mlc8 v.1.0
LED status display system for Hauptwerk virtual pipe organ
* user's guide *

1. Introduction

The **mlc8** is compact 8-port LED segment display controller, especially designed for use with Hauptwerk or any other application that supports Hauptwerk's original *System Exclusive* console status messages formats. It also supports MIDI *Control Change* and *Program Change* so that Controller Data or Program Number can be displayed in suitable form of decimal numbers, or bar graphs. The unit can control up to 8 basic LED display modules. The supported types of basic modules are: 1-digit, 1 signed digit, 2-digit, 3-digit (actually 2 1/2, where most significant digit can be only "1") , 10-point or 10 double-point bar graphs (see Table 4). Combining two basic display modules allows displaying unsigned values of up to 4 digits (two 2-digit modules side-by-side), or signed values of up to 3 digits (one signed 1-digit and one 2-digit module side-by-side) etc. The possible combinations are many and only depend on user's needs. Each of basic display modules takes one slot on **mlc8** controller board, so when combining them, the complementary display would take two slots. All basic LED display modules are available in reed and green color. Some may be available in yellow upon request.

Each of the 8 ports is separately configurable for what parameter to display and how to display it. For this purpose free downloadable configuration utility **mlc8set** (Windows only) is available on our site.

The configuration data is upload via specific *SysEx* message described in *Appendix A*.

The communication between **mlc8** and the World goes thru standard MIDI input and output. The unit requires external power supply of 12V AC/DC.

Any following information related to Hauptwerk in this document has been taken from the original Hauptwerk User Guide.

2. Function

Each of the 8 ports on **mlc8** ends with 26-pin header connector and is further referred to as "slot". Each slot is separately configurable for two parameters:

- *Message ID.* This determines the Hauptwerk message ID in case of displaying Hauptwerk-specific parameter, Channel and Controller number in case of displaying *Control Change* data, Channel in case of displaying *Program Change* data. The list of supported Hauptwerk status variables is shown on *Appendix A*.
- *Display format.* This determines the way of displaying, hence it determines the type of basic LED display module to be used with this slot. User can select the format of display (not signed, signed number with/without Leading Zero, or bar graph) as well as the displayed part of the parameter data (TENTS,UNITS or THOUSANDS,HUNDREDS) when complementary displays are necessary. When TENTS&UNITS is selected, the display would show only the two least significant decimal places of the value. When THOUSANDS&HUNDREDS is selected, the data will be integer divided by 100 and the two least significant decimal places of the result will be displayed. This way user can display bigger values up to 9999, like "1234" on complementary 4-digit display (two 2-digit displays installed side-by-side displaying "12" and "34").

Therefore, the possible display formats with practical meaning are:

```
1-digit, not signed (0..9);
1-digit, signed (-9..0..+9);
2-digit, not signed, no LZ (0..99);
2-digit, not signed, LZ (00..99);
3-digit (0..199), not signed, no LZ;
```

3-digit, signed , LZ (-999..999) by combining 1-digit signed with 2-digit not signed, LZ;
4-digit, not signed, LZ (0000..9999) by combining two 2-digit not signed, LZ;
5-digit, not signed, no LZ (0..19999) by combining 3-digit (0..199) no LZ and 2-digit no LZ;
10-point bar graph;
10-double point bar graph;
20-point bar graph by combining two 10-point bar graphs;
20-double point bar graph by combining two 10-double point bar graphs.

When bar graphs are used, user can choose the data range to be mapped over 10-segments. Supported ranges in firmware **version 1.0** are (0..10), (0..31), (0..100) and (0..127) for 10-point bar graphs and (0..127) for 20-point bar graphs.

The **mlc8** unit is MIDI-transparent. This means it does not transmit any own MIDI messages and each MIDI byte it receives is being retransmitted immediately. This allows easy insertion in existing setups, without need of MIDI Splitter or Merger. Only MIDI cables are necessary to connect it to existing MIDI system.

3. What to order?

mlc8 is supposed to work with set of up to 8 basic LED displays per user choice. That is why customer should decide what LED display modules to order together with the **mlc8** unit. This choice depends on *what* parameters are to be displayed and *how* they are to be displayed. The decision making sequence is:

1. Choose list of Hauptwerk/MIDI parameters to be displayed (see *Table 1* and notes below it). The list can be up to 8 parameters, but in case any of them requires complementary LED display module, consider two slots for it. It is not necessary to use all 8 slots if you need less.

2. Distribute the chosen parameters over slots. This has to do with further steps of slots configuration, where you have to know which slot for what parameter and what display format should be set. Note that slots don't recognize automatically the type of attached display, so if you attach display of wrong type it will display garbage. The unit cannot be damaged by such mistake. All slots are functionally identical, so any of them can be set to any combination of parameter/display mode. *If necessary, more than one slots can be programmed to display same variable in same or different formats.*

3. Choose the display format per each slot. Refer *Table 1* for value ranges of chosen parameters and *Table 2* for supported display formats. For choosing display modules of right type/color refer Table *3*.

4. Order the **mlc8** with desired set of LED displays. Each display goes with **dci26-26/25** ribbon cable long 25cm.

5. When the package arrives, check if everything ordered in in package and then follow user-programming instructions.

4. User-programming

For each of slots intended for use, the user must set two things: Parameter to display and Display Format. Please follow instructions shown in *Appendix B*.

Table 1. Hauptwerk Status variables IDs:

Var ID	Var Name	Type	Range/Display
0	CurrOrganShortName	String	16 chars
1	CuedFavOrganNum	7-bit unsigned integer	1..32
2	CuedFavOrganShortName	String	16 chars
3	LastOrganShortName	String	16 chars
4	CurrCombSetShortName	String	16 chars
5	CuedFavCombSetNum	7-bit unsigned integer	1..32
6	CuedFavCombSetShortName	String	16 chars
7	CurrTemperShortName	String	16 chars

Var ID	Var Name	Type	Range/Display
8	CuedFavTemperNum	7-bit unsigned integer	1..32
9	CuedFavTemperShortName	String	16 chars
10	FloatingDiv1RouteNum	7-bit unsigned integer	1..4
11	FloatingDiv1KbdShortNameList	String	16 chars
12	FloatingDiv2RouteNum	7-bit unsigned integer	1..4
13	FloatingDiv2KbdShortNameList	String	16 chars
14	FloatingDiv3RouteNum	7-bit unsigned integer	1..4
15	FloatingDiv3KbdShortNameList	String	16 chars
16	FloatingDiv4RouteNum	7-bit unsigned integer	1..4
17	FloatingDiv4KbdShortNameList	String	16 chars
18	FloatingDiv5RouteNum	7-bit unsigned integer	1..4
19	FloatingDiv5KbdShortNameList	String	16 chars
20	CurrCombStepperFrameNum	28-bit signed integer	0..999
21	CuedCombStepperFrameBankNum	28-bit signed integer	0..990
22	CurrMasterGeneralNum	7-bit unsigned integer	1..20
23	LastTriggeredMasterRegObjType	7-bit unsigned integer	1..4
24	CurrMasterCrescNum	7-bit unsigned integer	1..4
25	CuedMasterCrescStage	7-bit unsigned integer	0..31
26	TransposerIncSemitones	28-bit signed integer	-12..+12
27	OrganBasePitchHz	Floating-point	0.0..13421772.7
28	MasterTuningIncCents	28-bit signed integer	-200..+200
29	OrganAudioLevelTrimDecibels	Floating-point	-24.0..+24.0
30	PolyphonyLimitSetting	28-bit signed integer	256..32768
31	SampleRateHz	28-bit signed integer	0..134217727
32	LatencyMs	Floating-point	0.0 to 13421772.7
33	IsSetterModeOn	Boolean	0/1(F/T)
34	IsScopeModeOn	Boolean	0/1(F/T)
35	IsRecordingAudio	Boolean	0/1(F/T)
36	IsRecordingMIDI	Boolean	0/1(F/T)
37	IsPlayingMIDI	Boolean	0/1(F/T)
38	IsOrganReady	Boolean	0/1(F/T)
39	IsInErrorState	Boolean	0/1(F/T)
40	ProgressIndicatorPct	7-bit unsigned integer	0..100
41	MasterOutputLevelCCPct	7-bit unsigned integer	0..100
42	FloatingDiv1ExprPedCCPct	7-bit unsigned integer	0..100
43	FloatingDiv2ExprPedCCPct	7-bit unsigned integer	0..100
44	FloatingDiv3ExprPedCCPct	7-bit unsigned integer	0..100
45	FloatingDiv4ExprPedCCPct	7-bit unsigned integer	0..100
46	FloatingDiv5ExprPedCCPct	7-bit unsigned integer	0..100
47	MasterCrescPedCC	7-bit unsigned integer	0..31
48	AudioLevelClipping	7-bit unsigned integer	0..2
49	PolyphonyClipping	7-bit unsigned integer	0..2
50	CPUClipping	7-bit unsigned integer	0..2
51	RAMClipping	7-bit unsigned integer	0..2
52	CurrObjShortNameAllTypes	String	16 chars
53	CuedFavNumAllTypes	7-bit unsigned integer	1..32

Var ID	Var Name	Type	Range/Display
54	CuedFavShortNameAllTypes	String	16 chars
55	AllTypesObjType	7-bit unsigned integer	1..3

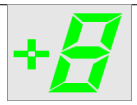
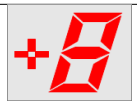
NOTES:

- Variables that are not supported by **mlc8** are grayed.
- In addition to above list, supported are Control Change (user-selected Controller on user-selected Channel) and Program Change (on user selected Channel).
- For more detailed information about Hauptwerk *SysEx* messages and Status variables please refer the Hauptwerk User Manual. The most up-to date version of this document is always available for download on their site www.hauptwerk.com.

Table 2. *Display* Formats supported by **mlc8**

Format ID	Format description	Suitable basic LED display type (see Table 4)
01	UNITS: Single digit (0..9)	ls1d-g, lsd1-r
02	UNITS: Single digit, signed (-9..0..+9)	ls1sd-g, ls1sd-r
03	TENS,UNITS: Double digit (0..99)	ls2d-g, ls2d-r
04	TENS, UNITS: Double digit, LZ (00..99)	ls2d-g, ls2d-r
05	HUNDRED,TENS,UNITS: Triple digit (0..199)	ls3d-g, ls3d-r
11	Bar graph, 10 points, mapping values 0..127	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
12	Bar graph, 10 points, mapping values 0..100	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
13	Bar graph, 10 points, mapping values 0..31	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
14	Bar graph, 10 points, mapping values 0..10	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
20	Bar graph, 10 points, mapping values 0..63 (LOWER part of complementary 20-point bar graph mapping values 0..127)	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
21	Bar graph, 10 points, mapping values 64..127 (HIGHER part of complementary 20-point bar graph mapping values 0..127)	ls10b-g, ls10b-r,ls10b2-g, ls10b2-r
65	HUNDREDS: single digit (0..9)	ls1d-g, lsd1-r
66	HUNDREDS: single digit, signed (-9..0..+9)	ls1sd-g, ls1sd-r
67	THOUSANDS,HUNDREDS: double digit (0..99)	ls2d-g, ls2d-r
68	THOUSANDS,HUNDREDS: double digit, LZ (00..99)	ls2d-g, ls2d-r
69	TEN THOUSAND,THOUSANDS,HUNDERDS: triple digit (0..199)	ls3d-g, ls3d-r

Table 3. Basic LED display modules supported by **mlc8**

Name	Picture	Description
ls1d-g		1-digit (0..9), Green
ls1d-r		1 digit (0..9), Red
ls1sd-g		1 signed digit (-9..0..+9), Green
ls1sd-r		1 signed digit (-9..0..+9), Red

Name	Picture	Description
ls2d-g		2-digit (0..99 or 00..99), Green
ls2d-r		2-digit (0..99 or 00..99), Red
ls3d-g		3-digit (0..199), Green
ls3d-r		3-digit (0..199), Red
ls10b-g		10-point (0..10p), Green
ls10b-r		10-point (0..10p), Red
ls10b2-g		10-double-point (0..10p), Green
ls10b2-r		10-double-point (0..10p), Red

5. Connection and use

The connection diagrams for Setup and Use are shown in *Appendix D*.

When used as part of Hauptwerk system, **mlc8** is inserted between MIDI output of the computer running Hauptwerk software and the other equipment listening for Hauptwerk MIDI messages (if any). **mlc8** will retransmit the MIDI messages byte-by byte without any altering.

It requires power from external power supply rated for 12V AC/DC, capable to source 100mA or more.

6. Technical parameters

Table 4. Technical parameters of **mlc8**

Parameter	Value	Unit	Comment
Power supply voltage	9-12 AC/DC	V	Adapter or transformer
Power supply current	>100	mA	
Recognized MIDI messages	Hauptwerk specific System Exclusive messages for console status, Control Change and Program Change, **mlc8** specific System Exclusive messages for slot settings	-	System Exclusive messages formats are described in *Appendix A*
Retransmitted MIDI messages	Any received	-	The unit is MIDI-transparent
User-programmable	Yes, by MGB-specific SysEx message	-	Software setup utility (Windows) available for free download
Size	**mlc8**: 13.5x6.6x2.5 **ls1d-g/r**: 4.4x2.1x2.5 **ls1sd-g/r**: 4.4x2.1x2.5 **ls2d-g/r**: 4.4x2.1x2.5 **ls10b-g/r**: 4.4x2.1x2.5 **ls10b2-g/r**: 6.2x2.1x2.5	cm	5.5”x2.6”x1” approx. 1.7”x0.8”x1” approx. 1.7”x0.8”x1” approx. 1.7”x0.8”x1” approx. 1.7”x0.8”x1” approx. 2.4”x0.8”x1” approx.

Parameter	Value	Unit	Comment
Weight	**mlc8**: 73 **ls1d-g/r**: 9 **ls1sd-g/r**: 10 **ls2d-g/r**: 12 **ls10b-g/r**: 12 **ls10b2-g/r**: 15	g	2.6oz 0.3oz 0.3oz 0.4oz 0.4oz 0.4oz 0.5oz

NOTES:
Some of sizes/weights above may differ due to continuous improvement of our products.

Appendix A. Recognized System Exclusive messages

Note: All MIDI data numbers are shown in hexadecimal notation!

mlc8 configuration message format:

```
Byte 1: 0xF0 - SysEx (system exclusive message start)
Byte 2: 0x00 - mandatory
Byte 3: 0x21 - manufacturer ID LSB (MGB)
Byte 4: 0x7F - manufacturer ID MSB (MGB)
Byte 5: 0x18 - device ID (mlc8)
Byte 6: 0x00..0x07 - device sub-ID (Slot number)
Byte 7: 0x00..0x7F - Parameter ID MSB, masked Status or 0
Byte 8: 0x00..0x7F - Parameter ID LSB, Data of Hauptwerk variable ID
Byte 9: 0x00..0x7F - Display Format (not all values in range are allowed!)
Byte 10: 0xF7 – EOX (end of system exclusive message)
```

Hauptwerk 7-bit unsigned integer/Boolean variable status message format :

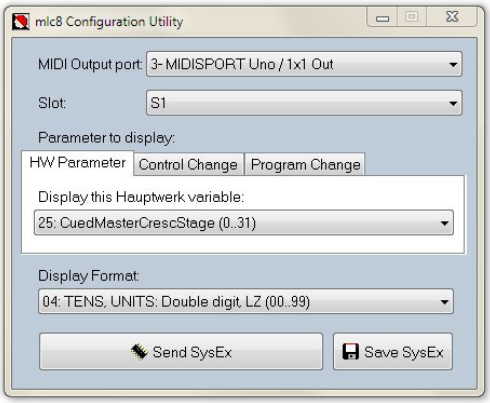
```
Byte 1: 0xF0 – SysEx (system exclusive message start)
Byte 2: 0x7D - manufacturer ID (Milan Digital Audio)
Byte 3: 0x1B - message type code for Hauptwerk 7-bit
               unsigned integer variable status message
Byte 4: variable ID (see Table 1)
Byte 5: 0x00..0x7F - variable value (0-127 for integer value or
                     1/0 for representing Boolean True/False values)
Byte 6: 0xF7 – EOX (end of system exclusive message)
```

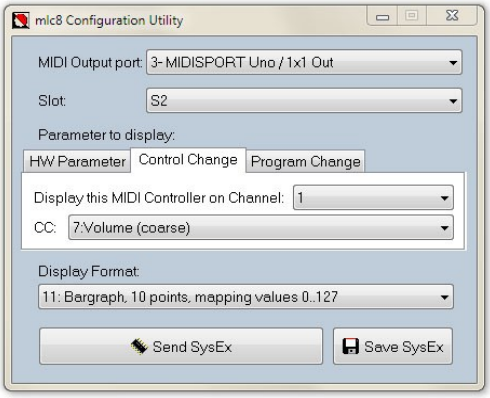
Hauptwerk 28-bit signed integer variable status message format:

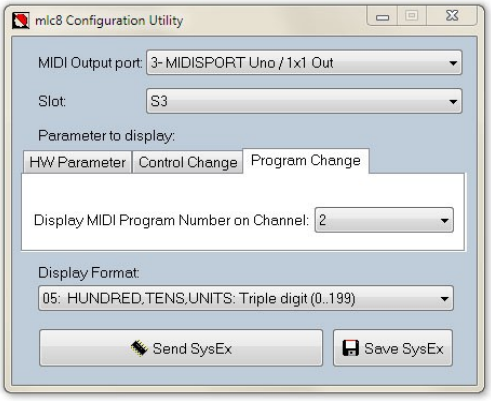
```
Byte 1: 0xF0 – SysEx (system exclusive message start)
Byte 2: 0x7D - manufacturer ID (Milan Digital Audio)
Byte 3: 0x1A - message type code for Hauptwerk 28-bit
               signed integer variable status message
Byte 4: variable ID (see Table 1)
Byte 5: variable value byte 1 (most significant 7 bits)
Byte 6: variable value byte 2
Byte 7: variable value byte 3
Byte 8: variable value byte 4 (least significant 7 bits)
Byte 9: 0xF7 – EOX (end of system exclusive message)
```

Appendix B. Step-by step instruction for use of **mlc8set** utility

The ***mlc8set*** (Windows only) software utility is easy-to-use, free-downloadable application, that does not need any installation and registration. Just download, unpack in separate folder and run it. Its user interface is simple, clearly depicting the few steps that must be followed during **mlc8** setup procedure.







Step 0. Learn what is **mlc8**. Read the available documentation, including this User Manual.

Step 1. Connect and power the **mlc8** unit, according to Setup diagram shown in *Appendix C*. For setup procedure the MIDI input of **mlc8** must be connected to the MIDI output of PC, running the ***mlc8set*** software. The MIDI output of **mlc8** should not be connected to anything, to avoid possible MIDI loops. The power should be applied to power connector.

Step 2. Choose the MIDI output port in ***mlc8set***. The Drop-down list will show all available virtual and hardware MIDI out ports. Choose the hardware port to which the **mlc8** unit is physically attached.

Step 3. Choose the Slot to be configured. Slots are named S1,S2 .. S8, listed in "Slot" drop-down list.

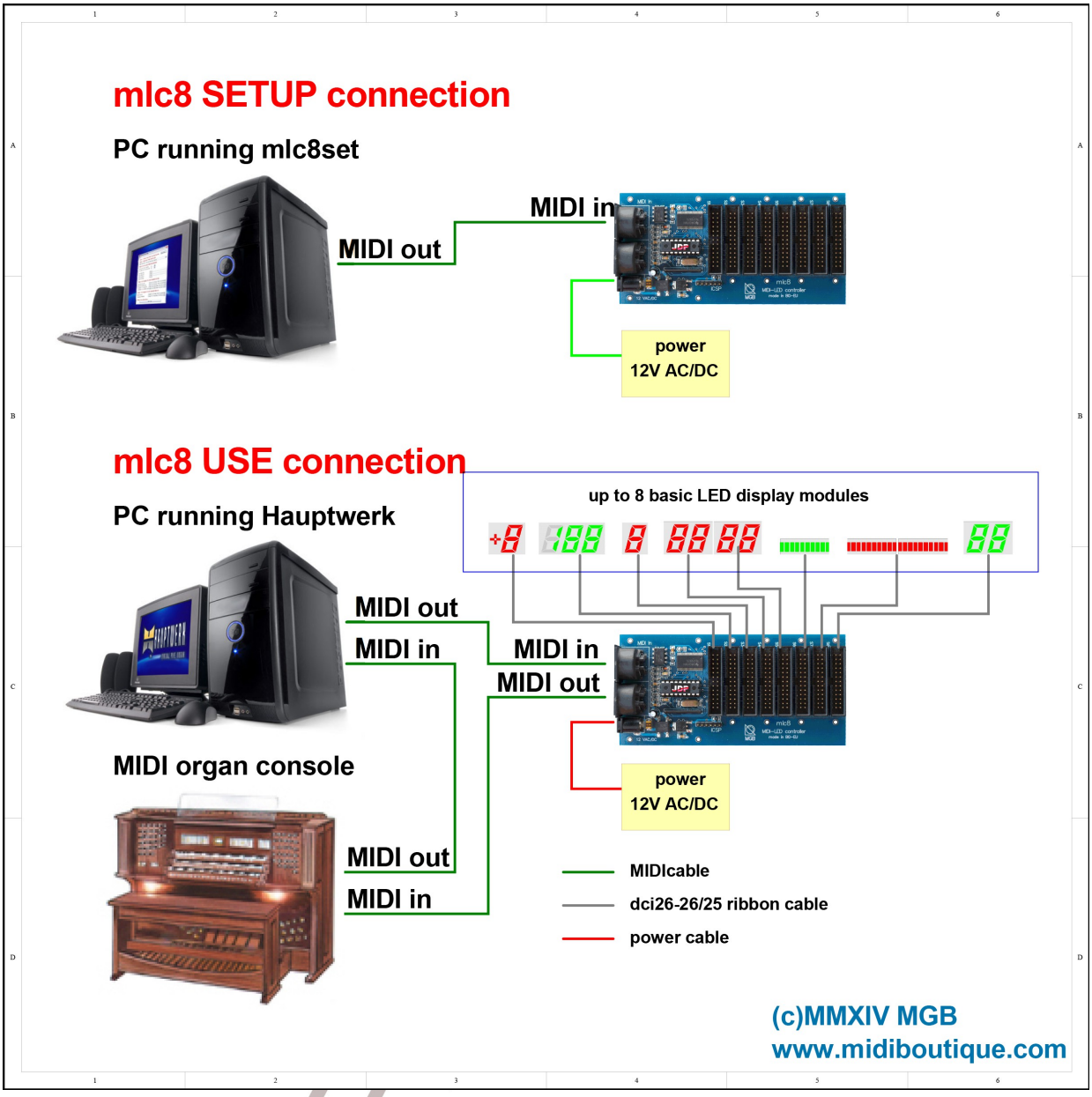
Step 4. Choose what you want to display on selected slot. There are three groups of parameters that can be displayed: Hauptwerk parameter, MIDI Control Change and MIDI Program Change. For Hauptwerk parameter you have to navigate to "HW Parameter" tab and choose desired Hauptwerk status variable from the drop-down list. For Control Change you have to navigate to "Control Change" tab and choose MIDI Channel and Controller (CC). For Program Change you need to navigate to "Program Change" tab and choose the MIDI Channel.

Step 5. Choose the display format. The format depends on parameter you want to display and the preferred way to visualize it (as number or as bar graph). Note that many parameters it is possible to be displayed in more than one way. Parameters that have wider range may need more than one slot to be displayed on complementary displays (complementary display consists of two basic displays put side-by-side). These parameters will take two slots on **mlc8**.

Step 6. Upload the settings to **mlc8** by clicking on "Send SysEx" button. The SysEx message can also be saved in standard .SYX format for later use with third-party MIDI hardware or software sequencers running on different operating system than Windows.

Repeat steps from 3 to 6 as many times as you need to configure all necessary slots.

Appendix C. Wiring diagrams for **mlc8**



Appendix D. Factory preset

Unless other requested upon order, all 8 slots on the **mlc8** are configured for testing purposes for Control Change #7 (Volume) on MIDI Channel #1, Display Format 05 (3 digit).

Customer may request any other particular configuration *upon order* by submitting following data:

Slot	Parameter	Display Format	Display Module (see *Table 3*)
1			
2			
3			
4			
5			
6			
7			
8			

info@midiboutique.com
www.midiboutique.com