πλ²

PI L SQUARED

- MIDI powered, duophonic Synth
- square wave synthesis
- digital & analog filter

User Manual

πλογτεc Ploytec GmbH – **πλ²** (PL2) Synthesizer - English Manual - Version 1.2, last revised: Dezember 2013

Disclaimer

Safety Instructions

Please only connect analogue audio connections when switched off, in order to protect the speaker membranes and your hearing against sudden sound level peaks. Connecting the device to the USB port of your computer may also cause a noise—please turn down the volume of your playback system accordingly.

Contents

Introduction

We are pleased that you have chosen a Ploytec **πλ²** (*Pi Lambda squared 2* or simply PL2) synthesizer system for your musical endeavors and would like to congratulate you on your decision. We're convinced this innovative development will prove extremely useful to you in the coming years and, above all, provide you with a great deal of entertainment.

We hope you find this manual both informative and entertaining to read, and hope you find lots of pleasure in the Ploytec PL2 synthesizer system.
… Your Ploytec-Team!

Important Notes about Power Supply

The PL2 can generally be powered from the MIDI port without the need for a power adapter. You should ensure, however, that the external MIDI device connected to this port can provide the required current. If this isn't the case you can use a common 5 Volt DC (100mA min.) USB power adapter (e.g. as commonly used for mobile phones) and connect to the PL2 USB Micro-B port. Of course a standard PC or HUB USB port can provide the needed power as well.

Power supply adapter and USB cables are not part of the scope of delivery.

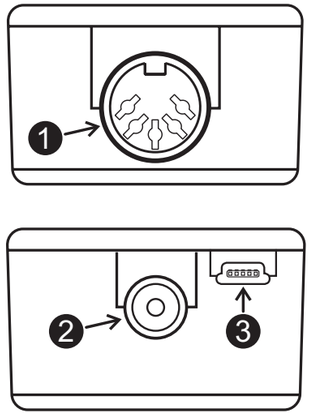
Overview of Technology

Despite its small housing the PL2 is a complete duophonic mono synthesizer. The PL2 generates an enormous variety of sounds with the help of two square wave (pulse) oscillators which can be interconnected in variable and innovative ways - these are fun to experiment with. Not only the classic waveforms such as saw-, sine- or pulse-waves will be simulated, rather newly and interesting sounds - from warm to destructive - are also generated.

The PL2 receives its data always via MIDI channel 1 and all setting parameters can be edited by MIDI controller commandos. Up to 32 of your own self-programmed sounds can be stored in the user memory area. In addition, further 32 factory sounds are located within a fixed memory area which provides ideal starting material to experiment with.

Generally the PL2 follows the principle of subtractive synthesis in which the waveform (generated by the oscillators) first runs through a wide range adjustable digital filter stage (low- high- and band-pass) to edit the frequency spectrum and/or amplify the resonance area if desired. After the digital filter an additional analog low-pass filter follows which particularly ensures the necessary warmth especially for destructive- and digital-like sounds.
Wait, there's more: a dedicated analog saturation stage at the output provides dynamic compression and therefore a respectable bass punch is created.
Of course the PL2 includes several additional options in terms of sound and playing manipulation like LFO modulation, PWM, ADSR envelope and various play modes. Another interesting detail: LFO- and envelope-speed synchronise automatically to an external applied MIDI clock - whereby the PL2 perfectly adjust to your song tempo.
Thanks to the memory flash technology: future PL2 synthesizer extensions or new features can be integrated by updating the firmware via MIDI system exclusive (SysEx) transmission.

Connectivity

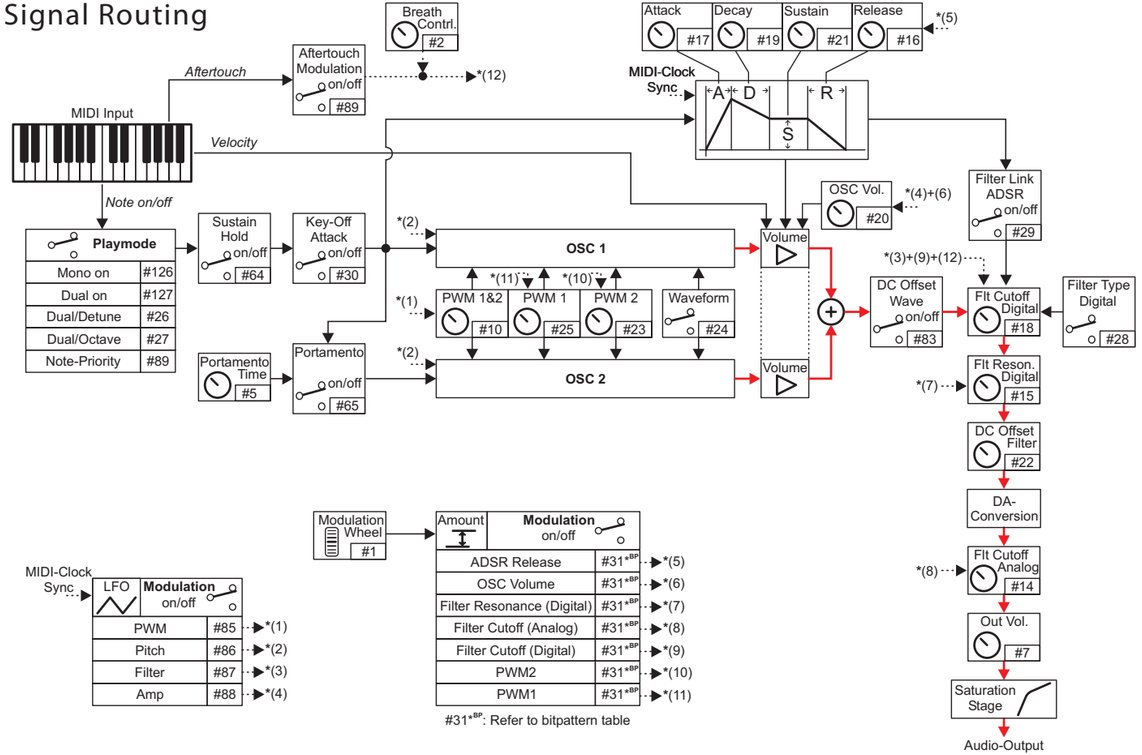


1. **MIDI jack.** With the MIDI input jack it is possible to connect external MIDI peripheral (e.g. keyboards, PC MIDI interfaces, etc.) Usually the PL2 will be powered through this jack also.

2. **Audio output jack.** The output jack is designed to be connected to unbalanced RCA (cinch) lines. If possible only use high quality RCA audio cables.

3. **Micro-B USB jack.** In most cases the PL2 synthesizer will be powered through the MIDI jack and no external power supply will be required. You can connect a separate power supply (not included) or USB PC/HUB port to this jack, if necessary. Also refer to **"Important Notes about Power Supply"** .

Signal Routing



Play Modes

Instruction	Status Byte	Data Byte	Meaning
Mono On	126	0-127	Only oscillator 1 is active.
Dual On	127	0	Both oscillators (having equal phase positions) are active as soon two notes are played at the same time. If more than two notes are played MIDI controller #89 sets the priority.
Dual/Detune	26 or 77	On: 0-63 Off: 64-127	Both oscillators have unequal phase positions. [Off] will switch back to the mono mode.
Dual/Octave	27 or 78	On: 0-63 Off: 64-127	Both oscillators have equal phase positions. Oscillator 2 is pitched one octave higher than oscillator 1. [Off] will switch back to the mono mode.
Note Priority	89	On: 0-63 Off: 64-127	In dual modes the values up to 63 leading to play the both highest notes. The values above 63 leading to play the both lowest notes and **one octave lower**. Note: controller #89 switches [Aftertouch] also.
Aftertouch	89	On: 32-127 Off: 0-32	With values from 32 the aftertouch information will control the digital filter cut-off. Note: controller #89 switches [Note Priority] also.
Breath Control	2	0-127	Like for [Aftertouch] breath control controls the filter cut-off. Note that [Breath Control] and [Aftertouch] will overwrite each other.
Sustain Hold	64	On: 64-127 Off: 0-63	Hold function. If [On] is selected note-off commands are no longer processed. A played note holds a fixed level - which is set by controller #21 ([Sustain] of ADSR envelope) - until new notes occurs. This depends on the particular mono-/ dual-mode.

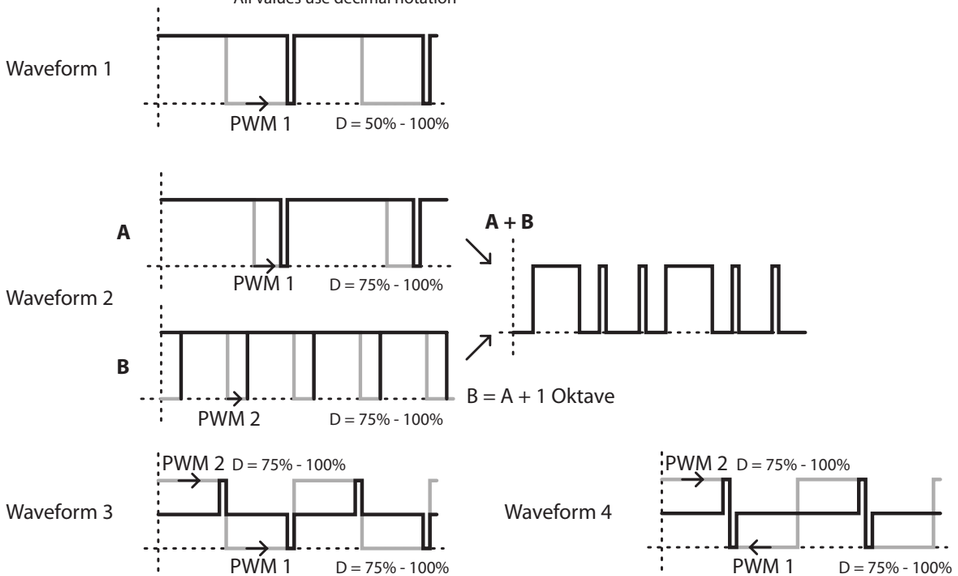
All values use decimal notation

Instruction	Status Byte	Data Byte	Meaning
Key-Off Attack	30 or 81	On: 64-127 Off: 0-63	If [On] is set note off commands will generate ADSR envelope re-trig-gering. Interesting for bassy and percussive sounds.
Portamento	65	On: 64-127 Off: 0-63	Glide. A new played note will slide from the previous to the new target pitch.
Portamento Time	5	0-127	If [Portamento] is selected this parameter controls the speed at which an oscillator moves to a new pitch.
All Sound Off	120	0	Silence all notes currently sounding.
All Notes Off	123	0	Turns off all voices. A note-off message will address each note to stop hanging sounds if necessary.

All values use decimal notation

Instruction	Status Byte	Data Byte	Meaning
Waveform	24 or 75	1: 0-31 2: 32-63 3: 64-95 4: 96-127	1: Classic square wave (pulse) form - [PWM 1] is adjusting. 2: Combined by A and B - [PWM 1] adjusts A, [PWM 2] adjusts B. 3 and 4: Complex square wave forms - [PWM 1] adjusts lower half wave, [PWM 2] adjusts upper half wave.

All values use decimal notation



Oscillators

Instruction	Status Byte	Daten Byte	Meaning
PWM 1	25 or 76	0-127	Pulse width modulation 1, will be overwritten by [PWM 1&2].
PWM 2	23 or 95	0-127	Pulse width modulation 2, will be overwritten by [PWM 1&2].
PWM 1&2	10	0-127	Pulse width modulation 1&2, controls in absolute and not in relative terms.
OSC Volume (Pre Filter Volume)	20 or 92	0-127	Oscillator maximal level. The velocity and the envelope generator (ADSR) modulate the volume to a maximum level set here.
DC Offset Wave	83	On: 64-127 Off: 0-63	Bitshifter. The waveform will be shifted upwards by a fixed level set here. As soon the upper limit is reached the truncated part will be inserted at the lower limit again. Thereby distorted and destructive sounds can be generated.

All values use decimal notation

Envelope

The envelope speed will synchronise automatically to an external applied MIDI clock.

Instruction	Status Byte	Data Byte	Meaning
ADSR Attack	17 or 73	0-127	Rise time of the ADSR envelope generator.
ADSR Decay	19 or 91	0-127	Decay time of the ADSR envelope generator.
ADSR Sustain	21 or 93	0-127	Holt level of the ADSR envelope generator.
ADSR Release	16 or 72	0-127	Release time of the ADSR envelope generator.

All values use decimal notation

Filter

Instruction	Status Byte	Daten Byte	Meaning
Filter Cutoff	18 or 74	0-127	Adjusts the digital filter cut-off frequency.
Filter Resonance	15 or 71	0-127	Amplifies the digital filter resonance area.
DC Offset (Post Filter)	22 or 94	0-127	Bitshifter. The waveform after the digital filter can be shifted upwards by a level set here. As soon the upper limit is reached the truncated part will be inserted at the lower limit again. Thereby experimental sounding tones can be generated here once more.
Filter Type	28 or 79	LP: 0-63 BP: 64-95 HP: 96-127	LP = low pass filter BP = band pass filter HP = high pass filter
Filter Cutoff (Analog)	14 or 70	0-127	After the digital filter and DA conversion an additional analog low-pass filter follows. Adjusts the analog filter cut-off frequency here. Note : this parameter isn't useful for dynamic control because disturbing noises can occur while playing notes and changing this parameter at the same time.
Filter Link ADSR	29 or 80	On: 64-127 Off: 0-63	The amplifier envelope can control the digital filter cut-off frequency if linked. [On] will activate the link.

All values use decimal notation

LFO

The integrated low frequency oscillator (LFO) can effect up to five destination parameters. The LFO speed will synchronise automatically to an external applied MIDI clock.

Instruction	Status Byte	Data Byte	Meaning
PWM	85	On: 64-127 Off: 0-63	Controls the parameter [PWM 1&2].
Pitch	86	On: 64-127 Off: 0-63	Controls the main pitch.
Filter	87	On: 64-127 Off: 0-63	Controls the parameter [Filter Cutoff Digital].
Amp	88	On: 64-127 Off: 0-63	Controls the parameter [OSC Volume].

All values use decimal notation

Modulation

Instruction	Status Byte	Data Byte	Meaning
Modulation Wheel Mode	31 or 82	0-127 Bitpattern	Up to seven destination parameter can be effected by the modulation wheel: [ADRS Release], [OSC Volume], [Filter Resonance], [Filter Cutoff Analog, [PWM 1] and [PWM 2] can be assigned in form of an bitpattern to any possible combination. The desired combination can be taken from the "Bitpattern" table chart.

All values use decimal notation

Modulation Wheel Bitpattern

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
00							
01							✓
02						✓	
03						✓	✓
04					✓		
05					✓		✓
06					✓	✓	
07					✓	✓	✓
08				✓			
09				✓			✓
10				✓		✓	
11				✓		✓	✓
12				✓	✓		
13				✓	✓		✓
14				✓	✓	✓	
15				✓	✓	✓	✓
16			✓				
17			✓				✓
18			✓			✓	
19			✓			✓	✓
20			✓		✓		
21			✓		✓		✓
22			✓		✓	✓	
23			✓		✓	✓	✓
24			✓	✓			
25			✓	✓			✓
26			✓	✓		✓	
27			✓	✓		✓	✓
28			✓	✓	✓		
29			✓	✓	✓		✓
30			✓	✓	✓	✓	
31			✓	✓	✓	✓	✓

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
32		✓					
33		✓					✓
34		✓				✓	
35		✓				✓	✓
36		✓			✓		
37		✓			✓		✓
38		✓			✓	✓	
39		✓			✓	✓	✓
40		✓		✓			
41		✓		✓			✓
42		✓		✓		✓	
43		✓		✓		✓	✓
44		✓		✓	✓		
45		✓		✓	✓		✓
46		✓		✓	✓	✓	
47		✓		✓	✓	✓	✓
48		✓	✓				
49		✓	✓				✓
50		✓	✓			✓	
51		✓	✓			✓	✓
52		✓	✓		✓		
53		✓	✓		✓		✓
54		✓	✓		✓	✓	
55		✓	✓		✓	✓	✓
56		✓	✓	✓			
57		✓	✓	✓			✓
58		✓	✓	✓		✓	
59		✓	✓	✓		✓	✓
60		✓	✓	✓	✓		
61		✓	✓	✓	✓		✓
62		✓	✓	✓	✓	✓	
63		✓	✓	✓	✓	✓	✓

Modulation Wheel Bitpattern

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
64	✓						
65	✓						✓
66	✓					✓	
67	✓					✓	✓
68	✓				✓		
69	✓				✓		✓
70	✓				✓	✓	
71	✓				✓	✓	✓
72	✓			✓			
73	✓			✓			✓
74	✓			✓		✓	
75	✓			✓		✓	✓
76	✓			✓	✓		
77	✓			✓	✓		✓
78	✓			✓	✓	✓	
79	✓			✓	✓	✓	✓
80	✓		✓				
81	✓		✓				✓
82	✓		✓			✓	
83	✓		✓			✓	✓
84	✓		✓		✓		
85	✓		✓		✓		✓
86	✓		✓		✓	✓	
87	✓		✓		✓	✓	✓
88	✓		✓	✓			
89	✓		✓	✓			✓
90	✓		✓	✓		✓	
91	✓		✓	✓		✓	✓
92	✓		✓	✓	✓		
93	✓		✓	✓	✓		✓
94	✓		✓	✓	✓	✓	
95	✓		✓	✓	✓	✓	✓

Daten-Byte	ADSR Release	OSC Volume	Filter Reson. (Digital)	Filter Cutoff (Analog)	Filter Cutoff (Digital)	PWM 2	PWM 1
96	✓	✓					
97	✓	✓					✓
98	✓	✓				✓	
99	✓	✓				✓	✓
100	✓	✓			✓		
101	✓	✓			✓		✓
102	✓	✓			✓	✓	
103	✓	✓			✓	✓	✓
104	✓	✓		✓			
105	✓	✓		✓			✓
106	✓	✓		✓		✓	
107	✓	✓		✓		✓	✓
108	✓	✓		✓	✓		
109	✓	✓		✓	✓		✓
110	✓	✓		✓	✓	✓	
111	✓	✓		✓	✓	✓	✓
112	✓	✓	✓				
113	✓	✓	✓				✓
114	✓	✓	✓			✓	
115	✓	✓	✓			✓	✓
116	✓	✓	✓		✓		
117	✓	✓	✓		✓		✓
118	✓	✓	✓		✓	✓	
119	✓	✓	✓		✓	✓	✓
120	✓	✓	✓	✓			
121	✓	✓	✓	✓			✓
122	✓	✓	✓	✓		✓	
123	✓	✓	✓	✓		✓	✓
124	✓	✓	✓	✓	✓		
125	✓	✓	✓	✓	✓		✓
126	✓	✓	✓	✓	✓	✓	
127	✓	✓	✓	✓	✓	✓	✓

Output

Instruction	Status Byte	Data Byte	Meaning
Out Volume	7	0-127	The output includes an analog volume control which is linked commonly with the following saturation stage. The output signal therefore gets rising compression by rising output level.

All values use decimal notation

Program Memory

The PL2 program memory includes 64 positions which can be selected by standard MIDI program change messages. The first 32 programs include the factory sounds which are fixed and can not be overwritten. The memory space from 33 to 64 is the user area. All parameter changes made here will be stored automatically as soon as you switch (via MIDI program change) to another program. Upon delivery the factory sounds can be found additionally at program position 33-64 and therefore provides ideal starting material to experiment with. The program numbers 65-128 include random sounds.

Factory Sounds

Progr.	Name
1	Upright Bass
2	Analog Synth
3	Lord
4	Mario
5	Analog Strings
6	Summer Bass
7	Will You
8	Berlin 61

Progr.	Name
9	Main Bass
10	On Air
11	Black Roses
12	Poison
13	5th down
14	Dub Bass
15	Charles
16	Wesley

Progr.	Name
17	Analog Bass
18	Signals
19	Mr. Finger
20	Dead Cat
21	Titanium
22	Neon Light
23	Herr Schneider
24	Numb

Progr.	Name
25	Geiger
26	Metropolis
27	Vettel
28	Analog Pad
29	Lukas
30	Transformator
31	Smacker
32	Electric Moskito

Appendix

Declaration of Conformity

We:
Ploytec GmbH • Fahrnauerstr. 64 • 79650 Schopfheim
hereby declare that the product
Ploytec PL2 Synthesizer ,
to which this declaration refers is in compliance with the following standards or standardising documents:
• EN 55022: 1998+Corrigendum July 2003+A1:2000+ Corrigendum April 2003+A2:2003
• EN 55024: 1998+A1:2001+A2:2003
to which this declaration refers is in compliance with the following standards or standardising documents:
residential, business and commercial environments and small-company environments.

Technical Data:

Current consumption:	10mA max.
Output level:	580mV$_{RMS\ (nom.)}$
Dimensions:	46.5 x 27.5 x 52.0 [mm] (wxhxd)

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PI L SQUARED

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MIDI Implementation Chart

[PL2 (PI L SQUARED) duophonic square wave synth] Date:20.10.2013

PL2 MIDI Implementation Chart

Function	Transmitted	Recognized	Remarks
Basic Default	x	1	
Channel Changed	x	x	
Mode Default	x	Mode 4	
Mode Messages	x	POLY, MONO	
Mode Altered	**********	x	
Note	x	0-127	
Number: True Voice	**********	0-127	
Velocity Note On	x	o 1-127	
Velocity Note Off	x	x	
Aftertouch Key's	x	x	
Aftertouch Ch's	x	o	
Pitch Bender	x	o	-12<-0->+12 semi, 8 bit resolution *2
Control Change 1	x	o	Modulation Wheel *3
Control Change 2	x	o	Breath Control *4
Control Change 5	x	o	Portamento Time
Control Change 7	x	o	Out Volume
Control Change 10	x	o	PWM 1 & 2 *5
Control Change 14, 70	x	o	Filter Cutoff - Analog
Control Change 15, 71	x	o	Filter Resonance - Digital
Control Change 16, 72	x	o	ADSR Release
Control Change 17, 73	x	o	ADSR Attack
Control Change 18, 74	x	o	Digital Filter Cutoff
Control Change 19, 91	x	o	ADSR Decay
Control Change 20, 92	x	o	OSC Volume (Pre Filter Volume)
Control Change 21, 93	x	o	ADSR Sustain
Control Change 22, 94	x	o	DC Offset (Post Filter)
Control Change 23, 95	x	o	PWM 2 *6
Control Change 24, 75	x	o	Waveform *1
Control Change 25, 76	x	o	PWM 1
Control Change 26, 77	x	o	Dual/Detune *1
Control Change 27, 78	x	o	Dual/Octave *1
Control Change 28, 79	x	o	Filter Type - Digital *1
Control Change 29, 80	x	o	Filter Link ADSR *1
Control Change 30, 81	x	o	Key-Off Attack *1
Control Change 31, 82	x	o	Modulation Wheel Mode *7
Control Change 64	x	o	Sustain Hold *1
Control Change 65	x	o	Portamento *1
Control Change 83	x	o	DC Offset (Pre Filter) *1
Control Change 85	x	o	PWM Modulation (LFO) *1
Control Change 86	x	o	Pitch Modulation (LFO) *1
Control Change 87	x	o	Filter Modulation (LFO) *1
Control Change 88	x	o	Amp Modulation (LFO) *1
Control Change 89	x	o	Note Priority and Aftertouch *8
Control Change 120	x	o	All Sound Off *1
Control Change 123	x	o	All Notes Off *1

Function	Transmitted	Recognized	Remarks
Program Change True Number	x 0 - 127	o 0 - 63 0 - 63	*9
System Exclusive	x	o	*10
System Common SongPosition	x	x	
SongSelect	x	x	
Tune	x	o	*11
System Real Time Clock	x	o	*12
Commands	x	o Start	*13
Aux Mes- sages :Local On/Off	x	x	
:All Notes Off	x	o 1-127	
:Active Sense	x	x	
:Reset	x	o	*14

Notes

*1: Switch
*2: Pitch Wheel Change (E0 hex). MSB and bit 0 of LSB used
*3: Effects parameters according to bitpattern table (defined in controller #31, 82)
*4: Overwrites Aftertouch information and vice-versa
*5: Overwrites PWM 1 (controller #25, 76) and PWM 2 (controller #23, #95)
*6: Effective only for waveform 2-4 (controller #24, 75)
*7: Defines modulation wheel routings according to bitpattern table
*8: Controller #89 sets both, Aftertouch (bit 5) and Note Priority (bit6)
*9: 0-31 (program 1-32) is fixed factory set, 32-63 (program 33-64) is user set
*10: Used for future system exclusive firmware updates
*11: Reset to start-up condition
*12: Synchronising LFO clock and ADSR speed. Once linked a loosing clock signal will cause a complete system reset!
*13: LFO restart
*14: Reset to start-up condition

Mode 1 : OMNI ON, POLY Mode 2 : OMNI ON, MONO o :Yes
Mode 3 : OMNI OFF, POLY Mode 4 : OMNI OFF, MONO x :No