USB | MDB Master/Slave Interface
Product Documentation

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<th>Reason For Changes</th>
<th>Version</th>
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<td>Thomas Haug</td>
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<td>1.2</td>
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<tr>
<td>Jan Rasehorn</td>
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<td>1.3</td>
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<td>Silvan Sauter</td>
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3. Purpose

The purpose of this document is to provide technical information as well as to describe the concept of the MDB-USB interface Master/Slave.

4. Scope

This documentation is applicable only to MDB-USB Interface Master/Slave.

5. Responsibility

Qibitronics AG has full responsibility of this document.

6. Short description of the MDB-USB interface Master/Slave

The document provides general, technical specifications of the MDB-USB interface Master/Slave and describes the device’s functionality and communication protocols.

6.1 General

The new MDB-USB Interface Master/Slave from Qibitronics is a reliable, generic MDB Interface for vending machines and other MDB enabled devices. It can either connect the vending machine controller to modern IT solutions via USB or it can act as a vending machine controller, in which case the functionality is controlled by a separate computer.

The Interface can run as MDB-Master, MDB-Master and Slave, or as Slave. An optional USB A type output can supply power to external devices with up to 5 Watt, enough for a mini Linux Computer. An integrated relay can be used for general switching functions and is controlled by USB commands. While carrying out software integration, the user need not be concerned with time-critical communication – it is made easy by a message buffering concept.
6.2 Overview

The MDB-USB Interface Master/Slave can be used in different configurations, such as:

**MDB-USB Interface Master/Slave for cashless device (Slave Mode)**

**MDB-USB Interface Master/Slave for MDB analysis (Slave Mode)**
MDB-USB Interface Master/Slave for Special Application (Statistics, Price plans) (Concurrent Master and Slave)

MDB-USB Interface Master/Slave as Vending Machine Controller or Simulator (Master only Mode)
7. Short description of the MDB-USB interface Master/Slave

This chapter describes the mechanical and interface specifications of the MDB-USB interface Master/Slave.

7.1 Mechanical Characteristics

High quality plastic case, DIN Rail mount

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>W</th>
<th>L</th>
<th>H</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beacon Case mm</td>
<td>103mm</td>
<td>85mm</td>
<td>31mm</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Beacon Case &quot;</td>
<td>4.13&quot;</td>
<td>3.34&quot;</td>
<td>1.1&quot;</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Weight</td>
<td>0.29 lb / 0.132kg</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.2 Temperature and Humidity Range

<table>
<thead>
<tr>
<th></th>
<th>Min(°C)</th>
<th>Max(°C)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>0 °C / 32 °F</td>
<td>70 °C / 158 °F</td>
<td></td>
</tr>
<tr>
<td>Storage Conditions</td>
<td>0 °C / 32 °F</td>
<td>70 °C / 158 °F</td>
<td></td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>0 %</td>
<td>70 %</td>
<td>Non-condensing</td>
</tr>
</tbody>
</table>

7.3 Physical Interface Specification

The MDB-USB interface Master/Slave is compliant, according to the MDB specification version 4.2 (February 2011). The specification can be downloaded here:

7.3.1 Standard interface

The board contains two MDB Molex connectors:

**Connector Pin-out:**
- Pin1: VDC
- Pin2: GND
- Pin3: N/C
- Pin4: Master Receive
- Pin5: Master Transmit
- Pin6: GND

7.3.2 Schematics of MDB Circuit
7.3.3 Relay

The Relay can be controlled via USB.

**Connector Pin-out:**

<table>
<thead>
<tr>
<th>Pin1:</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin2:</td>
<td>COM</td>
</tr>
<tr>
<td>Pin3:</td>
<td>NO</td>
</tr>
</tbody>
</table>

7.3.4 USB Device

The female USB connector Type B accepts a device a minicomputer which controls the MDB functionality and small routers.

The connected device needs to provide the power for board (+5V DC, max. 500mA), according to the USB 2.0 specifications.

7.3.5 USB Host

This USB connector Type A can provide the power for an external minicomputer (+5V DC/ max. 3.0A*), non-isolated. The power is provided by the MDB-Bus.

*Note: Depends on the power supply or VMC-Controller, which is connected to the Molex connector.

7.3.6 RS232

**Connector Pin-out:**

<table>
<thead>
<tr>
<th>Pin1:</th>
<th>NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin2:</td>
<td>RXD</td>
</tr>
<tr>
<td>Pin3:</td>
<td>TXD</td>
</tr>
<tr>
<td>Pin4:</td>
<td>+5V</td>
</tr>
<tr>
<td>Pin5:</td>
<td>GND</td>
</tr>
<tr>
<td>Pin6:</td>
<td>NC</td>
</tr>
<tr>
<td>Pin7:</td>
<td>RTS</td>
</tr>
<tr>
<td>Pin8:</td>
<td>CTS</td>
</tr>
<tr>
<td>Pin9:</td>
<td>NC</td>
</tr>
</tbody>
</table>

7.4 LED indicator

The LEDs show the status of the MDB-USB interface. There are four green LEDs:

- Master TX
- Master RX
- Slave TX
- Slave RX
As soon as the board gets power, all LEDs will be ON. In operating mode, the LEDs are blinking for 10ms during data transmission accordingly. If there is an error (like parity error), TX and RX are blinking for 100ms simultaneously.

7.5 Jumpers

On the board, there are eight Jumpers (red marked) to configure the device.

7.5.1 USB Mode

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Device</th>
<th>Host</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP4</td>
<td>1-2</td>
<td>2-3</td>
<td>1-2</td>
</tr>
<tr>
<td>JP5</td>
<td>1-2</td>
<td>2-3</td>
<td>1-2</td>
</tr>
<tr>
<td>JP6</td>
<td>1-2</td>
<td>2-3</td>
<td>1-2</td>
</tr>
<tr>
<td>JP7</td>
<td>1-2</td>
<td>2-3</td>
<td>1-2</td>
</tr>
</tbody>
</table>

Note: The Host function is not yet supported
7.5.2 USB Bridge Mode

With the jumper J1, a bridge between the Master and Slave connector can be inserted. See also Chapter 7.3.2 Schematics of MDB Circuit.

<table>
<thead>
<tr>
<th>Jumper J1</th>
<th>MDB connectors</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Pin 4 (Master Receive)</td>
<td>OFF</td>
</tr>
<tr>
<td>3-4</td>
<td>Pin 5 (Master Transmit)</td>
<td>OFF</td>
</tr>
</tbody>
</table>

7.5.3 Other Jumpers

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Description</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP1</td>
<td>Master input pull-up resistor ON/OFF</td>
<td>ON</td>
</tr>
<tr>
<td>JP2</td>
<td>connects USB power output shield to signal GND</td>
<td>ON</td>
</tr>
<tr>
<td>JP3</td>
<td>Processor Boot-Mode, needed to flash Firmware to STM32 Processor</td>
<td>OFF</td>
</tr>
</tbody>
</table>
8. Software Environment

Since the function of the MDB-USB interface is to convert/translate commands from USB-Host to MDB and reverse, the device supports all commands, according the specification, which is mentioned in chapter 9.3 on MDB Interface Specification.


Terminology used in the following Protocol Description:

USB Host  Host Computer controlling the MDB Interface
MDB Interface USB | MDB Master/Slave Interface
MDB Device  Any MDB Device on MDB Bus
MDB Master  A 3rd Party MDB Master on MDB Bus

Note: Incoming messages (from USB Host view) are in lower case for identity.

8.1 USB Communication

The MDB Interface will be recognized by the USB-Host via VID and PID combination 16d0:0bd7.

As for the straight forward ASCII protocol, the generic usb-serial driver on any linux system can be assigned and used to communicate with the device.

On a typical embedded linux system the assignment can be done by telling the driver the VID:PID like this:

echo ‘16d0 0bd7’ > /sys/bus/usb-serial/drivers/generic/new_id

On a regular desktop linux system the usbserial module needs to be loaded with parameters:

modprobe usbserial vendor=0x16d0 product=0x0bd7

Make sure the module is not loaded when plugging in the MDB Interface and to run the above command with root privileges.

When the driver is assigned, two device files will be added at /dev/ttyUSB* (ttyUSB0 for Master channel and ttyUSB1 for slave channel, if no other usb-serial devices were previously plugged in).

As an alternative libusb can be used to open the MDB Interface as a raw usb device with VID:PID. Libusb is available for all platforms and a variety of programming languages and supports synchronous as well as asynchronous communication.
8.2 USB Endpoint Definition

The MDB Interface uses two different USB Endpoints in order to communicate on the Slave and on the Master Interface (IN and OUT):

<table>
<thead>
<tr>
<th>USB Endpoint</th>
<th>MDB Interface</th>
<th>Address OUT</th>
<th>Address IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP1</td>
<td>Master</td>
<td>0x01</td>
<td>0x81</td>
</tr>
<tr>
<td>EP2</td>
<td>Slave</td>
<td>0x02</td>
<td>0x82</td>
</tr>
</tbody>
</table>

8.3 USB Protocol description

8.3.1 MDB Interface in Master Mode

First Message needs to set operation mode:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;M,ON\n&quot;</td>
<td>Set channel mode to ON. Needs to be called when the all setup is done, to start usb-mdb communication</td>
</tr>
</tbody>
</table>

Response: m,ack on success

<table>
<thead>
<tr>
<th>USB Host:</th>
<th>MDB Interface:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control MDB Interface to send Request to Slave</td>
<td>Answering on Answer from Slave</td>
</tr>
<tr>
<td>&quot;R,XX,YYYY\n&quot;</td>
<td>&quot;p,ACK&quot; MDB Device sent ACK</td>
</tr>
<tr>
<td></td>
<td>&quot;p,NACK&quot; MDB Device did not Answer</td>
</tr>
<tr>
<td></td>
<td>&quot;p,YYYY&quot; Answer from MDB Device</td>
</tr>
<tr>
<td>&quot;R,RESET\n&quot;</td>
<td>-- -- will issue a ‘bus-reset’ to all devices</td>
</tr>
</tbody>
</table>

Whereas: XX: Address / Command Byte in Hex according to MDB Interface Specification YYYYY: optional Data Bytes (max 34)

Note: MDB Checksum is built by MDB Interface.

8.3.2 MDB Interface in Slave Mode

First Message needs to set operation mode:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;M,ON\n&quot;</td>
<td>Set channel mode to ON. Needs to be called when the all setup is done, to start usb-mdb communication</td>
</tr>
</tbody>
</table>

Response: m,ack on success
In *MDB Interface* Slave Mode, the appropriate MDB Device Address can be set according to function described in MDB Interface Specification (e.g. Cashless Device).

<table>
<thead>
<tr>
<th>USB Host: Control MDB Interface to Set Address</th>
<th>MDB Interface: Answering on Set Address Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A,XX\n”</td>
<td>“a,ACK” Address has been set</td>
</tr>
<tr>
<td></td>
<td>“a,NACK” Address has not been set</td>
</tr>
</tbody>
</table>

Requests from an *MDB Master* are forwarded to the *USB Host*:

<table>
<thead>
<tr>
<th>MDB Interface: Answering on Request from MDB Master</th>
<th>USB Host: Answering on Request from MDB Master</th>
</tr>
</thead>
<tbody>
<tr>
<td>“r,XX,YYYY\n”</td>
<td>EMPTY USB Host has no Data to answer</td>
</tr>
<tr>
<td>“r,ZZZZ\n”</td>
<td>“r,RESET\n” ‘bus-reset’ was issued by the VMC.</td>
</tr>
</tbody>
</table>

Whereas:
- **XX**: Address / Command Byte in Hex according to MDB Interface Specification
- **YYYY**: Data Bytes sent by *MDB Master* (max 34) according to MDB Interface Specification
- **ZZZZ**: Data Bytes answered by *USB Host* (max 34)

**Note:** In regular operation with an address set,
- only Requests from the *MDB Master* which correspond to the actual set MDB Device Address are forwarded to the *USB Host*.
- the MDB Interface confirms the reception of each requests from *MDB Master* by sending <ACK> on MDB Bus. <ACK> does not have to be sent by *USB Host*.
- In case of a response from the *USB Host*, the *MDB Interface* buffers the answer and only replies with answer by next poll from *MDB Master*.

**Note:** If no address is set, all requests from *MDB Master* will be forwarded, no <ACK> will be sent, all responses are sent directly without buffering. All timing is up to the *USB Host*

### 8.3.3 MDB Interface in Slave Mode with Address set to 0x00

If the *MDB Interface* is in Slave Mode and its Address is set to 0x00, ALL requests from the *MDB Master* are sent to the *USB Host*. In this Mode the *MDB Interface* can be used as an MDB Data Logger or Analyzer.

First Message needs to set operation mode:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>“M,SNIF\n”</td>
<td>sniffing mode will add a timestamp to each message.</td>
</tr>
</tbody>
</table>

Response: m,ack on success
To use the sniffing mode, the following jumper setting is needed:

<table>
<thead>
<tr>
<th>Jumper J1</th>
<th>MDB connectors</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>Pin 4 (Master Receive)</td>
<td>ON</td>
</tr>
<tr>
<td>3-4</td>
<td>Pin5 (Master Transmit)</td>
<td>OFF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Description</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP1</td>
<td>Master input pull-up resistor ON/OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

Note: For sniffing mode both channels need to be open, but SNIF Mode cmd only needs to be sent once to any channel. No need to switch them ON first.

### 8.3.4 MDB Interface Relay

The relay can be set on either channel, using "S,1\n" or "S,0\n". By default, the relay is not powered, so "S,0\n" on first try will do nothing.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;S,1\n&quot;</td>
<td>Relay ON</td>
</tr>
<tr>
<td>&quot;S,0\n&quot;</td>
<td>Relay OFF</td>
</tr>
</tbody>
</table>

### 8.3.5 Reset to defaults

The **MDB Interface** can be reset to its default state. This can be issued from either channel.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;M,DEFAULT\n&quot;</td>
<td>Slave channel address is set to 0x00, both channels are in mode &quot;OFF&quot;</td>
</tr>
</tbody>
</table>

### 8.3.6 Version and Unique-ID

The firmware version of the **MDB Interface** can be requested from either channel.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;\n&quot;</td>
<td>vX.X.X,YYYYYYYYYYYYYYYYYYYY</td>
</tr>
</tbody>
</table>

Whereas:
- **X.X.X.X:** Four digits Firmware version
- **YYYY:** The 96 Bit Unique ID of the controller in Hex