

### Description

The photovoltaics optimiser AD-PVO 3000 monitors the feed of solar energy at the main connection of a building. The analogue output (0...20 mA, 4...20 mA, 0...10 V or 2...10 V) can be parameterized freely, therefore, the electric heating rods can be controlled via a thyristor power controller. The AD-PVO 3000 regulates the heating rod output in such a way, that the feed is kept at zero. This is realised with an integral software PI regulator, which adjusts the power at the heating rod up to its maximum value of the feed-in power. With this device, the energy is optimally implemented on site and is not fed back into the public low-voltage network. This way, the PC units are optimised for personal consumption and the public network is relieved. Additionally, the AD-PVO 3000 has an error message LED and an integral error message relay, via which error messages (i.e. permanent failure of the in-feed) can be indicated or acoustically signalled outside the distribution cabinet. It is recommended to mount the AD-PVO 3000 directly after the energy-counter of the energy supply in the distribution cabinet, as measuring is to be carried as close as possible to the in-feed point. The device requires for its measuring all three external phase voltages and the neutral conductor. The AD-PVO 3000 measures the current via three external split core current transformer, which can be mounted space-saving (without separation) directly on the 3 phases after the counter. The photovoltaic optimizer receives the personal consumption energy from the measuring voltage L1.

### Application

Stepless control of heating rods with the aid of a thyristor power controller.



### Specific characteristics

- Supply via measuring voltages
- Analogue output for thyristor power controller
- Load regulation according to PI behaviour
- Current measuring via split core current transformer
- Parameterizing via PC (AD-Studio)

### Business data

Order number AD-PVO 3000

### Technical specifications

#### Current-inputs (I1...I3)

Measuring range 0 ... 33 mA AC (0 ... 100 A AC via external current transformer)  
Input resistance ca. 10 Ohm

#### Voltage-inputs (L1...L3)

Measuring range 230 V AC (+/- 10 %)  
Input resistance ca. 500 kOhm

#### External current-transformer

Primary current 0 ... 100 A AC  
Secondary current 0 ... 33 mA AC  
Transformation ratio 1:3000 (Np : Ns)  
Maximum wire diameter 15 mm  
Max. secondary wire length 2 m  
Isolation-voltage 2,5 kV / 1 min  
Dimensions (WxHxD) 32x42x46 mm

#### Analogue output - current

Output range 0 ... 20 mA, 4 ... 20 mA  
Max. load 400 Ohm  
Resolution 10 Bit  
Residual ripple ca. 30 µAss

#### Analogue output - voltage

Output range 0 ... 10 V, 2 ... 10 V  
Min. load 1 kOhm  
Resolution 10 Bit  
Residual ripple 50 mVss

#### Error-relay

Maximum switching load AC 250 V, 2 A  
Maximum switching load DC 50 V, 2 A  
Contact construction changeover contact  
Switching operations 10000000  
mechanical  
At 230V/2A AC, cos(phi)=1 600000  
At 230V/2A AC, cos(phi)=0,4 200000  
At 24V/2A DC 200000

#### Supply

Voltage range AC 230 V AC (+/- 10 %), 50/60 Hz  
Nominal voltage AC 230 V AC  
Power consumption max. 3,8 VA

#### Transfer behavior - in reference to the current value

Basic accuracy < 1 % (class 1)  
Temperature influence 80 ppm/K  
Response time < 2 s

#### Housing

Dimensions (WxHxD) 71x90x58 mm  
Type of protection IP 20  
Connection method screw clamp  
Terminals, wire cross section 2,5 mm<sup>2</sup> flex wire / 4 mm<sup>2</sup> one wire  
Bolting torque terminals 0,6 Nm  
Skinning length 6 mm  
Weight ~ 175 g + 3x 75 g (current-transf.)  
Manner of fastening 35 mm DIN rail 35mm

#### Environmental conditions

Ambient temperature 0 ... 50 °C  
Storage and transport -10 ... 70 °C (no condensation)



### Technical specifications

#### EMC

Product family standard	EN 61326 <sup>1)</sup>
Emitted interference	EN 55011, CISPR11 Cl. B

#### Electrical safety requirements

Product family standard	EN 61010-1
Overvoltage category	II
Pollution degree	2
Safety measurement	EN 61010-2-030
Measurement category	CAT III

#### Galvanic isolation, test voltages

Grid side to error relay	4 kV, 50 Hz (1 min.)
Grid side to the pc-interface	4 kV, 50 Hz (1 min.)
Grid side to control elements	4 kV, 50 Hz (1 min.)
Grid side to analogue output	3 kV, 50 Hz (1 min.)

#### Protection circuits

Input	electrical surge protection
Analogue output	electrical surge protection
Power supply	protection against over-temperature, over-voltage and over-current

<sup>1)</sup> During checking, slight signal deviations are possible.

### EMC-appropriate assembly

**When assembling the AD-PVO 3000, including a thyristor power controller, please observe the regional and/or country specific regulations of the network operator.**

When operating great loads with leading phase-angle or trailing phase-angle, considerable network reaction can be expected to the current intake, which is not sinusoidal.

The regulations for operation of heat generators with leading phase-angle or trailing phase-angle depend on the network operator. In case of doubt please contact the network operator.

The erector of the unit must, if necessary, reduce the electromagnetic emission with suitable chokes or suppressor filters.

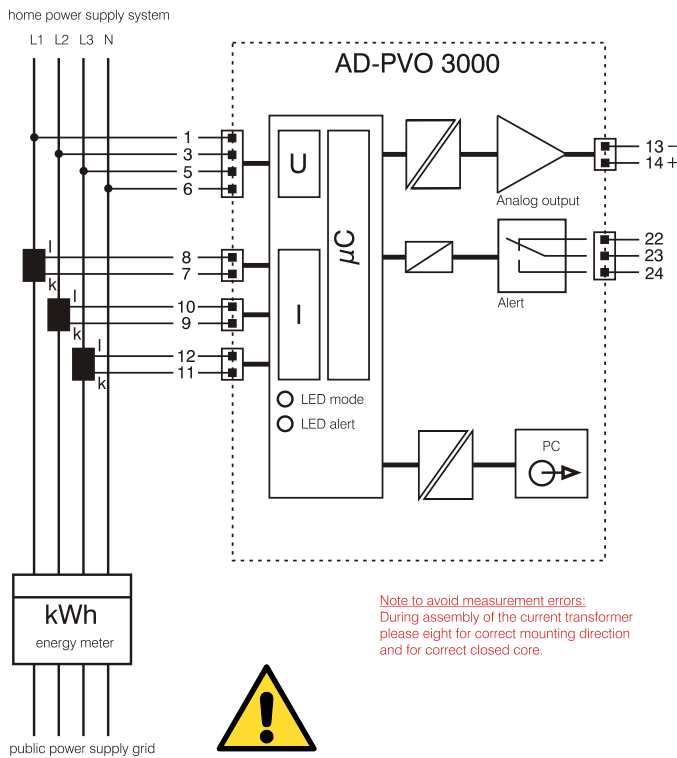
Chokes reduce the current-dependent network reactions and effect an improvement of the power factor. The current harmonics content is reduced and the network quality is improved.

Network filter serve mainly the protection from high-frequency disturbance variables, which are emitted, conductor bound, via the network cable or through the air.

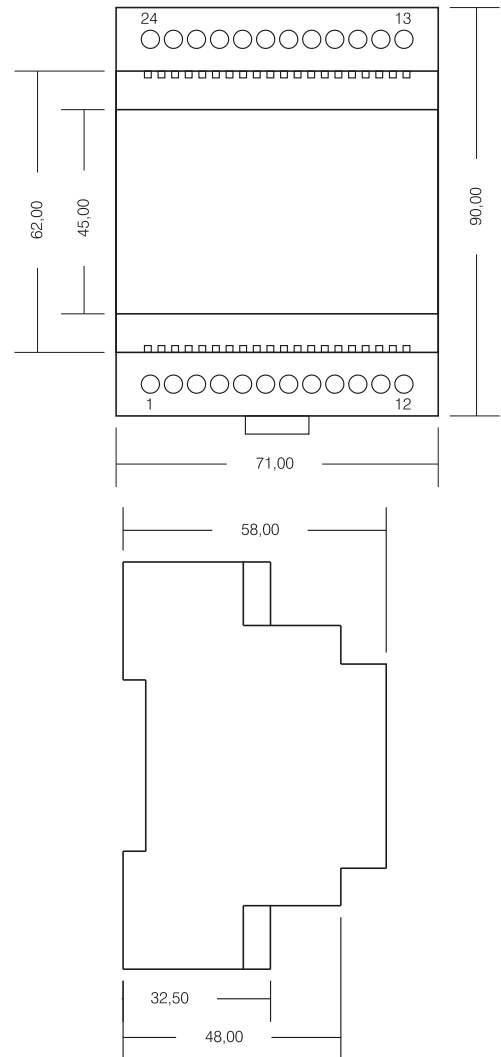
Shielding measures may be necessary to reduce the emission. The conductor between thyristor and load should be shielded.

The shield must be earthed with low impedance or over a large surface, however, it must not replace the PE conductor!

### Block and wiring diagram



### Dimensions



## Operation

### Operation LED

The green operation LED indicates the operating status of the device. - off: the device has no operating voltage - permanently on: the device is in normal operation - flashes with 5 Hz: the manual load connection is active.

### Error LED

The red error LED indicates, whether an error is present. - off: no error - on: error present

### Key: manual load

The key "Manual load" serves the manual 100% activation of the load. The load is activated and deactivated through a long pressure on the key (3s).

### Key: Quit

The key "Quit" is provided for quitting of an error message. If an error is present, the red error message LED lights up and the error message relay engages. An acoustic indicator can be connected at the error message relay. When the key "Quit" is activated, the relay releases again. The red error LED, however, is lit until the error is eliminated. With long key depression see "Automatic load calibration".

### Software and parameterizing

The device can be parameterized and read out via the parameterizing software AD-Studio and at the available USB programming adapter AD-VarioPass3. The appropriate USB driver for the USB programming adapter AD-VarioPass3 is supplied with the software AD-Studio. With this software, measuring values can also be read out or logged. For connection to the PC, the blind plug must be removed from the parameterizing interface (AD-PC) i.e. with a small screwdriver. Please insert the screwdriver into the slot provided for this and lever the blind plug out.

The following parameter can be edited:

- **Filter:** Analogue value filter for the input measured quantity. Serves the suppression of rapid measuring value alterations.
- **Current transformer type:** Specifies the connected current transformers type (distinguishing primary current).
- **Power of the load:** Here must be stated, which power intake the connected load has at the load relay. This specification is required for internal calculations.
- **Type of output signal:** Sets the type of signal at the analogue output (0...20 mA, 4...20 mA, 0...10 V, 2...10 V).
- **Error time in-feed:** Sets the time after which the alarm is released, if no in-feed has occurred during this time.
- **Unit size:** Here the size of the PV unit can be entered in kWp. Is only required with 70% message. - **Function Error message relay:** sets the function of the error message relay. You can choose between two types of functions: "In-feed error" and "70% message". The standard function "In-feed error" activates an error message after the time set in the parameter "error time in-feed". The function "70% message" activates a message, if more than 70% of the installed unit size in kWp is fed in, even though the load is switched on at the PVO. The parameter "unit size" is evaluated.
- **Proportional constant:** Sets the proportional constant of the PI regulators. Attention, influences the regulating behaviour of the device.
- **Integral constant:** Sets the integral constant of the PI regulator. Attention, influences the regulating behaviour of the device.
- **Scanning time:** Sets the scanning time of the PI regulator. Attention, influences the regulating behaviour of the device.

### Automatic Load calibration

For the commissioning of the AD-PVO 3000, the parameter are normally set appropriately via the parameterizing software AD-Studio and the available USB programming adapter AD-VarioPass3. However, an "Automatic load calibration" can also be started directly at the device. In this operating mode, the power of the consumer connected to the thyristor power controller is automatically calibrated and a PC is not required. This load calibration is started with a long key depression of the "Quit key" (3s). As long as the calibration is running, both LEDs flash alternately. This process can last for several minutes. If the calibration is cancelled with a short depression of the "Quit key", the values in the parameter are reset to the last status. After successful completion of the "Automatic load calibration", the device takes over the measuring data and returns to normal operation. If the load calibration is not completed after approx. 15 minutes, then there are too strong load deviations in the network. With too strong load deviations, the device has difficulties in calibrating itself. It is recommended to separate these loads briefly from the network during the calibration time, or to parameterize the device with a PC.

### Tested thyristor power controller

In principle, any desired thyristor can be connected to the analog output of the AD PVO 3000. However, the thyristor has to correspond to the technical specifications of the analog output. Below are two thyristor listed that have been tested in the house Adamczewski in combination with the AD-3000 PVO.

#### - Single phase applications:

Type: SIL465000  
 Manufacturer: CELDUC  
 Power supply: 160 ... 450 VAC  
 Analog input: 0 ... 10 V  
 Load: max. 22A (AC-51) - phase angle  
 Mounting: DIN rail (heat sink integrated)

#### - Three-phase applications:

Typ: RGC3 P 60 I 30 E A P  
 Manufacturer: CARLO GAVAZZI  
 Power supply: 90 ... 250 VAC  
 Analog input: 0/4 ... 20 mA  
 Load: max. 37A (AC-51) - phase angle  
 Mounting: DIN rail (heat sink integrated)

### Noise free stepless heating element

The heater AC Elwa has a 0 ... 10 V-interface via which it can be controlled. Thus, it is compatible with the AD-PVO 3000. It requires no additional thyristor. The technology for a stepless control is built into the heating element. The heater does not produce disturbances in the power network. It can therefore be used without the consent of the energy supplier with the AD-PVO 3000.

Typ: AC-Elwa  
 Manufacturer: my-PV GmbH  
 Power supply: 230 VAC  
 Analog input: 0 ... 10 V  
 Heating power: max. 3 kW  
 Mounting: 1,5"-screwing

## Safety instructions – it is essential to read these



### Explanation of symbols

Two squares, one inside the other, indicate a DOUBLE or REINFORCED insulation of the device against dangerous high voltages (i.e. mains voltage). This is valid for all parts at the housing, which can be touched, for the operating elements and the low voltages generated by and lead from the device.



### Explanation of symbols

An exclamation mark inside a triangle indicates important notes in the technical data sheet and in the notes on safety. Read both documents to the end prior to commissioning. They contain important notes for the correct operation and the installation. Non-observation and errors resulting from this can lead to dangers.

### Designated usage

The device must only be used for the purpose described in the relevant data sheet.  
The device conforms to the valid CE European guidelines and harmonised standards.  
Usage in explosion-endangered areas, outdoors or in damp rooms is NOT admissible.  
The device must only be operated with the specified nominal voltage. The specified switching capacities must not be exceeded.  
Opening or altering the device is not admissible. Do not repair the device yourself, but replace it with an equivalent new device. Repairs must only be carried out by the manufacturer.  
The manufacturer accepts no liability due to infringement.  
An operation under adverse environmental conditions is not admissible.  
Adverse environmental conditions are:

- high sun radiation
- wetness, dewing or too high humidity
- dust and flammable gases, vapours or solvents
- strong vibrations or electro-magnetic fields

Do not expose the device to stresses, which exceed the described limits.

Usage other than the one described in the relevant data sheet is not admissible and leads to damage of the product.

Furthermore, this is connected with dangers, as for instance short circuit, fire, electric shock etc., which can be fatal.

### Notes on safety and dangers

Any warranty claim becomes void for damages due to non-observation of these notes on safety and the relevant technical data sheet.

The following points must be noted:

- the valid laws, standards and regulations
- the stand of technology at the time of the installation
- the handbook and/or the technical data sheet
- the recognised rules of technology
- the fact that operating instructions can only state general regulations and that these regulations must be observed
- the device is not a toy and does not belong in the hands of children
- only operate the device with undamaged connection lines.

### Notes on connection and installation

WARNING: dangerous electric voltage can lead to electric shock and burns.

- The installation and maintenance must be carried out by qualified electricians.
- Observe the technical data specified in the data sheet.
- Provide a correctly dimensioned overcurrent device in the vicinity of the device.
- Mount the device in an appropriate control box/control cabinet with a suitable type of protection according to IEC 60529 to protect it from mechanical or electrical damages.
- During maintenance work, cut the device off from all effective sources of energy and secure it against restart.
- If operating elements of protection class 1 are connected to the contact outputs of the device, the protective earthing conductor connection must be carried out separately and properly.

### ESD

ATTENTION: When handling the device, protective measures against electrostatic discharge must be observed.

### Maintenance and cleaning

The device is maintenance-free and does not have to be cleaned.

### Disposal

Old electronic devices are valuable substances and do not belong into the household waste. If the device has reached the end of its useful life, dispose of the device according to the valid legal regulations.

Status: 09/2013

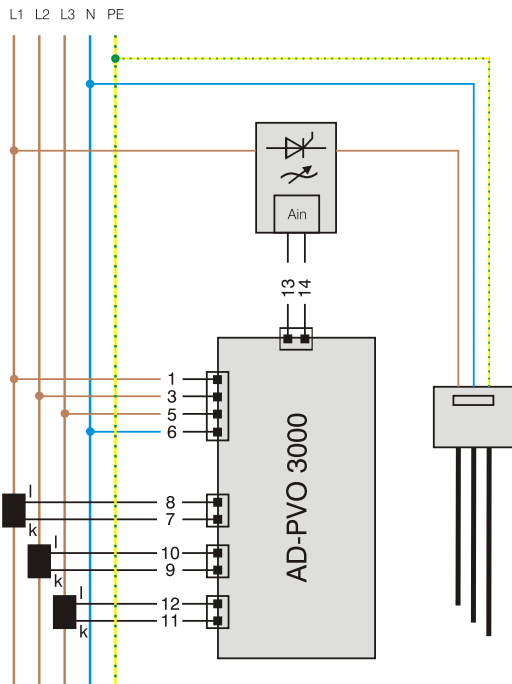
### Adamczewski

Elektronische Messtechnik GmbH

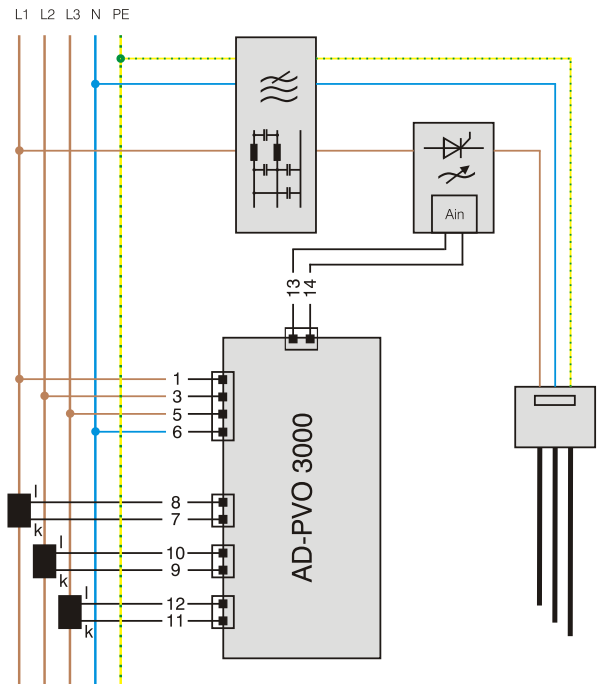
74374 Zaberfeld

[www.adamczewski.com](http://www.adamczewski.com)

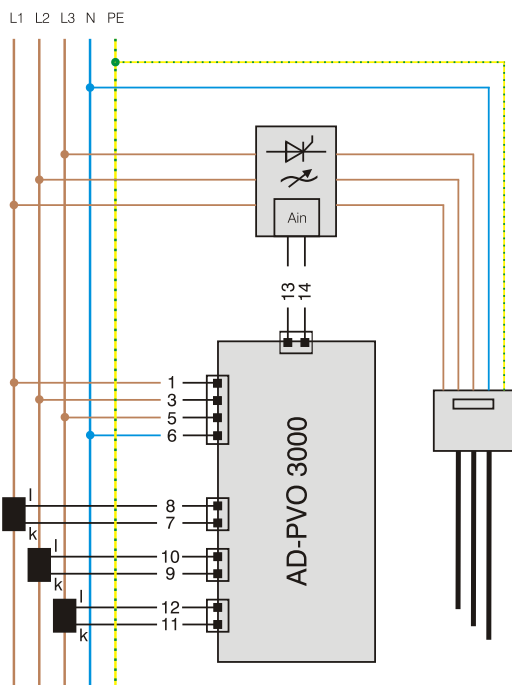
### Circuit examples



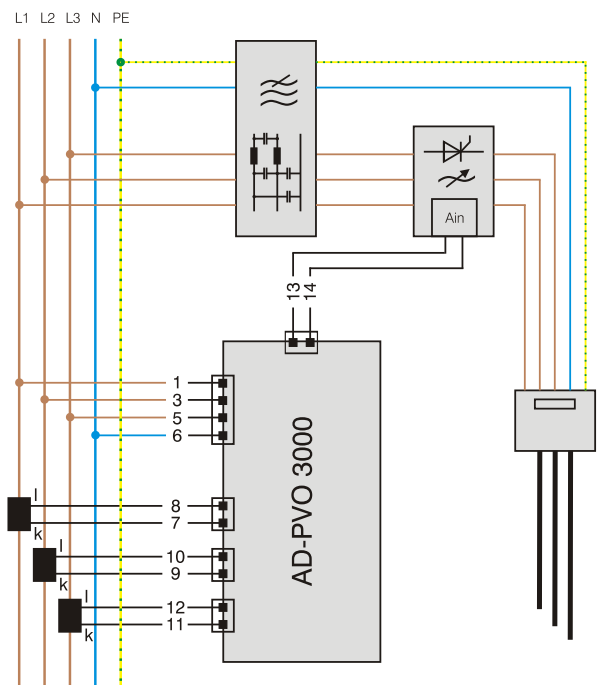
one phase without mains filter



three phases with mains filter



one phase without mains filter



three phases with mains filter