. After Standby Mode Behavior

If the USB hub returns into normal mode after the standby mode, it either resets the status of the ports as they were immediately before the standby mode; or it restores the ports into the same state as after switching on the USB hub. Whichever of the two patterns the hub shows, it can be configured.

8.5. Key Lock

The push button can be locked against unintentional operation. If this function is stored, the USB hub is always going to normal operation after switching on.

8.6. Storing of the Configurations

All settings can also be written to non - volatile memory. The current settings are not affected by this. Those settings will be recalled after power - up.



The non - volatile memory cells for configuration are subject to wear and tear (> 100,000 write cycles). The save commands therefore should not be located in a program loop or similar.

8.7. Identification Number

In the hub, a number (00 to FF hexadecimal or 0 to 255 decimal) can be permanently stored, which can later be queried again. This helps to keep more hubs distinguishable on a PC. This number has otherwise no other function.

8.8. Reset

By pressing the push button on the front for about 10 seconds the USB hub is reset to factory settings. The non-volatile memory remains unchanged. The ports and multiplexers are switched accordingly. When the key lock is activated, this function is not possible.

The factory settings are:

- After start up under normal operation
- Automatic selection of the control input
- No exceptions for the standby mode
- After the standby mode restoring to the state before the standby mode
- All USB ports are standard ports (SDP)
- The current limit for each port is 1000 mA
- Host notification is active on all ports
- The attach detection of the USB devices is switched on
- The push button is unlocked
- All USB ports are switched off
- All relay multiplexers are on
- The identification number remains unchanged



By resetting all USB ports are turned off. Do unmount all connected data storage devices from the operating system beforehand.

The relay multiplexers are all switched on. If necessary, remove all the connections where this is undesirable.

9. Software Manual

9.1. Programming Interface

After the Toolmonitor starts, the interface looks like this:

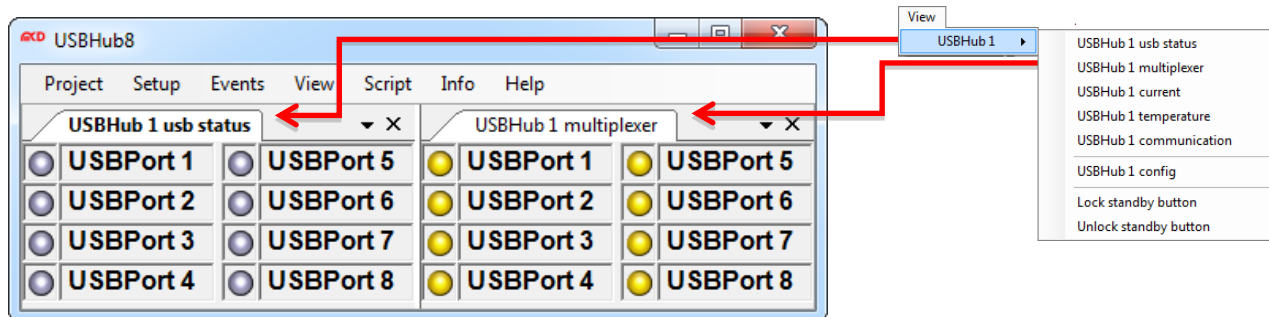


Figure 6: Starting Interface of the Toolmonitor

The switching state of each port and multiplexer output is shown.

Switching state of USB ports	
	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"> Excess current shutoff Connected device feeds current back into the USB hub

Switching state of relay multiplexer outputs	
	Output turned off
	Output turned on; no connected device detected
	Output is off because off an overcurrent event. To reactivate, turn output off and on again.

The supply or charging current out of the USB ports as well as the internal temperature of the device can also be displayed.

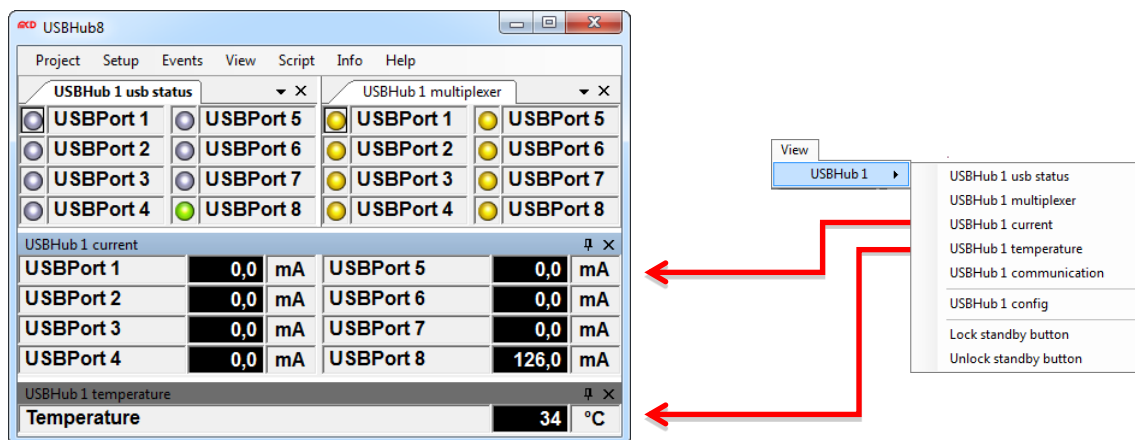


Figure 7: Display the Supply or Charging Current per Port

The program help provides further information. The following are the main features:

9.2. Program Settings

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

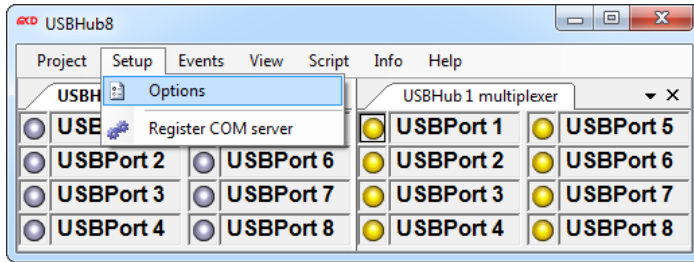


Figure 8: Enter Program Settings

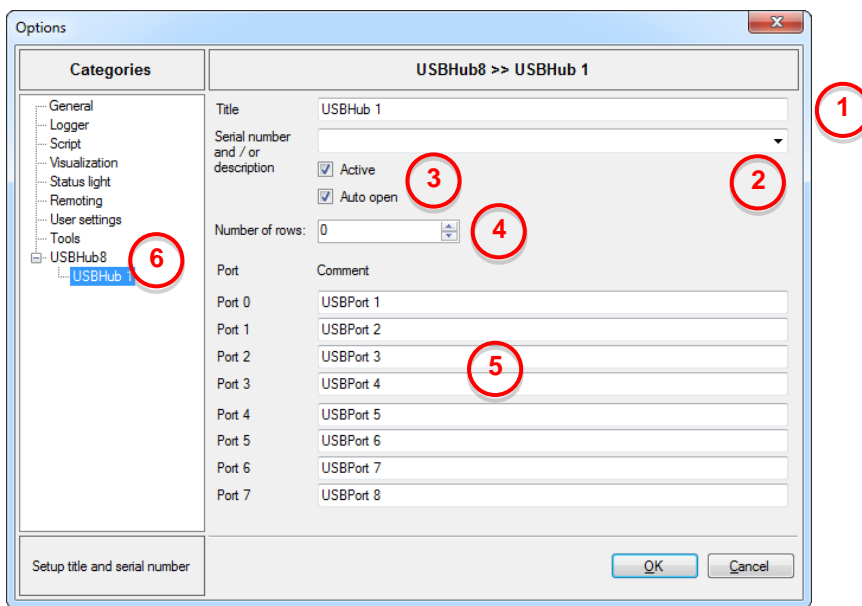


Figure 9: Menu Options

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. The same names are used for associated relay multiplexer outputs.
6	In "USBHub8", 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*.

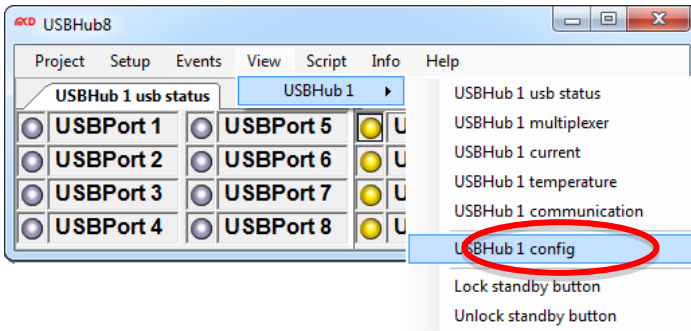


Figure 10: Configuration Dialog

9.3. USB Hub Configuration

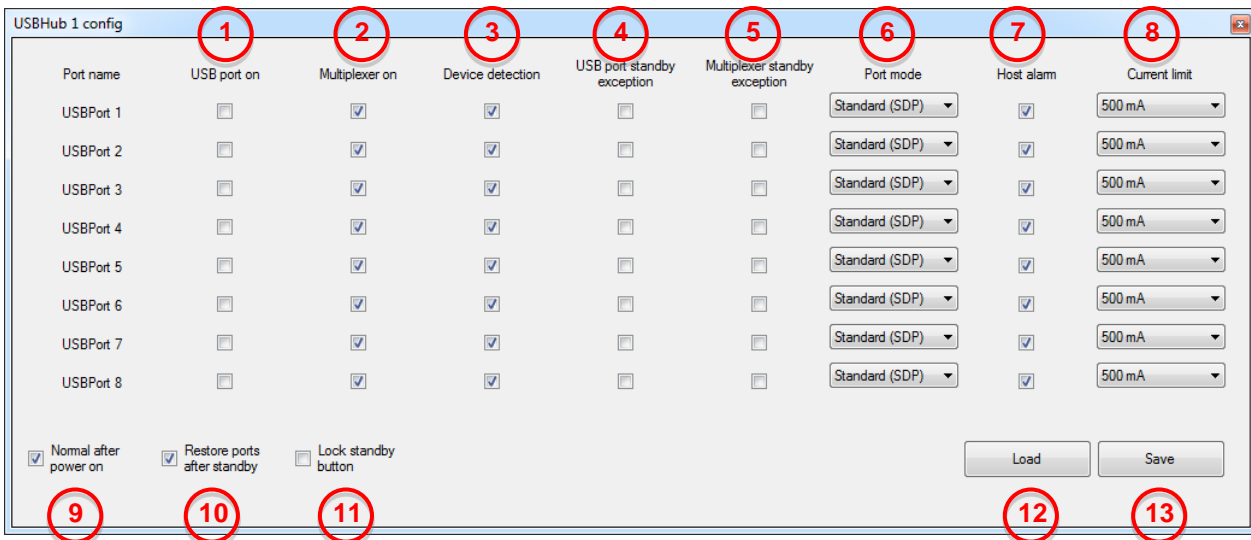


Figure 11: USB hub Configuration

1	On power up, the corresponding USB port is switched on when the box is checked.
2	On power up, the corresponding relay multiplexer output is switched on when the box is checked.
3	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.
4	Places an exception for the corresponding USB port. Such a port will not be influenced by standby.
5	The same for the relay multiplexer outputs.
6	Places the corresponding port into SDP, CDP, DCP, or charger emulation mode.
7	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.
8	Sets the current limitation per port.

9	If this option is active then the USB ports and relay multiplexer output are switched as configured when power is switched on. Otherwise the behavior is like the standby button was pushed at power on and only ports and outputs with exceptions applied can switch on.
10	With this option the USB hub restores the ports and multiplexer outputs after standby as they were before. Otherwise the power - up configuration is restored.
11	Activating this option disables the button on the front. The hub will always switch on normally after power - up so the function of item 9 does not apply.
12	Reads out the configuration currently stored.
13	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.

9.4. 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:

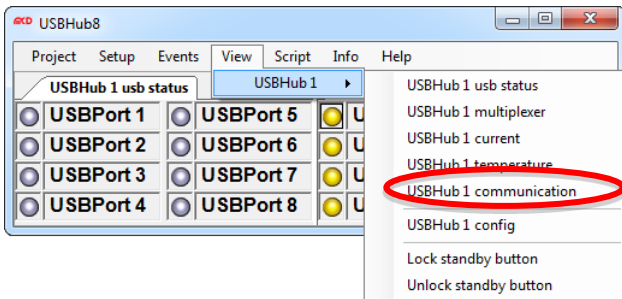


Figure 12: USB hub Command Line

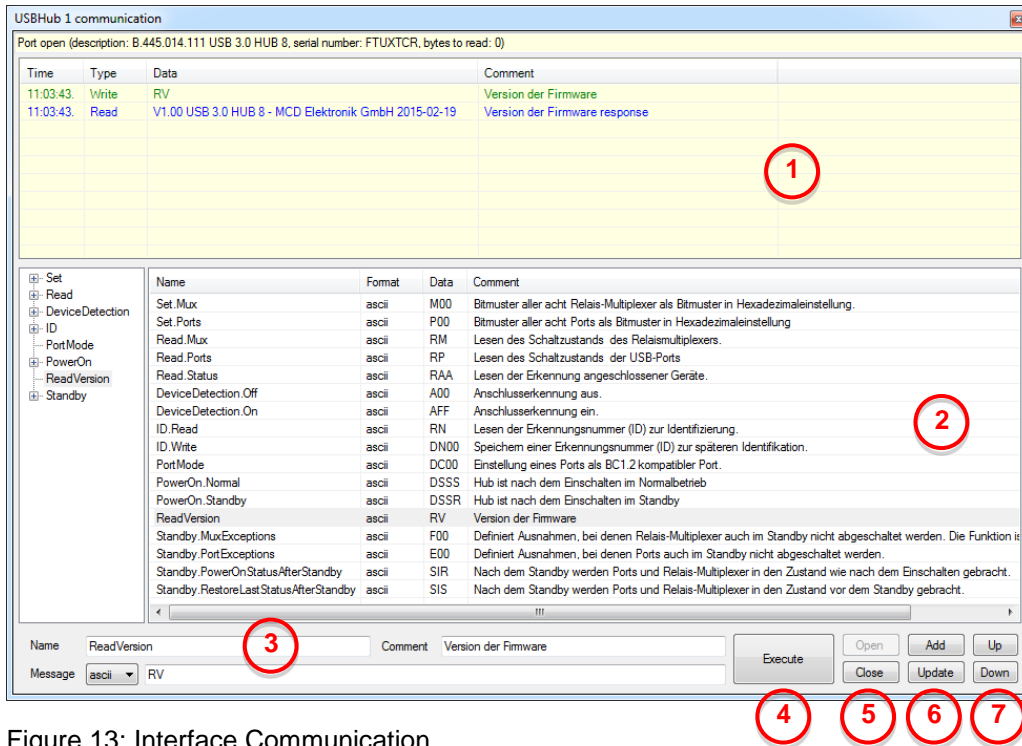


Figure 13: Interface Communication

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 11) 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.

9.5. 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 11.

10. Technical Data

Electrical Features		
Operating voltage	90 – 132 / 187 – 264 VAC 47 – 63 Hz	Disconnect device prior to changing!
Power	Max. 100 W	Power supplying of connected devices at the USB ports included
Output current limit of USB ports (5 V)	Adjustable: from 500 mA / Port to 2500 mA / Port	480 mA ... 500 mA 2370 mA ... 2500 mA
Connection values voltage input	Max. 30 VDC / 40 A	
Connection values voltage output	Max. 30 VDC / 5 A per output Resistive load Minimal load: 10 mA at 5 VDC	Automatic switch off at approx. – 4.5 A / + 5.5 A
Mechanical Features		
Frame size (H x W x D)	44mm x 350mm x 115mm	Without connected plugs and stand
Connections	IEC connector	Power supply (backside)
	1x USB - B 3.0	Upstream to the host (backside)
	1x USB - B 2.0	Alternative control input to a second host (backside)
	8x USB - A 3.0	Downstream to the USB devices; Port 1 on the left, port 8 on the right (front view)
	1x 2 terminal post 4 mm	Voltage feed (backside)
	8x 2 banana plugs 4 mm	Switched voltage output (front view)
Other Features		
USB version	USB 3.0	Requires a USB 3.0 Host (with a USB 2.0 Host only USB 2.0 functionality)
Control	Via USB	
Display	8x LED green	For activated USB ports
	8x LED yellow	For activated voltage outputs
	Illuminated button	Green = Normal operation Red = Standby
Control interface	Virtual serial port via USB	19200 baud 1 start bit 2 stop bits No handshake
Ambient temperature	0 – 40°C (32° F – 104° F)	
Weight w/o accessories	1.4 kg (3 lb)	

11. Interface Description

The command interface uses simple ASCII strings. Recognized and valid commands are acknowledged with the string "ok" when there is a setting command. Via a read command, the corresponding data are transmitted. An unrecognized command will be answered with "???". In standby mode, all writing commands will be answered with "off". A leading prefix "D" does not change any current settings, but writes or reads to the non - volatile memory, the settings that are taken from the hub when turned on. All strings are completed with a CR (ASCII 13).

Command	Parameter	Return Value	Comments	With prefix „D“
Switching				
P	00 - FF	ok	Bit pattern of all eight ports as bit pattern in hexadecimal setting. A set bit corresponds to an active USB port. If the least significant bit is set, then port 1 is active; if the most significant bit is set, port 8 is active.	X
M	00 - FF	ok	Bit pattern of all eight relay multiplexers as bit pattern in hexadecimal setting. The evaluation of this parameter is as described above.	X
R	P	00 – FF	Reading of desired switching condition of the USB ports.	X
R	PP	00 – FF	Reading of actual switching condition of the USB ports.	
R	PO	00 – FF	Reading of the USB ports switched off after failure.	
R	U 0 – 7 U	0 – 3	Reading of USB connection status; <ul style="list-style-type: none"> • 0 = no connection • 1 = USB 3.0 connection • 2 = USB 2.0 connection • 3 = USB 2.0 and USB 3.0 connection USB port to read from: <ul style="list-style-type: none"> • 0 – 7 = Downstreamport 1 to 8 • U = Upstreamport (Host) 	
R	M	00 – FF	Reading of desired switching condition of the relay multiplexer.	X
R	MM	00 – FF	Reading of actual switching condition of the relay multiplexer.	
R	MO	00 – FF	Reading of the relay multiplexer switched off after failure.	

Command	Parameter	Return Value	Comments	With prefix „D“
Port Functionality				
A	00 – FF	ok	Connection Detection On (Sense)	X
R	A	00 – FF	Reading of the active connection detection	X
R	AA	00 – FF	Reading of the recognition of connected devices	
C	0 – 7 0 – 3	ok	USB port to be set, mode of operation: <ul style="list-style-type: none"> • 0 = Standard Data Port • 1 = Charging Data Port (CDP) according to BC1.2 • 2 = Enhanced Charging Port (ECP) Multiprotocol (Sense should be active for this function!) • 3 = Dedicated Charging Port (DCP) according to BC1.2 	X
R	C 0 – 7	0 – 3	Read the operating mode (0-3, see above) Port to read from	X
R	B 0 – 7	0 – 9	Read the currently used charger emulation Port to read from	
L	0 – 7 0 – 7	ok	Port to set Current Limit (see table below)	X
R	L 0 – 7	0 – 7	Reading Current Limit (see table below) Port to read from	X
H	00 - FF	ok	Define which USB ports report to Host OS in case of an overcurrent event	X
R	H	00 – FF	Read reporting USB ports	X
R	I 0 – 7	0000 – 61A8	Reading the USB port current in 0,1 mA units Port to read from	
Behavior when switched on				
SS	S R	ok	Device status after power S = Hub is in normal operation after being turned on R = Hub is on standby after being turned on Only with prefix "D"!	X
R	SS	S R	Reading of device status after power on	X

Command	Parameter	Return Value	Comments	With prefix „D“
Behavior during standby				
E	00 – FF	ok	Defines exceptions where ports are not switched off in standby. Were the ports however off before standby, then they will stay off. Evaluation of the parameter is on the command 'P' as described above.	X
F	00 – FF	ok	Defines exceptions where relay multiplexers are not turned off in standby mode. The function is the same as with the ports.	X
R	E	00 – FF	Reading of the exceptions for the USB ports.	X
R	F	00 – FF	Reading of the exceptions for the relay multiplexer.	X
Special				
ST	S R	ok	Lock (S) or release (R) push button.	X
SI	S R	ok	Port setting according to standby mode: S = as before standby mode R = as after switching on	X
SC	A E H	ok	Choosing the control input: A = automatic (external when connected, otherwise hub) E = always via external connection H = always via hub input	X
N	00 - FF	ok	Reading of the identification number (ID) to identify; only with prefix "D"!	X
R	ST	S R	Reading of the push button lock.	X
R	SI	S R	Reading of the port setting according to standby mode.	X
R	SC	A E H	Reading the chosen control input configuration.	X
R	N	00 – FF	Reading of the identification number (ID) to identify.	X
R	T	00 – FF	Reading the internal device temperature. Value is 2s complement in °C.	
R	V	String	Version of the firmware.	

Table: Parameters for Current Limit

Parameter	Value Current Limit	Typical	Maximum
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