

# Register Overview

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All communications with the hardware is done via registers. This page provides a detailed description of all available registers of the PiLC hardware.

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## FPGA registers

### Identifikation Register

Address (Hex)	Name	Read	Write	Value
0x64	FPGA ID	X	0	0xEC
0x65	FPGA_Hardware_Version	X	0	32Bit
0x66	FPGA_Software_Version	X	0	32Bit
0x67	FPGA_Projekt_Nr.	X	0	32Bit
0x68	FPGA_Projekt_Version	X	0	32Bit

### IO Register

Address (Hex)	Name	Read	Write	Value
0x01	IO_1_Data_In_Register	x	x	32Bit
0x02	IO_1_Data_Out_Register	x	0	32Bit
0x03	IO_2_Data_In_Register	x	x	32Bit
0x04	IO_2_Data_Out_Register	x	0	32Bit
0x05	IO_3_Data_In_Register	x	x	32Bit
0x06	IO_3_Data_Out_Register	x	0	32Bit
0x07	IO_4_Data_In_Register	x	x	32Bit
0x08	IO_4_Data_Out_Register	x	0	32Bit
0x09	IO_5_Data_In_Register	x	x	32Bit
0x0A	IO_5_Data_Out_Register	x	0	32Bit
0x0B	IO_6_Data_In_Register	x	x	32Bit
0x0C	IO_6_Data_Out_Register	x	0	32Bit
0x0D	IO_7_Data_In_Register	x	x	32Bit
0x0E	IO_7_Data_Out_Register	x	0	32Bit
0x0F	IO_8_Data_In_Register	x	x	32Bit
0x10	IO_8_Data_Out_Register	x	0	32Bit
0x11	IO_9_Data_In_Register	x	x	32Bit

0x12	IO_9_Data_Out_Register	x	0	32Bit
0x13	IO_10_Data_In_Register	x	x	32Bit
0x14	IO_10_Data_Out_Register	x	0	32Bit
0x15	IO_11_Data_In_Register	x	x	32Bit
0x16	IO_11_Data_Out_Register	x	0	32Bit
0x17	IO_12_Data_In_Register	x	x	32Bit
0x18	IO_12_Data_Out_Register	x	0	32Bit
0x19	IO_13_Data_In_Register	x	x	32Bit
0x1A	IO_13_Data_Out_Register	x	0	32Bit
0x1B	IO_14_Data_In_Register	x	x	32Bit
0x1C	IO_14_Data_Out_Register	x	0	32Bit
0x1D	IO_15_Data_In_Register	x	x	32Bit
0x1E	IO_15_Data_Out_Register	x	0	32Bit
0x1F	IO_16_Data_In_Register	x	x	32Bit
0x20	IO_16_Data_Out_Register	x	0	32Bit

## IO Status Register

Address (Hex)	Name	Read	Write	Value
0x21	IO_Data_Direction_Register	x	0	32Bit
0x22	IO_Status_Register	x	0	32Bit

## IO-card registers

### Identifikation Register

Address (Hex)	Name	Read	Write	State																		
0x64	Card Type ID	x	0	<table border="1"> <thead> <tr> <th>ID (Hex)</th> <th>Card type</th> </tr> </thead> <tbody> <tr><td>0x01</td><td>IO NIM/TTL card</td></tr> <tr><td>0x02</td><td>ADC card</td></tr> <tr><td>0x03</td><td>DAC card</td></tr> <tr><td>0x04</td><td>Temperature card</td></tr> <tr><td>0x05</td><td>Adapter card</td></tr> <tr><td>0x06</td><td>Differential IO card (planned)</td></tr> <tr><td>0x07</td><td>Differential ADC card</td></tr> <tr><td>0x08</td><td>Thermo card</td></tr> </tbody> </table>	ID (Hex)	Card type	0x01	IO NIM/TTL card	0x02	ADC card	0x03	DAC card	0x04	Temperature card	0x05	Adapter card	0x06	Differential IO card (planned)	0x07	Differential ADC card	0x08	Thermo card
				ID (Hex)	Card type																	
				0x01	IO NIM/TTL card																	
				0x02	ADC card																	
				0x03	DAC card																	
				0x04	Temperature card																	
				0x05	Adapter card																	
				0x06	Differential IO card (planned)																	
				0x07	Differential ADC card																	
0x08	Thermo card																					
0x65	Hardware Version	x	0	8Bit																		
0x66	Software Version	x	0	8Bit																		

The identification register is common to all IO cards. The special registers for each type of IO card are described below.

### NIM / TTL IO card register

Address (Hex)	Name	Read	Write	States										
0x01	IO Status	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr><td>0x01</td><td>TTL Input</td></tr> <tr><td>0x02</td><td>TTL Output</td></tr> <tr><td>0x03</td><td>NIM Input</td></tr> <tr><td>0x04</td><td>NIM Output</td></tr> </tbody> </table>	Value (Hex)	State	0x01	TTL Input	0x02	TTL Output	0x03	NIM Input	0x04	NIM Output
				Value (Hex)	State									
				0x01	TTL Input									
				0x02	TTL Output									
				0x03	NIM Input									
0x04	NIM Output													

### ADC card register

Address (Hex)	Name	Read	Write	State
0x01	ADC Value High Byte	x	0	8Bit
0x02	ADC Value Low Byte	x	0	8Bit
0x03	Offset	x	x	8Bit
0x04	CPLD Firmware Version	x	0	8Bit

### DAC card register

Address (Hex)	Name	Read	Write	State
0x01	DAC Value High Byte read	x	0	8Bit
0x02	DAC Value Low Byte read	x	0	8Bit
0x04	CPLD Firmware Version read	x	0	8Bit

### Temperature card register

Address (Hex)	Name	Read	Write	State														
0x01	Temp. Value 1 Byte read	x	0	8Bit														
0x02	Temp. Value 2 Byte read	x	0	8Bit														
0x03	Temp. Value 3 Byte read	x	0	8Bit														
0x04	Temp. Value 4 Byte read	x	0	8Bit														
0x05	PT-Sensor	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x01</td> <td>PT 10</td> </tr> <tr> <td>0x02</td> <td>PT 50</td> </tr> <tr> <td>0x03</td> <td>PT 100 default</td> </tr> <tr> <td>0x04</td> <td>PT 200</td> </tr> <tr> <td>0x05</td> <td>PT 500</td> </tr> <tr> <td>0x06</td> <td>PT 1000</td> </tr> </tbody> </table>	Value (Hex)	State	0x01	PT 10	0x02	PT 50	0x03	PT 100 default	0x04	PT 200	0x05	PT 500	0x06	PT 1000
				Value (Hex)	State													
				0x01	PT 10													
				0x02	PT 50													
				0x03	PT 100 default													
				0x04	PT 200													
				0x05	PT 500													
0x06	PT 1000																	
0x06	PT-Strom	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x01</td> <td>25µA</td> </tr> <tr> <td>0x02</td> <td>50µA</td> </tr> <tr> <td>0x03</td> <td>100µA</td> </tr> <tr> <td>0x04</td> <td>250µA</td> </tr> <tr> <td>0x05</td> <td>500µA default</td> </tr> <tr> <td>0x06</td> <td>1mA</td> </tr> </tbody> </table>	Value (Hex)	State	0x01	25µA	0x02	50µA	0x03	100µA	0x04	250µA	0x05	500µA default	0x06	1mA
				Value (Hex)	State													
				0x01	25µA													
				0x02	50µA													
				0x03	100µA													
				0x04	250µA													
				0x05	500µA default													
0x06	1mA																	

### Adapter card register

Adresse (Hex)	Name	Read	Write	Zustände
0x01	Value 1	x	0	8Bit
0x02	Value 2	x	0	8Bit
0x03	Value 3	x	0	8Bit
0x04	Value 4	x	0	8Bit

0x05	Filter	x	x	<b>Value (Hex)</b>	<b>State</b>
				0x00	Filter Off
				0x01	Filter over 2 Values
				0x02	Filter over 4 Values
				0x03	Filter over 8 Values
				0x04	Filter over 16 Values
				0x05	Filter over 32 Values
				0x06	Filter over 64 Values
				0x07	Filter over 128 Values
				0x08	Filter over 256 Values
				0x09	Filter over 516 Values
0x0A	Filter over 1024 Values				
0x67	ID of the attached card	x	0	8Bit	

### DADC card register

Adresse (Hex)	Name	Read	Write	Zustände
0x01	Value 1	x	0	8Bit
0x02	Value 2	x	0	8Bit
0x03	Value 3	x	0	8Bit
0x04	Value 4	x	0	8Bit
0x67	ID of the attached card	x	0	8Bit

### Thermo card register

Adresse (Hex)	Name	Read	Write	Zustände	
0x01	Value 1	x	0	8Bit	
0x02	Value 2	x	0	8Bit	
0x03	Value 3	x	0	8Bit	
0x04	Value 4	x	0	8Bit	
0x05	Error	x	0	<b>Value</b>	<b>State</b>
				Bit 0	no connections
				Bit 1	short-circuited to GND
				Bit 2	short-circuited to VCC
0x06	Thermo Typ	x	0	8Bit (CHAR)	
0x67	ID of the attached card	x	0	8Bit	

### IO board registers

#### Identifikation register

Adresse (Hex)	Name	Read	Write	Zustände
0x64	IO Board ID	x	0	0xEC
0x65	Hardware Version	x	0	8Bit
0x66	Software Version	x	0	8Bit

#### Register

Register (Hex)	Name	Read	Write	States				
0x01	IO LED 1	0	x	Value 1	Value 2	Value 3		Example

0x02	IO LED 2	0	x	red	green	blue	color	interpretation									
0x03	IO LED 3	0	x	0x00	0x00	0x00	LED Aus	no card									
0x04	IO LED 4	0	x	0x00	0x00	0x64		NIM/TTL Output High									
0x06	IO LED 6	0	x	0x00	0x64	0x00		NIM/TTL Input High									
0x07	IO LED 7	0	x	0x00	0x64	0x64		ADC card									
0x08	IO LED 8	0	x	0x64	0x00	0x00		DAC card									
0x09	IO LED 9	0	x	0x64	0x00	0x64		NIM/TTL Input Low									
0x0A	IO LED 10	0	x	0x64	0x64	0x00		NIM/TTL Output Low									
0x0B	IO LED 11	0	x	0x64	0x32	0x00		Temperature card									
0x0C	IO LED 12	0	x	0xXX	0xXX	0xXX		Adapter card - Farbe passt sich an									
0x0D	IO LED 13	0	x														
0x0E	IO LED 14	0	x														
0x0F	IO LED 15	0	x														
0x10	IO LED 16	0	x														
0x11	Status LED 1	0	x														
0x12	Status LED 2	0	x														
0x14	All LEDs have same color	0	x														
0x15	LEDs Dimmen	0	x	<table border="1"><thead><tr><th>Value 1</th><th>Value 2</th><th>Value 3</th></tr></thead><tbody><tr><td>LED 18 &amp; 17</td><td>LED 16 to 9</td><td>LED 8 to 1</td></tr><tr><td>0b000000XX</td><td>0bXXXXXXXXXX</td><td>0bXXXXXXXXXX</td></tr></tbody></table>	Value 1	Value 2	Value 3	LED 18 & 17	LED 16 to 9	LED 8 to 1	0b000000XX	0bXXXXXXXXXX	0bXXXXXXXXXX				
Value 1	Value 2	Value 3															
LED 18 & 17	LED 16 to 9	LED 8 to 1															
0b000000XX	0bXXXXXXXXXX	0bXXXXXXXXXX															
0x16	LEDs blinking	0	x	<table border="1"><thead><tr><th>Value 1</th><th>Value 2</th><th>Value 3</th></tr></thead><tbody><tr><td>LED 18 &amp; 17</td><td>LED 16 to 9</td><td>LED 8 to 1</td></tr><tr><td>0b000000XX</td><td>0bXXXXXXXXXX</td><td>0bXXXXXXXXXX</td></tr></tbody></table>	Value 1	Value 2	Value 3	LED 18 & 17	LED 16 to 9	LED 8 to 1	0b000000XX	0bXXXXXXXXXX	0bXXXXXXXXXX				
Value 1	Value 2	Value 3															
LED 18 & 17	LED 16 to 9	LED 8 to 1															
0b000000XX	0bXXXXXXXXXX	0bXXXXXXXXXX															
0x17	Dimm Geschwindigkeit x*100ms	0	x	<table border="1"><thead><tr><th>Value 1</th><th>Value 2</th><th>Value 3</th></tr></thead><tbody><tr><td>0x00</td><td>0x00</td><td>0x00-&gt;0xFF</td></tr></tbody></table>	Value 1	Value 2	Value 3	0x00	0x00	0x00->0xFF							
Value 1	Value 2	Value 3															
0x00	0x00	0x00->0xFF															
0x18	Blink Geschwindigkeit x*100ms	0	x	<table border="1"><thead><tr><th>Value 1</th><th>Value 2</th><th>Value 3</th></tr></thead><tbody><tr><td>0x00</td><td>0x00</td><td>0x00-&gt;0xFF</td></tr></tbody></table>	Value 1	Value 2	Value 3	0x00	0x00	0x00->0xFF							
Value 1	Value 2	Value 3															
0x00	0x00	0x00->0xFF															

## Display registers

### Identification Register

Address (Hex)	Name	Read	Write	State
0x64	IO Board ID	x	0	0xEC
0x65	Hardware Version	x	0	8Bit
0x66	Software Version	x	0	8Bit

### Register

Address (Hex)	Name	Read	Write	State										
0x01	Status	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th><th>State</th></tr> </thead> <tbody> <tr> <td>0x00</td><td>Brightness is automatically adjusted (Default)</td></tr> <tr> <td>0x01</td><td>Brightness adjusted by Poti on main board (Display Leiterplatte)</td></tr> <tr> <td>0x02</td><td>Brightness is adjusted by the <i>Brightness Value</i> (see 0x02)</td></tr> <tr> <td>0x03</td><td>Display off</td></tr> </tbody> </table>	Value (Hex)	State	0x00	Brightness is automatically adjusted (Default)	0x01	Brightness adjusted by Poti on main board (Display Leiterplatte)	0x02	Brightness is adjusted by the <i>Brightness Value</i> (see 0x02)	0x03	Display off
Value (Hex)	State													
0x00	Brightness is automatically adjusted (Default)													
0x01	Brightness adjusted by Poti on main board (Display Leiterplatte)													
0x02	Brightness is adjusted by the <i>Brightness Value</i> (see 0x02)													
0x03	Display off													
0x02	Brightness Value	x	x	8 Bit										

## Mainboard registers

### Register

Address (Hex)	Name	Read	Write	State
0x64	IO Board ID	x	0	0xEC
0x65	Hartware Version	x	0	8Bit
0x66	Software Version	x	0	8Bit

### Register

Adresse (Hex)	Name	Read	Write	States														
0x01	USV Status	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>USV deactivated</td> </tr> <tr> <td>0x01</td> <td>USV active (Default)</td> </tr> </tbody> </table>	Value (Hex)	State	0x00	USV deactivated	0x01	USV active (Default)								
Value (Hex)	State																	
0x00	USV deactivated																	
0x01	USV active (Default)																	
0x02	Charging Status	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Battery charging off</td> </tr> <tr> <td>0x01</td> <td>Battery charging on (Default)</td> </tr> </tbody> </table>	Value (Hex)	State	0x00	Battery charging off	0x01	Battery charging on (Default)								
Value (Hex)	State																	
0x00	Battery charging off																	
0x01	Battery charging on (Default)																	
0x03	USV Überbrückungszeit nach Stromausfall in sek.	x	x	8Bit (Value * Seconds)														
0x04	Time after power failure in seconds	x	0	8Bit (Value * Seconds)														
0x05	Charging controller status	x	0	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Charging controller deactivated / no input voltage</td> </tr> <tr> <td>0x01</td> <td>Charging controller standby / no battery attached</td> </tr> <tr> <td>0x03</td> <td>Battery fully charged</td> </tr> <tr> <td>0x04</td> <td>Battery voltage is low</td> </tr> <tr> <td>0x05</td> <td>Battery is charging</td> </tr> <tr> <td>0x07</td> <td>Temperature failure / Timer failure</td> </tr> </tbody> </table>	Value (Hex)	State	0x00	Charging controller deactivated / no input voltage	0x01	Charging controller standby / no battery attached	0x03	Battery fully charged	0x04	Battery voltage is low	0x05	Battery is charging	0x07	Temperature failure / Timer failure
Value (Hex)	State																	
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0x03	Battery fully charged																	
0x04	Battery voltage is low																	
0x05	Battery is charging																	
0x07	Temperature failure / Timer failure																	
0x06	Audio-Volume	x	x	<table border="1"> <thead> <tr> <th>Value (Hex)</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>0x2B</td> <td>Volume_Low</td> </tr> <tr> <td>0x35</td> <td>Volume_Medium (Default)</td> </tr> <tr> <td>0x63</td> <td>Volume_High</td> </tr> </tbody> </table>	Value (Hex)	State	0x2B	Volume_Low	0x35	Volume_Medium (Default)	0x63	Volume_High						
Value (Hex)	State																	
0x2B	Volume_Low																	
0x35	Volume_Medium (Default)																	
0x63	Volume_High																	
0x07	Battery voltage MSB read	x	0	8Bit														
0x08	Battery voltage LSB read	x	0	8Bit														