DSPECIALISTS
Digitale Audio- und Messsysteme GmbH

User Manual

HARVEY mx.16
H-Text Protocol

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History

Version	Date of Change	Author	Description
1.0	01.10.2014	ST	Release of H-Text for V1.4 Composer & V1.5 Firmware

Contents

1 Introduction

HARVEY mx.16 can be controlled via the control dialogs in the HARVEY Composer software and via third-party controllers using any of HARVEY´s serial or network control interfaces (RS-232, RS-485 or TCP/IP Ethernet).

HARVEY mx.16 integrates two different types of control protocols:

1. H-Text: Human readable, string based, available since firmware V1.5 / GUI V1.4.
2. H-Net: More technical, byte-oriented.

Both protocols enable users to integrate the controllable features of HARVEY mx.16 into remote controls (e.g. by AMX, Crestron or other touch panel manufacturers). Controllable features are for instance parameters of functional processing blocks (e.g. gains, EQ settings), preset calls and the retrieval of current signal levels.

This document brings into focus the H-Text functionality of HARVEY mx.16 and intends to enable system integrators to use it in media control applications.

2 Compatibility

This User Manual is valid for following software releases:

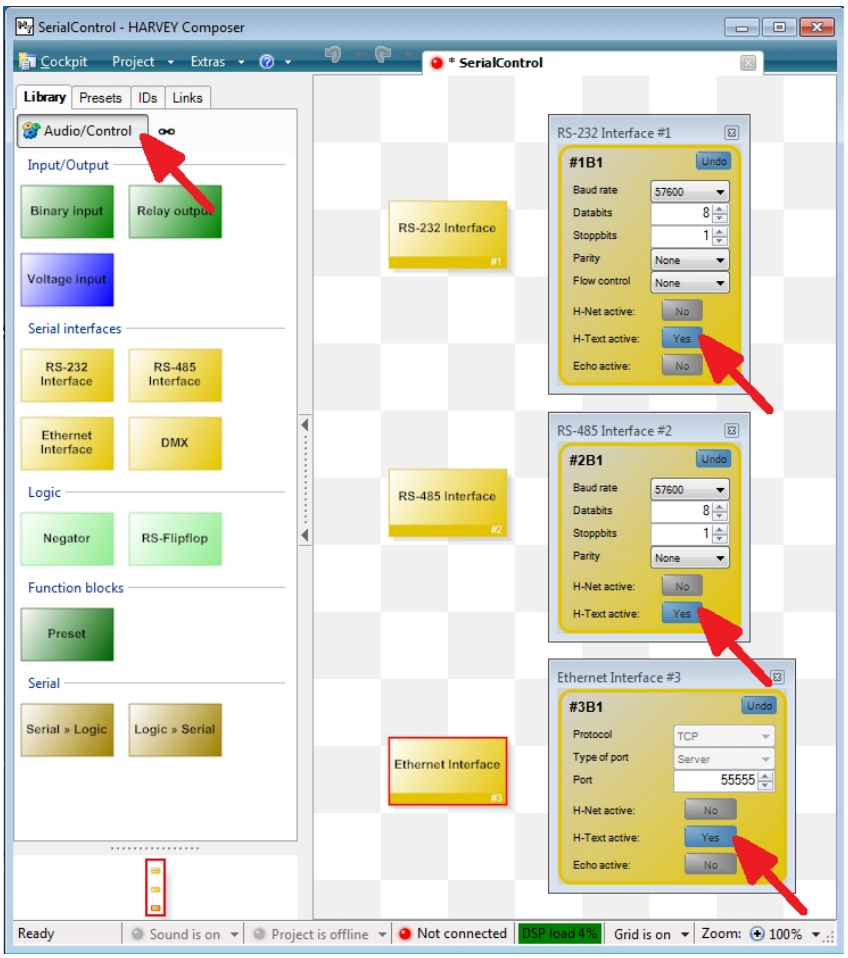
- HARVEY Composer V1.4.0
- HARVEY mx.16 firmware V1.5.0

3 Usage in HARVEY Composer

HARVEY mx.16 offers the control functionality via its RS-485, RS-232 and 10/100BaseT Ethernet interface.

Though the protocol payload is identical and fixed for all interface types, the user has to parameterize UART-parameters for RS-232 and RS-485 and network protocol parameters for Ethernet in HARVEY Composer. The interface's parameters have to be defined in HARVEY Composer on the control layer (switch by toggling “Audio/Control”):

Additionally the H-Text protocol parser has to be enabled in the appropriate serial interface block within your HARVEY Composer project.



3.1 RS-232 and RS-485 Interface parameters

Baud rate, data bits, stop bits and parity chosen in HARVEY Composer have to be used identically by the remote control. Default parameters are 57600 bits per second, 1 start bit, 8 data bits, 1 stop bit, no parity.

Notice: The “H-Text active” button needs to be switched to “Yes” in order to activate the H-Text parser on this interface.

Notice: If used in combination with a RS-232/RS-485 converter please disable flow control!

3.2 Ethernet Interface parameters

Currently the transport protocol is limited to TCP and server functionality on any valid port number. Default parameters are TCP, server and port 55555.

Notice: The “H-Text active” button needs to be switched to “Yes” in order to activate the H-Text parser on this interface.

Notice: There can be multiple Ethernet interfaces with an active H-Net parser, as long as they use different port numbers.

4 H-Text Protocol Reference

4.1 H-Text: Overview

H-Text follows a simple request-response handshake: A controller sends a command request to a HARVEY mx.16 device which executes the command and answers with a response message (see section 4.8).

A H-Text command string to be sent by a controller has this basic structure:

```
Command [DeviceNumber] Attribute InstanceID Index1 Index2 Value <LF>
```

A correct command string is answered by a response message from HARVEY mx.16:

```
Response <CR> <LF>
```

- "Command" defines the action to be performed on Attribute → Section 4.2
- "DeviceNumber" is used to identify the HARVEY mx.16 device. The "DeviceNumber" parameter is optional. → Section 4.3
- "Attribute" identifies the parameter type to be addressed. → Section 4.4
- "InstanceID" identifies the specific functional block or preset in a HARVEY Composer project to be addressed. → Section 4.5
- "Index1" and "Index2" are used for some attributes to address a specific element within a functional block (e.g. a matrix mixer node or equalizer band). → Section 4.6
- In a SET command string "Value" represents the content to be applied to the attribute. The representation of numeric values depends on the attribute.

  In an INC or DEC command string "Value" defines the step width the attribute is to be incremented or decremented. → Section 4.7
- The mandatory line feed <LF> (ASCII: 10dec) character terminates the command string and optionally may be preceded by a carriage return <CR> (ASCII: 13dec) character.
- Correct command strings are answered by a "Response". → Section 4.8

4.1.1 H-Text: Example Command Messages

In following examples "*blank*" represents an empty space within the command structure.

Example: String to set a Level Gain to -20 dB:

```
SET 1 LVLGAIN #2B5 -200 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	1	LVLGAIN	#2B5	*blank*	*blank*	-200	<LF>

Example: String to mute a Matrix Mixer Crosspoint on any device (device number omitted):

```
SET MXXPMUTE #10B1 3 5 1 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	*blank*	MXXPMUTE	#10B1	3	5	1	<LF>

Example: String to call a Preset:

```
RECALL 3 PRESET 3 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
RECALL	3	PRESET	3	*blank*	*blank*	*blank*	<LF>

4.2 H-Text: Commands

Following H-Text commands are available:

`SET`	Apply a new value to a parameter.
`GET`	Retrieve a parameter value.
`INC`	Increment parameter value by a step width.
`DEC`	Decrement parameter value by a step width.
`RECALL`	Recall stored preset.

Notice: Values that exceed the defined range of a parameter in a SET command maybe cropped automatically by the HARVEY mx.16 device to the respective minimum or maximum value. That will also be done in INC or DEC commands if the resulting parameter value would exceed the allowed range.

4.3 H-Text: Device Number

DeviceNumber is used to identify the HARVEY mx.16 device in the H-Text and H-Net protocols.

The DeviceNumber is *optional* and may be left out to address *any* device. That may especially be useful on point-to-point connections (RS232, TCP/IP) where the device identification is implied by the connection.

The default DeviceNumber is 1.

The DeviceNumber may be accessed using the SET or GET command via the DEVNUM system attribute. See section 0.

Example: H-Text string to get the device number of all listening device

```
GET DEVNUM <LF>
```

Example: H-Text string for changing the device number of device 3 to 11

```
SET 3 DEVNUM 11 <LF>
```

4.4 H-Text: Attribute Reference per Functional Block

4.4.1 Analog Input Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Mic/Line	INPMICLINE	SET, GET	None	0 = Mic 1 = Line
Phantom Power	INPPHPWR	SET, GET	None	0 = off 1 = on
Mic Gain	INPMICGAIN	SET, GET, INC, DEC	None	0; 10..65
Line Gain	INPLINEGAIN	SET, GET, INC, DEC	None	0 = 0dB 1 = 6 dB 2 = 12 dB 3 = 18 dB

4.4.2 Analog Output Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Mute	OUTMUTE	SET, GET	None	0 = unmuted 1 = muted
Gain	OUTGAIN	SET, GET, INC, DEC	None	0 = -18 dB 1 = -15 dB 2 = -9 dB 3 = 0 dB

4.4.3 Level Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Gain	LVLGAIN	SET, GET, INC, DEC	None	-1000..+100 Stepwidth: 0.1 dB
Mute	LVLMUTE	SET, GET	None	0 = unmuted 1 = muted
PhaseReverse	LVLPHREV	SET, GET	None	0 = normal 1 = reversed

4.4.4 Level Meter Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Current Level	METERLVL	GET	None	-1000..+500 Stepwidth: 0.1 dB

4.4.5 AGC Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass	AGCBYP	SET, GET	None	0 = AGC active 1 = AGC inactive

4.4.6 AVC Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass	AVCBYP	SET, GET	None	0 = AVC active 1 = AVC inactive

4.4.7 Dynamic Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass	DYNBYP	SET, GET	None	0 = Dynamics active 1 = Dynamics inactive

4.4.8 Ducker Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass	DUCKBYP	SET, GET	None	0 = Ducker active 1 = Ducker inactive

4.4.9 Mixers

In Mixer commands, Index1 is used to address input channels and Index2 to address output channels. In a Matrix Mixer both indexes are used to address crosspoint parameters.

Example: String to mute the Matrix Mixer Crosspoint for input 3 and Output 5

```
SET MXXPMUTE #10B1 3 5 1 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	None	MXXPMUTE	#10B1	3	5	1	<LF>

Example: String to mute the Matrix Mixer Input 6 (for all outputs)

```
SET MXINMUTE #10B1 6 1 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	None	MXINMUTE	#10B1	6	0	1	<LF>

4.4.9.1 Matrix Mixer Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Input Gain	MXINGAIN	SET, GET, INC, DEC	Index1	-1000..+100 Stepwidth: 0.1 dB
Input Mute	MXINMUTE	SET, GET	Index1	0 = unmuted 1 = muted
Output Gain	MXOUTGAIN	SET, GET, INC, DEC	Index2	-1000..+100 Stepwidth: 0.1 dB
Output Mute	MXOUTMUTE	SET, GET	Index2	0 = unmuted 1 = muted
Crosspoint Delay	MXXPDELAY	SET, GET, INC, DEC	Index1, Index2	0..48000 [Samples]
Crosspoint Gain	MXXPGAIN	SET, GET, INC, DEC	Index1, Index2	-1000..+100 Stepwidth: 0.1 dB
Crosspoint Mute	MXXPMUTE	SET, GET	Index1, Index2	0 = unmuted 1 = muted

4.4.9.2 Auto Mixer Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Hold time	AMHOLDTIME	SET, GET	None	25..1000 stepwidth: 0.01 s
Max NoM	AMMAXNOM	SET, GET	None	0..Number of channels
Last Mic	AMLASTMIC	SET, GET	None	-1 = Last open Mic 0 = none 1..n = channel number
Input Threshold	AMINTHRES	SET, GET, INC, DEC	Index1	-1000..0 stepwidth: 0.1 dBFS
Input Priority	AMINPRIO	SET, GET	Index1	0 = priority off 1 = priority on

4.4.10 Filter Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass	FILBYP	SET, GET	None	0 = Filter active 1 = Filter inactive
Gain	FILGAIN	SET, GET, INC, DEC	None	-120..120 Stepwidth: 0.1 dB
Frequency	FILFREQ	SET, GET, INC, DEC	None	200..220000 Stepwidth: 0.1 dB

4.4.11 Crossover Block

Notice: Index1 is used to address the specific Crossover filter section to be configured. e.g:

In a 2-way Crossover:

- Index1 = 1: addresses the low-pass filter section
- Index1 = 2: addresses the high-pass filter section

In a 3-way Crossover:

- Index1 = 1: addresses the low-pass filter section
- Index1 = 2: addresses the mid filter section
- Index1 = 3: addresses the high-pass filter section

In a 4-way Crossover:

- Index1 = 1: addresses the low-pass filter section
- Index1 = 2: addresses the lower mid filter section
- Index1 = 3: addresses the higher mid filter section
- Index1 = 4: addresses the high-pass filter section

The application of the filter frequency configuration depends on the filter section type:

- For the low-pass filter section only the low-pass filter applies, the high-pass frequency setting (CROSSFREQHP) will be ignored.
- For the mid filter sections both, the low-pass (LP) and high-pass (HP), filter frequencies apply
- For the high-pass filter section only the high-pass filter applies, the low-pass frequency setting (CROSSFREQLP) will be ignored

Parameter of Functional Block	**Attribute String**	**Applicable Commands**	**Applicable Index**	**Applicable Value Range**
Mute Out	CROSSMUTE	SET, GET	Index1	0 = Output unmuted 1 = Output muted
Gain Out	CROSSGAIN	SET, GET, INC, DEC	Index1	-120..120 Stepwidth: 0.1 dB
Frequency LP	CROSSFREQLP	SET, GET, INC, DEC	Index1	200..220000 Stepwidth: 0.1 dB
Frequency HP	CROSSFREQHP	SET, GET, INC, DEC	Index1	200..220000 Stepwidth: 0.1 dB

Example: Command string to set the output gain for the mid filter section of a 3-way crossover to -20 dB:

```
SET CROSSGAIN #22B1 1 -200 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	None	CROSSGAIN	#22B1	1	None	-200	<LF>

4.4.12 Equalizer Block

In Equalizer commands, Index1 is used to address band parameters. The value of Index1 states the number of the EQ band for which the parameter is to be set or retrieved.

Example: String to set the gain for EQ band 4 to 10 dB.

Notice: The Instance ID in this example refers to the third EQ in a stack.

```
SET EQBGAIN #4B3 4 100 <LF>
```

Command	Dev Nr	Attribute	Inst ID	Index1	Index2	Value	End
SET	None	EQBGAIN	#4B3	4	None	100	<LF>

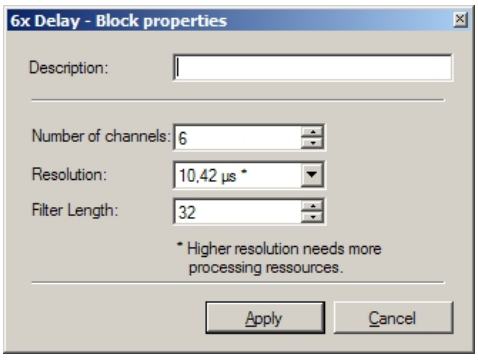
Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Bypass All	EQBYPALL	SET, GET	None	0 = EQ active 1 = EQ inactive
Band Bypass	EQBBYP	SET, GET	Index1	0 = Band active 1 = Band inactive
Band Gain	EQBGAIN	SET, GET, INC, DEC	Index1	-120..120 Stepwidth: 0.1 dB
Band Frequency	EQBFREQ	SET, GET, INC, DEC	Index1	200..220000 Stepwidth: 0.1 dB

4.4.13 Delay Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Delay time	DELTIME	SET, GET	None	0..48000 [Samples] depending on configured resolution (see table above)
Bypass	DELBYP	SET, GET	None	0 = delay active 1 = delay inactive

NOTICE: Delay time is configured in terms of audio samples to achieve the maximum possible accuracy. To get the number of samples from a desired timespan in milliseconds the following formula applies: `Samples = Milliseconds ÷ Resolution.`

The accepted values for the Delay time attribute depend on the Resolution and Filter Length (FL) which may be configured in the properties dialog of the Delay block. I.e. for higher resolutions than the default 48 kHz delay values below FL (or 2×FL) are restricted to multiples of 2 (or 4) as displayed in the following table.



Resolution	Value Range
48 kHz ≈ 20,83 µs	{0..48000} (Note: This ist he default setting)
96 kHz ≈ 10,42 µs	{0, 2, .. FL-2}, {FL, FL+1,..,48000}
192 kHz ≈ 5,21 µs	{0, 4, .. 2×FL-4}, {2×FL, 2×FL+1,..,48000}

4.4.14 Generator Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Type	GENTYPE	SET, GET	None	0 = Sine 1 = Pink Noise 2 = White Noise
Level	GENLVL	SET, GET, INC, DEC	None	-1000..+100 Stepwidth: 0.1 dB
Mute	GENMUTE	SET, GET	None	0 = unmuted 1 = muted
Frequency	GENFREQ	SET, GET, INC, DEC	None	200..220000 Stepwidth: 0.1 Hz

4.4.15 FlipFlop Block

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
State	FFSTATE	SET, GET	None	0 = Off 1 = On

4.4.16 DMX Block

The DMX Control block may be used to control external DMX devices.

Index1 is used to address a specific DMX channel in the range of 1..512

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Enable	DMXEN	SET, GET	None	0 = Controller disabled 1 = Controller enabled
Value	DMXVAL	SET, GET, INC, DEC	Index1	0..255

4.4.17 Preset Block

For Preset commands the Preset-ID is used as instance ID (see section 4.5).

Parameter of Functional Block	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Preset	PRESET	RECALL	None	None

4.4.18 System

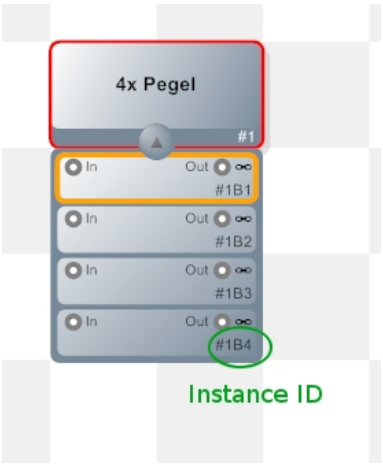
System commands are applied system wide and don’t require a specific Instance ID (see section 4.5).

Parameter	Attribute String	Applicable Commands	Applicable Index	Applicable Value Range
Device Number	DEVNUM	SET, GET	None	0..255

4.5 H-Text: Instance ID

InstanceID identifies the item (e.g. Block or Preset) to be addressed.

HARVEY processing blocks are identified by the block and channel number which in combination make up the Instance ID. Both numbers are concatenated with the delimiter ‘B’ and prefixed with a ‘#’. That ID is displayed in HARVEY Composer in the IDs tab or at the bottom right corner of a Channel of an unfolded Block on the worksheet.



Example: “#1B4” identifies Block 1 channel 4.

Notice: In a Gang only one channel has to be addressed to set a value in all members of the gang.

Notice: Preset IDs may be in the Range of 0 .. max Preset ID. They may be retrieved from the ID column within the Presets Tab in HARVEY Composer.

4.6 H-Text: Index

Some attributes may hold different values when referring to different inputs, outputs or parameter sets of a block. Those values are addressed using one or both of the Index fields in a command string.

Examples:

- An Equalizer uses Index1 to address which band a setting corresponds to.
- A Matrix Mixer uses Index1 to address inputs and Index2 to address outputs and both in combination to address nodes within the matrix.

The usage of an Index will be indicated in the attribute definitions in section 4.4.

Notice: Index values start at 1. Therefore, in an equalizer block Index1 = 1 addresses the first band, Index1 = 2 the second band and so on.

4.7 H-Text: Value

The format of a value in a SET command depends on the Attribute to be set.

Numeric values are always represented as Integers (signed or unsigned). Value ranges may contain a step width which defines how the value is being interpreted.

Example:

The following command will set the Level Gain parameter of Block 3B12 to -44.3 dB.

```
SET 1 LVLGAIN #3B12 -443 <LF>
```

Notice: Level Gain has a step width of 0.1 dB.

4.8 H-Text: Responses

HARVEY mx.16 responds with for different types of response messages.

Success: Upon successful execution of a SET, INC, DEC or RECALL command, HARVEY will respond with:

```
OK<CR><LF>
```

Value: Upon successful execution of a GET command, HARVEY will respond with the requested Attribute value, using the representation as specified in section 4.4, followed by carriage return and line feed.

Busy: If HARVEY is receiving messages faster than it can handle, it will drop new messages until enough resources for the handling of new messages are available and respond with:

```
BUSY<CR><LF>
```

Error: If execution of GET, SET, INC, DEC or RECALL command failed, HARVEY will respond with:

```
ERR<CR><LF>
```

Notice: HARVEY mx.16 does not respond on received messages which it cannot interpret as H-Text commands.

5 Addendum

5.1 Electrical Interfaces

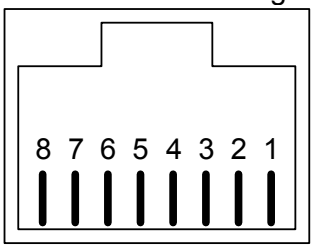
5.1.1 RS-485

HARVEY mx.16 has two RS-485 interfaces on its rear side represented by two 8-pin RJ45 connectors. Both interfaces are identical and allow a daisy-chained cabling of more than one device attached to HARVEY mx.16.

For long cable distances and/or high bit rates it is advised to use a terminating resistor of 120 Ohm at each end of a RS-485 line allowing a stable data link.

For RS485 system wiring please consider the advices in section *5.1*.

The pinning of both RJ45 connectors is identical as following:

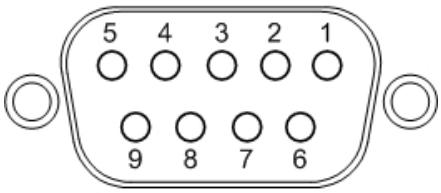


Type	8-pin RJ45
DATA+	Pin 3 + Pin 6
DATA-	Pin 4 + Pin 5
ISO GND	Pin 7 + Pin 8
SHIELD	CASE / PE

All other pins **must not** be used.

5.1.2 RS-232

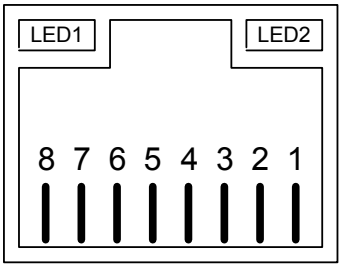
HARVEY mx.16 has one RS-232 DCE interface on its rear side represented by a standard DB-9 female connector.



Type	Direction	DB-9 female
TXD	Out	Pin 2
RXD	In	Pin 3
CTS	In	Pin 7
RTS	Out	Pin 8
GND		Pin 5
SHIELD		CASE

5.1.3 10/100BaseT Ethernet

HARVEY mx.16 has one 10/100BaseT Ethernet interface on its rear side represented by a standard RJ-45 connector including two LEDs displaying Ethernet link and activity.



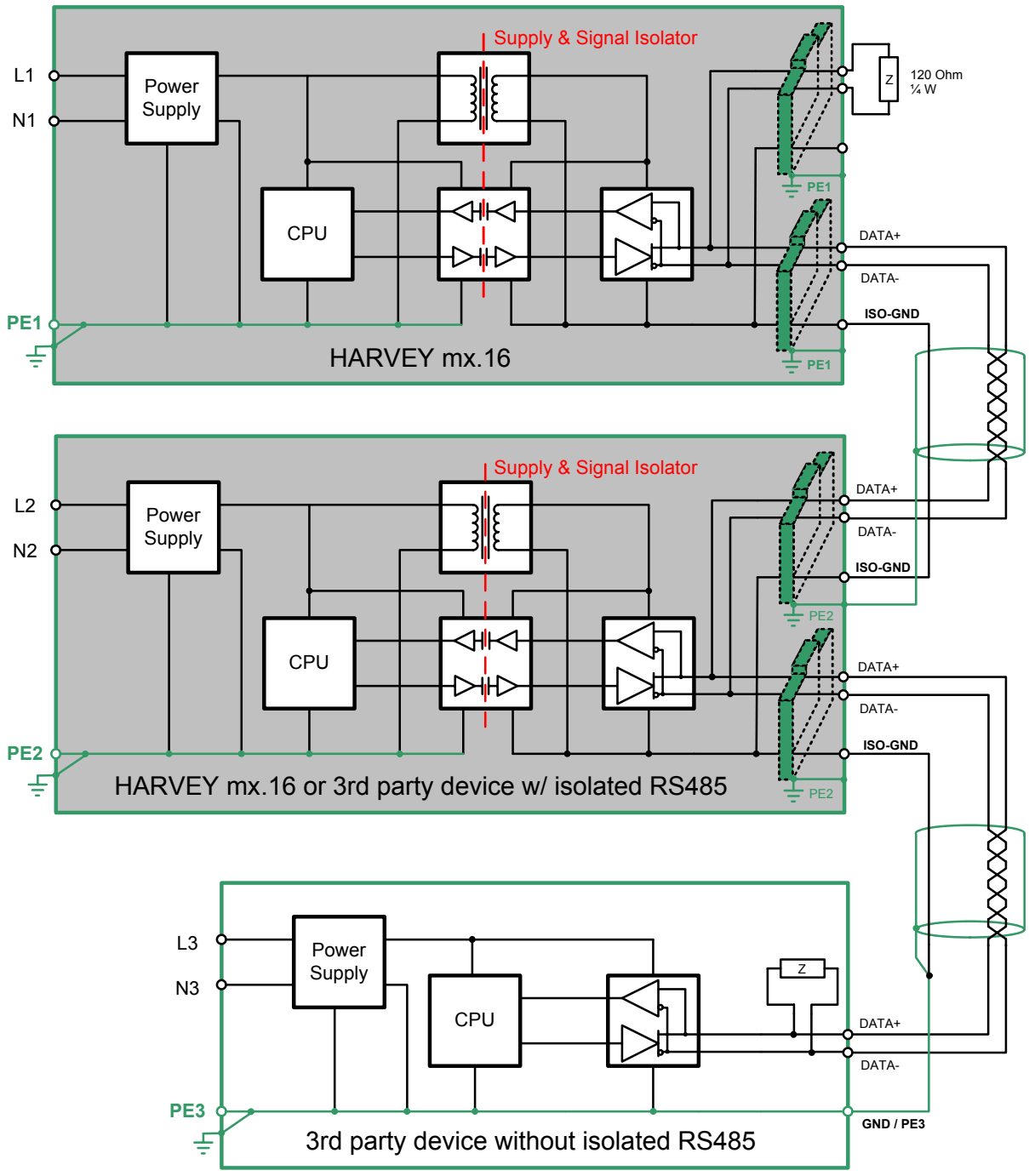
Type	Direction	8-pin RJ45
TXD+	Out	Pin 1
TXD-	Out	Pin 2
RXD+	In	Pin 3
RXD-	In	Pin 6
SHIELD		CASE

LED1: Activity / LED2: Link

5.2 RS-485 Wiring

HARVEY mx.16 offers two 2-wire RS-485 interfaces carried out as two RJ45 connectors on its rear side. Internally both interfaces are connected to one data transceiver. Thus a daisy-chained system integration of mx.16´s RS-485 interface is made possible.

Following diagram shows (a) the internal structure of the RS-485 interface and (b) presents a best practice system wiring in a three device setup:



Internally the RS-485 circuit is carried out isolated with regard to signals and power supply. This structure avoids ground loops which may occur in systems with long distances between the protective earth (PE) -grounding points and which may lead to communication faults.
Each RS-485 interface of HARVEY mx.16 offers a ground signal which is isolated from PE-ground. Only the RJ45-shield is connected to the PE-grounded device housing.

Thus following best practice RS-485 wiring applies:

1. Only connect one side of a shielded twisted-pair cable to the RJ45-shield of the RS-485-interface to prevent ground loops but to keep the shield effect against EMI problems.

2. In addition to the connection of the data signals, connect the isolated ground signal of HARVEY mx.16 RS-485 interconnections to each other.

3. If possible, use only one non-isolated RS-485 device and all other devices with an isolated RS-485 and connect the isolated ground signal to the PE-ground system only at one point in the system.

4. Use the passive terminator, which is delivered with HARVEY mx.16, and plug it into one RS-485 interface of HARVEY at the end of a RS-485-line which as a result allows bitrates of 500 kbps on cable distances >400 m.