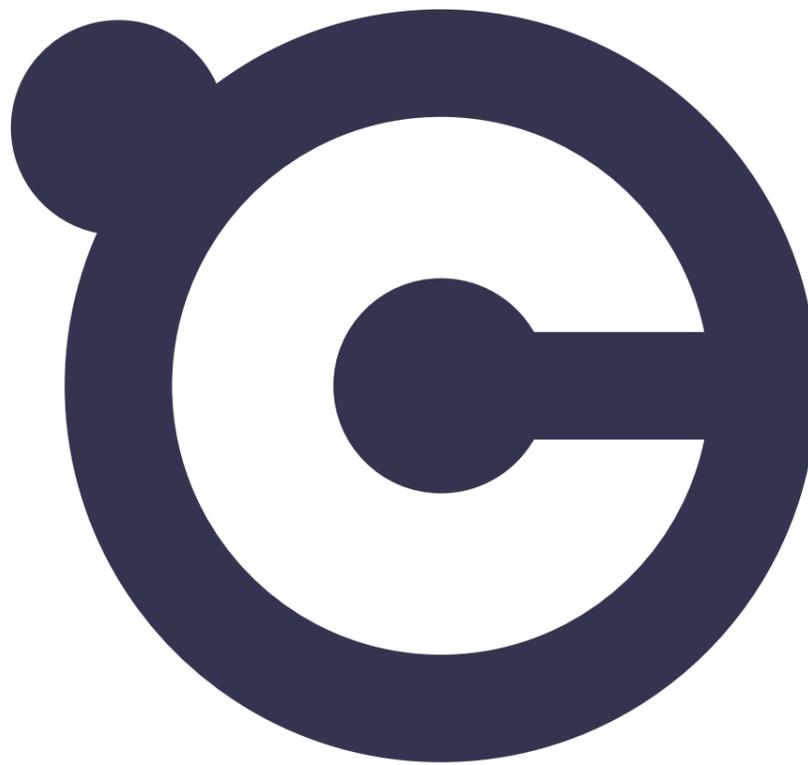




# PWR-CTRL-L

## Technical Datasheet

v1.1



# Change index

Version	Description	Date	Approved by
1.0.0	Initial release	31.07.2025	Sascha Wilhelm
1.1.0	Added drawing conductive cooled	30.10.2025	Sascha Wilhelm



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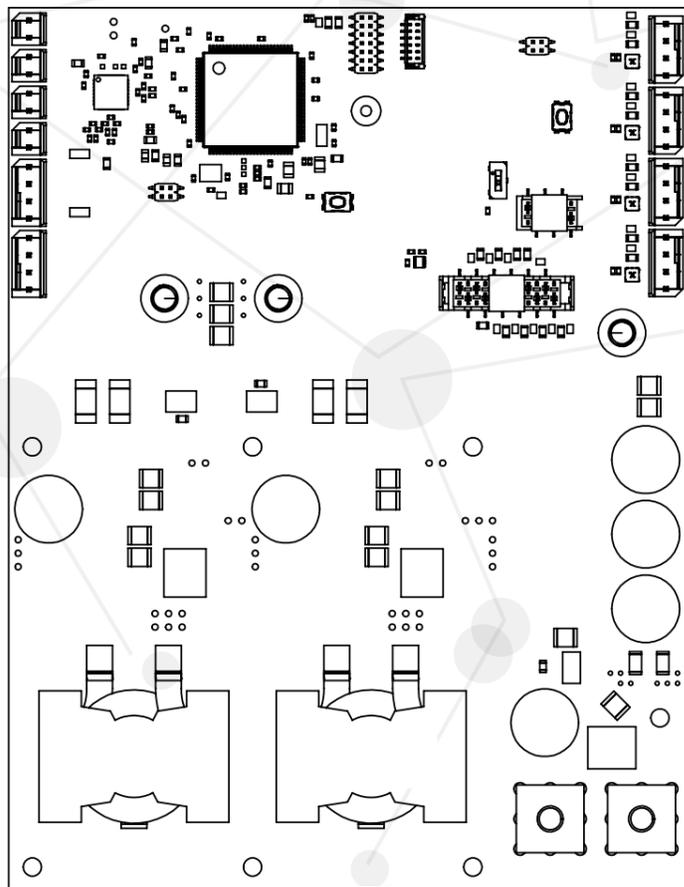
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# PWR-CTRL-L

## Overview



The **PWR-CTRL-L** is a specialized, precise OEM-Peltier-Controller.

With dimensions of **100x130x25.3 mm**, it is the most compact, full-featured Peltier controller in its class.

### Made for OEM Peltier-Application:

The performance package with 32A output current at up to 48V fits into any application thanks to its compact dimensions.

Thanks to its fully customisable configurations, the controller can be programmed by OEM manufacturers and institutes for any Peltier application.

### Peltier driver stage:

It has a bipolar output stage for heating and cooling functions. Thanks to the bipolar driver stage, developed for Peltier technology, precise control and ultra-fast temperature changes are possible with maximum component service life.

Various autotuning modes allow the control to be automatically adapted to the application.

### Embedded Cycle Control:

The embedded cycle control functionality allows the configuration of up to 5 main cycles, each with 10 steps and adjustable repetitions. The cycles can also be linked together.

Cycle control can be created using different strategies. When configured as "timed," the set cycle times are primarily taken into account. In "precise mode," the settled temperature is primarily relevant.

### Peripheral driver stage:

The controller has four integrated driver stages for peripheral devices belonging to the Peltier system, such as fans and pumps.

Depending on the configuration, the driver stages switch the supply voltage directly to the peripherals. The four outputs can be controlled and limited via PWM. Each output has its own tachometer input.

If the driver stages are configured as fans, different control modes can be set.

### GPIO:

The controller has 9 GPIOs for predefined functions. GPIOs 1-7 are freely configurable. If no peripheral devices are connected to peripheral stages 3 and 4, GPIOs 8 and 9 can be configured freely, too.

### Temperature inputs:

The controller has two high-resolution temperature inputs.

These can be connected to and configured with 2-, 3-, or 4-wire Pt100 or Pt1000 sensors.

These sensors are typically used as temperature input for the Peltier stage and enable highly accurate control.

Additionally, four low-resolution NTC inputs are implemented.

These can be used as control inputs for the peripheral fans or the Peltier stage and as indicators for events.

However, they can also be used as simple monitors with warning and error thresholds.

### HMI:

A 2.83-inch display can be connected to the controller for stand-alone functionality.

The display is divided into 4 quadrants. Each quadrant can be configured with its own values and plain text.

A basic keyboard can be configured via the GPIOs to adjust the setpoint temperature and to start and stop the control.

Furthermore, function keys can be configured to initiate autotuning or to start the cycling functionality.

### Communication interfaces:

The **COMM-Serial** option cards can be used to implement serial communication via RS232 or RS485/422 or USB, depending on requirements.

Each COMM-Serial also provides a micro SD card slot for data logging.

The PWR-CTRL-L can be expanded and linked to the separately orderable **COMM-PRO** via LVDS interface.

It supports communication via **REST API** and has an **embedded web server** for visualisation and control of up to 16 PWR-CTRL assemblies.

# Technical Data



## General:

Type	Value
Supply Voltage	12-48 V-DC
Dimensions (LxWxH)	130 x 100 x 25.3 mm
Communication on Board	UART, LVDS (to COMM-PRO), I <sup>2</sup> C (for sensors and extensions)
Communication with accessories	<b>COMM-SERIAL:</b> RS232   RS485 full duplex/ half duplex, RS422   USB Note: Every COMM-SERIAL is equipped with micro SD card slot for logging functions <b>COMM-PRO:</b> Embedded webserver, REST API

## Peltier-Driver:

Type	Value
Output Voltage	$\pm (V_{in} - 0.6 V)$ ; negative Voltage is cooling
Output Current	$\pm 32 A$ , negative Current is cooling
Efficiency	> 95 % at 80 % Load
Precision and stability	better 0.01 K - depending on the Peltier-System

## Peripheral-Driver:

Type	Value
General	4x on Board
Output Voltage	$V_{in} - 0.3 V$ ; with additional CVTR-DC/DC Step-Down Driver-Board: 12 V or 24 V selectable
Output Current	3 A/Stage
PWM-Output	Adjustable frequency: 1 kHz or 25 kHz
Tacho-Input	Adjustable limits and thresholds per stage

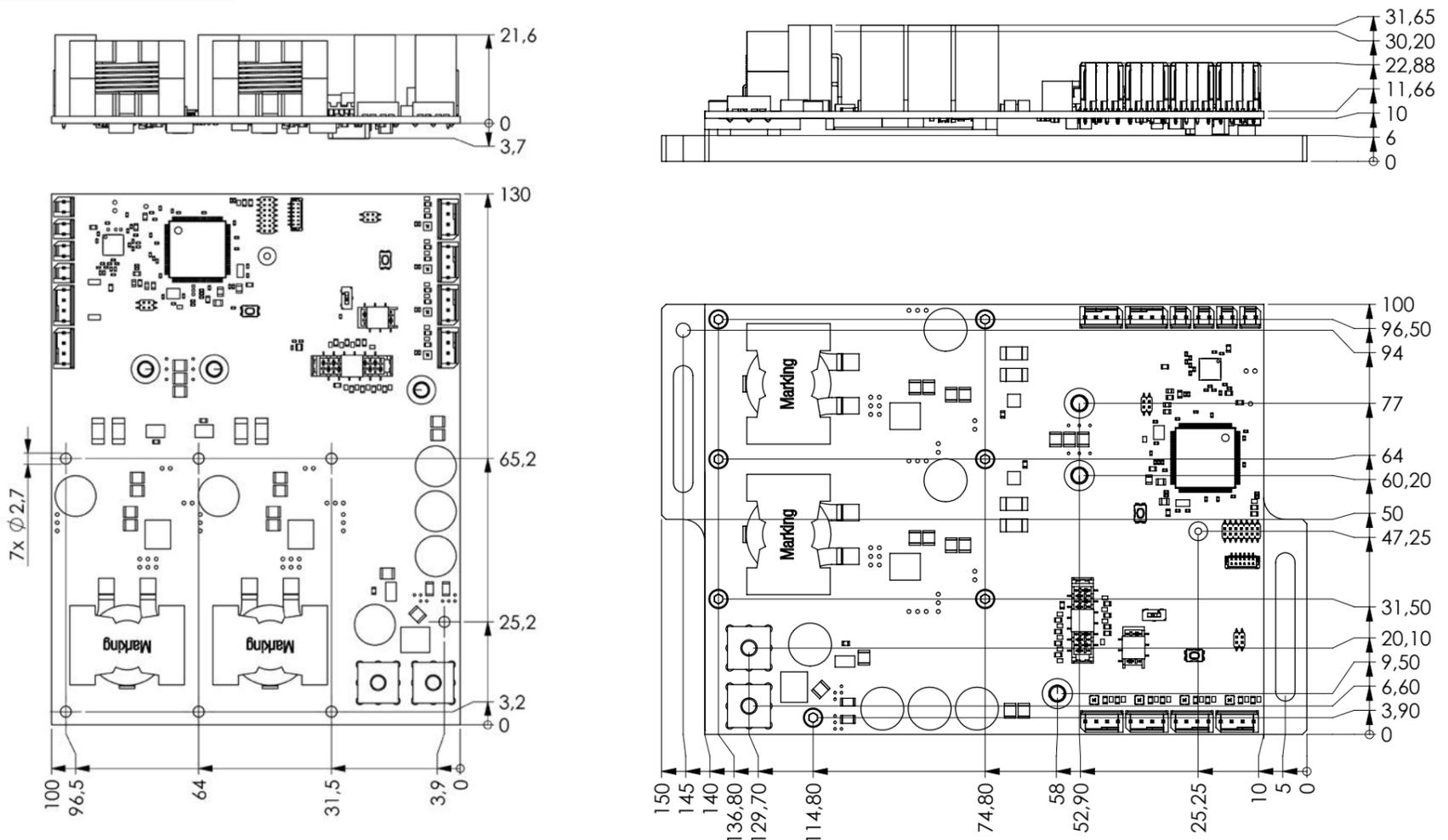
## Temperature-Inputs:

Type	Value
General	<b>High Resolution Selectable per Input: Pt100/ Pt1000 2-, 3-, 4-Wire</b> 2x on Board <b>Low Resolution Selectable per Input: NTC (NTC10k recommended)</b> 4x on Board
Resolution	<b>High Resolution (24 Bit):</b> Displayed: 0.001 °C   Internally: 0.0001 °C <b>Low Resolution (16 Bit):</b> Displayed: 0.001 °C   Internally: 0.001 °C
Precision	<b>High Resolution:</b> 0.001 °C <b>Low Resolution:</b> 0.1 °C

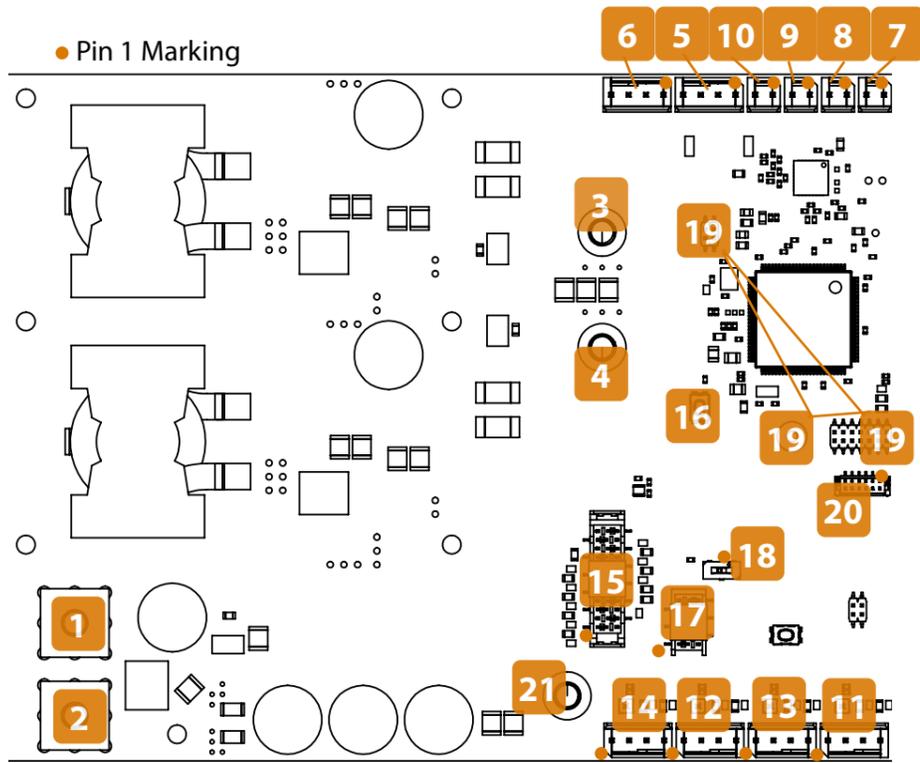
# Absolut Maximum Ratings

Parameter	Conditions	MIN	TYP	MAX	VALUE
<b>Supply</b>					
Input Voltage		5	-	50	V-DC
Standby Current	$V_{in} = 24\text{ V}$	100	250	350	mA
Input Current	$V_{in} = 24\text{ V}; 100\% \text{ Output Power}$	-	22.25	22.85	A
<b>Peltier-Stage</b>					
Output Voltage	$\pm (V_{in} - 0.6\text{ V})$	-49.4	-	49.4	V
Output Current	100 % Load	-32.4	$\pm 32$	32.4	A
Voltage Ripple	24 V; 6.25 A			50	mV <sub>pp</sub>
<b>Peripheral-Stage (per Stage)</b>					
Output Voltage	$V_{in} = 24\text{ V}$	23.4	23.7	-	V
Output Current	$V_{in} = 24\text{ V}; 100\% \text{ Output Power}$	-	-	3	A
<b>GPIO (per GPIO)</b>					
Input Current		-	2	200	nA
HIGH-Level Input		2.31	-	3.3	V
LOW-Level Input		-0.3	-	0.99	V
Output Current		-	-	8	mA
HIGH-Level Output		1.32	-	3.3	V
LOW-Level Output		-	-	0.4	V

## Dimensions



# Connectors



**Power-Input + Peltier Output**  
Mating Part: M4 ring cable lug

PIN	Value	Description
1	$V_{in}$	Supply Voltage
2	$GND_{in}$	GND from Power Supply
3	$V_A$	Peltier-Output A
4	$V_B$	Peltier-Output B

**HR-Temperature:**  
Mating Part: Würth Elektronik 661004151922

PIN	Value	Description
5.1	$HR_{1+}$	Pt100/ Pt1000_1 +
5.2	$HR_{1+}$	Pt100/ Pt1000_1 +
5.3	$HR_{1-}$	Pt100/ Pt1000_1 -
5.4	$HR_{1-}$	Pt100/ Pt1000_1 -
6.1	$HR_{2+}$	Pt100/ Pt1000_2 +
6.2	$HR_{2+}$	Pt100/ Pt1000_2 +
6.3	$HR_{2-}$	Pt100/ Pt1000_2 -
6.4	$HR_{2-}$	Pt100/ Pt1000_2 -

**LR-Temperature:**  
Mating Part: Würth Elektronik 661002151922

PIN	Value	Description
7.1	$LR_{1+}$	Low Resolution Input 1 +
7.2	$LR_{1-}$	Low Resolution Input 1 -
8.1	$LR_{2+}$	Low Resolution Input 2 +
8.2	$LR_{2-}$	Low Resolution Input 2 -
9.1	$LR_{3+}$	Low Resolution Input 3 +
9.2	$LR_{3-}$	Low Resolution Input 3 -
10.1	$LR_{4+}$	Low Resolution Input 4 +
10.2	$LR_{4-}$	Low Resolution Input 4 -

**Peripheral:**  
Mating Part: Würth Elektronik 661004151922

PIN	Value	Description
11.1	$V_{sys}$	Output Voltage/ System-Voltage L1
11.2	VL1-	Switched Ground Peripheral L1
11.3	$T_{L1}$	Tacho Input Peripheral L1
11.4	$PWM_{L1}$	PWM Output Peripheral L1
12.1	$V_{sys}$	Output Voltage/ System-Voltage L2
12.2	VL2-	Switched Ground Peripheral L2
12.3	$T_{L2}$	Tacho Input Peripheral L2

**Peripheral:**  
Mating Part: Würth Elektronik 661004151922

PIN	Value	Description
12.4	$PWM_{L2}$	PWM Output Peripheral L2
13.1	$V_{sys}$	Output Voltage/ System-Voltage L3
13.2	VL3-	Switched Ground Peripheral L3
13.3	$T_{L3}$	Tacho Input Peripheral L3
13.4	$PWM_{L3}$	PWM Output Peripheral L3
14.1	$V_{sys}$	Output Voltage/ System-Voltage L4
14.2	VL4-	Switched Ground Peripheral L4
14.3	$T_{L4}$	Tacho Input Peripheral L4
14.4	$PWM_{L4}$	PWM Output Peripheral L4

**15: GPIO-Connector:**  
Mating Part: Würth Elektronik 690157001272

PIN	Value	Description
1	$GPIO_1$	GPIO1
2	$GPIO_2$	GPIO2
3	$GPIO_3$	GPIO3
4	$GPIO_4$	GPIO4
5	$GPIO_5$	GPIO5
6	$GPIO_6$	GPIO6
7	$GPIO_7$	GPIO7
8	$GPIO_8$	GPIO8 - use only, when no peripheral is connected to L3
9	$GPIO_9$	GPIO9 - use only, when no peripheral is connected to L4
10	GND	System Ground
11	5V	System 5V
12	GND	System Ground

**16: Reset-Button:**  
Use a pen or something similar to reset the controller

**17: LVDS-Connector:**  
Mating Part: Würth Elektronik 690157000672

PIN	Value	Description
1	5V	5V to supply COMM-PRO - use only at the first PWR-CTRL
2	GND	Ground
3	5V	5V to supply COMM-PRO - use only at the first PWR-CTRL
4	GND	Ground
5	$LVDS_A$	A-Pin for LVDS Communication to COMM-PRO
6	$LVDS_B$	B-Pin for LVDS Communication to COMM-PRO

**18: LVDS Termination resistance:**

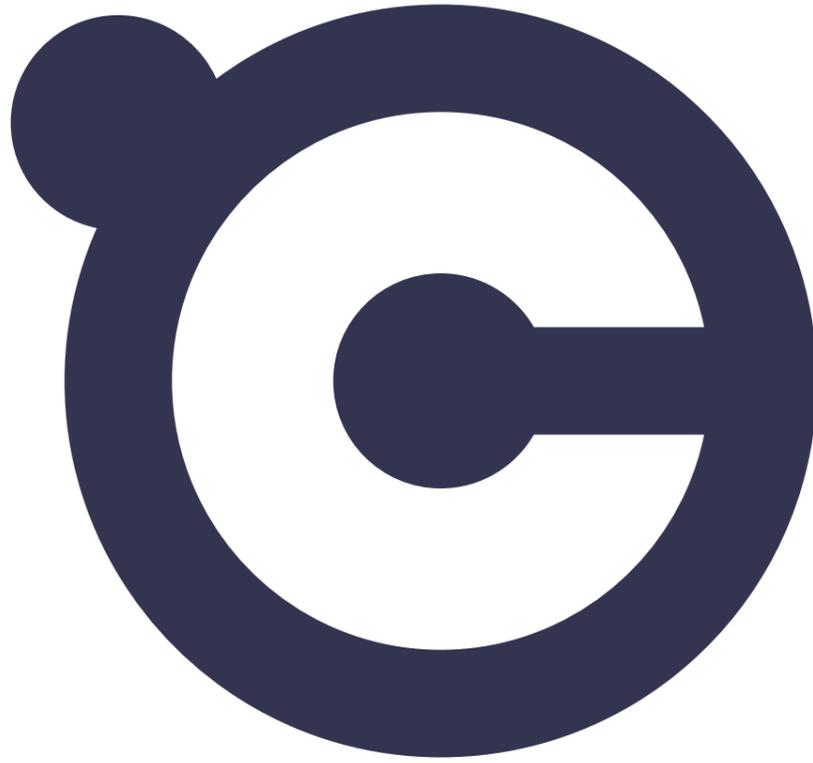
Switch	Value	Description
OFF	-	no termination resistance
ON	•	termination resistance activated

**19: COMM-Serial-Shield-Interface:**  
Mating Part: COMM-Serial-USB; -RS232; -RS485/422  
Insert the shield card and secure it with the M2 screw

**20: I<sup>2</sup>C-Connector:**  
Mating Part: Würth Elektronik 665006113322

PIN	Value	Description
1	GND	Ground
2	I <sup>2</sup> C SCL	SCL Pin for I <sup>2</sup> C Communication (GPIO-Voltage-Level)
3	I <sup>2</sup> C SDA	SDA Pin for I <sup>2</sup> C Communication (GPIO-Voltage-Level)
4	0-10V <sub>in</sub>	0-10V Analog Input
5	5V	5V Output
6	3V3	3.3V Output

**21: GND-Terminal:**  
Mating Part: M4 ring cable lug  
Ground Terminal for peripheral



**DNPT**



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