

Hydra A2 System V. 1.6.0 Installation Manual V. 1.1

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Getting Started

Thank you for choosing the HYDRA A2 system; please take the time to familiarize yourself with the material in this manual.

This manual applies to HYDRA A2 Solar Water Heating System version 1.6.0. The version of this manual is 1.1. Updated versions of this manual can be found on <https://www.weppeler.co/lit/>

Important Safety Information

SAVE THESE INSTRUCTIONS.

- This manual contains important safety, installation, operating and maintenance instructions for the equipment.
- For safety purposes, these instructions must be followed during installation, operation and maintenance of the equipment.
- Read all of the instructions and cautions in the manual before beginning installation.
- There are no user serviceable parts inside the equipment. Do not disassemble or attempt to repair the equipment.

The following symbols are used throughout this manual to indicate potentially dangerous conditions, important safety instructions, or important procedures:



WARNING: Indicates a potentially dangerous condition. Use extreme caution when performing this task.



CAUTION: Indicates a critical procedure for safe and proper operation of the specified equipment or part.



NOTE: Indicates a procedure or function that is important to the safe and proper operation of the specified equipment or part.

Safety Precautions



WARNING: RISK OF ELECTRIC SHOCK

- OUTPUT TERMINALS ARE NOT ELECTRICALLY ISOLATED FROM SOLAR DC INPUT, AND MAY BE ENERGIZED WITH DANGEROUS VOLTAGE.
 - DISCONNECT ALL POWER SOURCES BEFORE ATTEMPTING ANY MAINTENANCE OR INSTALLATION.
 - TEST VOLTAGES BETWEEN TERMINALS AND GROUND BEFORE TOUCHING.
 - EXTERNAL SOLAR DISCONNECT IS REQUIRED.
 - SOLAR PANELS PRODUCE DC ELECTRICITY AS SOON AS THEY ARE EXPOSED TO LIGHT!
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General Precautions

- This equipment is not outdoor rated. Install indoors and prevent exposure to the elements.
- Do not place in a location where water can enter the equipment.
- Install SPU and HCU equipment in a location that prevents casual contact. SPU and HCU casing acts as a heatsink and can be hot during operation.
- Avoid wearing jewelry during installation.
- Preferably use insulated tools.
- Perform installation with someone nearby to assist in case of an accident.
- Power connections must be tight as loose connections may cause excessive heating.
- Place appropriate interrupters on all input and output power circuits.
- Use properly sized conductors and circuit interrupters.

Intended Use and Installation

This equipment is NOT intended for use:

- In explosive atmospheres.
- In aircraft or marine installations.
- In medical applications.
- At elevations above 2,000 m ASL.

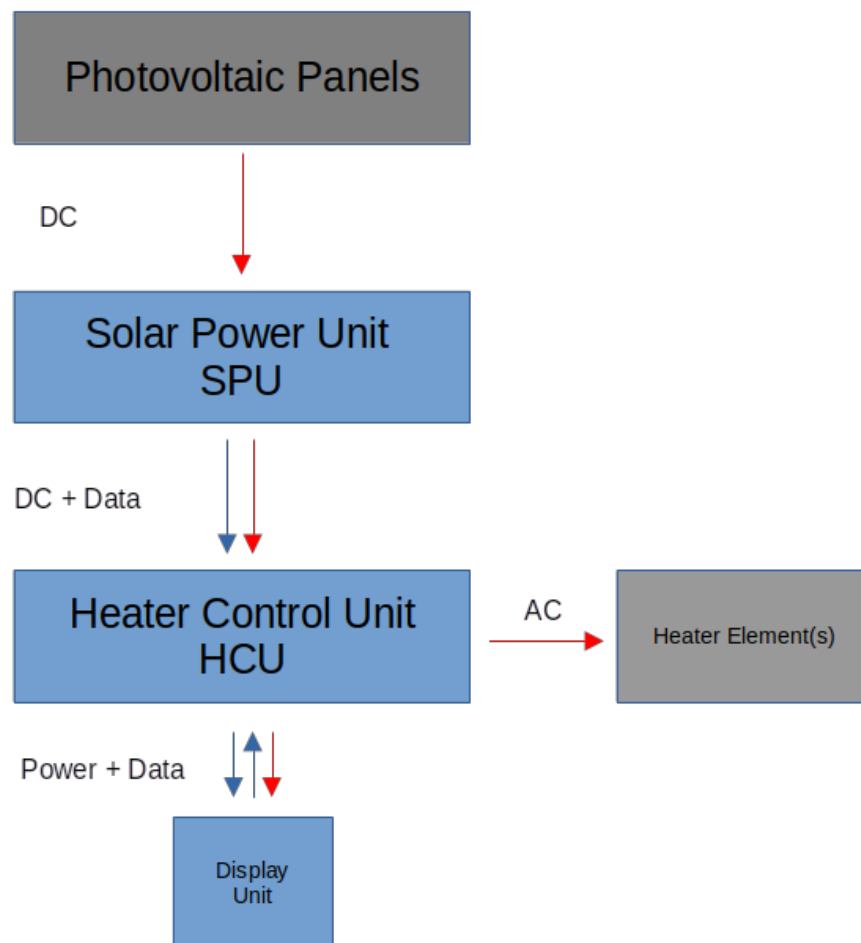
Installation Warning

- This equipment must be installed by a qualified technician, in accordance with the electrical regulations of the country of installation.
- These installation and servicing instructions are for use by qualified personnel only. To reduce the risk of electrical shock, do not perform any servicing other than that specified in the operating instructions, unless qualified to do so.

System Architecture

The system is intended to power standard immersion water heating elements by using solar power from standard photovoltaic panels, even in small arrays (1 kWp and above). The low DC voltage produced by the PV array is stepped up by the Solar Power Unit (SPU), optimized with MPPT and then fed to the Heater Control Unit (HCU). The HCU converts DC into 50 Hz AC waveform compatible with any water heating element.

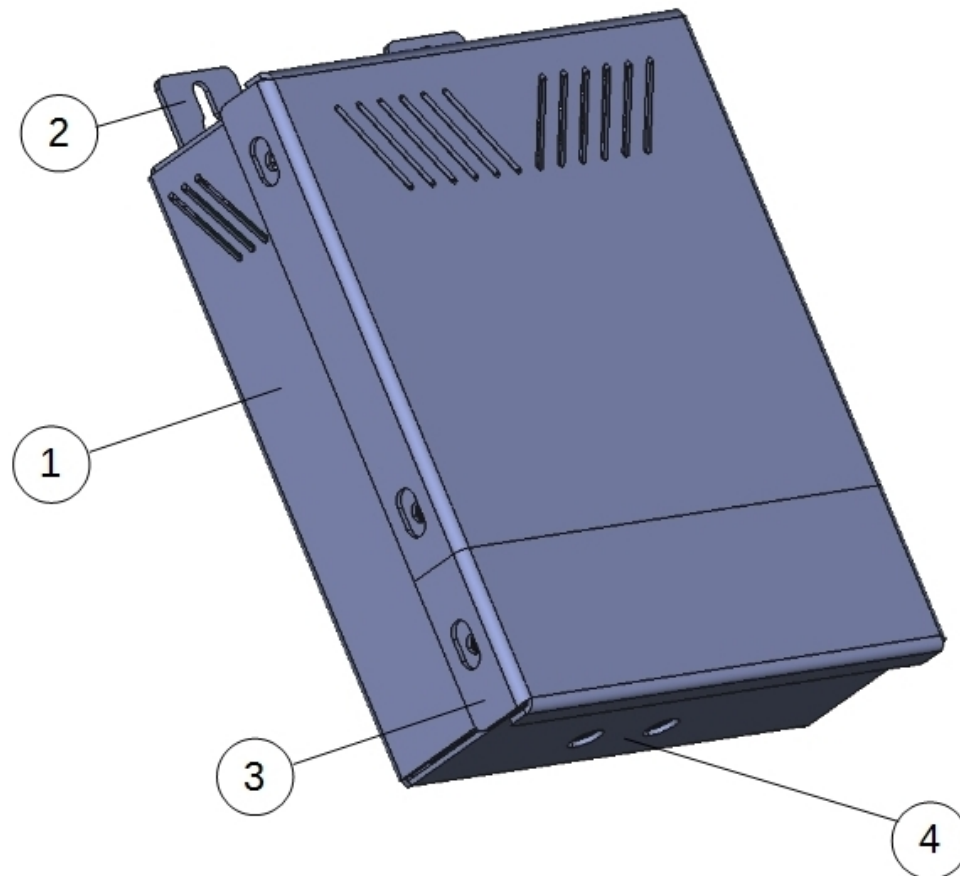
The Display Unit (DU) is installed in a user-accessible location to provide system operation feedback and access to basic settings via a touch screen.



Hydra A2 System Architecture

Solar Power Unit (SPU)

SPU Exterior

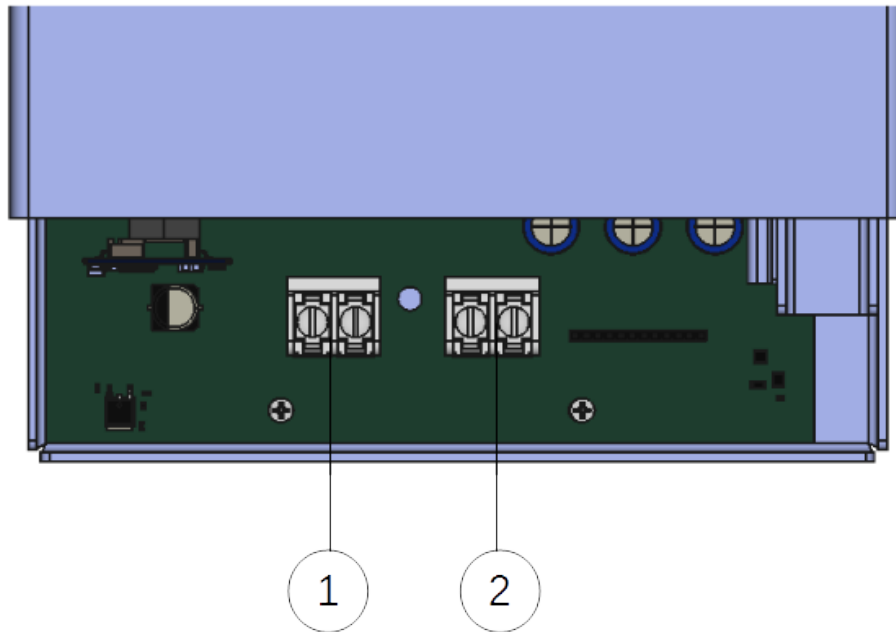


Solar Power Unit (SPU) Exterior

The diagram above shows main exterior features of the SPU.

1. **SPU Main Unit Casing**
2. **Wall-Mount Brackets**
3. **Removable Terminal Access Cover**
4. **Bottom Cable Entry Openings**

SPU Connectors



Solar Power Unit (SPU) Connectors

The diagram above shows the connectors of the SPU.

1. **Solar DC Input – Terminal Block**
2. **DC Output to HCU – Terminal Block**

SPU Description

The Solar Power Unit is a DC to DC converter. It connects to the solar panel array, and outputs an optimized DC voltage to the HCU so it can power itself and the electric water heater element.

When SPU is powered, it will bypass the solar input directly to the output and start sending information messages to the HCU. The HCU will decide when to activate the heater load (based on solar parameters, water temperature, etc). Once the load is applied and exceeds a certain threshold, the SPU will start applying Maximum Power Point Tracking to optimize solar performance.

The SPU performs the following tasks:

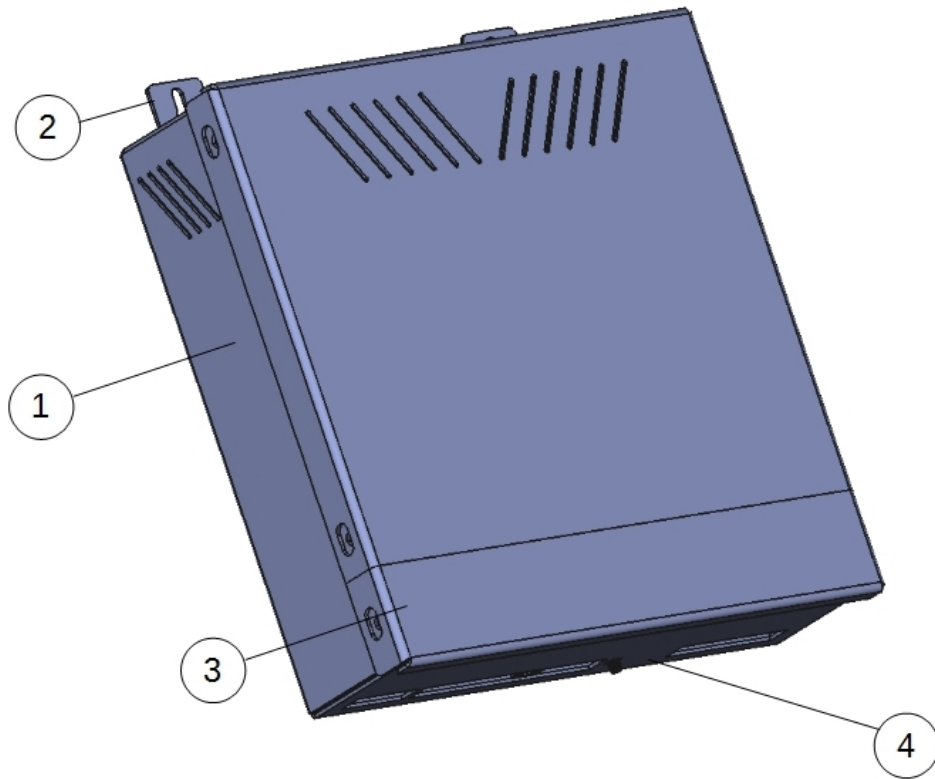
- Increases the voltage of solar panels by using a DC/DC boost architecture.
- Implements MPPT (Maximum Power Point Tracking) algorithm to optimize solar performance.
- Provides monitoring of PV voltage, PV current, output voltage, and its own internal temperature.
- Communicates with the HCU over the power line bus for status reporting and power control.

SPU Specifications

Maximum PV Power	2,200 Watts
PV Voltage Operational Range (Power Voltage)	80 - 220 VDC
Maximum PV Input Voltage (Open Circuit)	250 VDC
Maximum PV Input Current (Operational)	15 A
Maximum PV Input Current (Short Circuit)	18 A
Input/Output DC Connector Cable Gauge	Up to 4 mm (11 AWG)
Communications Interface	Narrowband PLC at 1.66 MHz, DBPSK Modulation
Ingress Protection Rating (IP Rating)	IP 54
Case Material	Aluminium, Powder Coated
Storage Temperature / Humidity	0 to +70 Degrees C, 90% RH
Operational Ambient Temperature / Humidity	0 to +40 Degrees C, 60% RH
Dimensions	260 mm x 193 mm x 73 mm
Unit Weight	2 kg

Heater Control Unit (HCU)

HCU Exterior

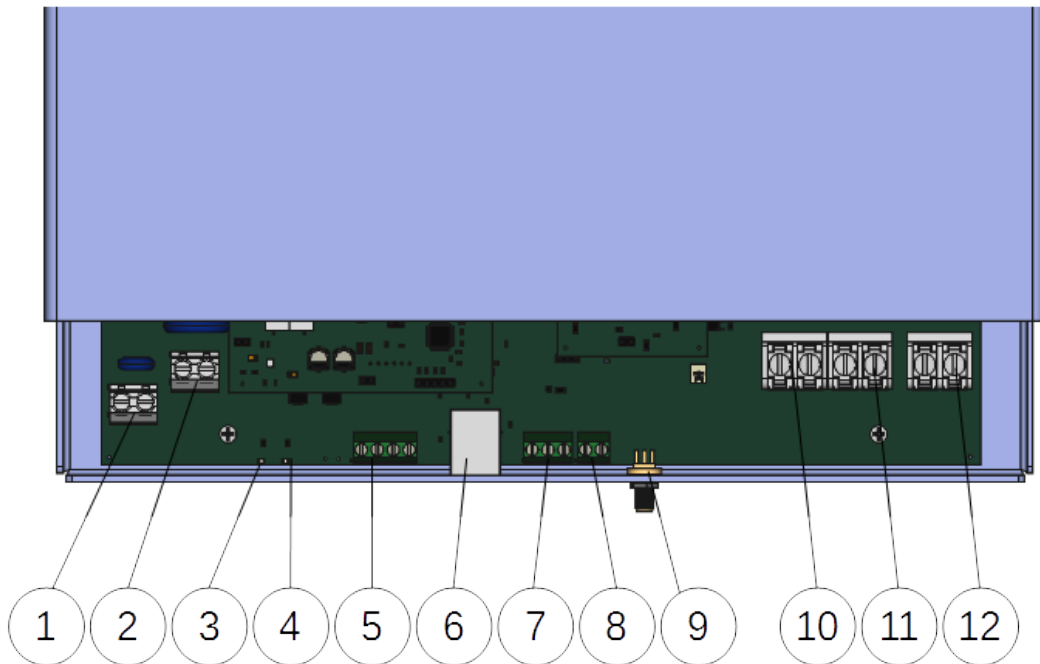


Heater Control Unit (HCU) Exterior

The diagram above shows main exterior features of the HCU.

1. **HCU Main Unit Casing**
2. **Wall-Mount Brackets**
3. **Removable Terminal Access Cover**
4. **Bottom Cable Entry Slots and Ports**

HCU Interfaces



Heater Control Unit (HCU) Interfaces

The diagram above shows the interfaces of the HCU.

1. **HCU Mains Power – Terminal Block**
2. **DC Input from HCU – Terminal Block**
3. **Power LED**
4. **Status LED**
5. **Display Unit Connector – Terminal Block**
6. **Ethernet LAN Port – RJ45**
7. **Temperature Sensor Connector – Terminal Block**
8. **Relay Safety Cutoff Connector – Terminal Block**
9. **WiFi Antenna Connector**
10. **Secondary AC Heater Input Connector – Terminal Block**
11. **Secondary AC Heater Output Connector – Terminal Block**
12. **Primary (Solar Powered) AC Heater Output Connector – Terminal Block**

HCU Description

The Heater Control Unit is the main controller in a HYDRA A2 system installation and performs the following functions:

- Converts DC voltage from the SPU to alternating 50 Hz supply to power an electric water heater element and controls the activation of the heater.
- Provides water temperature monitoring for information and safety purposes.
- Contains an internal Residual Current Device (RCD) for shock protection in case of a heater element fault.
- Provides Wi-Fi and Ethernet connectivity for cloud functions such as mobile app and software updates.

Interfaces Description

HCU Mains Power – Terminal Block

This AC mains input provides backup power to the HCU. The HCU uses solar power when available, and only uses mains when solar power is insufficient or overnight. This input is NOT used for water heating.

DC Input from HCU – Terminal Block

Incoming DC power from SPU. The same cable carries digital data from the SPU using inductive coupling.

Power LED

This LED lights up when the HCU is powered.

Status LED

This LED blinks at 1 second intervals when in normal operation. In a fault condition, this LED blinks rapidly.

Display Unit Connector – Terminal Block

This 4-pin terminal block connects the Display Unit to the HCU and provides data (RS232) and power (12 VDC).

Ethernet LAN Port - RJ45

10/100 Mbps MDI-X capable Ethernet Port.

Temperature Sensor Connector – Terminal Block.

This 3-pin terminal block is used to attach the digital sensor for monitoring water tank temperature. The sensor is a 1-Wire DS18B20 or compatible. This connector also provides sensor power (5 VDC).

Relay Safety Cutoff Connector – Terminal Block.

The safety cutoff switch is a backup miniature bi-metallic thermostat that will cut off power to the HCU relays if water temperature exceeds 80 degrees C.

Wi-Fi Antenna Connector

2.4 GHz RP-SMA Wi-Fi antenna is attached here.

Secondary AC Heater Input Connector – Terminal Block

Auxiliary heater AC mains input, passing through internal relay. This input is used to power a secondary heater element.

Secondary AC Heater Output Connector – Terminal Block

Auxiliary heater AC mains output.

Primary (Solar Powered) AC Heater Output Connector – Terminal Block

The heater element to be powered by solar is connected here.

HCU Specifications

Maximum Solar Heater Output Power	2,200 Watts
Solar Heater Element	Standard 220 VAC Element, 750 - 3000 Watts
Solar Heater Output	80 - 230 VAC, 50 Hz, Square Wave
DC and AC Connectors Cable Gauge	Up to 4 mm (11 AWG)
Secondary Heater Relay	16 A
AC Input (HCU Backup Power)	80 - 260 VAC
Temperature Sensor	Digital 1-Wire Protocol (DS18B20), Powered (5 VDC)
Cloud Connectivity	2.4 GHz Wi-Fi, 10/100 Mbps RJ45 Ethernet
Wi-Fi Antenna	2 dBi, RP-SMA
Communications Interface	Narrowband PLC at 1.66 MHz, DBPSK Modulation
Ingress Protection Rating (IP Rating)	IP 54
Case Material	Aluminium, Powder Coated
Storage Temperature / Humidity	0 to +70 Degrees C, 90% RH
Operational Ambient Temperature / Humidity	0 to +40 Degrees C, 60% RH
Dimensions	345 mm x 311 mm x 98 mm
Unit Weight	2.5 kg

Display Unit (DU)

DU Exterior



Display Unit (DU) Exterior

The diagram above shows main exterior features of the Display Unit device.

DU Description

The Display Unit is a small, wall-mounted device with a touch capable colour LCD screen. The DU is connected to the HCU using a 4-wire cable and can be located up to 50 meters away from HCU.

- Shows water temperature.
- Shows system status and solar power and production figures (instantaneous and cumulative).
- Allows access to basic configuration and system status information using the menus.
- Shows the current date and time as a convenience (when HCU has a Wi-Fi or LAN connection).

DU Specifications

Display Type	LCD, Resistive Touch
Resolution	2.4 Inch, 320 x 240 Pixels
Maximum Brightness	240 Nits
Power Supply	12 VDC, 200 mA
Communications Interface	RS-232, 9600 baud
Connector	Terminal Block, Maximum Wire Gauge 1 mm (17 AWG)
Ingress Protection Rating (IP Rating)	IP 44
Case Material	ABS Plastic
Dimensions	86 mm x 86 mm x 25 mm
Unit Weight	120 g

Installation and Commissioning

SPU Installation



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CAUTION: Equipment Damage

- The SPU is only designed for Solar Photovoltaic inputs. Do NOT connect the SPU to any other power source.
 - Be sure to observe the correct polarity when connecting PV input. THERE IS NO REVERSE POLARITY PROTECTION.
 - Verify that the highest temperature-compensated solar array open-circuit voltage (Voc) will not exceed SPU maximum rated input voltage.
 - Verify that the highest power current (IMPP) of the solar array does not exceed the SPU maximum rated current.
-

SPU Mounting and Installation

1. Choose a suitable location that is protected from rain, sun, high temperatures, and exposure to water.
2. Secure cable routing for input (PV) and output (HCU) cables.
3. The SPU connectors do not have strain relief. Ensure cables are externally secured to avoid cable weight being supported by the connectors.
4. The SPU is fan-less, and its case is a heatsink. Ensure at least 20 cm clearance from top and right sides of the SPU for adequate convection.
5. Drill holes to hang the SPU using its wall-mount brackets and securely hang the unit.
6. An external solar Surge Protective Device (SPD) is recommended. Install at the panel side as per manufacturer's instructions.
7. Remove the Removable Terminal Access Cover by removing side screws.
8. Connect the PV array (via a disconnect) with suitably rated cable to the SPU input, observing the polarity.
9. Connect the SPU output (via a disconnect) with suitably rated cable to the HCU DC Input, observing the polarity.

Test Power-Up

1. With the output disconnect in the OFF position, power up the SPU by activating the PV array disconnect. The LED indicator will light up indicating power.
2. Optionally measure the voltage at the SPU input and output terminals; this will be same as the PV array voltage. SPU will not operate the MPPT function without a load.
3. Turn all disconnects off until HCU is ready.
4. Replace the Removable Terminal Access Cover and secure with the screws.

HCU Installation



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CAUTION: Equipment Damage

- The HCU DC input port is only designed for DC from the SPU. Do NOT connect the HCU DC input to any other power source.
 - Be sure to observe the correct polarity when connecting SPU output to HCU DC input. THERE IS NO REVERSE POLARITY PROTECTION.
-

HCU Mounting and Installation

1. Choose a suitable location that is protected from rain, sun, high temperatures, and exposure to water.
2. Secure cable routing for input (DC from HCU, backup AC power) and output (heater element) cables.
3. Attach the temperature sensor and the safety cutoff switch to the HCU.
4. Position the temperature sensor and the safety cutoff switch in suitable position in the water tank (this depends on the heater element, construction of the tank etc.) Ensure both are as close to tank body as possible or are inserted into special probe tubes in the tank.
5. The HCU connectors do not have strain relief. Ensure cables are externally secured to avoid cable weight being supported by the connectors.
6. The HCU is fanless, and its case is a heatsink. Ensure at least 20 cm clearance from top and right sides of the HCU for adequate convection.
7. Drill holes to hang the HCU using its wall-mount brackets and securely hang the unit.
8. Connect the necessary input and output cables to the appropriate terminal blocks, passing them through bottom entry slots.
9. At this point the HCU can be temporarily powered up from the backup (mains power) source. If the power LED comes on, the HCU is functional and powered.
10. Turn HCU off before performing the DU installation.
11. HCU hardware installation is complete, proceed to DU installation before power-up.

DU Installation



CAUTION: Equipment Damage

- Be sure to observe the correct polarity when connecting the DU power supply + and – wires. **THERE IS NO REVERSE POLARITY PROTECTION.**
-

DU Mounting and Installation

1. Choose a suitable location that is protected from rain, sun, high temperatures, and exposure to water.
2. Secure cable routing for the cable used between HCU and DU.
3. It is recommended to use a 2-pair twisted pair cable. Alternatively, CAT5 or similar data cable can be used.
4. On the HCU, connect the cables to the "display" terminal block. It is recommended to follow standard color coding practices (e.g. red for power and black/brown for ground).
5. On the DU, connect the 12V + and – to the respective terminals on the DU, and connect the wires labelled "TX" and "RX".
6. On the DU, connect the wires labelled "TX" and "RX" in the opposite order: HCU "TX" should be wired to DU "RX" and vice versa.
7. Mount the DU on the wall using the wall-mount ears on the back or another attachment method (e.g. double-side tape).

DU installation is complete.

SPU Pairing

When SPU, HCU and DU are mounted, the system is ready for the first power up. The new HCU will not operate until it is paired with the SPU device by linking to it's serial number. The serial number is sent by the SPU during the first 30 seconds of powering the SPU on.

The pairing procedure is conducted

1. Power up the HCU by activating the circuit breaker on its backup (mains) power supply.
2. The DU will now display a message requiring SPU pairing and a "START" button.
3. Press the "START" button and power up the SPU. In about 30 seconds the HCU will recognize the SPU and reboot.
4. The system is now ready for use.



SPU Pairing Message

Normal Operation

If all the installation procedures are successful, and there is a valid PV input to the SPU with sufficient power to operate the heater, the HCU will switch to Day Mode. In Day Mode the DU will display solar performance information, water temperature, and date/time (if Wi-Fi or LAN is connected to the Internet).



HCU Day Mode Displayed on DU