ELEKTRONIK GMBH

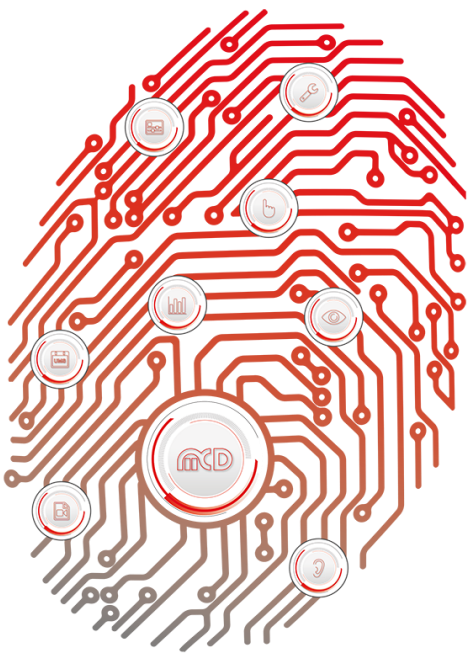
GET IN touch
WITH SENSITIVE TESTING

Softline
Modline
Conline
Boardline
Avidline
Pixline

Application

Manual

USB hub 2.0 8-Port, Switchable



MCD Elektronik GmbH
Hoheneichstr. 52
75217 Birkenfeld
Tel. +49 (0) 72 31/78 405-0
Fax +49 (0) 72 31/78 405-10
info@mcd-elektronik.de
www.mcd-elektronik.com
HQ: Birkenfeld
Managing CEO: Bruno Hörter
Register Court Mannheim
HRB 505692

Template version: 5.4 / 2018-04-09
V2.10 2021-04-27 MR (JJ)

Table of Contents

1. General

This USB hub has eight USB 2.0 downstream ports that can be turned on and off individually via USB. When they are turned off, the power supply (+ 5 V) and the data lines are isolated by semiconductor switches. The control is provided by the USB hub Toolmonitor (PC software).

Each USB port can be configured as a standard port (SDP), charging - capable connection (CDP), or a charger connection (DCP) and provides the connected device with up to 2.5 A.

In addition to the USB ports, the USB hub also has an 8 - channel relay multiplexer that can be used to turn a centrally connected voltage (at most 48 V) on each port individually on and off independently from one another, for example for supplying a device with a voltage other than 5 V. The connection uses a 4 mm banana plug.

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

A switch on the device can be used to turn off all ports temporarily or to restore the previous switching state of all ports.

A number that can be stored in the device can be used to distinguish between multiple USB hub 2.0 8-Port units on a PC.

External software can be used to control the USB hub Toolmonitor completely remotely. COM / DCOM or a .Net assembly can be used as the interface. This allows the USB hub Toolmonitor 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: # 121142

2. Extent of Delivery

1x USB hub 2.0 8-Port
1x USB storage card with installation software
1x USB 2.0 connection cable 0,8 m
1x power cord 1.8 m

3. Safety Instructions

The USB hub 2.0 8-Port is intended for use indoors. It may not be exposed to moisture. If the device is brought from a cold environment into a warm one, it must be allowed to stand for at least one hour without the power cord and other cables connected until any condensation moisture has dried.

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, disconnect the power cord and wait for about a minute.

4. Connection and Installation

4.1. Connecting the Device

The USB hub 2.0 8-Port can optionally be operated on 110 V or 230 V power grids. The power switch on the back turns the device on and the button on the front left lights up. When delivered, all relays turn on and all USB ports are off. This is indicated by the different signal LEDs. The power - on behavior can be changed later.

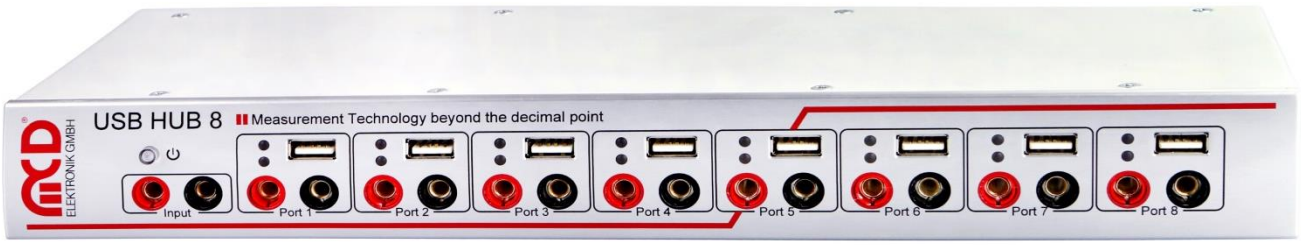


Figure 1: Front View of the USB hub

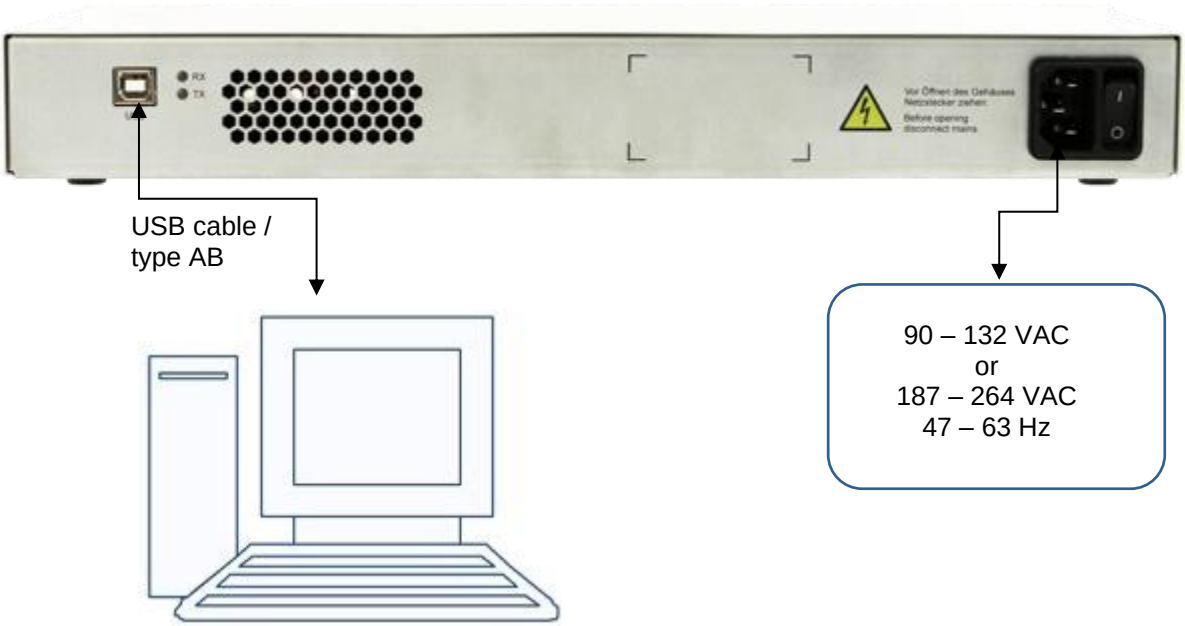


Figure 2: Connecting the USB hub to your PC

4.2. Installing Drivers

Connect the USB hub 2.0 8-Port to a free USB port and turn it on with the switch on the back The actual hub will be automatically detected by Windows® and appropriate drivers will be installed.. Additional drivers are required for the control components. The following options are available:

1) If the PC has access to the Internet, starting with Windows 7® the driver is automatically loaded and installed by Windows® Update.
2) Alternatively, the driver can be loaded and installed from http://www.ftdichip.com/Drivers/VCP.htm.
   For a simple installation, please click "setup executable".
3) If "MCD USBHub8Monitor" is included, after it is installed the driver can be found and installed in the "USB Driver" directory of its installation directory.
   By default, the installation path is:
   <Drive name>:\MCD Elektronik GmbH\MCD USBHub8Monitor\USB Driver

4.3. Installing Toolmonitor

The USB hub 2.0 8-Port can be completely controlled via text commands (see Chapter 11 on p. 20). Optionally, the “USBHub8Monitor” can be installed as a graphical user interface and as an interface for other applications. To do this, start the USBHub8Install installer (EXE or MSI file) and follow the instructions in the installation dialog. After installation, the Toolmonitor can be started from the start menu.

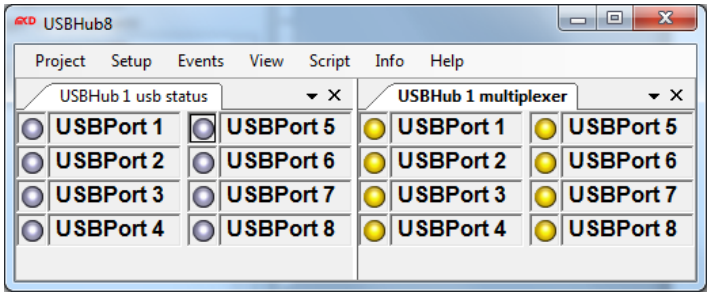


Figure 3: Toolmonitor Interface

Under **Setup → Register COM Server**, the Toolmonitor can be registered so that it can be controlled from other applications.

5. Introduction

5.1. Features

- **Relay multiplexer**
  - 8 channels, individually switchable
  - Up to 48 VDC / 2 A (max. 30 W) per channel under resistive load
  - Display for channel on or off
- **USB downstream ports**
  - 8 ports, individually switchable with up to 2.5 A per port
  - 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
    - ⇨ Also detects 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**
  - Controlled from USB hub connection
    - ⇨ Hub functionality and control of the hub with just one cable
- **Button**
  - Indicates operating / ready mode on
  - Turns off previously determined or all USB ports and relay channels
    - ⇨ Can provide the function of an emergency stop
    - ⇨ If necessary, turns only certain devices off, while for example the mouse and keyboard remain active
- **Other**
  - 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 hub to distinguish it from other USB hubs on the controlling host

5.2. Construction

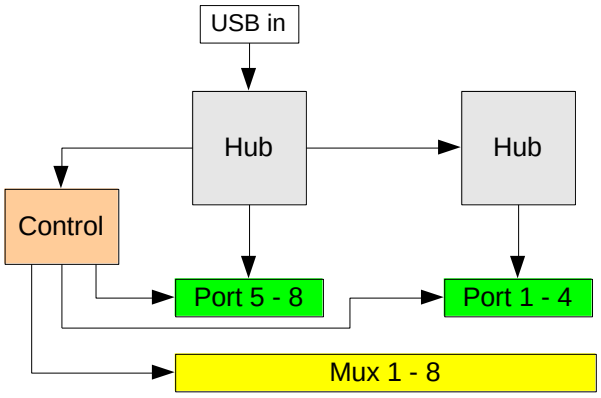


Figure 4: Construction of the USB hub

5.3. Display

	Relay turned off
	Relay turned on
	USB port turned off
	USB port turned on, but no device connected
	USB port turned on

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

5.4. Button

	Device turned off
	Ready mode
	Normal mode

6. Function of the USB Ports

6.1. Operating Modes

The USB hub provides eight 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).
   The current is limited to the maximum possible value.
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. Dedicated charging port (DCP)
   The port attempts to negotiate a charging protocol with the connected device. To do this, it tries different variants one after the other, 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 maximum possible value.
   In this mode, no USB communication is possible with the connected device!

DCP connections can also be active without a host connected.

Due to the many charging schemes – some of which are manufacturer - specific – there is no guarantee that battery charging will succeed with a particular mobile device and that no damage can result!

6.2. 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 such a device, but does not detect when it is disconnected. This has no effect on the other functions of the USB hub, however. Connecting a normal USB device or turning the port on and off will reset connection detection again.

6.3. 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.

6.4. 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:

Mode	*Current limitation*
Standard port (SDP)	900 mA – 1000 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.

7. Function of the Relay Multiplexer

The relay multiplexer makes it possible to emit an externally powered voltage on up to eight outputs. This permits, for example, USB devices to be powered that cannot be operated with operating voltage via USB.

The multiplexers can be switched independently of the USB ports. The connection uses a 4 mm banana plug.

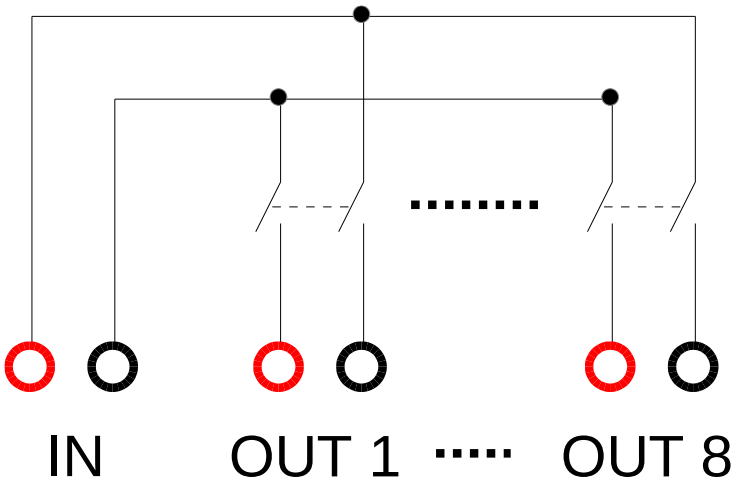


Figure 5: Relay Multiplexer

The multiplexers are not fused. They can be damaged in case of overload.

8. Function of the USB hub 2.0 8-Port

8.1. Behavior when Power is Applied

It can be determined whether the USB goes into normal mode after power is turned on, or initially into ready mode. If normal mode is active, then the ports and multiplexers are turned on as configured in advance. If the hub has not yet been enumerated by the host, all communications ports (SDP and CDP) remain off until enumeration is complete and will only then be turned on.
In ready mode, the hub acts as though it had been placed in ready mode immediately after being turned on (see next section). Ports for which no exceptions are defined are not turned on.

8.2. Behavior in Ready Mode

The button on the front panel can be used to switch the USB hub from normal mode into ready mode and back. In ready mode, all ports and multiplexers are normally turned off; however, exceptions can be defined for devices that should not be turned off (e.g. for the mouse / keyboard or for charging ports). Ports or multiplexers that are already switched off, however, are not turned back on in ready mode, even if an exception has been defined for them. In ready mode, the hub rejects any command for configuration or setting of ports or multiplexers from the PC. Read accesses continue to work. This prevents devices turned off manually from being turned back on by the PC unintentionally.

8.3. Behavior after Ready Mode

If the USB hub returns to normal mode after ready mode, it either restores the state of the ports immediately before ready mode or switches the ports to the same state as before the USB hub was turned on. Which of these two behavioral patterns is followed can be configured.

8.4. Button Lock

The button can be locked against unintentional actuation. If this function is saved, the USB will always go into normal mode after being turned on.

8.5. Saving the Configuration

All settings can also be written to the hub for storage. In this case, the currently active settings are not affected. Saved settings will be restored the next time the hub is turned on.

The storage cells for configuration are subject to a certain amount of wear (> 100,000 write cycles). The storage commands should therefore not be executed within a program loop or something similar.
The USB ports always change mode only after the device is turned off and on again.

8.6. Recognition Number

The USB hub can permanently store a number (00 to FF hexadecimal, or 0 to 255 decimal) that can be queried later. This helps distinguish between multiple hubs on a PC. Otherwise, this number has no function.

8.7. Resetting

Pushing the button on the front panel for about 10 seconds resets the USB hub to factory settings. The hub then restarts. The ports and multiplexers will be switched accordingly. This must be followed by the corresponding command. If the button lock is active, this function is not possible. The factory settings include:

- Normal mode after power on
- No exceptions for ready mode
- After ready mode, restore the state from before ready mode
- All USB ports are standard ports (SDP)
- Current limitation of all ports is 2.5 A
- Connection detection for USB devices is enabled
- The button is unlocked
- All USB ports are off after the USB hub is turned on
- All relay multiplexers are on after the USB hub is turned on
- The recognition number is not changed

All USB ports are turned off by a reset. Disconnect all connected storage media from the operating system previously.
The relay multiplexers will all be turned on. Disconnect any connections for which this is not desired.

9. Software Manual

9.1. Programming Interface

After the Toolmonitor starts, the interface looks like this:

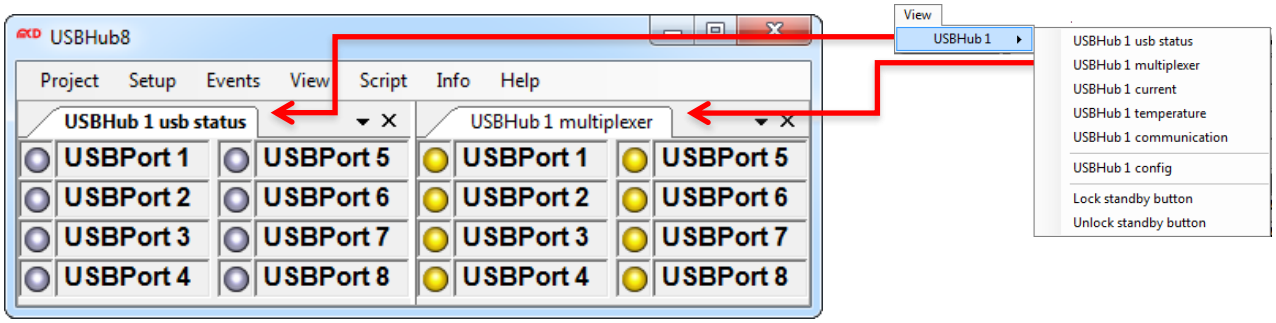


Figure 6: Starting Interface of the Toolmonitor

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: • 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

The supply or charging current out of the USB ports can also be displayed.

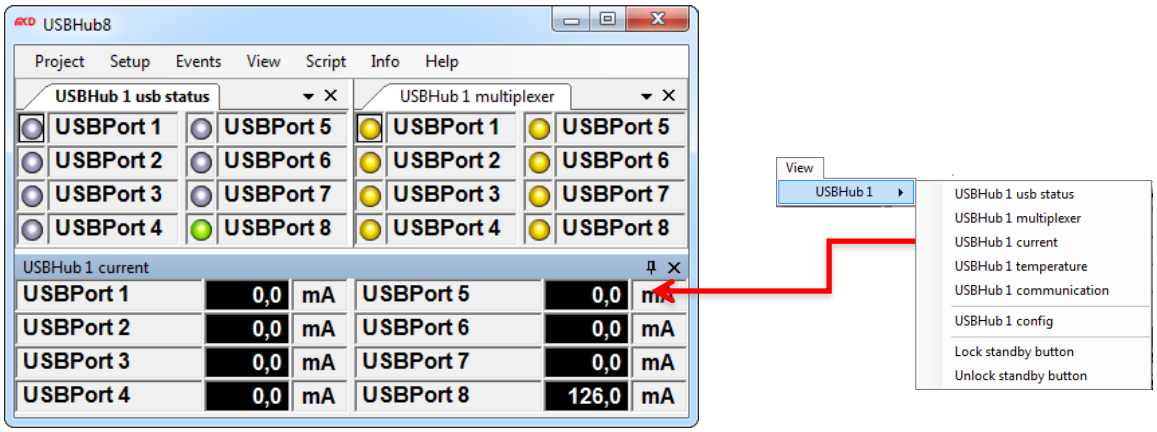


Figure 7: Display the Supply or Charging Current per Port

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.

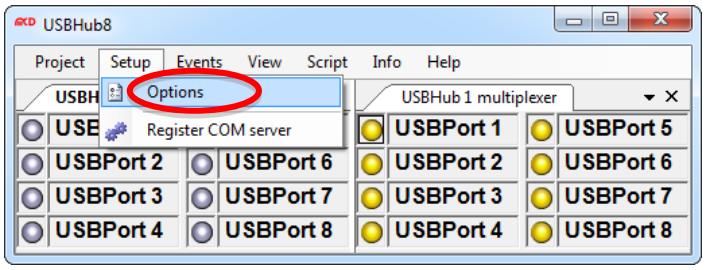


Figure 8: Enter Program Settings

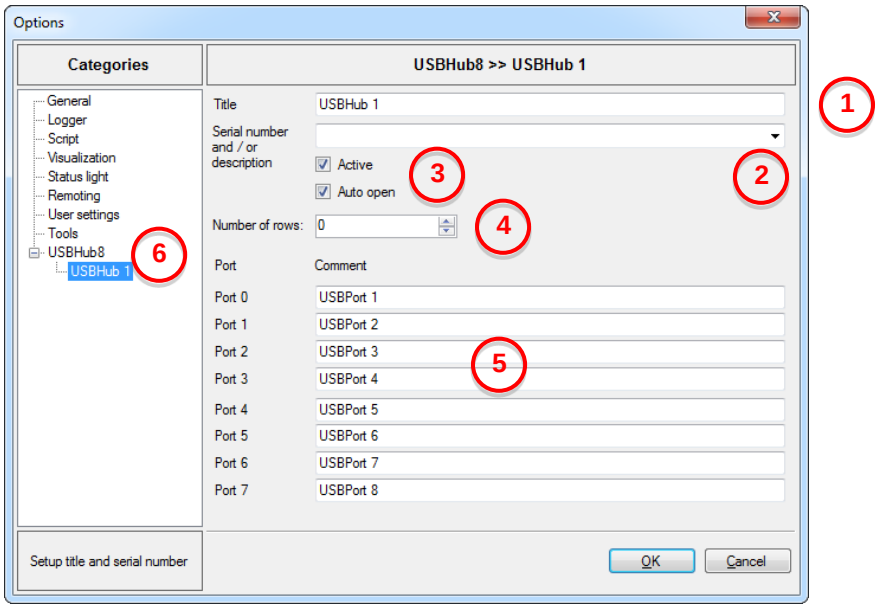


Figure 9: Menu Options

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*:

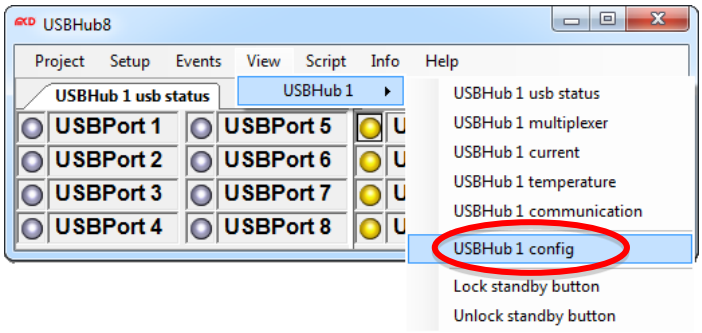


Figure 10: Configuration Dialog

9.3. **USB Hub Configuration**

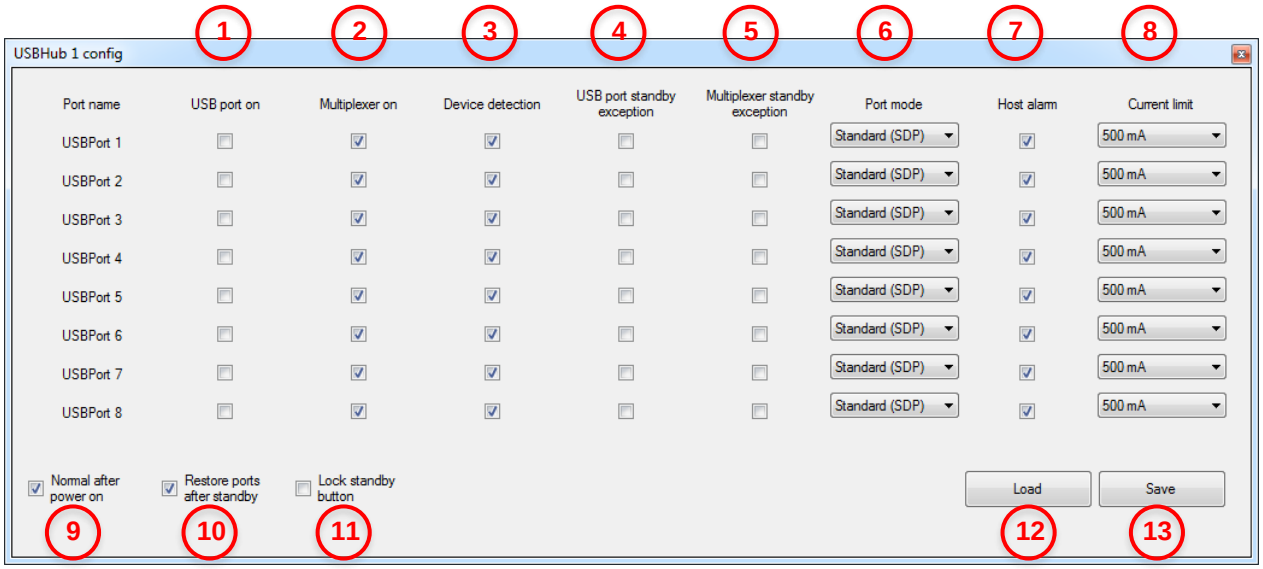


Figure 11: USB hub Configuration

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:

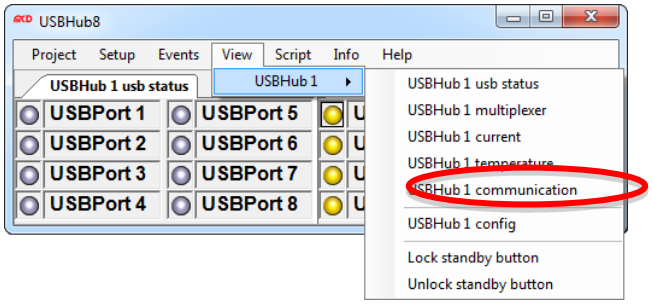


Figure 12: USB hub Command Line

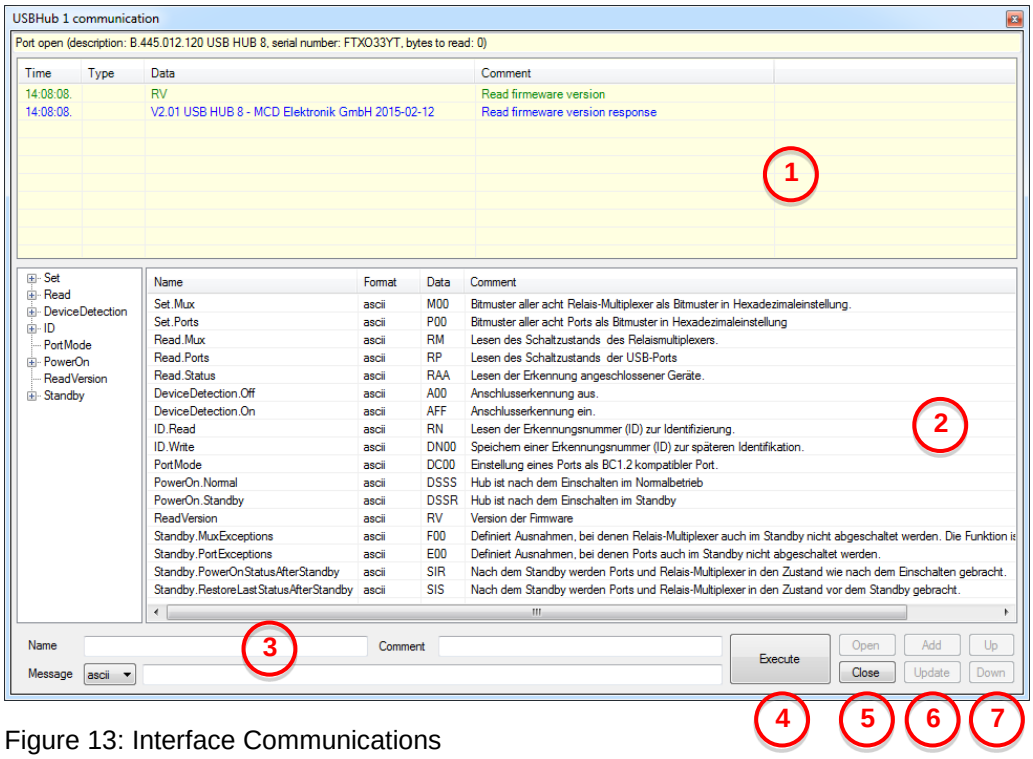


Figure 13: Interface Communications

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 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.

9.1. **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 chapter11.

9.2. Example Program for Remote Control

For Remote Control, the virtual COM port is to be opened first (for example COM8). Then the ASCII command is sent (for example P01) and the response is read. A list of all possible commands can be found in chapter 11 of this manual.

Here is an example implementation for remote control where you have two parameters: The interface name and command to be sent. In this example you would call the program with *USBHubCom <interface> <command>* (for example USBHubCom COM8 P01).

```
using System;
using System.IO.Ports;

namespace USBHubCom
{
    class Program
    {
        static void Main(string[] args)
        {
            try
            {
                if (args.Length == 2)
                {
                    string response = SendReceive(args[0], args[1]);
                    Console.WriteLine(response);
                }
                else
                {
                    Console.WriteLine("Usage:");
                    Console.WriteLine();
                    Console.WriteLine("USBHubCom <PortName> <Command>");
                    Console.WriteLine();
                    Console.WriteLine("for example:");
                    Console.WriteLine();
                    Console.WriteLine("USBHubCom COM8 P01");
                    Console.WriteLine();
                }
            }
            catch (Exception ex)
            {
                Console.WriteLine(ex.Message);
            }
        }

        private static string SendReceive(string portName, string command)
        {
            using (SerialPort serialPort = new SerialPort(portName, 19200, Parity.None, 8, StopBits.One))
            {
                serialPort.Handshake = Handshake.None;
                serialPort.WriteBufferSize = 256;
                serialPort.ReadBufferSize = 256;
                serialPort.WriteTimeout = 3000;
                serialPort.ReadTimeout = 3000;
                serialPort.NewLine = "\x0D";

                serialPort.Open();

                try
                {
                    serialPort.DiscardInBuffer();
                    serialPort.DiscardOutBuffer();
                    serialPort.WriteLine(command);
                    return serialPort.ReadLine();
                }
                finally
                {
                    serialPort.Close();
                }
            }
        }
    }
}
```

10. Technical Data

Electrical Characteristics		
Operating voltage	90 – 132 / 187 – 264 VAC 47 – 63 Hz	When changing the input voltage, turn off the device first!
Connection power	Max. 100 W	Including power supply to connected devices via USB
Output current limitation on USB ports (5 V)	Configurable in steps: From 500 mA / port To 2500 mA / port	 450 mA – 500 mA 2250 mA – 2500 mA
Connection values for input voltage	Max. 48 V / 10A	
Connection values for output voltage	Max. 48 V / 2 A per output Maximum switched power 30 W	Total current on all outputs may not exceed 10 A
Mechanical Characteristics		
Dimensions (H x W x D)	44 mm x 350 mm x 115 mm	Without connectors or supporting feet
Connections	Cold - device plug	Power supply (back)
	1 x USB - B	Upstream to host (back)
	8 x USB - A	Downstream to USB devices Port 1 is at the top left, Port 8 at the bottom right (front view)
	1 x 2 banana plugs 4 mm	Power supply (front)
	8 x 2 banana plugs 4 mm	Switched power output (front)
Other Characteristics		
USB version	USB 2.0	Requires a USB 2.0 host
Control	Via USB	
Display	8 x green LEDs	For active USB ports
	8 x yellow LEDs	For active voltage outputs
	Illuminated button	Green = normal mode Red = ready mode
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 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).

Command	***Parameter***	***Response value***	***Comment***	***With prefix "D"***
Switching				
P	00 - FF	ok	Bit mask of all eight 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 highest bit is set, Port 8 is active.	X
M	00 - FF	ok	Bit mask of all eight relay multiplexers in hexadecimal. The parameters are evaluated as described above.	X
R	P	00 – FF	Read the switching state (set state) of the USB port.	X
R	PP	00 – FF	Read the switching state (actual state) of the USB port.	
R	M	00 – FF	Read the switching state of the relay multiplexer.	X
Port Functionality				
A	00 – FF	ok	Connection detection on.	X
R	A	00 – FF	Read active connection detection.	X
R	AA	00 – FF	Read the detection of connected devices.	
C	0 – 7 0 – 3	ok	USB port to be configured Mode: • 0 = Standard port (SDP) • 1 = USB - IF BC1.2 charge - capable port (CDP) • 2 = Multiprotocol dedicated charging port (DCP) • 3 = USB - IF BC1.2 dedicated charging port (DCP)	X
R	C 0 – 7	0 – 3	Read the mode (0 – 3; see above) Port to be read	X
L	0 – 7 0 – 7	ok	USB port to be configured Current limitation (see table below)	X
R	L 0 – 7	0 – 7	Read current limitation (see table below) Port to be read	X
R	I 0 – 7	0000 – 61A8	Read actual current in 0.1 mA steps Port to be read	

Command	*Parameter*	*Response value*	*Comment*	*With prefix "D"*
Behavior when power is applied				
SS	S | R	ok	Device state after power applied S = hub goes into normal mode after power applied R = hub goes into ready mode after power applied Only with prefix "D"!	X
R	SS	S | R	Read device state after power applied.	X
Behavior in Standby Mode				
E	00 – FF	ok	Defines exceptions for which ports will not be turned off even in standby mode. However, if they were off before standby, they remain off. The parameters are evaluated as described above under "P".	X
F	00 – FF	ok	Defines exceptions for which relay multiplexers will not be turned off even in standby mode. This function works just like the ports.	X
R	E	00 – FF	Read exceptions for the USB ports.	X
R	F	00 – FF	Read exceptions for the relay multiplexers.	X
Special				
ST	S | R	ok	Button locked (S) or released (R)	X
SI	S | R	ok	Port setting after ready mode: S = as before ready mode R = as after power applied	X
N	00 - FF	ok	Store an ID number for later identification; only with prefix "D"!	X
R	ST	S | R	Read button lock status	X
R	SI	S | R	Read port settings after ready mode	X
R	N	00 – FF	Read the ID for identification	X
R	V	String	Version of the firmware	

Table: Parameters for Current Limitation

Parameter	*Nominal value of current limitation*	*Minimum*	*Typical*	*Maximum*
0	500 mA	450 mA	467 mA	500 mA
1	900 mA	810 mA	839 mA	900 mA
2	1000 mA	900 mA	932 mA	1000 mA
3	1200 mA	1080 mA	1112 mA	1200 mA
4	1500 mA	1350 mA	1385 mA	1500 mA
5	1800 mA	1620 mA	1892 mA	1800 mA
6	2000 mA	1800 mA	1892 mA	2000 mA
7	2500 mA	2250 mA	2355 mA	2500 mA