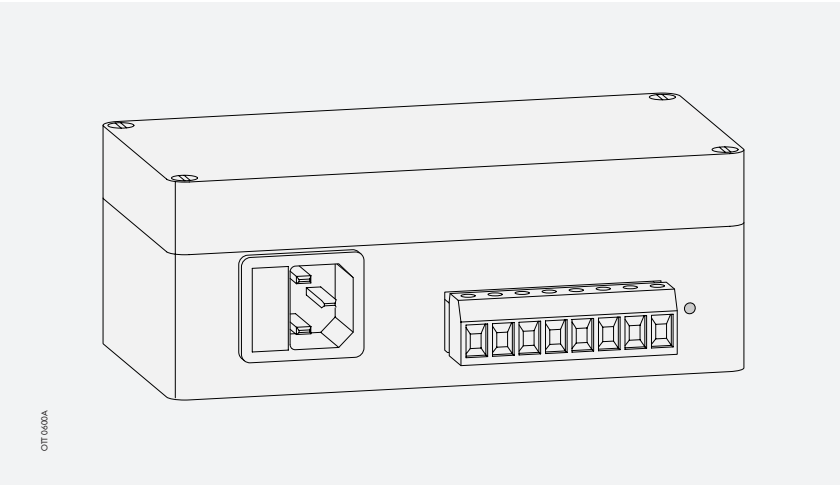
OTT
HYDROMETRIE

Operating Instructions
Power Control Unit
PCU 12

English



We reserve the right to make technical improvements!

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1 Scope of delivery

▶ **PCU 12**

– 1 Multi-function power supply unit with a mounting box for non-heating equipment and a plug-in screw terminal strip to connect the battery, solar panel, power consumers and earth.
- 1 operating manual

2 Order numbers

▶ **PCU 12**	**Multi-function power supply unit**	97.750.096.9.5
▶ **Accessories**	**Mains cable**	96.120.088.9.5
	Battery	on request
	Solar panel	on request

3 Introduction

The OTT multi-function power control unit PCU 12 (**P**ower **C**ontrol **U**nit) provides 12 V voltage. It is mainly aimed at use in hydronomy and meteorology. Alternatively, it can be operated either from the network or by a solar panel.

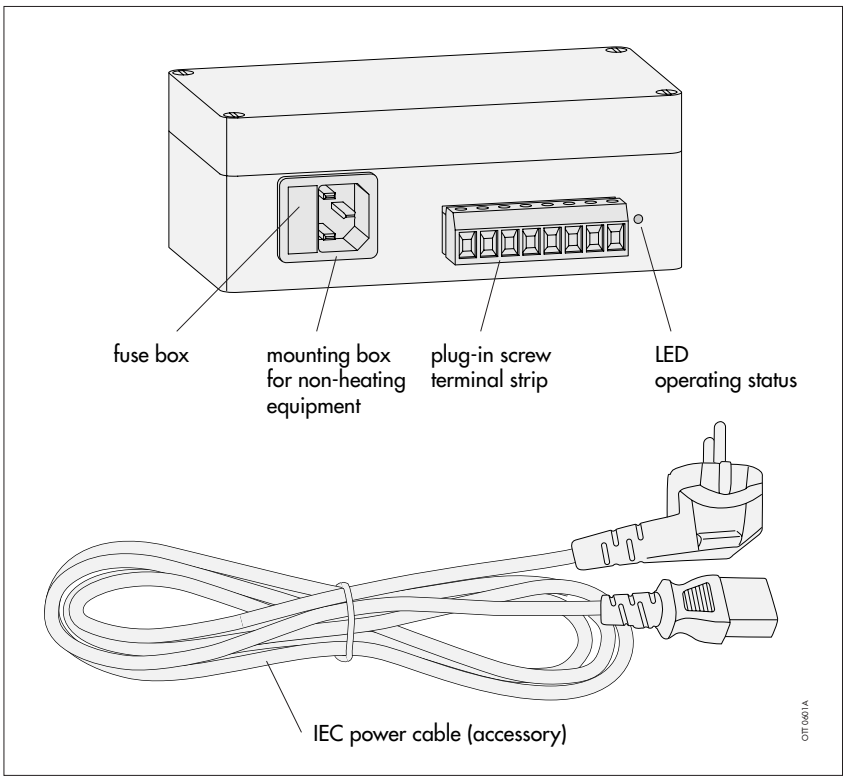
Thanks to the different methods of supplying current, and the unit's advanced monitoring and regulatory mechanisms, it can be used in a wide range of situations. It therefore incorporates a solar charge regulator, an exhaustive discharge protection battery and a stabilised mains supply with automatic recognition of the input voltage.

The unit does not need to be opened in order to be connected to the power supply or the power consumers. The fuse can also be changed without opening the unit.

The following are examples of its possible uses:

- operation independent of the mains (solar panel with battery)
- mains operation without battery buffer.
- mains operation with battery buffer (non-stop current supply)
- battery charger
- exhaustive discharge protection battery

Fig. 1: Multi-function-power control unit PCU 12



4 Safety instructions

In developing and manufacturing the PCU 12, we have observed all relevant standards and regulations. However, there still exists – as with all electric equipment – the danger of being injured. By using and installing the unit correctly, as described in this operating manual, these hazards can be avoided. This will also prevent the PCU 12 from being damaged.

Please observe the following safety instructions:

- Before using the unit for the first time, please read this operating manual. Familiarise yourself thoroughly with the use and installation of the PCU 12 and the accessories.
- Only use the PCU 12 as described in this manual.
- When using this unit, pay attention to all the information on hazards provided at each step.
- Do not make changes of any kind to the PCU 12.
- If the PCU 12 is damaged, have it checked and repaired by our service department. Do not carry out repairs yourself under any circumstances.
- Protect the unit from humidity and dampness.

WARNING: Do not open the unit; dangerous electric voltage inside!

Operating with battery

Observe the safety regulations enclosed with the battery,
in particular:

- When batteries are being charged, charging gases arise. These are explosive, therefore:
  – avoid the formation of sparks,
  – no open fire,
  – do not smoke,
  – when releasing the connections, disconnect the earth cable first of all, when attaching the
  – connections, attach the earth cable last of all,
  – when charging, connect the battery to the charger first of all, and only then
  – start the charger
  – when charging, make sure the the room is very well ventilated.
- During charging, the acid temperature must not exceed 55 °C.
- Avoid short-circuits at all costs; do not place any tools on the battery. Connect the supply leads.
- Battery acid is highly caustic, therefore if it leaks out
  – onto clothing, rinse it with soapsuds and a lot of clear water
  – into the eyes and onto the skin: rinse them for approx. 5 minutes with clear water and then consult a doctor immediately.

Operating with solar panel

Observe the safety regulations enclosed with the solar panel,
in particular:

- Make sure the solar panel is safely secured in accordance with national construction regulations.

5 Description of unit and putting it into operation

5.1 Connections

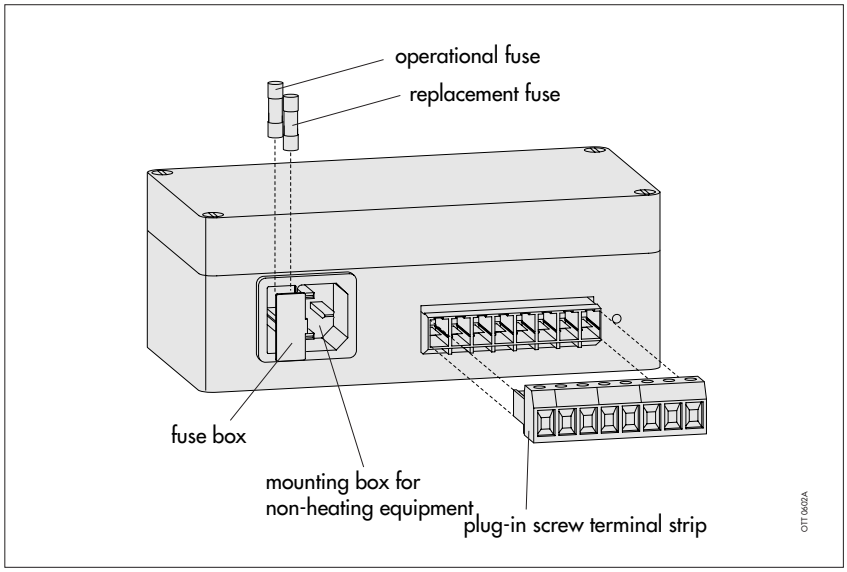
Mounting box for non-heating equipment in accordance with IEC 320
To be used for connection to the power supply system using the attached plug-in IEC power cable with an earthing-pin plug. In countries with different plug standards, your local specialist dealer can provide you with a suitable power cable.

Plug-in screw terminal strip
The power consumer, solar panel and battery are connected via a screw terminal strip (see Fig. 2). This strip is also equipped with an earth connector. The eight-pin screw terminal strip can be removed to allow the cables to be attached easily. Wires with a maximum cross-section of 2.5 mm can be used. Flexible litz wires should be equipped with wire end ferrules. Cable routing should generally be as short as possible.

5.2 Fuse

A fuse carrier is built into the mounting box for non-heating equipment. It is equipped with two fuses for the mains voltage: an operational and a replacement fuse (see Fig. 2).
You can access the fuses, for example by carefully pushing a screw driver sideways under the cover plate of the fuse carrier and then pulling the carrier out. You will then see two fuses. The inner one is the operational fuse, the outer one the replacement fuse. If the operational fuse is faulty, replace it with the replacement fuse and then carefully push the fuse carrier back in fully.
Should the replacement fuse also blow when you try operating the unit again, the device is faulty. In this case, do not try to repair the device yourself. Instead contact the OTT service department.
If the device is ready for operation after changing the fuse, do not forget to put a new replacement fuse into the fuse carrier at the earliest opportunity. Use only type 2 A fast-blowing miniature fuses.

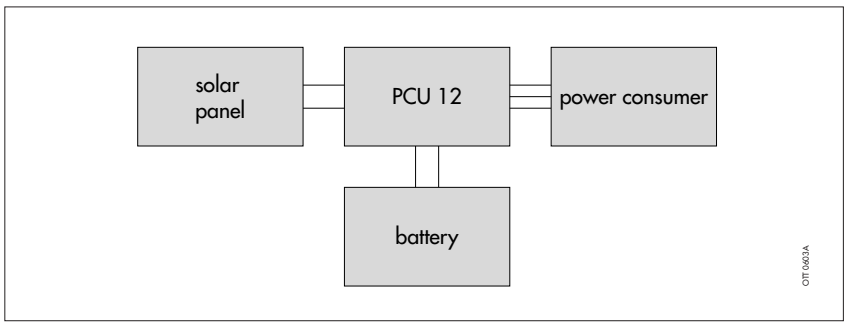
Fig. 2: Connections and fuse carrier with fuses



5.3 Solar operation

When operating independently of the mains with a solar panel and a battery, the PCU 12 regulates the charging of the battery (overload protection) and protects it from an exhaustive discharge. This ensures a long working life for the battery and high availability of the system.

Fig. 3: Connection diagram for solar operations



The solar panel current must not exceed 12 A, while the open-circuit voltage must not exceed 23 V (12 V in the case of nominal voltage). If the load current is greater than the solar panel current, the battery is discharged. When dimensioning the battery and the solar panel, you must ensure that the discharging of the battery is compensated for by a suitable charging cycle. The battery capacity must not exceed 200 Ah.

The power consumer is powered by the solar panel and/or the battery. Depending on the battery capacity, the maximum load current may be up to 12 A.

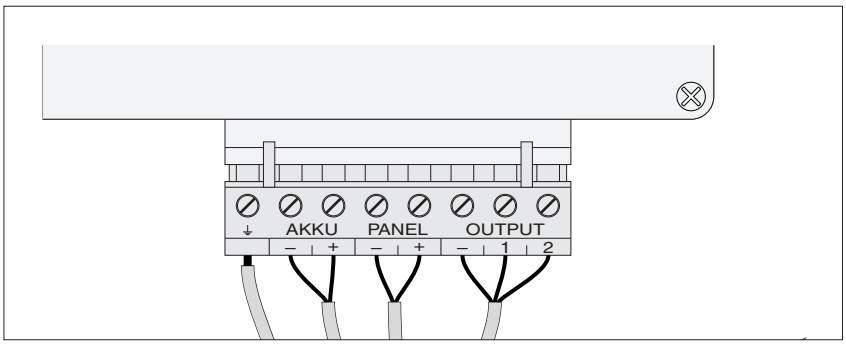
The PCU 12 is equipped with two outputs in order to protect the battery from an exhaustive discharge if the solar panel has a long power failure or is under-performing, due to long periods of bad weather or fog, for example. At output 1 (terminal 1 on the plug-in screw terminal strip) the load is disconnected when it reaches 7.5 V. System components connected here should preferably remain in operation for as long as possible, i.e. sensors and data loggers. At output 2 (terminal 2 on the plug-in screw terminal strip) the load is disconnected at 10.5 V. Less important modules are connected here, i.e. communication equipment. This slows down further discharging. Both outputs have a common minus pole (terminal "–" on the plug-in screw terminal strip).
If the battery voltage rises again during the switch-over to normal operation, both outputs are connected again.

The battery is charged automatically. The PCU 12 protects it from overloading. For this purpose, the battery voltage is measured. It typically rises in the course of charging and reaches the maximum value when the battery is fully charged. When this voltage value (end-of-charging voltage) has been reached, the charging current is turned off.
The end-of-charging voltage depends on the temperature. The PCU 12 is therefore equipped with a thermostat in order to determine the correct ambient temperature for the end-of-charging voltage. Therefore make sure that the battery and the PCU 12 are exposed to the same ambient temperature. As a rule, this is the case if they are situated close to each other.

The solar panel, battery and power consumer are connected to the plug-in screw terminal strip on the PCU 12:

solar panel at	"PANEL",	terminal "–" and terminal "+";
battery at	"AKKU",	terminal "–" and terminal "+";
power consumer at	"OUTPUT"	operating point 7.5 V terminal "–" and terminal "1";
		operating point 10.5 V terminal "–" and terminal "2".

Fig. 4: Terminal strip connection for solar operations



Overvoltage protection and earthing
When setting up the system, observe all regulations relating to overvoltage protection and earthing.
The PCU 12 has overvoltage fine protection at the panel, battery and power consumer connections as well as between these connections.
The mains inlet is equipped with coarse and fine protection.

Dimensioning the solar panel

Designing a solar system with a battery requires considerable calculation. This must take into consideration parameters such as average daily radiation, lowest and highest average temperatures for each month, latitude and longitude, weather patterns (bad weather periods), total daily energy requirement etc. For larger systems in particular, the help of a specialist, i.e. the manufacturer of the solar module, will be required.
For systems purchased entirely from OTT, we handle the dimensioning of the solar panel.

For other system configurations, the following is a simplified version of how the dimensioning of the solar panel for a pure direct current system can be calculated:

1. Establish the output of each power consumer [W].
2. Multiply each output value by the length of time the machine concerned is used per day [h].
3. The sum of the figures for each machine is the average daily power requirement [Wh].
4. Add 30% to this figure to make up for battery and system losses. This is the total energy requirement to be covered by the solar system [Wh].
   Using this figure, you can select a solar panel suited to your geographical location from the information provided by the manufacturer.

The manufacturer will also provide you with information on installing the solar panel, i.e. where to install it, shadowing, and alignment according to geographical position

Dimensioning the battery

Designing a solar system with a battery also requires considerable calculation. For larger systems in particular, the help of a specialist, i.e. the manufacturer of the solar module, will be required (see also "Dimensioning the solar panel"). For systems purchased entirely from OTT, we handle the dimensioning of the battery.

For other system configurations, the following is a simplified version of how the dimensioning of the battery for a pure direct current system can be calculated:

1. Calculate the total energy requirement per day [Wh] as shown in the section "Dimensioning the solar panel".
2. Multiply this figure by the system autonomy (in days) [Wh].
   The system autonomy is determined by the importance of having the specific system available in times when the solar panel is not providing any energy.
3. Add 30% to this figure as spare capacity in the battery [Wh].
4. Divide this figure [Wh] by the battery voltage [V]. This will give you the necessary battery capacity in Ah.

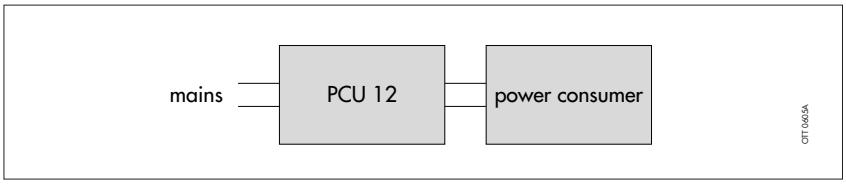
The battery capacity must not exceed 200 Ah.

5.4 Mains operation

The unit can be operated with mains voltage of between 90 – 250 V AC/40 – 60 Hz without any particular adjustments. The power input is max. 30 VA.
The PCU 12 can be used in mains operation either as
– a power pack without a battery buffer, or
– a power pack with a battery buffer, or
– a battery charger.

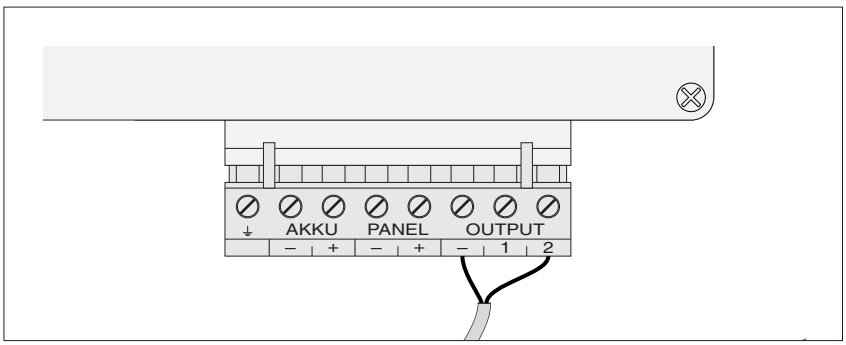
Power pack without a battery buffer
The PCU 12 is used to operate a device with 12 V supply voltage. The load current must not exceed 2 A.

Fig. 5: Connection diagram for mains operation, power pack without battery buffer



The power consumer is connected to the plug-in screw terminal strip on the PCU 12:
"OUTPUT" operating point 10.5 V terminal "–" and terminal "2".

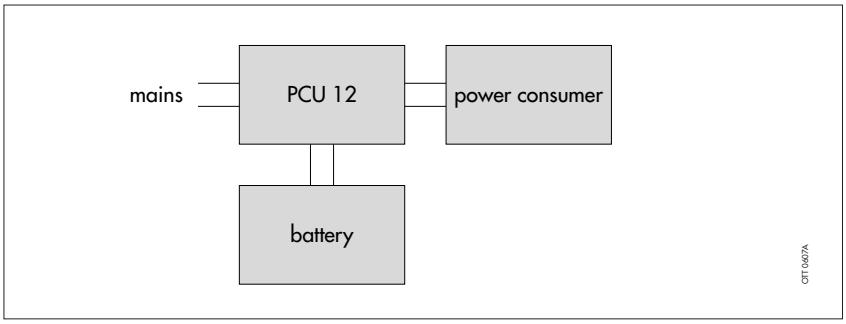
Fig. 6: Connection of terminal strip for mains operation, power pack without battery buffer



Power pack / battery charger with battery buffer
The battery capacity must not exceed 200 Ah.

The PCU 12 is used to operate a device with 12 V supply voltage. In the event of a power failure, the battery supplies the voltage, and it provides additional power for peak loads.
During trouble-free operation, the power consumer is powered by the power pack, and – if need be – the battery. Depending on the battery capacity, the maximum load current may be up to 12 A.

Fig. 7: Connection diagram for mains operation, power pack / battery charger with battery buffer



Operation during power failure

For systems purchased entirely from OTT, we handle the dimensioning of the solar panel.

For other system configurations, the following is a simplified version of how the dimensioning of the battery for a pure direct current system can be calculated:

1. Calculate the total energy requirement per day [Wh] as shown in the section "Dimensioning the solar panel". This must be less than the PCU 12 capability, i.e. less than 2 V x 2 A x 24 h = 576 Wh.
2. Multiply this figure by the system autonomy (in days) [Wh].
   The system autonomy is determined by the importance of having the specific system type available in times when the solar panel is not providing any energy.
3. Add 30% to this figure as spare capacity in the battery [Wh].
4. Divide this figure [Wh] by the battery voltage [V]. This will give you the necessary battery capacity in Ah.

Protection against exhaustive discharging:
In order to protect the battery from exhaustive discharging, e.g. in the event of a long power failure, the PCU 12 is equipped with two outputs. At output 1 (terminal 1 on the plug-in screw terminal strip) the load is disconnected when it reaches 7.5 V. Components connected to the system here should preferably remain in operation for as long as possible, i.e. sensors and data loggers. At output 2 (terminal 2 on the plug-in screw terminal strip) the load is disconnected at 10.5 V. Less important modules are connected here, i.e. communication equipment. Both outputs have a common minus pole (terminal "–" on the plug-in screw terminal strip).
When the battery voltage rises again during the switch-over to normal operation, both outputs are connected again.

Operation during periods of peak load:

The PCU 12 output current is max. 2 A. If the load current is >2 A, the battery is discharged. When operating with load currents which exceed the PCU 12 capacity, you must therefore ensure that the discharging of the battery is compensated for by a suitable charging cycle when dimensioning the battery.

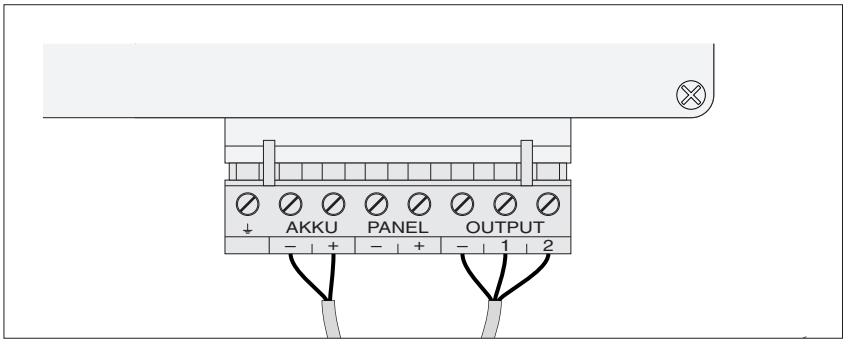
Charging the battery

The battery is charged automatically with a maximum charging current of 2 A. The PCU 12 protects the battery from overloading. For this purpose, the battery voltage is measured. It normally rises in the course of charging and reaches the maximum value when the battery is fully charged. When this voltage value (end-of-charging voltage) has been reached, the charging current is turned off.
The end-of-charging voltage depends on the temperature. The PCU 12 is therefore equipped with a temperature probe in order to determine the correct ambient temperature for the end-of-charging voltage. Therefore make sure that the battery and the PCU 12 are exposed to the same ambient temperature. As a rule, this is the case if they are situated close to each other.

The battery and power consumer are connected to the PCU 12 at its plug-in screw terminal strip:

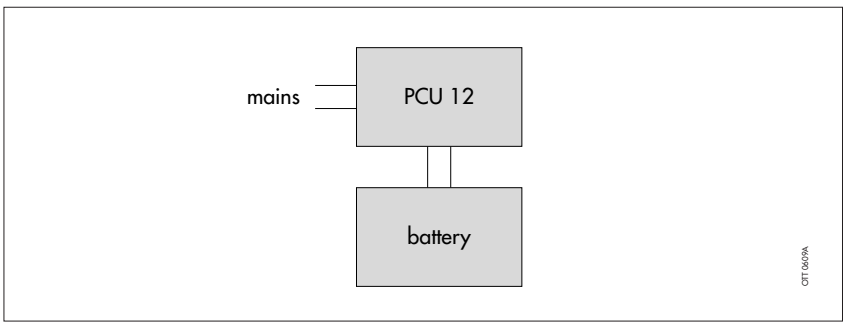
solar panel at	"PANEL",	terminal "–" and terminal "+";
battery at	"AKKU",	terminal "–" and terminal "+";
power consumer at	"OUTPUT"	operating point 7.5 V terminal "–" and terminal "1";
		operating point 10.5 V terminal "–" and terminal "2".

Fig. 8: Connenction of terminal strip for mains operation, power pack/ charger with battery buffer



Battery charger
The PCU 12 is used to charge a 12 V battery, for example if a fully charged battery is required when testing a system or using it for the first time.

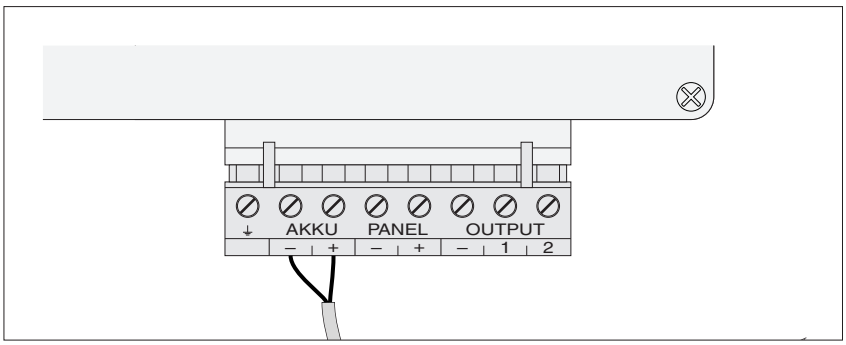
Fig. 9: Connection diagram for mains operations, battery charger



The battery is charged automatically with a maximum charging current of 2 A. The PCU 12 protects the battery from overloading. For this purpose, the battery voltage is measured. It normally rises in the course of charging and reaches the maximum value when the battery is fully charged. When this voltage value (end-of-charging voltage) has been reached, the charging current is turned off.
The end-of-charging voltage depends on the temperature. The PCU 12 is therefore equipped with a temperature probe in order to determine the correct ambient temperature for the end-of-charging voltage. Therefore make sure that the battery and the PCU 12 are exposed to the same ambient temperature. As a rule, this is the case if they are situated close to each other.

The battery and power consumer are connected to PCU 12 at its plug-in screw terminal strip:
"AKKU" terminal "–" und terminal "+".

Fig. 10: Connection of terminal strip in operation as a battery charger



6 Attaching PCU 12

Important: before opening the housing, always disconnect the plug-in mains line and the screw terminal strip to avoid electrocution.

- Disconnect the plug-in mains line.
- Disconnect the screw terminal strip.
- Release the four cross-recessed screws on the upper side of the equipment and remove the cover.
- Secure the PCU 12 at the points shown in the figure, using four machine screws (4 x 40), for example.
- Put the top back on and tighten the four cross-recessed screws.

7 Examples of use

7.1 Operating independently of the mains with battery and solar panel

This system consists of a solar panel which provides the energy, a battery which acts as an energy buffer, the PCU 12 and, for example, a HYDROSENS "MIDI" housing, equipped with various HYDROSENS modules (OTT-LOG, OTT-COM, …).

The PCU 12 regulates the battery charging process and protects it from exhaustive discharging.

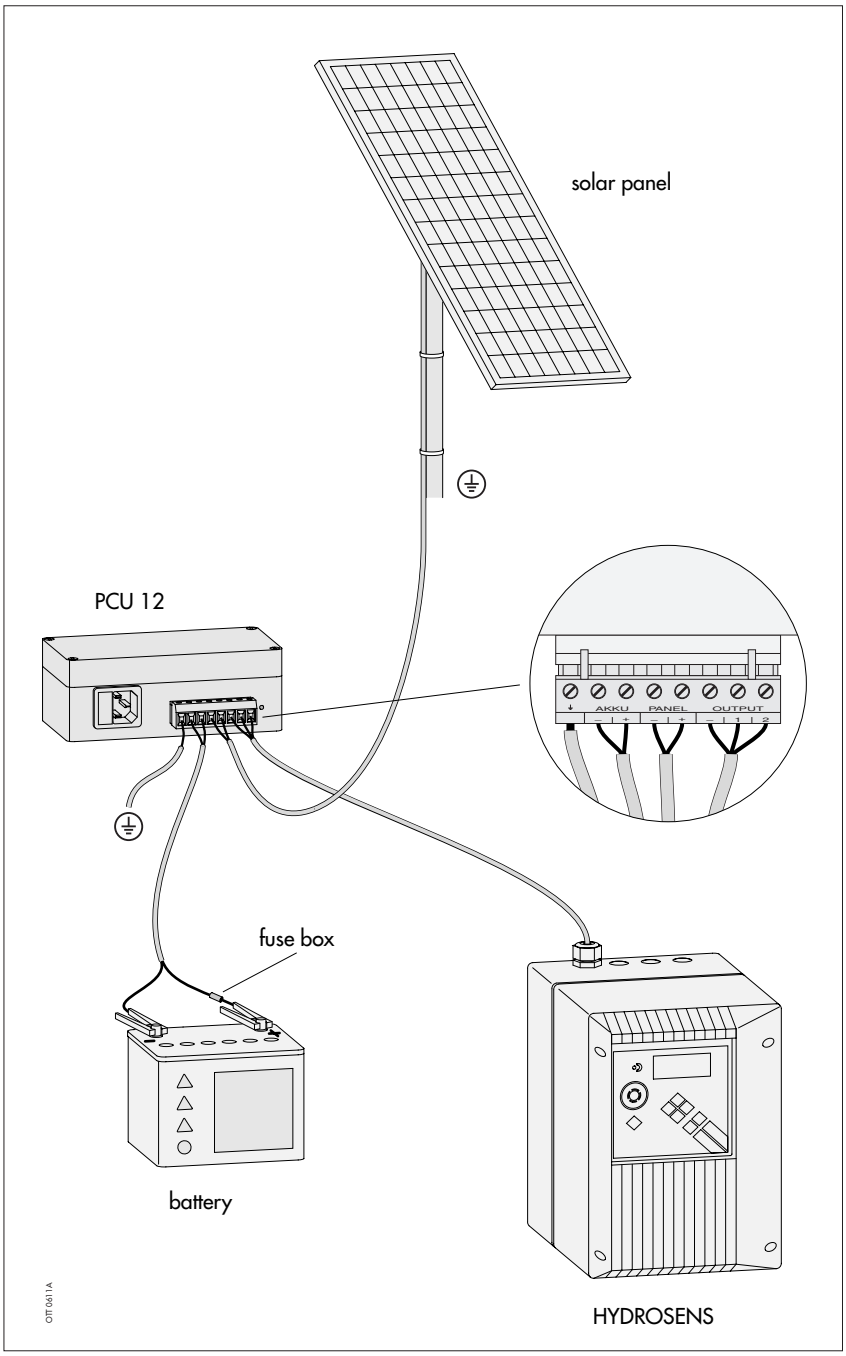


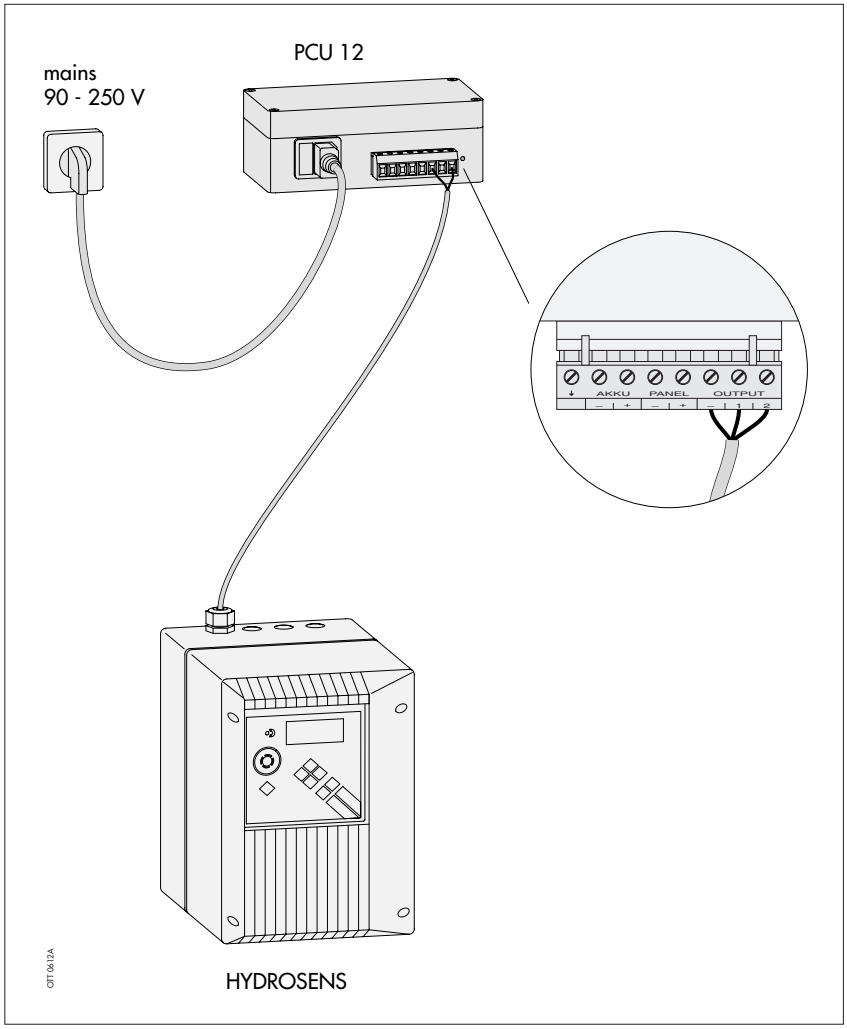
Fig. 12: Example of use: operating independently of the mainswith battery and solar panel

7.2 Mains operations without a battery buffer

This system consists of a PCU 12 powered by the mains and a HYDROSENS "MIDI" housing equipped with various HYDROSENS modules (OTT-LOG, OTT-COM, …).

The PCU 12 supplies power to the HYDROSENS equipment. This configuration is suitable for systems without high fail-safety requirements or which have a very reliable mains supply.

Fig. 13: Example of use: mains operation without a battery buffer

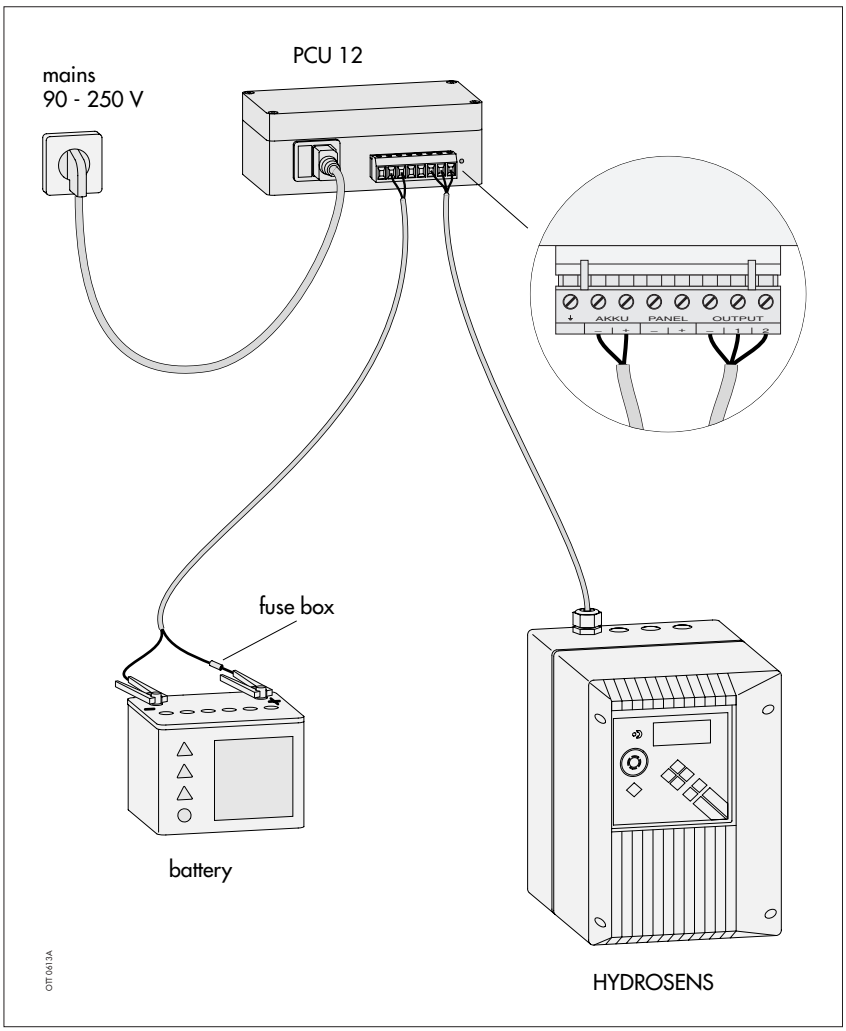


7.3 Mains operations with battery buffer

This system consists of a PCU 12 powered by the mains, a battery which acts as an energy buffer and a HYDROSENS "MIDI" housing equipped with various HYDROSENS modules (OTT-LOG, OTT-COM, …).

The PCU 12 charges the battery, regulates the battery charging process and offers considerable protection against exhaustive discharging. This configuration is suitable for systems with high fail-safety requirements and/or which have an unreliable mains supply. This system therefore supplies power to the HYDROSENS equipment without interruption.

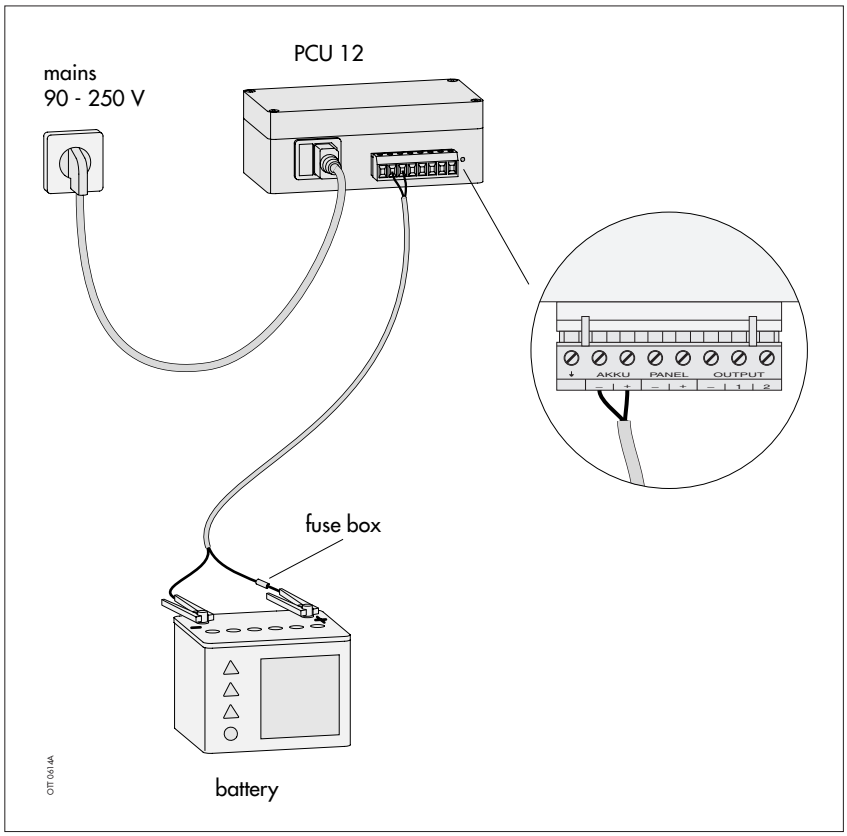
Fig. 14: Example of use: mains operation with battery buffer



7.4 Battery charger

This system consists of a PCU 12 powered by the mains and a battery.
The PCU 12 is used to charged the battery and regulate the charging process.
This configuration is used, for example, to charge a battery before putting a system into operation. With a fully charged battery, the system is immediately ready for operation and can therefore be tested as soon as it is put into operation.

Fig. 15: Battery charging unit

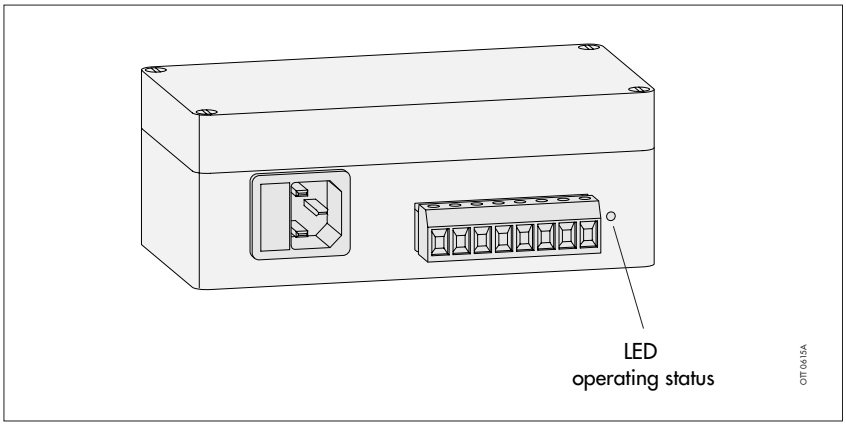


8 LED displays and troubleshooting

8.1 LED displays

The PCU 12 has an LED beside the plug-in screw terminal strip. This can be used to diagnose the operating status.

Fig. 16: Position of the operating status LED



The LED has the following signal modes:
LED off, LED continuously on, LED approx. 2.5 s on, flashing every 2 – 3 s, continuous blinking.

LED	**operating status**
continuously on	power supply by mains
continuously off	exhaustive discharge protection on
blinks continuously	short circuit or output overload
flashes 1 x	only output 1 active
flashes 2 x	output 1 and 2 active
flashes 3 x	battery charging by solar panel

8.2 Troubleshooting

Connecting the battery

Target display	LED must light up for 2.5 sec. when the battery is being connected
Actual display	LED does not light up
Malfunction	short-circuit or polarity reversal
Correction of malfunction	disconnect the battery and connect it correctly

Connecting the panel

Target display	LED must flash three times (this will only happenif the panel is supplying the voltage)
Actual display	LED does not flash although panel voltage is available
Malfunction	short-circuit or polarity reversal
Correction of malfunction	disconnect the panel and connect it correctly

Connecting the output or operating with power consumer

Target display	various possiblities
Actaul display	blinks continuously
Malfunction	short circuit or output overload (output voltage 0 V)
Correction of malfunction	disconnect the battery, panel or mains and eliminate the cause of the short-circuit or output overload.

9 Maintenance work

9.1 Maintaining systems without a battery or solar panel

PCU 12 applications without a solar panel or battery do not need to be serviced as they operate entirely from the mains. Should problems arise, check the built-in fuse.

9.2 Maintaining systems with a battery and solar panel

In order to ensure smooth and problem-free data acquisition, we recommend that the entire voltage supply system be checked and serviced at regular intervals (at least once a year).
When doing so, you should pay particular attention to the solar panel and battery.
Systems which require on-site data sampling can, for example, be checked and serviced during this sampling.

Solar panel

- Check
  - – the solar panel for mechanical damage;
  - – the azimuthal and elevation angles of the panel;
  - – whether all screws are securely tightened and the module is securely anchored;
  - – all connection leads for corrosion or loosening;
  - – all leading-in housings and connections for leaks.
- If need be, measure the panel's open-circuit voltage and short-circuit current. Compare the values measured with those specified by the solar panel manufacturer.
- If need be, clean the surface of the module.

Battery

- Check
  - – the liquid level in each cell of open, non-maintenance-free batteries, and refill them with distilled water if necessary;
  - – the terminals for corrosion and loose cable connections;
  - – the surface of the battery. Traces of liquid could indicate that the battery or PCU 12 has been damaged;
  - – the ventilation in the room.
- Establish the condition of the battery's load in accordance with the manufacturer's instructions, e. g. measure the no-load and load voltage and/or the acid density.

Please bear in mind that all batteries age. Depending on the frequency of the charging and discharging cycles and the degree of discharging, batteries possess only a fraction of their original capacity after a certain time. If the ambient temperature is lower that 0 ° celsius, this reduced capacity may then no longer be sufficient.

- Replace batteries ideally after 5 years. This is particularly important for systems with very important measurment values.

System

- Make sure that all safety features such as the earthing of all components, overvoltage protection devices etc. are in working order.

10 Technical data

Mains voltage	90 to 250 V, 40 to 60 Hz; automatically adjusted
Power input (mains)	< 30 VA
Output voltage (without battery buffer)	10.5 to 14 V
Output current without battery	max. 2 A
with battery	max. 20 A (depending on battery capacity)
Own current consumption	
mains operation	< 20 mA
solar operation	< 2 mA
battery operations	< 0.5 mA
Solar panel	
open-circuit voltage	< 23 V
nominal voltage	12 V
short-circuit current	< 12 A
power	< 200 W_p
Battery capacity	max. 200 Ah
End-of-charging voltage	approx. 15.5 V at ≤ –20 °c approx. 14.2 V at +20 °C approx. 13.3 V at ≥ +50°C
Deep charging thresholds (separated load connections)	10.5 V and 7.5 V
Connecting the load connections	11.5 V
Operating status display	LED, visible from outside
Protection in the event of polarity reversal, overload, short-circuit	current automatically limited at the battery and solar panel input
Earth	group earth at the solderless terminal strip, connected to the protective earth conductor
Overvoltage protection	in accordance with IEC 100-4-5
Protection	IP 54 (without IEC connector)
Dimensions L x W x H	150 x 80 x 50 mm
housing material	plastic, grey
Ambient temperature range	–40 °C to +85 °C

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