DomeCtrl

Domestic installation **ControlBox**

Features

- Robust, **industrial** grade electronic **interfaces**
- Enclosure with **convenient mounting** flanges
- **Pluggable** screw terminals
- **Raspberry-Pi header** for control via pre-installed privacy-respecting local **Home Assistant**
- **W32-ESP01 header** for control via **ESPHome**
- **230VAC or 110VAC** IEC-320 C-14 **inlet**
- **16x 24VAC** solid-state relay **output**
  - Potential-free or 24VAC
- **4x 230VAC** solid-state relay **output**
  - Potential-free or 230VAC/110VAC
- **1-Wire bus** for sensors over long cable distance
  - 2 channels, one driver per channels
  - Connect up to 30 temperature sensors
- **32 PWM** controlled **LED outputs**
- **3x** opto-isolated **input 5-24V**
- **2x** opto-isolated **PWM output**
  3x opto-isolated **output**
  - Isolated 5V or 12V, or no pull-up for outputs
- Half duplex **RS485 bus**
- **433MHz** receiver & transmitter
- Extendable with **Home Assistant** compatible hardware

Applications

- **Domotics** / Home automation
- Heater installation **control**
- Light / **LED** strip control
- **Saving energy** by **smart integration** of different renewable energy devices like solar collectors, photo-voltaic installations, heat pumps, hydraulic pumps & valves.
- **Saving energy** by **smarter scheduling** of room temperatures

Description

ControlBox can be used to control various types of domestic installation devices. Specifically, it is designed to control floor heater thermal valves, hydraulic (PWM) pumps, hydraulic valves and various other installation devices.
It can read up to 30 (depending on the setup even more) DS18B20-PAR temperature sensors over long cables (>6m). All in- and outputs are protected with fuses and/or EDS-suppressing diodes.

Integration with the Home Assistant automation platform is made by providing a Raspberry-Pi compatible header. This allows Home Assistant to use Direct-IO for all integrated functions in a reliable, economic and efficient way. If using Direct-IO is not preferred, the end-user can run Home Assistant on any provided hardware, and connect to the ControlBox via the W32-ETH01 Ethernet-supporting ESPHome module. A header for this ESP32 board is provided as well.

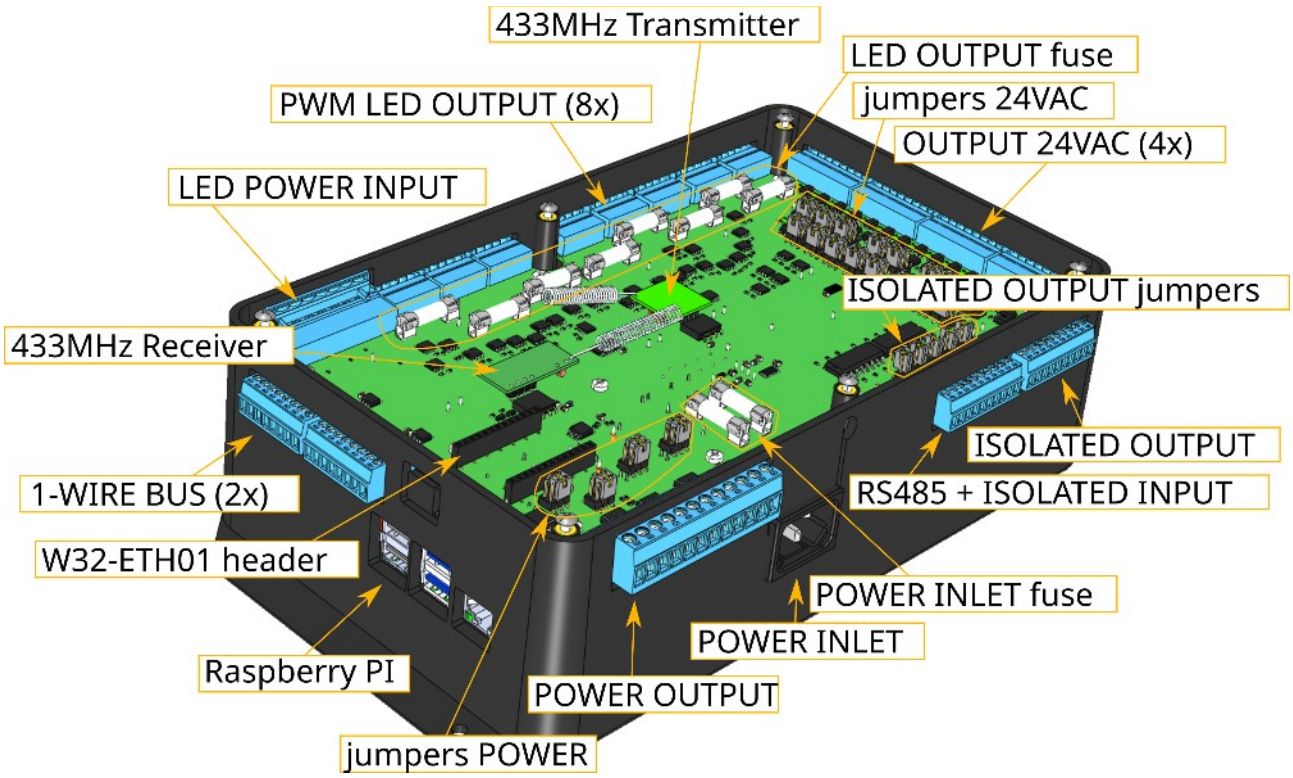
Besides the control of installation devices, the ControlBox also supplies a 32-channel brightness controller for LED-strips. The 32-channels are distributed over 8 connectors. Depending on the configuration of Home Assistant, the outputs can be used as single-color, RGB or RGBW lights. Each of the 8 connectors can supply up to 10A current at a maximal voltage of 24VDC.

With the integrated 433MHz transmitter and receiver it will be easy to integrate additional devices to Home Assistant. Examples are ‘ClickOnClickOff’ devices, curtain rails, screens, garage doors, etc. If required, the Home Assistant native SkyConnect USB dongle can be plugged in the Raspberry Pi USB ports to further expand the users possibilities with ZigBee and Matter support.

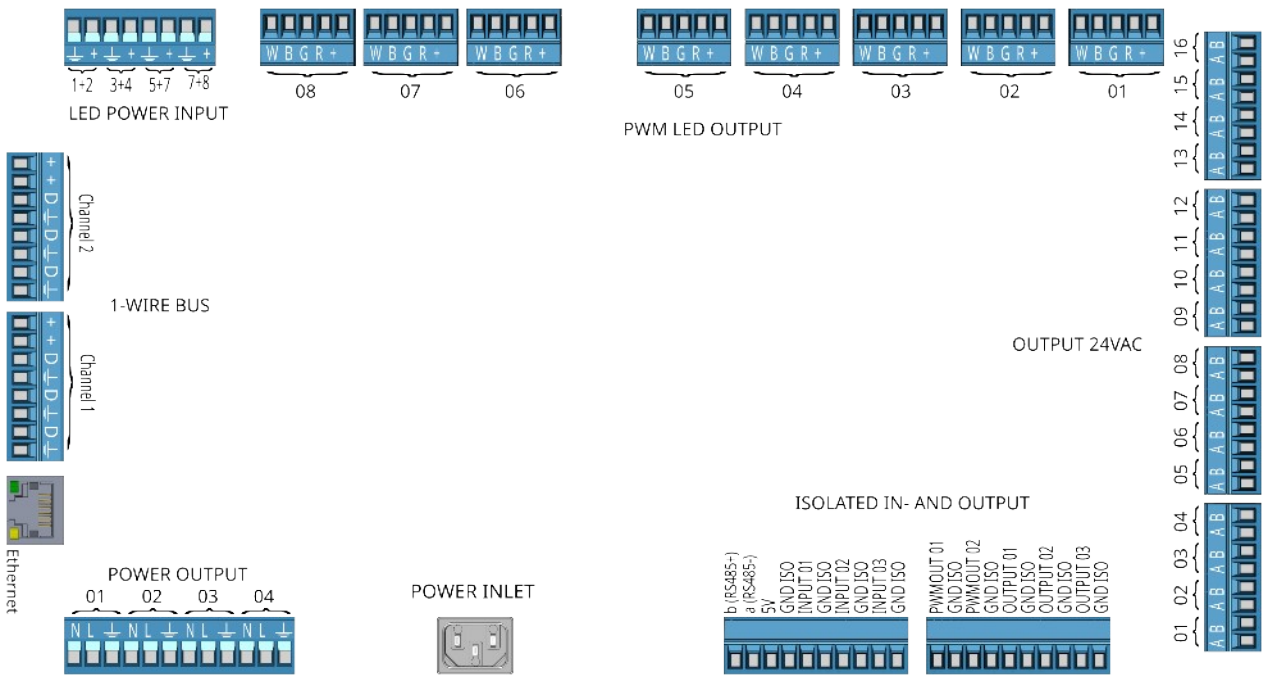
Typical usage

- Implement a software thermostat per room; no additional hardware is required as the user can use a the native Home Assistant app on a smartphone to control the temperatures.
- Schedule floor heater systems according to internet-accessible scheduler. This may include automatic pre-heating, so that rooms are on comfortable temperature when required. The other periods they will be on as-low-as-possible temperatures. This will reduce energy consumption. If temperature can be lowered up to 3ºC over 12 hours per day, this might already reduce energy consumption by 7% in winter time.
- Automatically switch off the pumps for floor heater systems when there is no heat requested in order to save even more energy.
- More efficient regulation of solar collectors by optimizing the switch-on moment and using a software PID regulator. It is proven in practice that a vacuum-tube collector performed more efficient, especially on cold & cloudy days, when controlled by the ControlBox & Home Assistant.
- Automatically switching off floor heaters in a room when wood stove starts burning.

Connector & header location



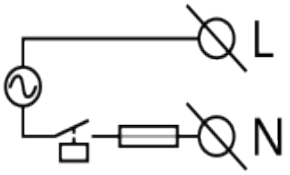
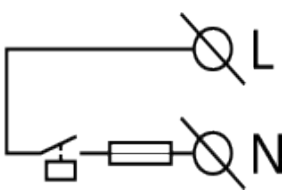
Pin assignment

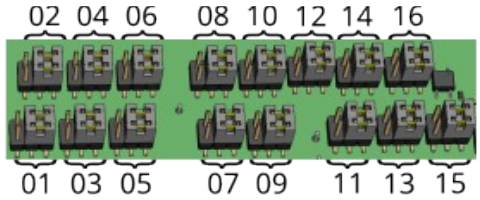
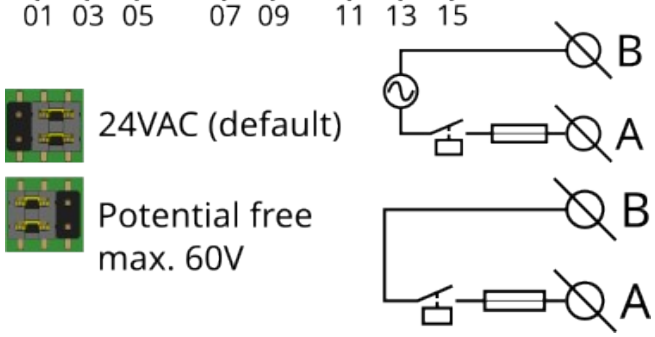
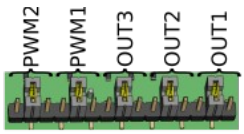
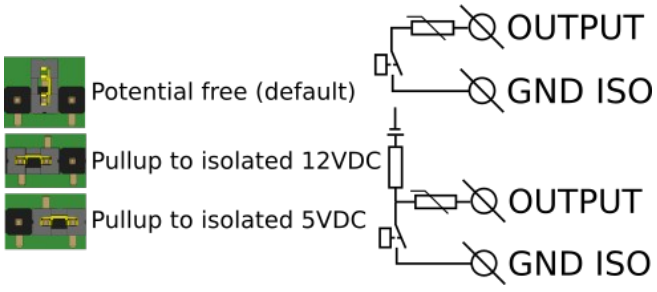


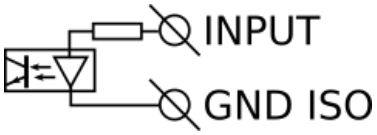
Connector & Header specifications

Screw-in plugs have 5mm pitch (LED POWER INPUT and POWER OUTPUT) and 3.5mm pitch (other connectors). Wire & mounting specification for those screw-plugs is as following:

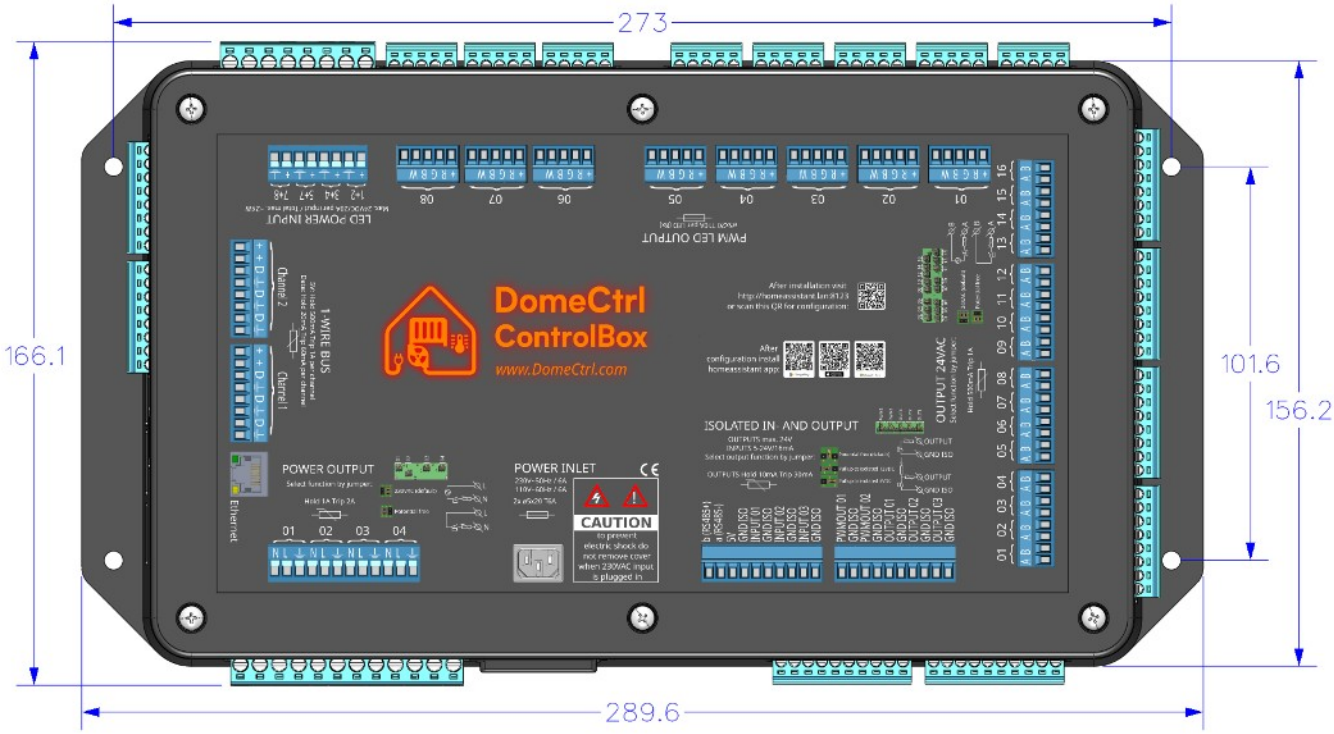
5mm pitch	3.5mm pitch
Wire range: 2.5mm^2/0.34-2.5mm^2 Solid wire(AWG): 12-24/14-22 Stranded wire(AWG): 12-24/14-22 Torque: 5Lb-In/0.5Nm/0.56Nm Screw: M3 Wire strip length: 7-8mm	Wire range: 1.5mm^2 Solid wire(AWG): 16-28 Stranded wire(AWG): 16-28 Torque: 3Lb-In/0.2Nm Screw: M2 Wire strip length: 6-7mm

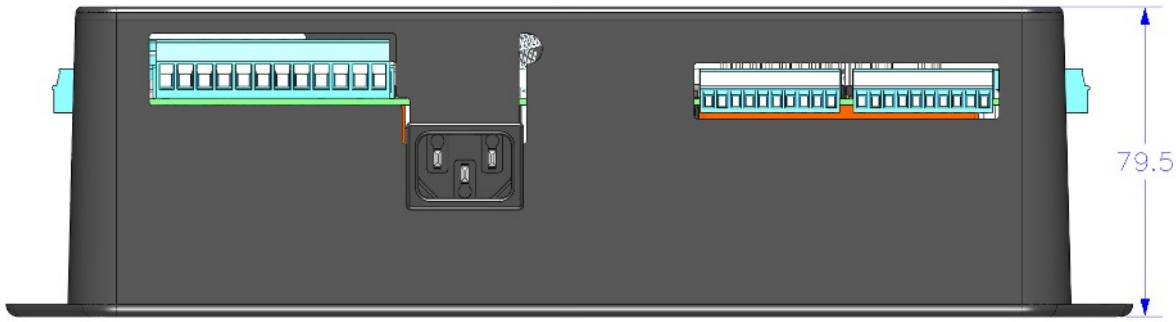
Header	Specification	Typical use
POWER INLET	230VAC or 110VAC IEC-320 C-14 inlet. Fused by double ⌀5x20 F6A glass-tube fuse on the PCB. Fuse number: 021606.3MXR8SPP (Littelfuse) *Typical power usage using a Raspberry Pi model 5 running Home Assistant and no activated hardware: ca. 6W.*	Net power input
POWER OUTPUT	4x 230VAC/110VAC solid-state relay output. Switching is synchronized @ zero crossing. ESD protection IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact). Fused by 1.5A ceramic fast SMD fuse. Fuse number: 0679H1500 Bel Fuse. Function of the outputs can be configured with jumpers:   230VAC (default)   Potential free 	Hydraulic pumps and other devices, <1.5A For 230VAC: <300W For 110VAC: <150W

Header	Specification	Typical use
OUTPUT 24VAC	16x 24VAC solid-state relay output. ESD protection by clamping @ 58VAC. Fused by 500mA ceramic fast SMD fuse. Fuse number: C1F 500 Bel Fuse. *The 24VAC voltage is generated by transformators. In order to save energy when not in use, a switch is provided to disable these.* Function of the outputs can be configured with jumpers:  	Floor heating thermal wax actuators/valves, 24VAC driven hydraulic valves
ISOLATED OUTPUT	3x opto-isolated GPIO output, 2x opto-isolated PWM output. Max. voltage allowed: 24VDC. ESD protection IEC 61000-4-2 ESD 15kV(Air), 8kV (Contact). PWM frequency configurable, default 1kHz. Fused by polyfuse with 10mA hold/30mA trip current. Pullup to 5 or 12V DC supply can be configured with jumpers:  	PWM output: set speed of PWM controlled hydraulic pumps. GPIO output: Isolated IO communication to external devices.

Header	Specification	Typical use
ISOLATED INPUT	3x opto-isolated GPIO intput. Voltage: 5-24VDC. Max current 16mA. ESD protection IEC 61000-4-2 ESD 15kV(Air), 8kV (Contact). Input current limited by 1.5kΩ resistor. *Due to a limited amount of GPIO, INPUT3 is not available when using the W32-ETH01 module.* 	Isolated IO communication from external devices.
LED POWER INPUT	Power input for PWM LED ouputs. Max. voltage: 24VDC, max current 20A per pin, 2kW total. ESD protection IEC 61000-4-2 ESD 15kV(Air), 8kV (Contact). Current is limited per PWM LED output connector, each pin is connected to 2 PWM LED outputs.	Connect this to a high-current DC power supply to provide power to your LED strips.
PWM LED OUTPUT	32 PWM controlled outputs for LED strips. Max. voltage: 24VDC, max current 10A per connector. PWM frequency configurable, default 200Hz. *By default configured as 8 RGBW lights, but can be configured to any Home Assistant supported light.* Fused by ⌀5x20 F10A glass-tube fuse on the PCB. Fuse number: 0617010.MXP Littelfuse .	Connect a RGBW LED strip per connector, or use one connector to create multiple LED strip lights.
1-WIRE BUS	2 channels to 1-Wire line drivers. Each connector: 3x data pin, 2 x 5V pin, 3x GND pin. Data line voltage: 5V, max. 20mA (parasitic mode allowed). Power line max. 500mA / 5V for both channels simultaneously. Dataline fused by polyfuse with 20mA hold/60mA trip current. Powerline fused by polyfuse with 500mA hold/1A trip current. ESD protection IEC 61000-4-2 ESD 20kV.	Reading 1-Wire temperature sensors like the DS18B20 and DS18B20-PAR.
RS485 BUS	Half-duplex RS485 communication bus. Protection by isolated MAX22027FAWA+ driver. Bus voltage 5V. *Maximal baud rate to be tested. Target is >250kbps*	Auxiliary devices, e.g. solar inverters or DMX controllers.
433MHz HEADERS	2 headers to plug in 433Mhz Superheterodyne transmitter & receiver modules. Power supplies of the modules are stabilized with a capacitor, and for the receiver an additional ferrite bead.	'ClickOnClickOff' devices, curtains screens, garage doors, etc.

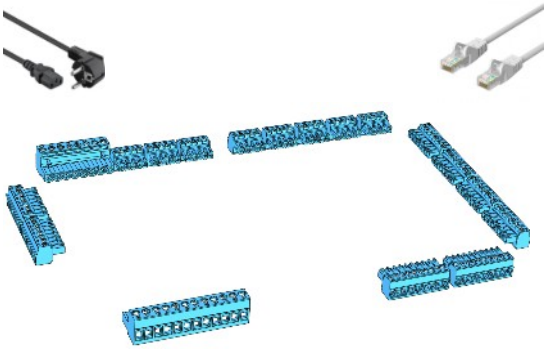
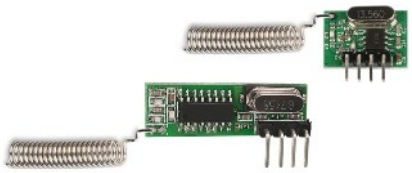
Mechanical specifications





Ordering information

Use EU (230VAC)- or US(110VAC) order code to specify 230VAC or 110VAC input power variant.

Order code	**Description**	
CTRL_BOX_EU CTRL_BOX_US	Bare ControlBox. *No Raspberry Pi or W32_ETH0 included.* *No connector plugs included, no cables included.*	
CTRL_BOX_EU_PI CTRL_BOX_US_PI CTRL_BOX_EU_PI+ CTRL_BOX_US_PI+	ControlBox with pre-installed Home Assistant on a RPi 5 4GB + 128GB NVMe SSD. *Default: no connector plugs included, no cables included.* +: CTRL_BOX_CONN and CTRL_BOX_433 included.	
CTRL_BOX_EU_ESP CTRL_BOX_VS_ESP CTRL_BOX_EU_ESP+ CTRL_BOX_US_ESP+	ControlBox with pre-programmed ESPHome at W32_ETH0 board. *Default: no connector plugs included, no cables included.* *+: CTRL_BOX_CONN and CTRL_BOX_433 included.*	
CTRL_BOX_EU_CONN CTRL_BOX_US_CONN	Connector kit: - C13 net cable 0.5m - Ethernet cable 0.5m - 1x CUI TBP04P1-500-12BE - 1x AMPHENOL TJ0871600000G - 8x AMPHENOL TJ0511630000G - 6x CUI TBP03P3-350-08BE - 2x CUI TBP03P3-350-10BE	
CTRL_BOX_433	433MHz kit with a superheterodyne receiver and transmitter module.	

Manufacturer information

This product is designed and produced by:

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Version information

Date	Author	Description
17-11-2023	AWV	Initial document
21-03-2024	AWV	- Added 110VAC config option for USA market - Added RPi5 with SSD option
31-10-2024	AWV	- Updated fuse information - Removed SD-card option; SDD is much more reliable.