DOEPFER MUSIKELEKTRONIK GMBH

WHEEL ELECTRONIC

(Universal Midi Control Electronics for Modulation Wheels, Foot Controllers , Breath-Controller, Joy Sticks etc.)

V1.0

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Electrical safety / EMC compatibility

WHEEL ELECTRONIC (abbreviated "*WE*" in the following) is a so-called **OEM product** (OEM original equipment manufacturer) that cannot be used independently but has to be combined with additional electrical or electronical equipment to become a working device (e.g. potentiometers, switches, power supply, case/housing). The manufacturer of *WE* does not know the final assembly of the complete device in which the *WE* is used as a part of the complete device. The final responsibility with regard to **electrical safety** and **electromagnetic compatibility** is up to the user who is assembling the complete device.

Electronic basic knowledge is required to install WE and to connect the controls resp. control voltages. If you are not sure whether your knowledge is sufficient please consult an expert. We cannot take back modules that became defective because of wrong installation or wrong connection of the controls or voltages.

Please pay attention to the following items:

The **power supply** used in combination with the *WE* has to be a closed type (in Germany a power supply with VDE approval is required). Normally an AC adapter with plastic case is used. It is not allowed to use **open power supplies** whith open **mains voltage** access (e.g. via mains lead, pcb tracks, electronic parts).

On the *WE* **preventing measures** against **electromagnetic radiation** are taken (e.g. an RF filter at the power supply input). But it is impossible to estimate to what extend the **components added by the user** affect the **EMC properties** of the complete assembly. Therefore the **complete device** has to be **shielded** against **electromagnetic radiation** (incoming and outgoing)**.** These demands are normally met by a closed metal case that covers the complete assembly. The metal case should be connected to GND of the *WE*.

Warranty

- Applying any negative voltage (< 0V) or positive voltage above +5V (> +5V) to one of the five inputs ST1…ST5 will destroy the circuit !
- If potentiometers and/or switches are connected between GND and +5V of *WE* as described in this manual no problems will occur.
- When external control voltages are connected to *WE* the user has to pay attention that the voltages applied are strictly within GND and +5V referenced to GND of *WE* !
- Do not solder directly to any of the pin headers but use cable sets with suitable female connectors to make the connections between *WE* and the potentiometers, switches, voltages or other parts. A cable set that contains all required connectors and cables is included with *WE*.
- Carry out all connections in the off-state of *WE* (i.e. when powered-off only) !
- Do not power on *WE* (i.e. do not connect the power supply to the corresponding jack socket) before all five inputs ST1…ST5 are connected. Do not leave analog inputs unconnected ! Unused inputs have to be connected or jumpered to GND or +5V.
- *WE* electronics is an electrostatic sensitive device. Avoid any electrostatic charges ! Do not touch any of the inputs with your fingers !
- Avoid short circuits !
- Ignoring any of these items will cause warranty loss !
- Return of the *WE* within the 2 weeks return time limit (valid only in Germany) is only possible if all these items have been met. Return of used cable sets is not possible. We also cannot take back modules that have been soldered by the user.

Introduction

- *WE* is an universal DIY kit to built your own Midi control box. Up to four analog controls and one switching control can be connected to *WE* transmitting five different Midi messages.
- The controls (e.g. modulation wheels) are not included but have to be purchased by the customer in addition. We have suitable parts available as spare parts.
- Typical examples for analog controls connected to the pin headers ST1…ST4 are modulation wheels, foot controllers, joy sticks, rotary potentiometers, faders, drawbars, rotary switches (with resistor chains connected between GND and +5V to generate several analog voltages), ribbon controllers, pressure sensors, light depending resistors or breath controllers.
- Typical examples for the switching control connected to the pin header ST5 are momentary or toggling foot switches or any other switches. But even more unusual parts like photo diodes or photo transistors can be used.
- 16 so-called *presets* are available. A preset defines the assignments of Midi messages to the five control inputs ST1…ST5. The actual preset is selected by a group of jumpers. Different combinations of Midi control change, pitch bend and (monophonic) after touch messages are available (pitch bend and after touch are no control change messages). If in the following the term *controllers* are used this includes pitch bend and after touch too.
- If none of the presets is suitable for the application other combinations of Midi controllers can be programmed upon request as a special design. Please contact Doepfer Musikelektronik GmbH for details like additional charges or delivery time (e.g. via email to software@doepfer.de or hardware@doepfer.de).
- For each of the four analog inputs a jumper is available to select if the full voltage range (0...+5V) or an adjustable voltage range (0…+V with V+ = +3...+5V) is used for measurement. This measure is necessary e.g. for modulation or pitch wheels, foot controllers or joy sticks that do not cover the complete angle of rotation. If such an element is connected to GND and +5V the maximal output voltage is much less than +5V (e.g. +3V only). Even breath controllers (e.g. Yamaha BC-1/2/3) output only about +3.5V maximal voltage. If an electronics is used that analyses the full voltage range 0...+5V the higher Midi data values are missing. A high resolution trimming potentiometer is available to adjust the limited voltage range.
- If an element is assigned to Midi pitch bend a "plateau" is used in the middle of the voltage/data range (data value 64). This feature is meaningful in combination with spring-loaded wheels or joy sticks as due to mechanical tolerances the exact center position is not always reached
- Even voltages sources can be used instead of the controls provided that the voltages applied are strictly within the range 0...+5V (referenced to *WE* GND)! Voltages beyond this range will destroy the electronics !
- The four analog controls are connected to four single row pinheaders (three pins each). The switching control is connected to a pinheader with two pins. Cable sets with suitable female connectors are available. In this way the controls might be disconnected from the electronics very easily.
- *WE* is equipped with Midi In and Midi Out. The incoming Midi messages are merged to the data generated by *WE* provided that the Midi data does not exceed a certain amount. In this way several *WE* can be linked together to obtain larger controller arrays
- *WE* is available only as an assembled and tested pc board (about 59 x 56 x 25 mm).
- An external power supply (7-12VDC@min. 100mA) is required for the *WE*. It is included for all shipments within Germany (230V version with European mains plug). For shipments outside Germany please ask your local representative or dealer.
- We do not offer a suitable housing as this would have to be completely different for various combinations of controls.

Connection and Installation

Please pay attention to the following notes !

*Electronic basic knowledge is required to install the **WE** electronics and to connect the controls. If you are not sure whether your knowledge is sufficient please consult an expert. We cannot take back modules that became defective because of wrong installation or wrong connection of the controls or voltages. We also cannot take back modules or cables which have been soldered by the user.*

Power Supply (1)

WE does not have a built-in power supply. Instead it uses a plug-in type external power supply (AC adapter). One reason for this feature is electrical safety. Keeping danger voltages (main) out of the **WE** increases the electrical safety. Therefore an external power supply of high quality and safety should be used. If **WE** is used in Germany the external power supply has to be VDE approved. Another reason for the external power supply is the fact that mains voltages and plug types vary considerably from country to country. Using a plug-in external supply **WE** can be used any where with a locally purchased power supply, thus keeping the retail price down.
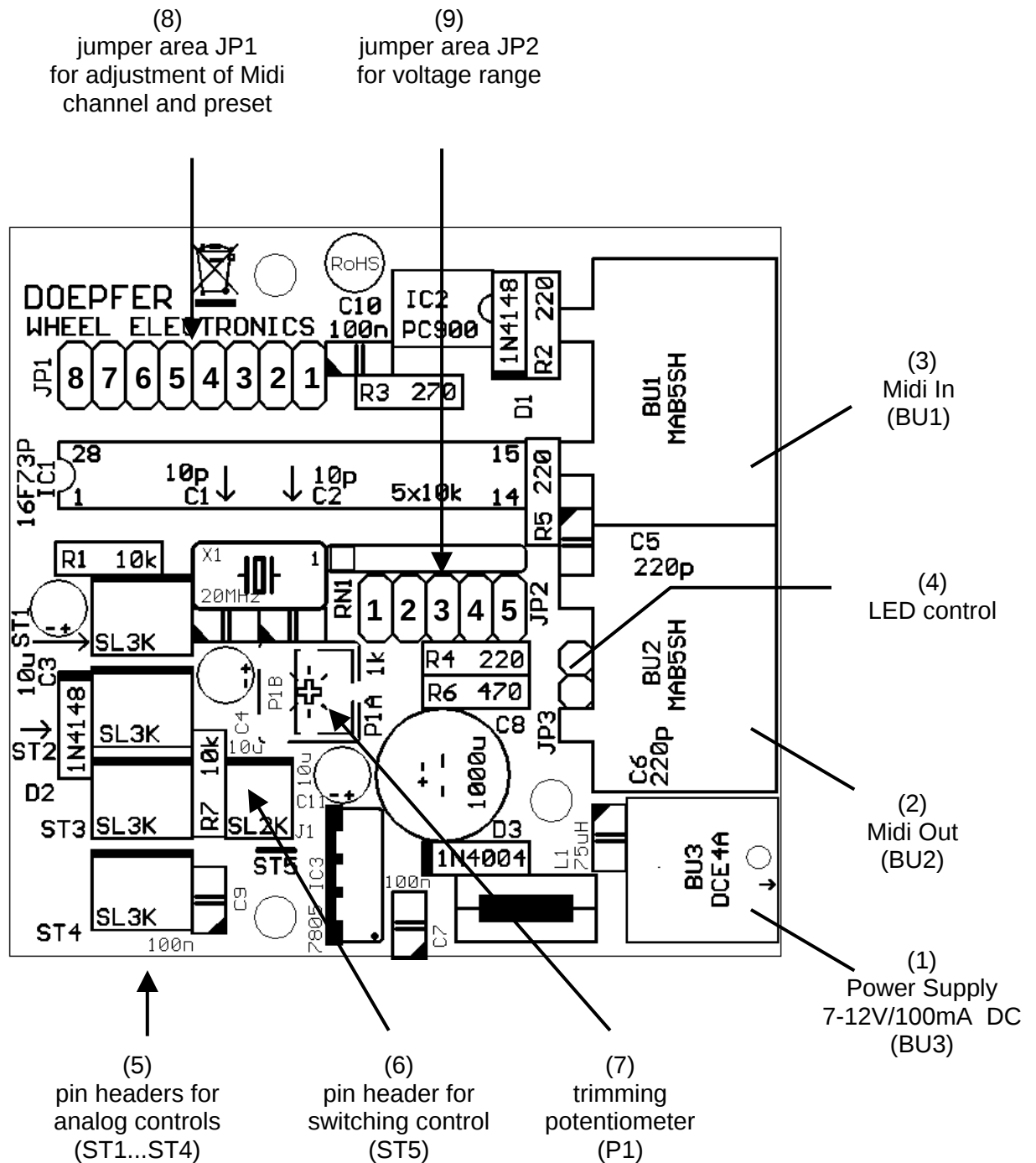
The power supply has to be able to deliver 7-12 VDC unstabilized voltage, as well as a minimum current of 100mA. **WE** is switched ON by plugging the AC adapter into a wall outlet and connecting it to the appropriate jack on the **WE** board. There is no separate ON/OFF switch. After power on the preset adressed by the setting of the jumpers is called up.

If the polarity of the power supply is incorrect, **WE** will not function. However, there is no danger of damage to the circuitry since it is protected by a diode. The correct polarity is: outside ring = GND, inside lead = +7...12V. A power supply for 230V mains voltage with European type mains plug is included with the **WE** (valid only within Europe, for other countries ask you local Doepfer representative or dealer).

Midi Out Socket (2)

Connect the Midi Out socket with Midi In of the device to be controlled by **WE** (e.g. sound expander, synthesizer, sample player, computer with Midi interface and suitable software, second daisy-chained **WE**) via a suitable Midi cable. If you want to control more than one Midi device you have to use daisy chain Midi Thru / Midi In connection of the devices ore use a external Midi Thru box.

Overview: Wheel Electronic Connectors and Controls

(8)
jumper area JP1
for adjustment of Midi
channel and preset

(9)
jumper area JP2
for voltage range

(3)
Midi In
(BU1)

(4)
LED control

(2)
Midi Out
(BU2)

(1)
Power Supply
7-12V/100mA DC
(BU3)

(5)
pin headers for
analog controls
(ST1...ST4)

(6)
pin header for
switching control
(ST5)

(7)
trimming
potentiometer
(P1)

Midi In Socket (3)

The *WE* features a Midi input. This input may be connected to another Midi device (e.g. Midi keyboard). The incoming Midi data are merged to the data generated by *WE*. The Midi input may be used as well for daisy-chaining several *WE*. The Midi input of *WE* is not suitable for large amounts of Midi data (e.g. SysEx strings or Midi messages coming from an computer sequencer) as the *WE* has only a small Midi buffer. In case of large amounts of incoming Midi data loss or delay of data may occur.

If the merge feature of the *WE* is not required the Midi input is left open.

LED Control (4)

After power on the LED is permanently on. If this does not happen probably the power supply is not suitable (i.e. not the correct voltage range, minimum current or polarity) or defective. As soon as a Midi out event occurs the LED turns off for a short time thus indicating MIDI activity. The LED can be used to show the correct function of *WE* in principle.

Connectors for the four analog controls (5)
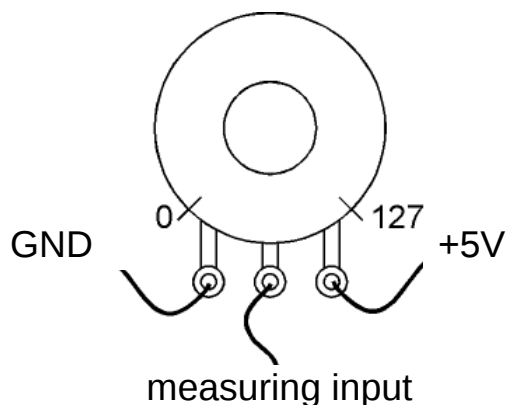
Remark: In the following the terms GND (= abbreviation of ground) and 0V (zero volts) are used synonymous.

The four pin headers ST1…ST4 with three pins each are used to connect the analog controls. The pins of these connectore have these functions:
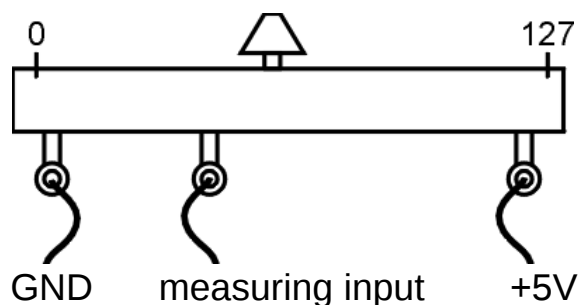
Position	Function	To be connected to ...
left	GND	end terminal #1 of the potentiometer (the terminal that corresponds to Midi data 0)
center	measuring input (control voltage)	center terminal of the potentiometer
right	+5V	end terminal #2 of the potentiometer (the terminal that corresponds to Midi data 127)

The control voltages are normally generated by rotary or fader potentiometers that are connected between GND and +5V. In this case the wiper of the potentiometers outputs a voltage in the range 0...+5V while the potentiometer is operated. Another possibility is the connection of momentary switches or toggle switches (see below). Special potentiometers (e.g. modulation wheels, foot controllers, joy sticks) usually do not cover the complete angle of rotation. If an electronics is used that analyses the full voltage range 0...+5V the higher Midi data values are missing. For this the *WE* is equipped with a high-resolution trimming potentiometer (P1) that generates a second reference voltage for controls that do not cover the complete voltage range 0…+5V. For each of the analog inputs one can select if the full range (0…+5V) or the reduced range (0…+V, +V adjusted by P1) is used for generating the Midi data. Even breath controllers (e.g. Yamaha BC-1/2/3) output only about +3.5V maximal voltage. For details please refer to jumper area JP1.

We recommend the usage of three-pin cable sets with suitable female connectors to establish the connections between *WE* and the analog controls. In this way the controls might be disconnected from the electronics very easily.

Connecting a rotary potentiometer
to ST1…ST4
(valid for potentiometers of
modulation wheels, foot controllers
and joysticks too)

Connecting a fader potentiometer
to ST1…ST4
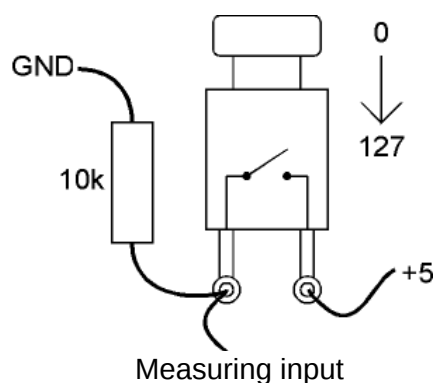
Linear potentiometers with resistance values 4k7 ... 100k can be used. We recommend 10k (linear).

Important: Unused measuring inputs have to be connected to GND or +5V. Avoid open inputs !
An open input will cause the transmission of random Midi data causing undesirable side effects at the Midi receiver (e.g. Midi overflow or random parameter fluctuations). E.g. jumpers can be used to connect the center pin of ST1…ST4 to GND (left position) or +5V (right position).
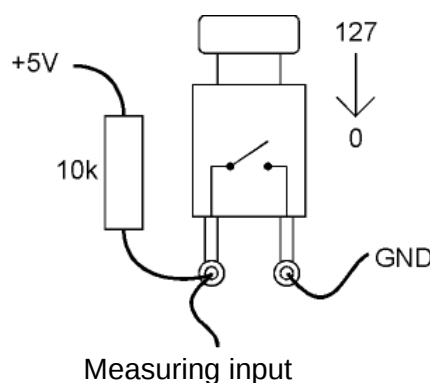
Even momentary or toggle switches can be connected to ST1…ST4 altought *WE* was not developed for this application. The switches can be used in two different ways:

	state of rest		active state	
	Midi data	voltage	Midi data	voltage
version 1	0	0V	127	+5V
version 2	127	+5V	0	0V

Simple momentary switches (1 contact, open at rest) or simple toggle switches (1 contact on/off) are required. According to the desired behaviour (version 1 or 2 in the above table) the switch has to be wired correspondingly:

Connection of a momentary or
toggle switch (version 1)
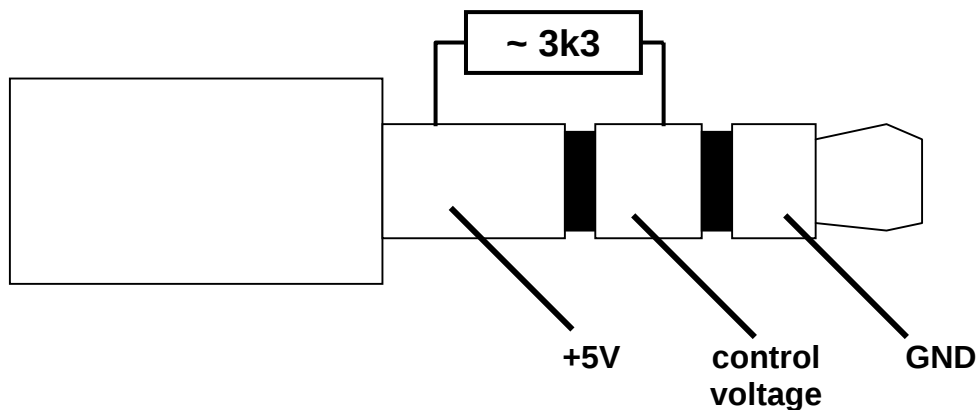
Connection of a momentary or
toggle switch (version 2)

In both cases an additional 10k resistor is required (possible range 4k7 to 100k) to pull the analog input to a defined state during the switch is open.

- Version 1: The resistor is soldered between GND and the measuring input . This way the input is pulled to GND (=0V corresponding to Midi data 0) as long as the switch is left open. When the switch is closed the voltage jumps to +5V corresponding to Midi data 127.

- Version 2: The resistor is soldered between +5V and the measuring input . This way the input is pulled to +5V (corresponding to Midi data 127) as long as the switch is left open. When the switch is closed the voltage jumps to 0V corresponding to Midi data 0.

Even a Yamaha breath controller BC-1/2/3 can be connected to connector ST4 if preset #2 is used (please refer to page 11). The stereo miniature plug of the BC-1/2/3 uses the same signals as ST4 of *WE*: GND, control voltage and +5V. In addition a pull-up resistor (about 1k ...4k7) has to be added between the control voltage pin and +5V. This measure is – at least for the BC-2 – required as a serial diode is added to the breath controller's output. Then BC2 generates a voltage in the range of +5V (no pressure) to ~ +2,5V (maximum pressure). In addition the behaviour can be adjusted by the trimming potentiometers *offset* and *gain* of the BC2.

The pinout of the breath controller connector is taken from the service manual of Yamaha BC2. Pay attention to the unusual connection of +5V and GND ! A BC2 has been tested successfully in combination with WE. The specification of the breath control connector is without obligation for other devices! Please check if the connector of your breath control is identical. We are not responsible for defective breath controllers connected in the wrong way. We recommend the usage of a 3,5 mm stereo jack socket for the connection. The socket is connected to ST4 of WE via the 3-pin cable set that is included with WE.

Connector for the switching control (6)

The switching control (e.g. a foot switch or any other switch) is connected to the two pins of ST5. The polarity for the switch is adjusted by means of the jumper JP2-5. If the foot switch behaves in the opposite way as expected simply change the setting of JP2-5. For details please refer to the chapter **Function of the jumper area JP2**

We recommed the usage of two-pin cable set with suitable female connector to establish the connection between *WE* and the switching control. In this way the controls might be disconnected from the electronics very easily.

Controls and Operation

In addition to the elements connected to ST1…ST5 **WE** has these controls available:

- Jumper area JP1 for adjustment of Midi channel and preset selection
- Jumper area JP2 for voltage range selection and polarity of the foot switch
- Trimming potentiometer P1 for adjustment of the reduced voltage range +V

Function of the jumper area JP1

The jumper area JP1 is made of a double row pin header with 16 pins that can be used to install up to 8 jumpers. The jumpers 1…4 are used to adjust the Midi channel. With the jumpers 5…8 one of the presets is selected. A preset defines the assignments of Midi messages to the analog inputs ST1…ST4 and the switching input ST5.

The following table shows the relation between the settings of the jumpers 1…4 of JP1 and the corresponding Midi channels:

Jumper #				Midi-channel
1	2	3	4	
⑤	■	■	■	1
	■	■	■	2
■		■	■	3
		■	■	4
■	■		■	5
	■		■	6
■			■	7
			■	8
■		■		9
	■	■		10
■		■		11
		■		12
■	■			13
	■			14
■				15
				16

⑤ = jumper installed

The factory setting is shaded grey (Midi channel 1).

The following table shows the relation between the settings of the jumpers 5…8 of JP1 and the corresponding preset:

Preset #	Jumper #				Midi function of ...				
	5	6	7	8	ST1	ST2	ST3	ST4	ST5
1	■	■	■	■	PIT	MOD	VOL	AT	SUST
2		■	■	■	PIT	MOD	VOL	*BC (*)*	SUST
3	■		■	■	VOL	VOL+1	VOL+2	VOL+3	SUST
4			■	■	MOD	*68*	VOL	EXP	SUST
5	■	■		■	1/2	3/4	5/6	7/8	SUST
6		■		■	SUST	SOST	SOFT	VOL	SUST
7	■			■					
8				■					
9	■	■	■						
10		■	■						
11	■		■						
12			■						
13	■	■							
14		■							
15	■								
16					PAN	EXP	VOL	BAL	SUST

⑤ = jumper installed

The factory setting is shaded grey (preset # 1).

Abbreviations:

PIT	pitch bend
AT	monophonic after touch
MOD	modulation (control change # 1)
BC (*)	breath control (control change # 2), *voltage range adapted to BC2 (+5...+2,5V)*
VOL	volume (control change # 7)
BAL	balance (control change # 8)
PAN	panorama (control change # 10)
EXP	expression (control change # 11)
SUST	sustain (control change # 64)
SOST	sostenuto (control change # 66)
SOFT	soft pedal (control change # 67)
number	other controller (number = control change number)

Remarks:

- Preset #1 is the standard preset for pitch bender, modulation wheel and two controllers for volume and after touch.
- Preset #2 is similar to preset #1 but after touch is replaced by breath control. The *WE* firmware has been adapted to the *Yahama BC2*. Provided that the BC2 is wired as described on page 9 it generates a voltage in the range of +5V (no pressure) to ~ +2,5V (maximum pressure), i.e. the behaviour is reverse (higher pressure → lower voltage) and the voltage range is limited to about +2,5...+5V. In preset #4 connector ST4 has been adapted to this reverse behaviour.
- Preset #3 is planned to control the volume on four succeeding Midi channels. The Midi channel selected by the jumpers 1...4 is valid only for ST1. ST2, ST3 and ST4 transmit their volume data on the following Midi channels (marked by V+1, V+2, V+3).
- Preset #4 is a special preset for the organ emulation B4 by Native Instruments. The control change numbers 1 (actually modulation) and 68 are used to control the rotary speakers.

Control change # 1 is used for fast/slow, # 68 for on/off. Please refer to the B4 manual for details. In addition volume and expression are available.

- Preset # 5 is a special preset for joy sticks. Starting from the center position (i.e. about +2.5V control voltage) for up/down and left/right movement of the joy stick different Midi control changes are used (1/2, 3/4, 5/6 and 7/8).
- Preset # 6 is a special preset for triple (or dual) foot controllers. For sustain one can choose between the continuous version (ST1) or the switching version (ST5). In addition a volume controller can be used. If a foot controler with switches is used the wiring for switches has to be made (please refer to page 9). If a foot controller with potentiometers is used it depends upon the type of potentiometer how it has to be wired. If potentiometers with three terminals are used they are connected like normal potentiometers (please refer to page 8). If potentiometers with only two terminals are used (variable resistor only) the two terminals have to be connected to GND and the measuring input. In addition a pull-up resistor has to be connected between the measuring input and +5V. One has to try out different values for the resistor. Half the value of the potentiometer is a good starting point. Even a trimming potentiometer instead of a fixed resistor can be used. If the behaviour is reverse the connections have to be exchanged: pull-down resistor between GND and the measuring input, potentiometer of the foot controller between the measuring input and +5V). Even foot controllers with a combination of switches and potentiometers are available (e.g. the FATAR VFP3-2D).
- Presets # 7 to 15 are not used in the first version of the *WE* firmare.

Function of the jumper area JP2

The jumper area JP2 consists of a double row pin header with 10 pins that can be used to install up to 5 jumpers. Four jumpers are used to select between full voltage range (0…+5V) or reduced voltage range (0…+V) for the analog inputs ST1…ST4. The following table shows the relation between the settings of the jumpers of JP2 and the corresponding voltage ranges for the analog inputs ST1…ST4:

Jumper				Input	Voltage range
1	2	3	4		
■				ST1	0…+5V
-					0…+V
	■			ST2	0…+5V
	-				0…+V
		■		ST3	0…+5V
		-			0…+V
			■	ST4	0…+5V
			-		0…+V

■ = jumper installed
 - = jumper not installed

The factory setting is shaded grey (all inputs full range 0...+5V).

The fifth jumper JP2-5 is used to adjust the polarity of the foot switch connected to ST5. If JP2-5 is installed the foot switch has to be *closed-at-rest*. If JP2-5 is not installed the foot switch has to be *open-at-rest*. If the foot switch behaves in the opposite way as expected simply change the setting of JP2-5. The factory setting is installed.

Function of the trimming potentiometer P1

The trimming potentiometer P1 is used to adjust the reduced voltage range V+. Any voltage between 0V and +5V can be adjusted though only voltages in the range +3...+5V should be used. Reference voltages below +3V cause malfunction of the analog-to-digital converters though nothing can be damaged. The reduced voltage V+ becomes valid for an input if the corresponding jumper of JP2 is removed (see above table).
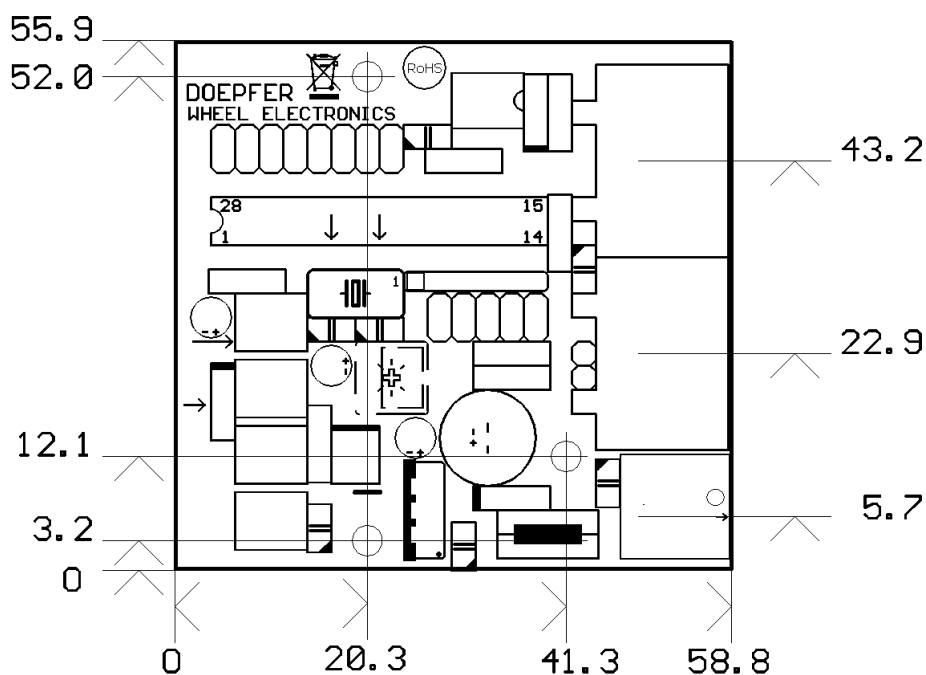
For the adjustment of P1 a small screw driver is necessary. P1 is a multi-turn potentiometer to enable a fine adjustment of V+. When P1 is turned counterclockwise (CCW) V+ increases, clockwise (CW) V+ decreases. The factory setting is fully CCW (+5V). This is the same as if the +5V range is selected by the corresponding jumper of JP2.

If the reduced voltage range V+ is required (e.g. for modulation wheels, foot controllers, some joy sticks) the element connected to ST1...ST4 should be set to it's maximum position, i.e. the position that corresponds to a Midi data value 127. Beginning from fully CCW P1 is adjusted so that a Midi value a bit below 127 is sent (e.g. 125). Then P1 is re-adjusted a little bit until just data 127 appears. If the element connected to ST1...ST4 does not transmit Midi data 0 in it's minimum position the potentiometer inside the modulation wheel, foot controller or joy stick has to be twisted until data 0 is send. After that P1 has to be readjusted again as described above. A Midi monitor program is a very useful tool for the adjustment of P1, e.g. *Midi Ox*. A link to this shareware program is available on our website.

Mounting

Before **WE** is put into operation the board has to be fixed on a suitable support and built into a metal case together with the controls (refer to EMC notes on page 2). The metal case has to be connected to GND of **WE**. We recommend to use the metal plate of the voltage regulator 7805/IC3 or the GND terminal of the power supply socket for this connection.

The board measures about 59 x 56 x 25 mm. Three mounting holes with 3 mm diameter are available for mounting the board inside the case e.g. with distance sleeves or spacers (> 5 mm in length) and suitable screws. Pay attention that no short circuits are made – neither on the top of the board (electronic parts) nor on the bottom (solder points or pcb tracks). In case of doubt use isolating plastic parts (e.g. plastic screws, nuts and washers) for mounting.

Check list

In case that your *WE* installation does not work at the first go please check the following points:

- Does the power supply work correctly ?
- After power on the LED has to turn *on* ! Otherwise the AC adapter used is not suitable, has the wrong polarity, voltage or current, or does not work. The correct polarity is: outside ring = GND, inside lead = +7...12V.
- Are the controls connected correctly as described in this manual ?
- Is the right Midi channel selected with the jumpers 1…4 of JP1 ?
- Is the right preset number selected with the jumpers 5…8 of JP1 ?
- Is the right voltage range selected with the jumpers jumpers of 1...4 JP2 ?
- Are unused analog inputs connected to GND or +5V (or jumpered correspondingly directly at the pin headers ST1…ST4) ? When the LED is flickering permanently without operating one of the controls probably one of the four analog inputs is left open !
- If inputs jumpered for the reduced voltage range seem to work not as they should (e.g. permanent data transmission or no data transmission) check if the voltage V+ adjusted with P1 is more than +3V. With reference voltages below +3V the a/d converters do not work properly.
- Is the LED flickering if incoming Midi messages appear at the Midi In of *WE* (e.g. from a keyboard)?
- Was no short circuit made (neither in the wiring nor mounting) ?
- If the diode D3 and the voltage regulator IC3 become hot probably a short circuit between GND and +5V was made !
- If momentary or toggle switches are used at the analog inputs ST1…ST4: are the 10k (4k7...100k) resistors soldered accordingly?
- Are the Midi connections between *WE* and the other Midi devices installed correctly ? Midi Out of *WE* has to be connected to Midi In of the Midi device controlled by *WE*. Especially when computers are used Midi In and Out are very often mixed up by the user. Once again: Midi Out $\rightarrow$ Midi In (not Midi Out $\rightarrow$ Midi Out nor Midi In $\rightarrow$ Midi In).
- Please use only cables that are suitable for Midi.
- When a PC with sound card is used only high quality multimedia cables should be used. Low cost multimedia cables without optocouplers for Midi In and without drivers for Midi Out very often cause Midi data problems.
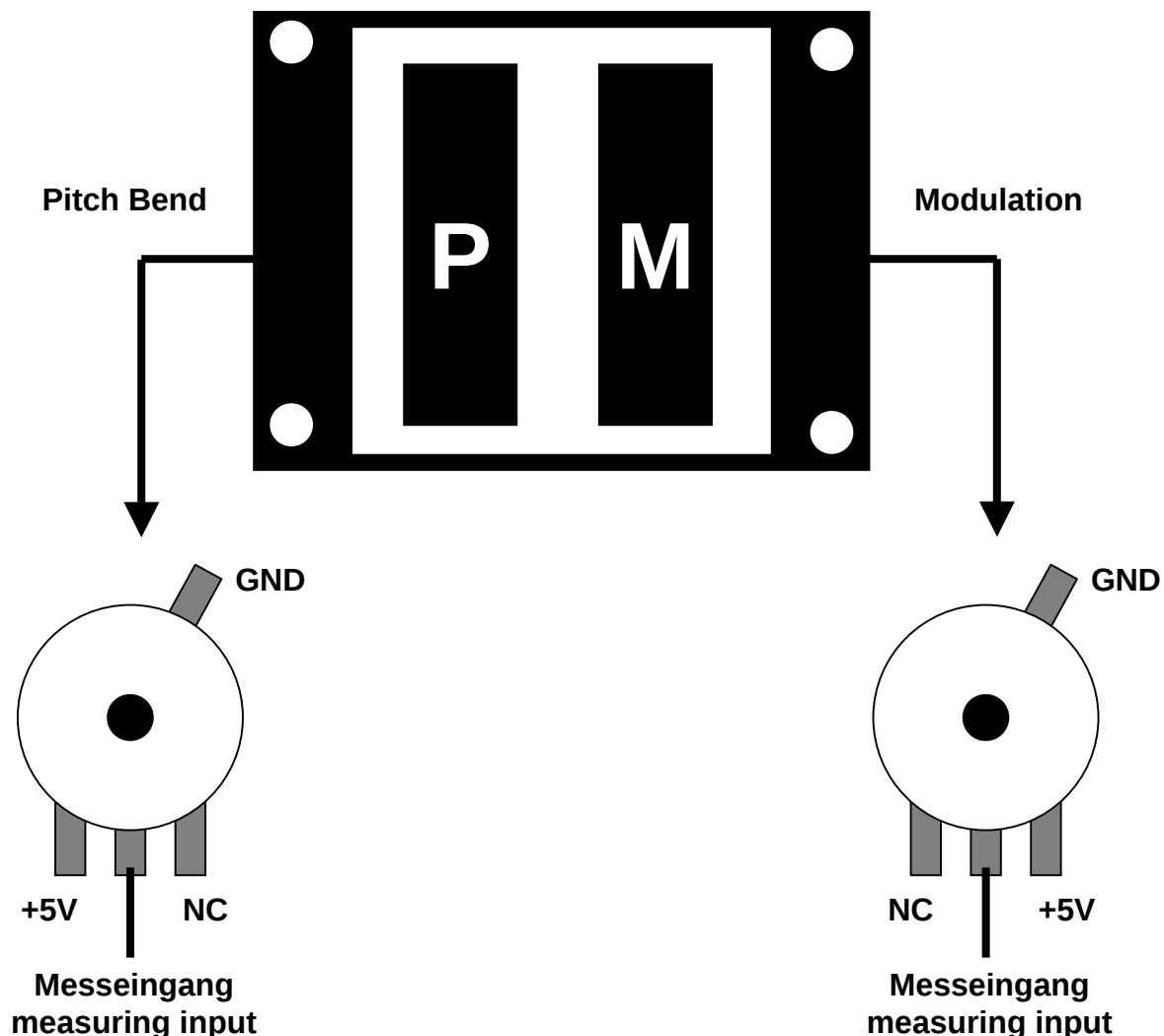
Extent of delivery

The *WE* delivery contains the following parts:

- Wheel Electronic pc board, assembled and tested
- Power Supply (230V mains voltage, European type mains plug, output voltage range 7...12V, current min. 100 mA) <u>included only for shipments within Germany, for shipments outside Germany please contact your local representative or dealer</u>
- This Wheel Electronic user's guide
- Four 3-pin cable sets (about 30 cm) for ST1…ST4
- One 2-pin cable sets (about 30 cm) for ST5

Elements that can be connected to *WE* (e.g. modulation or pitch wheels, rotary or slider/fader potentiometers, foot controllers, foot switches, joy sticks and so on) are not included and have to be purchased in addition. Suitable parts can be found on our website <u>www.doepfer.com</u>. Please use the link *accessories and spare parts* of the product overview page. Prices can be found in the price list.
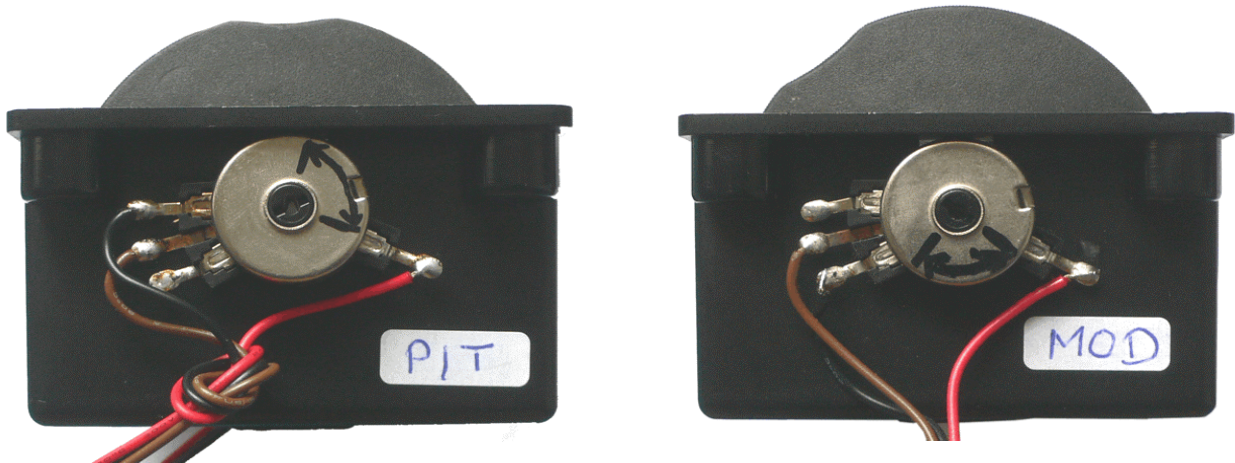
Appendix: Connecting the modulation wheel box to Wheel Electronic

Pitch Bend

P **M**

Modulation

GND

GND

+5V   **NC**

NC   **+5V**

Messeingang measuring input

Messeingang measuring input

<u>voltage range</u> (JP2):
limited voltage range (+V)
adjust +V so that in the center position the
pitch bend data 40H (64 decimal) is sent

Spannungsbereich (JP2):
voller Bereich (+5V)
voltage range (JP2):
full range (+5V)

Pictures of the wired wheel box

Both potentiometers have to be turned into the correct positions because the potentiometers may be mounted at different positions from the factory. There are two possibilities:

- Unscrewing the nut that holds the potentiometer by means of a suitable screw wrench – rotating the potentiometer into the correct position – fixing the nut
- Pulling the wheel off the potentiometer axis and achse and installing the wheel at the correct position

The correct position can be found by moving the wheel to the lowest position. Then the potentiometer has to be rotated that just the Midi data 0 is sent. As soon as the wheel is moved Midi data > 0 have to be send (without much dead zone – otherwise the potentiometer has to be readjusted again). Then the trimming potentiometer of the Wheel Electronic is adjusted so that with the wheel in the upper position Midi data 127 is sent (again with not too much dead zone). For the pitch-bend wheel in addition the center position has to be checked. In the neutral position of the wheel Midi data 64 has to be sent. Otherwise the position of the potentiometer and/or the trimming potentiometer setting has to be corrected again. The adjustment is correct if 64 is sent in the center position, 0 is reached at the lowest position of the wheel and 127 in the upper position of the wheel.